The double-bind relationship between environment and organic agriculture. Organic farming as a solution for environmental problems and environment as an asset for the development of organic farming ?

Philippe Fleury, Stephane Bellon, Servane Penvern

BOOK OF PROCEEDINGS

INTERNATIONAL CONFERENCE ON

ORGANIC AGRICULTURE IN SCOPE OF ENVIRONMENTAL PROBLEMS

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ORGANIC COTTON PRODUCTION IN NORTH BENIN – AN OPTION FOR SMALL SCALE FARMERS?

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INTRODUCTION

In Benin the export of conventional cotton represents the main source of export earnings and plays a crucial role for rural poverty reduction. Most of cotton farmers are small scale farmers with subsistence constraints. Cotton production is one activity of a production system involving the production of cereals, vegetables and other activities. For many farmers, cotton production as a cash crop gives them access to cash insurance against food crop failure and to input market. For them producing cotton is often the only way to have access to input, also fertilizer for maize (one of the main staple crops) production. Conventional cotton farmers buy fertilizers and pesticides on credit, deducted from their earnings after harvest. In the last years, problems of economic efficiency of cotton production, management difficulties due to policy reforms of the sector, low yield and productivity performance, and land degradation affect households welfare and food security among smallholders. Increase in cotton production is principally achieved by extension of cultivated area. Climatic hazard and land degradation (poor soil, soil depletion) compromise yields. These problems linked to policy reforms of the cotton sector, together with increasing input price and decreasing price of cotton on world market have exacerbate the liquidity problems and the indebtedness situation of many farmers and sometime lead many of them to leave cotton production without any other better production alternative. Since 1996, organic cotton production is becoming more important despite its labour intensity and lower yields (around 0.5 ton compared to 1 ton in the conventional sector).

This study aims at clear understanding of the overall system environment of conventional and organic cotton farmers in two regions in North Benin, the communes of Tanguiéta/Matéri and Kandi. The conventional and organic farms are compared under current policy in the scope of the relative importance of cotton production and sustainability of production. Potentials and challenges of adopting organic cotton production for farmers to the protected area of Pendjari National Park are discussed.

STUDY AREA AND DATA

The analyses presented in this study relate to data collected in two cotton growing zones of North Benin. The main reason for selecting the first region (region1), Tanguiéta / Materi was its location close to the Pendjari National Parc and the presence of a new initiative starting with the introduction of organic cotton farming. Because of short term experience with organic farming, only conventional cotton farmers are studied in region 1. The second region, Kandi, was purposively selected because organic cotton farming was introduced there in 1996, meaning that many farmers converted to organic production rely on middle to long term experience. Growers in both research areas are small scale farmers and depend mostly on income from this cash crop. The sampling process yielded a sample of 161 households (87 conventional and 74 organic farming households).

METHOD: AN APPLICATION OF COMBINED PRINCIPAL COMPONENT ANALYSIS AND CLUSTER ANALYSIS

Measures of household wealth can be reflected by socioeconomic indices. For this purpose, Principal Component Analysis (PCA) was used to construct relative household socio economic indices. This method allows incorporation of a greater range of variables. Upon construction, the computed factor scores were used as the input for a cluster analysis (CA) in order to identify representative household types for each group.

RESULTS AND DISCUSSION

Principal Component Analysis

Various variables were used as inputs for numerous PCA. The most common rule for selecting significant principal components is to retain those with eigenvalue greater than 1. Because of their correlation structure and their relevance 3 variables (components) for the group of conventional farmers and 4 variables (components) for the group of organic farmers were selected for the final PCA. Table 1 illustrates the rotated component matrix with the factor loadings and shows the correlation coefficients with the original variables.

Table 1: Variable scores (correlation coefficients) on derived variables (principal components)

Principal Components on variables for conventional cotton farming households in Region 1		Principal Components on variables for organic cotton farming households in Region 2	
	Coefficients		Coefficients
Component 1: Level of Specialisation in Conventional Cotton Farming		**Component 1: Level of Specialisation in Organic Cotton farming**	
Share of maize in cultivated land	-0,775	Share of maize in cultivated land	-0,786
Share of conventional cotton in cultivated land	0,473	Share of organic cotton in cultivated land	0,782
Component 2: Wealth and Household Resources		**Component 2: Wealth and Household Resources**	
Cotton income	0,793	Value of residence, and other structures of the household	0,856
Savings	0,755	Value of agricultural equipment	0,751
Cultivated land size	0,726	Cultivated land size	0,647
Value of residence, and other structures of the household	0,692	**Component 3: Land use Management**	
Number of livestock	0,664	Land use intensity	-0,800
Household size	0,553	Years of schooling of household head	0,668
Component 3: Household Head Status		Index for soil improving practices	0,665
Age of household head	0,828	**Component 4: Experience in Organic Cotton Farming**	
Years of schooling of household head	-0,754	Age of household head	0,806
		Years of organic cotton farming practice	0,801

The principal component for level of specialisation reveals, with the negative sign for the share of maize in cultivated area, the situation of competition in term of cultivated area between maize and cotton in both cases, conventional and organic farming households. Under household resources and wealth, the factor identified in the case of conventional farmers is seen to be strongly correlated with cotton income, savings, total cultivated land, and value of residence and other structures of the household and household size (number of household members). For organic farmers, the factor titled as wealth and household resources is observed as strongly correlated with value of residence and other structures, value of agricultural equipment (incl. animals for animal traction). The third component for the conventional farmers is the household head status which shows that younger head are by trend more educated than older head. For the group of organic farming household two factors remain: land use management and experience in organic farming. The land use management factor is highly correlated with the education level of head and the index for soil improving practices. This index (0 to 10) covers 10 soil conservation and fertility improving measures. The last component for organic farming households, the correlation with initial variables indicates that experience in organic cotton farming increase with the age of head. This reveals that relative older household head have shown very early a special interest in organic farming and did not break up with organic farming.

Cluster analysis

In a second step, computed factor scores of the PCA were used as an input for the cluster analysis. Descriptive statistics (table 2) illustrate the main differences between the different farm household groups.

Compared to region 2, households of region 1 are more subject to land constraints. This is mainly due to their location close to the national park. For both groups, conventional and organic farming households, the cultivated cotton area increases with total cultivated area and with their general wealth and resources level. But the importance of cotton production in terms of area differs between clusters and groups. Resource-poor and resource poorest subsistence households represent 56 % of the group of conventional cotton farmers (region 1), and are characterised with low share of cotton in their total cultivated area and high consummation rate of their own production. Farms with more land resources are more able to increase their cotton cultivated area and reach higher resources and wealth level. Subsistence households more specialised in cotton farming (50 % of their cultivated area is cotton) are relative young headed farms. Traditional big family farms with older head and more land resources reach the highest area of cotton but staple crops represent 66 % of total cultivated area and they can commercialise 33 % of own produced maize. This shows that this group is more able to diversify their revues from commercialisation of own production.

Compared to region 1, food security is more guarantied for farmers in region 2. Semi-subsistence households in region 2 diversify their revenue with commercialisation of higher share of their own staple crop production. Households where organic cotton share in total cultivated area reach 40 % are relatively more engaged in organic cotton farming. They can be describe as resource rich traditional big family farms with middle age head, and are characterised with relatively better agricultural equipment and the highest rate of organic cotton producers in the household (especially women).

Table 2: Characterisation of clusters for Conventional Cotton Farming Households in region 1 and Organic Farming Households in Region 2

	CC_1	CC_2	CC_3	CC_4	OC_1	OC_2	OC_3	OC_4
Nr. of households	35	12	27	10	22	14	20	10
% of households	42	14	32	12	33,3	21,2	30,3	15,2
Household size	7	8	7	12	6	7	8	9
Age of head	39	24	32	55	33	58	39	41
Years of schooling head	0	6	1	0	0	0	1	3
Value of residence, and other structures	297823	476708	481907	771950	496705	629321	865868	1814950
Number of cattle of head	1	1	3	7	6	8	14	21
Total cultivated area (ha)	4,4	4,6	6,1	10,4	7	7	8	11
Cotton area (ha)	1,7	1,3	3	3,6	2,3	1,8	1,5	4,9
Maize area (ha)	1,3	1,6	1,9	3,4	2,1	2,1	4,1	3
Share of cotton (%) in cultivated land	40	30	50	34	34	28	20	42
Maize quantity sold on total production	14	12	25	33	46	47	40	44
Cotton income (FCFA)	123809	127927	287310	225312	258568	155325	228646	628368
Number of cattle for animal traction	0	0	1	0	2	2	4	4
Value of agricultural equipment	28393	0	77801	90000	67727	77857	117500	149000
Soil conservation and fertility management index	2,8	2,9	2,9	4,1	6	6	7	6
Formal credit (FCFA)	8571	13333	12778	18500	23545	32857	69500	46000
Savings (FCFA)	21857	20000	72037	77500	909	0	60000	36000
Experience in organic farming of head (years)					4	8	3	6
Nr. of OC producers in the household					1,7	1,8	1,6	2

4 Clusters of conventional cotton farming households:

CC_1: Resource-poorest subsistence households
CC_2: Resource-poor subsistence households
CC_3: Subsistence households specialised in CC farming
CC_4: Subsistence households with more resources

4 Clusters of organic cotton farming households:

OC_1: Semi-subsistence households with young head
OC_2: Semi-subsistence households with old head
OC_3: Resource rich diversified household farms
OC_4: Resource richest households more specialised in OC farming

In the case of organic cotton farmers, the share of organic cotton to total cultivated land is proportional to the absolute number of organic cotton cultivated but this share in region 2 remains inferior to the share of conventional cotton to cultivated area on region 1.

Socio-economic conditions are less favourable in region 1 compared to region 2. With lower resource level, average farm size reach 6 ha compared to 8 ha in region 2. The average conventional cotton area is 2 ha in region 1 and average organic cotton area is 3 ha in region 2. Because of input credit system, conventional cotton farmers, especially those who use this fertilizer for maize production get less money for their produced cotton.

Most of producers in region 1 have bad access to land and are more vulnerable to food shortage. With a lower share of cotton in total cultivated area and higher level of commercialisation of their own staple crop, organic cotton farming households in region 2 can be seen as more diversified as conventional cotton farmers in region 1. Furthermore more cattle and better knowledge give organic farmers more opportunity to reach higher index of soil fertilisation and conservation.

In the last years, conventional farming has shown some weaknesses. Especially small scale farmers have experienced a decrease of their revenues because of less favourable market conjuncture and organisation, low level of production, little diversification possibilities, and lower soil fertility. They became used to pay input on credit thanks to cotton production, facing every year repayment and indebtedness problems. Far from this, organic cotton farming is becoming an interesting alternative for these farmers, offering also higher producer price. In the case of households in region 1 close to a protected area, they could be able, with good farming management quality to better cope with food security, cotton income and soil fertility by introducing organic cotton. From the data analysis, it becomes also clear that land constraint is an obstacle to intensification of cotton production, diversification of production and realisation of income from other crops. Small scale farmers need a certain level of diversification, not just for own consumption but also to diversify their revenues from commercialisation of own production to better face production risks. A next difficulty in region 1 for the introduction of organic cotton is also the low cattle availability in farms which does not allowed a high level of manure production for organic fertilisation of soils.

THE EFFECT OF DIFFERENT COMPOST APPLICATIONS ON SOME FRUIT QUALITY PARAMETERS OF ORGANICALLY PRODUCED RED PEPPER

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ABSTRACT

This research was established to study the effects of composted plant residues, farmyard manure, turkey manure, certificated commercial organic manure, and their combinations with green manure crop on red pepper (*Capsicum annuum* L.) yield and fruit quality. Combination of farmyard manure (20 tonnes.ha^{-1}) + green manure crop plot is determined as the highest for fruit length/width/pulp thickness/fructose content, and yield. In conclusion, the more qualifier peppers were obtained from organic plot when compared the conventional one.

Keywords: Pepper, *Capsicum annuum* L., manure, compost, green manure crop, yield, fruit quality.

INTRODUCTION

Turkish organic pepper production plays a significant role in the Turkey's vegetable organic trade due to its volume and quality. The production is generally realized from Mediterranean Climate conditions and organic pepper production has gained importance since 1990's in Turkey. Pepper fruits are generally used in the diets and eaten raw or processed. But, production is limited by the nitrogen fertilization. Matured organic sources are alternative additives for farmer's traditionally usage to maintain the soil fertility and plant production. Numerous research results indicated that organic pepper's fruit diameters, chemical compounds and yield significantly affected by the organic fertilization.

This investigation was conducted to determine the different composted materials effects on fruit quality and yield of organically field grown red pepper.

MATERIAL AND METHOD

Experiment was conducted at the Aegean Agricultural Research Institute's experimental area located in the Mediterranean Region during the years of 2002-2003. Some physical and chemical properties of the experimental soil, the applied manures and compost were analyzed according to standard methods (1, 2) (Table 1, 2). The compost material was obtained by composting vegetable residues from the agricultural production of the Institute. Farmyard and turkey manures were composted for 8 months. The experiment was conducted in randomized block design in 72 parcels, as 4 replications, 68 plants making up each parcel. Distances between the parcels were approximately 2.1 m. Treatments were presented in Table 3. The nitrogen values were based for fertilization calculations and equalized in both organic and conventional parcels at the rate of 170 kg/ ha/ year. Common vetch (*Vicia sativa* L.) - barley (*Hordeum vulgare* L.) mixture was tested as 80 % + 20 % respectively and incorporated back to the soil as a green manure at the time of spring. Pepper seedlings were further transplanted to the field in May. The experiment was carried out under organic conditions and the research plot was converted to organic production system two years prior to sowing green manure crop seeds. Plant materials selected for the trial were all standard varieties. The standard varieties have been used highly by farmers locally.

Table 1: Properties of soil samples (0-30 cm).

Properties	
pH	7.4
Tot. Salts (%)	0.1
$CaCO_3$ (%)	4.8
OM (%)	0.6
Texture	Sandy Clay
N (%)	0.1
P (mg/kg)	1.4
K (mg/kg)	225
Ca (mg/kg)	5880
Mg (mg/kg)	540
Na (mg/kg)	155
Fe (mg/kg)	6.0
Cu (mg/kg)	0.9
Mn (mg/kg)	4.3
Zn (mg/kg)	0.5
NO_3^- (mg/kg)	3

Table 2: Chemical analysis results of composts.

Properties	C[1]	F[2]	T[3]	CO[4]
pH	7.7	8.7	7.7	9.2
Tot. Salts (%)	0.9	3.7	3.9	4.3
$CaCO_3$ (%)	4.5	4.9	8.7	3.8
OM (%)	40.6	52	45.7	64.0
C/N	26.6	21.1	15.7	15.0
CEC (meq/100 g)	42.3	55.2	53.0	58.0
N (%)	1.2	1.7	1.3	2
P (%)	1.8	1.3	1.8	1.9
K (%)	2.9	1.7	2.5	1.7
Ca (%)	2.3	1.3	4.2	4.0
Mg (%)	1.3	1.6	3.3	1.2
Na (%)	0.2	0.4	0.4	0.3
Fe (mg/kg)	3075	3850	5430	5880
Cu (mg/kg)	25	45	62	65
Zn (mg/kg)	176	265	478	385
Mn (mg/kg)	269	348	580	440

[1] composted plant residues
[2] farmyard manure
[3] turkey manure
[4] certified commercial organic manure

Table 3: Treatments.

1) 0 (control) (non treated)	**7)** F1 (farmyard manure) (10 ton/ha)	**13)** T2 (turkey manure) (10 ton/ha)
2) NPK50 (control) (85/50/100 kg/ha,-half of recommended chemical fertilization)	**8)** F1+G	**14)** T2+G
3) NPK100 (control) (170/100/200 kg/ha, recommended chemical fertilization)	**9)** F2 (farmyard manure) (20 ton/ha)	**15)** C1 (compost) (20 ton/ha) (composted various vegetable residues)
4) G (green manure crop) (common vetch-barley mixture)	**10)** F2+G	**16)** C1+G
5) CO (certified commercial organic manure)	**11)** T1 (turkey manure) (5 ton/ha)	**17)** C2 (compost) (40 ton/ha) (composted various vegetable residues)
6) CO+G	**12)** T1+G	**18)** C2+G

After transplanting the seedlings to the field, only aphid species were observed at economic threshold level and a plant extract (pyrethrum, 1%) permitted by the Turkish 01.12.2004/5262 regulation (24.12.1994/22145, 11.07.2002/24812 regulations) and the EU 2092/91 regulation was used to treat the peppers. A synthetic pesticide was applied in the conventional management parcel. Because of moderate labour's costs in Turkey, weed-control was manual.

Furrow irrigation system was practiced and totally 600 mm of water was applied only in summer during the pepper production period. The results of characteristics of fruit were statistically calculated using JMP program.

RESULTS

The results of fructose analysis and measurements of fruit length/width/pulp thickness for the highest organic and conventional treatments and also minimum and maximum rates are presented in Table 4. It is obtained that organic F2+G plot and conventional NPK100 plot were displayed the highest rates for fructose analysis and measurements of fruit length/width/pulp thickness. Results showed that the content of fructose in organic red pepper fruits was found statistically significantly different from that in conventional fruit.

Industrial pepper's pulp thickness is one of the major desirable qualities and a strong correlation between yield and fruit pulp thickness as 0.531 ($p<0.01$) is found. The highest yields were 29.7 tonnes.ha^{-1} at first year and 26.5 tonnes.ha^{-1} at second year with F2+G plot.

Table 4: The highest content of fructose and fruit length/width/pulp thickness in red pepper from organic and conventional cultivation

Unit	**Fructose***	**Fruit length****	**Fruit width****	**Fruit pulp thickness****
	g/100 g f. w.	**cm**		**mm**
Organic (F2+G)	2.17a (1.year) 3.9ad (2.year)	9.5a (combined of 1.and 2. years)	4.8a (combined of 1.and 2. years)	4.4a (1.year)
Conventional (NPK100)	1.45b (1.year) 3.6ad (2.year)	8.1ab (combined of 1.and 2. years)	4.3ab (combined of 1.and 2. years)	3.5ad (1.year)
Minimum	0.9	5.7	2.8	1.2
Maximum	3.9	11.3	5.1	5.1
170/100/200 kg/ha Recommended Chemical Fertilization; TUKEY (0.05); * : significant for p<0.05, ** :significant for p<0.01				

DISCUSSION

There is clearly long-term researches need for a comparison between organic and conventional red pepper cultivation in terms of the pepper's fructose content and fruit diameters. Even though there are few results from which short-term researches to evaluate, it is supported that organic cultivation is inclined to better fruit quality (3; 4; 5).

CONCLUSION

Organically produced bell peppers contained significantly more fructose than conventionally grown fruits. Green manure applications in combination with farmyard manure which is applied as 20 tonnes.ha^{-1} is showed the highest measurements for fruit length, width, pulp thickness, and determined also the highest yield, significantly.

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FORAGE IN ORGANIC POULTRY DIETS

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ABSTRACT

The topic of forage intake and its significance in relation to nutrient need is of practical importance. Another consideration is that one of the most important egg quality parameters for the consumer is the yolk color, which can be affected by forage intake and quality. As is known feed constitutes a substantial cost in organic production so organic poultry may have access to pasture, a nutrient source that has the potential to curtail feed costs. Besides in the organic poultry production, the free range keeping of hens can present problems with higher incidences of feather pecking that in severe cases may lead to cannibalism. One way to minimize that could be supplementation of foraging material in diets. The present paper describes that feed costs can be reduced by increasing forage consumption in organic poultry diets and checks on these feed materials can effect sensory evaluation of poultry production and quality.

Key words: forage, organic, poultry, diet, quality

INTRODUCTION

Organic farming is increasing interest from farmers, politicians and consumers worldwide. Generally, organic farming aims at creating a sustainable agroecological system based on local resources. Good animal health and welfare are important parts such a system [1]. The International Federation of Organic Agricultural Movements (IFOAM) recognized basic standards of organic farming. These standards provide to animals that show their natural behavior is limited to two livestock units per hectare. For a transition period, the use of a limited proportion of conventional feed is authorized. The maximum percentage per year is 10% in the case of herbivores and 20% for other species. The use of synthetic aminoacids and growth promoters is forbidden. The indoor area is supplemented by an outdoor area that must be at least 75% of the indoor area [2].

In organic poultry production, the free-range keeping of bird can, in some flocks, present problems with higher incidences of feather pecking than in severe cases may lead to cannibalism. One way to minimize feather pecking and cannibalism in free-range flocks could be supplementation of foraging material [3], in which time spent feeding increases compared with normal pelleted.

Also the use of the outdoor run by the birds, which is reflected in the spatial pattern of herbage intake [4]. Most studies, however, have been conducted with free-range laying hens instead of broilers, so there is not much information on the foraging pattern of this type of birds. Considering the differences in the production system (age of the animals, length of the production period, genetic background) it is expected that the foraging pattern of broilers would differ too [5].

OPTIMAL FORAGING THEORY

A bird should adopt a strategy that best balances the energetic demands of foraging relative to the energetic rewards of consuming various foods. Optimal solutions to this cost-benefit relationship form the basis of optimal foraging theory. According to this concept, a bird's morphological, physiological, and behavioral traits have been shaped by evolutionary pressures in a way that maximizes net energy acquisition. Critics point out that only a small part of a bird's foraging characteristics can currently be explained by such theories. Also, other nutrients, such as aminoacids or calcium, are frequently the limiting nutrients during the most nutritionally demanding periods of reproduction and growth of many species [6], [7].

FORAGES IN POULTRY DIET

In poultry production, feed can account for up to 70% of the total variable costs [8]. So it is of major importance to adjust feed intake and match it with the requirements of the birds. It has been estimated that a laying hen can consume up to 30-40 g of dry matter per day from herbage, worms and insects, in addition to more than 100 g of concentrates [9]. Also Walker and Gordon [8] and Hermansen et al. [10] pointed out the necessity to know the actual intake of herbage by outdoor poultry with the purpose of adjusting the amounts of concentrates to the real requirements of free-range broilers. Such data, despite being an approximation and depending on many factors, could help animal nutritionists to make adjustments in the feed formulation that are likely to reduce costs.

The nutritional value of roughage depends largely on the relative proportions of cell contents and cell-wall constituents and on the degree of lignifications of cell walls. The protein content of green plant tissue is variable ranging from 5 to 35 % of dry matter. Some plants store high amounts of starch and sugar within their vacuoles. These nonstructural carbohydrates are much more digestible than structural carbohydrates, such as cellulose. The moisture content of plants decreases with maturity and highly correlated with digestibility [11]. Alfalfa (Lucerne) is the most common roughage fed to avian.

Forage intake provides a practical advantages and it is another consideration is about egg-quality parameters for the consumer is the yolk color. Fuller [12] reported that access to pasture resulted in a 6% saving of total feed consumed when pullets were fed a conventional mash-grain diet. Although laying hens are able to consume considerable amounts of roughages [13], information on herbage intake from range areas by high-performance layers is scarce. Also, restriction in nutrient supply has shown to increase forage intake in pullets, which could result in a drastic reduction in intake of protein and some aminoacids and a negative effect on plumage condition due to feather pecking [14], [15].

Some researchers found a linear relationship between intake of grass and the grass content in the crop at the end of the day for confined hens, indicating that daily forage intake could be estimated from the content of plant material in the crop of hens slaughtered in the evening [16].

The type of supplementary feed affected the intake of several feed items suggesting that a reduced nutrient content in the supplementary feed can be used as a method of increasing foraging in the outdoor area. Thus, hens fed whole wheat and oyster shells as the only supplementary feed had more plant material, oyster shells, insoluble grit and soil in the crops than hens fed a complete feed mixture [17].

The results suggested that hens found a considerable part of their nutrient requirements by foraging, even though some lost weight. The hens with access to chicory showed a relatively high egg production and did not lose weight to the same extent as those with access to grass/clover or mixed forbs [18].

Other plant material can provide valuable nutrients to poultry. Some researchers conducted an experiment using maize silage, barley-pea silage and carrots as foraging materials for laying hens. Hens receiving silage had greater gizzard weights and showed decreased pecking damage [19].

CONCLUSION

Modern broiler breeds have very little desire to consume plant vegetation. However when provided with high quality forage, we have observed as much as 20% of the diet intake from forage. These observations are mostly noted on forage such as clover and alfalfa. Forage consumption based on a mixed sward varies from 5-20% of the total diet. Feed efficiency depends on feed concentrate intake, water intake, live weight, and average ambient temperatures. The findings indicate that good-quality forage has the potential to supply a significant proportion of nutrient needs of poultry.

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SAFETY AND QUALITY OF ORGANIC MEAT

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ABSTRACT

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible. Health is the wholeness and integrity of living systems. In view of this the use of fertilizers, pesticides, animal drugs and food additives may have adverse human health. From this viewpoint, consumers usually perceive organic meat a safer and healthier compared to conventional product and this is the main reason for purchasing organic food. Organic processing and banning animal flour, GMO food and chemicals in animal feeding, gives consumers the assurance to avoid many diseases affecting modern livestock. The present paper briefly describes safety organic meat and the effects of organic farming on meat quality (e.g. pH, color, texture, sensory tenderness and flavor) and on differentiation from conventional meat.

Key words: meat, organic meat, meat quality, meat safety

INTRODUCTION

A clear comparison between organic and conventional products is difficult to establish due to the huge variation within the production methods, concerning among other things, intensification, feeding method or breed used. Honikel [1] concluded that the characteristics of product quality, the nutritional, hygienic, sensorial and technological factors are not very different between the production methods. In some factors organic food gets better marks, in others conventionally produced food scores higher.

The organic production could lead to a lower quality of carcass and meat due to a reduced energy supply and growth rate as the consequence of the positive implications on carcass parameters [2]. On the other hand, implications of reduced nutrient supply on carcass qualities can be compensated for by choosing breeds more adapted to the basic fodder on the farm [3]. Some research suspected that there might be a higher risk for the contamination of products with parasites due to a higher rate of outdoor-systems in organic compared to conventional farming [1]. There is a little evidence for a system-related effect on product quality due to the production method. Product quality is primarily a function of farm management, showing a high variability in both organic and conventional livestock production.

MEAT QUALITY

Meat quality is a very brood term describing various kinds of meat parameters interesting to users of meat. For the modern meat consumer, taste and nutritional value are to important quality attributes of meat. The tendency is to focus on the production of edible lean with a minimum of excess visible fat [4], but the fact remains that fat in meat contributes to the eating quality of meat [5], [6]. Recent studies confirm that there is a chemical perception of dietary fat in the oral cavity [7]. It is also widely accepted that the amount and type of fat in meat influence two major components of meat quality notably tenderness and flavor [8]. Technological quality concerns the suitability of the meat for further processing into various meat products, and nutritional quality regards fat content, mineral, bioactive compounds etc.

ORGANIC PRODUCTION EFFECT MEAT QUALITY

Meat quality can be affected by all process in the production line from farm to fork. Treatment of animals during breeding, transport, stunning method, slaughter process, chilling and storage are all factors affecting the final meat quality. The difference between conventional and organic production of meat occurs of farm level and especially organic feeding has a major impact on meat quality.

In organic feed artificial aminoacids are not allowed and it is difficult to obtain raw materials with high protein quality. This results in slow growth rate of the animals, which normally has a negative impact on meat tenderness [9]. Consumers usually rank tenderness as one of the most important eating quality attributes, thus organic feeding is expected to have a negative impact on eating quality [10].

A typical way to adding proteins to organic diet is to use whole seed and seed meal, which are produced vegetable oils. Both meals and whole seeds have a high content of unsaturated fat and this is reflected in the fat tissue of the animals. A high degree unsaturated fat is a technological problem in the meat production [9].

THE DIFFERENCES BETWEEN CONVENTIONAL AND ORGANIC MEAT

The former studies show that organic animal feeding affects meat texture parameters. There was a highly significant effect on both tenderness and hardness of the meat. The conventionally fed animals produced tenderer and less hard meat compared to the organic fed animals. The 100% organic fed animals produced the least tender and the hardest meat [9], [11].

The professional sensory panelist indicated that organic animal meats lest more than 50% fluid during retail storage than conventional animal meat. Organic meat had less meat flavor, more than flavor and was crispier. The high fat flavor was probably caused by a high fat content in the organic meat [12]. Also the meat differentiated only in the surface color, the organic being lighter. A chemical analysis of the chops meat founded that organic meat had a low content of intramuscular fat and a high content of unsaturated fatty acid in the back fat [9], [13].

The fatty acid composition of the back fat was also tested, and fraction of saturated fatty acids was higher in the conventional fed animals and the fraction of unsaturated fatty acids was highest in organic fed animals [9], [12].

CONCLUSION

Organic livestock farming is not a production method to solve all problems in animal production. Also organic livestock farming is challenge not only for the former but also agricultural research and interdisciplinary work. The main conclusion can be summarized in the following statements:

- The slow growth rate up the time of slaughter for organic fed animals has a negative fed animals has a negative impact on meat tenderness
- There seems to be a smaller effect on meat flavor
- The fatty acid composition of fat tissue is more unsaturated in organic fed animals, which can result in technological problems.

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SELECTION OF NATIVE CHERRY LAURELS (PRUNUS LAUROCERASUS L.) IN THE BLACKSEA REGION

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ABSTRACT

This study was carried our pomological traits of native cherry laurel (*Prunus laurocerasus* L.) types which are grown in Samsun, Ordu, Giresun, Trabzon, Rize and Artvin provinces in 2007-2009. The aim of this study was to select the distinguished cherry laurel types from natural flora. Weighted Ranging Method was used to evaluate the types.

Observations on the types were done. Obtained data results was evaluated by Weighted Scaling Method. Weighted Ranging Method was done according to criteria regarding, fruit number per cluster, fruit bigness, fruit weigh, fruit flesh/seed rate, total soluble solids (TSS), fruit taste, acridity and fruit uniformity. As a result of these evaluations, it was determined that 32 types were distinguished than the others. Fruit number per cluster was between 2.0-30.6, fruit bigness were 10.12 – 22.46 mm; fruit weight was 0.69-7.82 g; fruit flesh/seed rates were 10,79 – 16,08; total soluble solids were 2.4-32.0 °Brix, and titratable acid content was between 0.11-1.023 % for the all types.

Key words: *Laurocerasus officinalis* Roemer, pomology, taflan, karayemiş, Turkey

INTRODUCTION

Turkey is a very important area for plant diversity. Many fruit species are grown and many different local or native fruit species and varieties are known. One of these is cherry laurel *(Prunus laurocerasus* L.).

Cherry laurel originated in central and west Asia, southeastern Europe and Anatolia [12], [13]. Cherry laurel is grown as a native fruit crop in the eastern Black Sea region of Turkey, which is one of the origins of cherry laurel [3]. The main crops in this region are hazelnut and tea. Annual precipitation is 831 mm, distributed throughout the year. Annual mean temperature is 14.5 ^{o}C and relative humidity is 75%. Cherrry laurel is consumed in fresh or dried, in jam and marmalade, canned or pickled. Cherrry laurel is used for food additives as flavoring [11]. The leaves and seed of this species are used in pharmacetically. The glossy, dark green leaves are very attractive large and leathery. In early spring, single upright flower clusters are produced. The flower is small white and born in erect panicles. The tree is also valuable for ornamentation as an evergreen broadleaf plant [8]. It is easily propagated by cutting [3].

Cherry laurel is an important fruit for Black Sea region of Turkey. There are many local cultivars like kiraz, su, vavul, bal etc. In this study, it was evaluated on native cherry laurels.

MATERIALS AND METHODS

Tree and fruit characteristics were measured for cherry laurel cultivars, grown in eastern Black Sea region of Turkey, in 2007-2009 years.This area included 6 provinces, 52 town.

Leaf width and length, petiole length and thickness, cluster length and weight were estimated from 10 clusters. Number of fruit per cluster was counted. Fruit weight, fruit width, fruit length, fruit stem length, fruit stem thickness, stone weight, stone width and stone length were also estimated from 20 samples. Soluble solids (°Brix), pH value and titratable acid content (as % malic acid) were determined based on three samples. Fruit color was mesured with minolta CR 400. Types or clones was selected according to Weighted Ranging Method.

RESULTS AND DISCUSSION

Cherry laurel is a vigorous growing species, evergreen tree of 5 to 6 m. Leaves are 13.8 cm long and 5.5 cm wide. Fruit which is conical drupe resembles black cherries. But it grows in clusters similar to grapes. At eating maturity, fruit colour is red to purplish-black. Shape of fruit is roundish to slightly oblate. Fruit with was between 9.72-20.52 mmfruit lengh was between 10.55-24.41 mmfruit weight was 0.69-7.82 g and average fruit weights of 4.85 g. Cluster weight 4.74-126.54 g were recorded. Clusters contain between 2.0-

30.6 fruit (Table 1). Prior to mature fruits are astringent, but become aromatic and suitable for fresh consumption with advancing maturity. Skin is smooth, thin and glossy. Flesh is juicy. Total soluble solids content was between 2.4-32.0 °Brix, and titratable acid content was between 0.11-1.023 % (Table 1). Fruirt color was changed between reddish orange to black, taste was changed poor to excellent, and harvest time was between 28 June and 5 September (Table 2).

Similar studies on cherry laurel types grown inTrabzon, Vakfıkebir and Akçaabat districts of Trabzon recorded number of fruit per cluster, fruit weight, fruit width, fruit length, were determined as 19, 3.28 g, 12 mm and 16 mm [9]; 18, 4.4 g, 17 mm and 19 mm, respectively [10]. In other studies, fruit weight, soluble solids and pH values in cherry laurel types were determined as 5.9 g, 17.6 % and 4.3, respectively [1] and fruit weight was 1,40-5,39 g, TSS was 8,6-21,3 % [2] and fruit weight was 2.06-6.79 g [5]. İslam [7] and Bostan [4] reported that 'Kiraz' and 'Su' cultivars was very juicy and the flesh colour atractive. This cultivar tended to have smaller cluster weight, similar fruit number per cluster and soluble solids.

In coclusion, the cherry laurel is highly promising because of its high number of fruit per cluster and fruit weight and alternative crops sorts . Meanwile the fruit taste or skin and flesh color are desirable. I think that cherry laurel will be an important fruit for future.

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Table 1. Important pomological characteristics of selested native cherry laurel types

Types	Fruit number per cluster	Fruit size (mm)	Fruit weight (g)	Fruit/ Seed	Total soluble solid	Taste
S-15	15.1	19.60	5.20	9.78	16.0	5
S-37	8.8	20.93	6.35	14.26	24.6	4.5
S-47	8.6	17.76	4.62	12.50	23.8	5
O-20	3.3	20.55	5.56	11.70	20.8	5
O-37	6.5	20.50	6.24	16.08	16.2	4
O-38	8.6	19.24	5.17	12.34	19.4	4
O-44	3.3	19.48	5.06	12.33	25.0	4.5
G-7	3.8	19.58	5.27	14.26	22.5	4.5
G-40	12.8	19.06	4.85	13.80	21.0	5
T-22	7.1	19.14	5.40	15.84	23.2	4
T-87	10.7	22.83	6.68	12.16	15.2	3
T-98	5.7	20.04	5.18	11.95	24.0	5
T-159	7.4	19.18	4.38	13.78	21.3	5
T-163	9.3	21.74	5.83	12.00	20.0	3
T-193	8.2	19.12	5.53	14.88	18.2	5
T-203	7.5	19.14	5.32	13.90	19.2	5
T-214	4.3	18.77	4.88	16.16	20.5	5
R-20	7.8	21.59	7.02	14.58	18.2	4.5
R-22	13.6	18.75	4.27	9.01	18.5	5
R-24	6.7	20.77	5.48	11.10	20.5	5
R-25	10.6	20.34	5.72	11.75	20.0	5
R-27	17.1	19.53	4.67	9.52	19.8	5
R-28	15.6	19.27	4.69	10.51	18.0	5
R-107	6.4	22.54	6.50	11.10	17.2	4
R-126	5.1	19.53	5.62	13.33	22.7	5
R-135	10.0	19.69	6.02	14.82	21.8	4
R-136	11.7	19.64	6.23	14.91	18.8	4
R-149	12.5	20.09	6.46	16.17	20.0	3
A-4	5.2	24.48	9.24	16.27	18.0	4
A-14	12.8	20.84	6.05	12.53	18.4	4
A-19	12.6	19.50	5.67	12.83	21.1	5
A-23	7.3	19.42	5.64	16.06	17.9	5

Table 2. Color and organoleptic characteristics, harvest time period in cherry laurel

Types	Fruit Color	Taste	Harvest Time
S-15	Reddish black	Perfect	10-30 July
S-37	Reddish black	Perfect	21 August-10 Sep.
S-47	Black	Perfect	21 August-10 Sep.
O-20	Black	Perfect	10-30 July
O-37	Black	Good	01-20 August
O-38	Reddish black	Good	01-20 August
O-44	Black	Perfect	10-30 July
G-7	Black	Perfect	10-30 July
G-40	Reddish black	Perfect	01-20 August
T-22	Black	Good	01-20 August
T-87	Reddish black	Fair	10-30 July
T-98	Black	Perfect	01-20 August
T-159	Black	Perfect	01-20 August
T-163	Black	Fair	10-30 July
T-193	Black	Perfect	10-30 July
T-203	Black	Perfect	10-30 July
T-214	Black	Perfect	10-30 July
R-20	Red	Good	01-20 August
R-22	Reddish black	Perfect	01-20 August
R-24	Black	Perfect	01-20 August
R-25	Black	Perfect	01-20 August
R-27	Reddish black	Perfect	01-20 August
R-28	Reddish black	Perfect	01-20 August
R-107	Reddish black	Good	01-20 August
R-126	Black	Perfect	01-20 August
R-135	Black	Good	21 August-10 Sep.
R-136	Black	Good	21 August-10 Sep.
R-149	Reddish black	Fair	01-20 August
A-4	Reddish black	Good	01-20 August
A-14	Reddish black	Good	01-20 August
A-19	Reddish black	Perfect	21 August-10 Sep.
A-23	Black	Perfect	01-20 August

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IMPACT OF CLIMATE CHANGE ON WHEAT PRODUCTIVITY IN IRAN

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ABSTRACT

Agricultural is most important of economics activity. Climate change continues to have major impact on crop productivity all over the world That it depended to climate change, in this research, was been studied abut effect of time climate change on wheat productivity, at base of time series and cross-section data for 14 province from 1992 to 2005 Iran. Wheat input and output data are from state statistics organization agricultural Yearbook and hydrology organization .in study used Cobb-Douglas function with two methods of OLS, GMM. The results show that positive effect rainfall and effect temperature negative variables were been two methods in each province, also change productivity dependent to rainfall. Rainfall and temperature growth on productivity was 0/9,-0/95 percentage.

Keyword: wheat productivity, climate change, panel data

INTRODUCTION

Impact of climate change on Iranian wheat productivity in Iran

The adoption of modern varieties and the increased use of irrigation and fertilizers during Green Revolution dramatically increased crop yields all over the world (Evenson and Gollins 2003b; Rosegrant and Cline 2003). The Green Revolution enabled food production in developing countries to keep pace with population growth (Conway and Toenniessen 1999). Crop yield growth has slowed since 1990s (Evenson and Gollins 2003b; Rosegrant and Cline 2000). But continued crop yield increases are required to feed the world in the 21st century (Rosegrant and Cline 2003; Cassman 1999) given the continuing decline of area suitable for grain production due to urbanization and industrialization. Food security, in particular in developing countries, remains a challenge. This challenge is made worse by the adverse effect of predicted climate change in most food insecure developing countries (Rosenzweig and Parry 1994).

Given the large body of research that has been done to quantify the contributions of crop productivity (Evenson and Gollins 2003a; Evenson and Gollin 2003b), we know factors such as modern varieties, increasing input use, and better farm management contribute greatly to crop yield growth. However, our knowledge on the impact of climate on crop productivity remains quite uncertain. While many researchers have evaluated the possible impact of global warming on crop yields using mainly indirect crop simulation models (e.g., Rosenzweig and Parry 1994; Brown and Rosenberg 1997; Reilly et al. 2003; Liangzhi et al 2005), there are relatively few direct assessments on the impact of observed climate change on past crop yield and growth except for a few studies (Nichalls 1997; Carter and Zhang 1998; Naylor et al. 2002; Lobell and Asner 2003; Peng et al. 2004). In a recent study, Peng et al (2004) reported that rice yields decline with higher night temperatures. Lobell and Asner (2003) showed that corn and soybean yields in the US could drop by as much as 17 percent for each degree increase in the growing season temperature. Though climate is the major uncontrollable factor that influences crop development, it is difficult to separate this influence from other factors such as the increased use of modern inputs and intensified crop management that were introduced during the Green Revolution. In fact, one major concern for the above-mentioned studies is the simplification of approximating such no climate contributions as a linear trend (Gu 2003; Godden, Gatterham and Drynan 1998).

In this paper, we use crop-specific panel data to investigate the climate contribution to Iran's wheat yield growth. We find that global warming has a significantly negative impact on wheat yield in Iran, but the magnitude of impact is less than those reported by previous studies in other regions.

DATA AND METHOD

We use time series and cross-section data from 1992 to 2005 for fifteen major wheat producing provinces in Iran and the corresponding climate data such as temperature and rainfall during this period. Wheat input and output data are from State Statistics

Yearbook (1992-2005) and Iran's Rural Statistical Yearbook (1992-2005) published by Iran's National Statistical Bureau, and Iran Agricultural Cost and Return Yearbook (1992- 2005) published by Iran's Price Bureau. Climate data are from Climate Research Unit at Hydrology Iran. The provincial climate parameters are calculated by averaging all the values of those pixels within the provinces. Iran grows both winter wheat and spring wheat. The majority of wheat production in Iran, about 80-90 percent, is winter wheat. Winter wheat is grown throughout most of eastern and southern Iran while spring wheat in northeast and western Iran. Both winter and spring wheat are grown in Northern Iran. The growing season for wheat varies from province to province. The annual climate data are monthly averages during the wheat growing seasons, taking account of the changing growing seasons by province.

The analytical challenge is to separate the non-climate effect on crop yields from the climate change effect. We hypothesize the crop yield as a function of crop inputs, technology, management, land quality, and climate factors. The initial explanatory variables for the yield equation include inputs such as chemical fertilizer, seeds, pesticide, machinery and other physical inputs; regional production specialization; climate variables such as temperature and precipitation; a set of regional dummy variables. Our own estimation confirms this finding: labor and draft animals have a negative sign for wheat yield equation, indicating the impact of these two variables on yield were negligible. Therefore the inputs of labor and draft animal are not included in the model. The physical inputs are measured in expenses per unit harvested area, and are selected based upon the sign and level of statistical significance. We included chemical fertilizer, seeds, pesticide, machinery, individually and combined the rest of inputs into an aggregated category of "other inputs". The regional production specialization variable is represented by the share of wheat area in total crop area in that province. This variable is created to reflect the other factors such as soil quality and other regional government supports to wheat production. It is expected that the regions with a higher share of the crop production have better suitable land and better environment for wheat production and therefore higher wheat yield. Admittedly, this variable may be a potentially endogenous variable, as the trade-off between how much area to grow in a grain crop and how much to grow in a cash crop depends on trade-offs that involve yields and relative productivity and profitability. The Hausman-Wu procedure (Wu 1973; Hausman 1978) was used to test the exogeneity of the share of area under wheat. Predicted wheat areas are not significant in the test equation, indicating that it is exogenous for the yield equation. A set of regional dummy variables are used to represent time-persistent, regional differences in social, economic, and natural endowments not accounted for by the other variables. During our study period (1992 – 2005)

Finally, a Cobb-Douglas form of wheat yield function is specified as follows:

$$\ln Yield_{it} = (\alpha_0 + \alpha_1 t) + \sum_j \beta_j \ln X_{jit} + w \ln Climate_{it} + \sum_{i=1}^{2} r_i D_i + \varepsilon_{it}$$

The seven regions in Iran are: Northeast (Tabriz, ardabil), North (Golestsn, Oromih), Northwest (Khorasan), Central (Tehran,Qazvin,Asfehan), Southeast (Lorestan,kermanshah,Hamedan), South (Khozwstan, Fars).

Where ln is natural log, t = 1, 2, …, 22 denotes observations from the years from 1992 to 2005. Yieldit refers to wheat yield for Iran's province i at time t (the time trend from 1992 to 2005); X represents the conventional inputs per hectare of sown wheat area including seeds, fertilizer, pesticide, machinery, and other inputs such as irrigation, manure, and animal power; Climate is the climate variables including temperature and rainfall during wheat growing season. We include a set of regional dummy variables, Dr, to represent time-persistent, regional difference in social, economic and natural endowments not accounted for by other variables. α, β, w, r are parameters to be estimated and ε is the error term.

ESTIMATION AND RESULTS

We first perform Augmented Dickey-Fuller Unit Root Test to test the stationary of both dependent and independent variables. Result is showed in tabel1, No problems are found.

Table 1- Estimation Dickey-Fuller Unit Root Test

Explanatory variables	**Levin, lin and chu**	**probablity**
Ln Fertilizer	-4.184**	0.00
Ln Seeds	7.362***-	0.00
Ln Pesticide	4.376**-	0.00
Ln Machinery	-7.56***	0.00
Ln Temperature	-2.769*	0.003
Ln Precipitation	-3.42**	0.003
Ln yield	-9.445***	0.003

*, ** and *** represent 0.10, 0.05 and 0.01 levels of statistical significance, respectively.

The model is estimated by Eviews 5 package. Since the OLS (ordinary linear square) and GMM (Generalized method of Moments) estimation have autocorrelation problems, we also estimated Equation (1) using and autoregressive error model with one year lag

(AR1). The constant variance error (no heteroscedasticity) assumptions are examined by plots between the predicted values and residuals using AR1 estimation. The plot (not reported here) shows that the assumptions for Equation (1) is reasonably held. We also examine another plot between predicted value and time trend and found no autocorrelation problem. Another potential problem may be omitted variable bias where some temperature-related variables (such as disease or pests) that affect wheat yield but have been left out of Equation (1). We perform the Ramsey (1969) regression specification error test (RESET) for omitted variables. The test is passed (P> 28percent). The assumptions of normal distribution for errors, outliers, and linearity are also diagnosed and these assumptions are found to still hold. In addition, we estimate the equation with both fixed-effects and random-effects but found little difference.

The estimated results are reported in Table 1. The OLS (ordinary linear square) estimates for all parameters for physical inputs are significant at the 10 percent level or below with the expected signs.

Table 2-Estimated wheat yield function in Iran 1992-2005. Dependent variable =Ln(wheat yield). Numbers in parentheses are t-values.

Explanatory variables	**OLS**	**GMM**
Constant	**1.758(3.69)****	**5.43(3.33)****
Ln Fertilizer	**0.066(2.16)***	**0.3(2.17)***
Ln Seeds	**0.4(2.64)****	**0.62(1.29)***
Ln Pesticide	**-0.017(1.54)***	**-0.22(1.69)***
Ln Machinery	**0.049(1.84)***	**0.25(1.58)***
Ln Temperature	**-0.084(-3.18)***	**-0.09(-1.9)***
Ln Precipitation	**0.067(1.81)**	**0.36(4.22)*****
Time	-	**0.01(0.25)**
Regional Dummy (North)	**0.042(1.36)***	**0.5(1.54)***
Regional Dummy (South)	**-0.008(-1.03)**	
Regional Dummy (Northwest)	**0.02(2.19)***	
Regional Dummy(Southwest)	**-0.054(2.26)****	**0.13(1.02)**
Regional Dummy(Central)	**-0.05(-2.12)***	**-0.26(-2.1)***
Degree of freedom	**215**	**216**
Adjusted *R2*	**0.84**	**0.68**

*, ** and *** represent 0.10, 0.05 and 0.01 levels of statistical significance, respectively

The AR1 estimates differ slightly from OLS, GMM with some improvements, and all parameters are still significant at the 10 percent level or below. So we will only refer to the AR1 results in the rest of the paper. As expected, the regional specialization is positively correlated with wheat productivity. The regional dummies in North, Northwest, Central, and Southwest Iran are statistically significant.

We find no significant relationships between wheat yield and rainfall and Temperature However, the temperature has a significantly negative effect on wheat yield. Because we use double-log functional form, the estimated coefficients are elasticities in the above equation. The coefficient for temperature, –0.084, means a one percent increase of growing season temperature could reduce wheat yield by 0.084 percent. On the other hand, coefficient for precipitation has positive 0.067 on wheat yied, means a one percent increase of growing precipitation might increase wheat yield by 0.067 percent.

Since our major focus is to measure the contribution of growing season temperature on wheat yield, it is convenient to treat other terms in Equation (1) as “residual” effect. By subtracting the non-climate terms from the wheat yield, we single out the wheat yield change due to climate change. We define $Yield^{C\lim ate}$ as:

$$\ln Yield^{C\lim ate} = \ln Yield_{it} - (a_0 + a_1 t) - \sum_{j=1}^{4} b_j \ln X_{jit} - \sum_{l=1}^{5} r_1 D_1$$

This estimated effect of temperature on wheat yield is smaller than the previous four studies: rice in Philippines (Peng et al. 2004), wheat in Australia (Nichalls 1997), corn and soybean in USA (Lobell and Asner 2003), wheat in china (Liangzhi et al 2005) Table 3 shows the comparison among these studies. The reason for this is two-fold: this might reflect the nonlinear effect of physical inputs and crop management on crop yields (Gu 2003; Godden, Batterham and Drynan 1998), or imply that the temperature effect on crop yields varies from one region to another, or from crop to crop.

Table 3 - Comparison: Impact of 1oC increase of growing season temperature

Study	Crop	Location	Impact
Nichalls (1997)	Wheat	Australia	+30~+50%
Lobell & Asner (2003)	Corn, Soybean	USA	-17%
Peng et al (2004)	Rice	Philippines	-10%
Liangzhi et al (2005)	Wheat	China	-2%~-5%

To assess the relative contribution of rising growing season temperature on the wheat yield, we take the first derivative of Equation (1) with respect to t (Lin 1992; Fan and Pardey 1997; Liangzhi et al 2005).

$$\ln Yield_{it} = (a_0 + a_1 t) + \sum_j b_j \ln X_{jit} + w \ln Climate_{it} + \sum_{I=1}^{2} r_i D_i + e_{it}$$

Table 4 reports the growth accounting based on the estimate of the wheat yield function in column 1 of Table 2. The total wheat yield growth from 1992 to 2005 was 78.88 percent. From the accounting in Table 4, it appears that 77.55 percent of this yield growth comes from increased use of physical inputs. Rising temperature attributed to 0.76 percent of decline in wheat yield. This negative contribution is relatively small compared to that of physical inputs, which underlines the necessity of including physical inputs in the regression analysis of crop yield-climate interactions.

Table 4 -Accounting for wheat yield growth. The estimated coefficients are taken from Table 2, and the change in explanatory variable refers to percentage growth of that variable from 1979-81 to 1998-2000 (three year averages are taken to avoid atypical year). The numbers in parentheses are the percentage shares of contribution to total wheat yield growth, with total yield growth set at 100.

	1992-2005			
Contribution to growth (3)=(1)X(2)	Change in explanatory variable(2)	Estimated Coefficient (1)		Explanatory variable
77.55				INPUTS
10.2(12.9)	154	0.066	Chemical fertilizer	
2.7(3.3)	154	0.017	Pesticide	
26.8(1.2)	547	0.049	Machinery	
37.6(47.7)	94	0.4	Seeds	
-0.76(0.95)	11.3	-0.084		Temperature
0.95(0.9)	11.2	0.067		Precipitation
78.88(100)				TOTAL GROWTH

Finaly Uses of Sensitivity Analysis how the optimal solution changes in different circumstances .SA can be used to assess the "riskiness" of a strategy or scenario. By observing the range of objective function values for the two strategies in different circumstances, the extent of the difference in riskiness can be estimated and subjectively factored into the decision. Table 5 reports the different scenario on the estimate of the wheat yield provinces in Iran. Effect the different scenario show rainfall affecter than Temperature. In this scenario 1-4 temperature is fix and precipitation increasing or decreasing; golestan, lorestan and tabriz most reflect to change precipitation .on the other hand in scenario 5-7 precipitation is fix and temperature increasing or decreasing; most change is in khozestan. Also scenario 8-10 precipitation and temperature increasing or decreasing;

Table 5- Accounting different scenario for wheat yield provinces

Provinces/senario	1	2	3	4	5	6	7	8	9	10
Temperature	0	0	0	0	15	7	-5	15	7	-15
Precipitation	15	-10	7	-5	0	0	0	5	-5	-10
Ardabil	0.22	-0.15	0.11	-0.07	-0.01	-0.006	0.004	0.09	-0.07	-0.016
Oromih	0.48	-0.32	0.22	-0.16	-0.02	-0.007	0.005	0.18	-0.15	-0.34
Asfehan	0.19	-0.13	0.09	-0.06	-0.03	-0.01	0.008	0.09	-0.05	-0.15
Tabriz	0.62	-0.42	0.29	-0.21	-0.02	-0.009	0.006	0.23	-0.2	-0.43
Tehran	0.35	-0.23	0.17	-0.12	-0.03	-0.01	0.006	0.14	-0.11	-0.26
Khorasan	0.41	-0.27	0.19	-0.14	-0.02	-0.01	0.007	0.19	-0.13	-0.29
Khozestan	0.4	-0.27	0.19	-0.14	-0.05	-0.03	0.02	0.18	-0.11	-0.32
Fars	0.41	-0.27	0.19	-0.14	-0.03	-0.013	0.009	0.16	-0.12	-0.03
Qazvin	0.5	-0.33	0.23	-0.17	-0.02	-0.009	0.007	0.19	-0.16	-0.35
Golestan	0.76	-0.53	0.37	-0.26	-0.02	-0.01	0.008	0.29	-0.25	-0.55
Hamedan	0.44	-0.29	0.21	-0.15	-0.02	-0.009	0.006	0.23	-0.2	-0.43
Kermanshah	0.38	-0.25	0.18	-0.13	-0.02	-0.01	0.007	0.15	-0.23	-0.28
Lorestan	0.74	-0.49	0.35	-0.25	-0.02	-0.01	0.005	0.26	-0.24	-0.51

CONCLUSION

While the majority of wheat productivity increase is due to increase use of physical inputs and the institutional change, the gradual increase in growing season temperature and precipitation in the last few decades has had a measurable effect on wheat productivity. In this paper, we have evaluated the impacts of climate and non-climate factors on wheat yield growth in Iran, and find that a one percent increase in wheat growing season temperature reduces the yield by about 0.084 percent. The rising temperature from 1992- 2005 cut wheat yield growth by 0.76 percent. There is a deficiency in the current literature about how to measure the influence of climate on productivity. Authors frequently fail to distinguish between climate factors and the influence of modern inputs and management practice on productivity. We emphasize the necessity of including such major influencing factors as physical inputs into crop yield-climate functions in order to have an accurate estimation of climate impact on crop yields. With so much uncertainty on the potential impacts of climate change, it is essential to first evaluate what past climate changes have had on agricultural productivity. Our study demonstrates a clear need to synthesize climate and crop-specific management and inputs data in order to investigate the impact of climate change.

In Iran, providing enough food to feed over 72 million people is always a challenge.

There is an increasing concern about the impacts of climate change on Chinese food security.

Our study shows that climate change does have a measurable negative impact on wheat

Productivity. This negative impact would probably become worse with accelerating change of future climate. Our study demonstrates the need to consider climate change and its effects on crop productivity in order to meet the food security goals in Iran as well as in other developing countries. There is also a need to extend such studies to other regions, in particular to food insecure countries where climate change would have the most severe adverse impact on crop productivity.

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ORGANIC AGRICULTURE: MODERN TOOL TO MITIGATE CLIMATE CHANGE

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ABSTRACT

A field experiment was conducted to know the effect of organic nutrient sources on sweet sorghum for juice and ethanol production at Bangalore (India) during kharif 2006 under rainfed conditions. In ten different treatments recommended dose of fertilizer produce higher millable stalk, juice and ethanol yield (51.85 tonnes/ha, 21.93 kilolitre/ha and 745.62 litres/ha, respectively), followed by integration of organic and inorganic sources which was attributed to the increase in growth and yield parameters. Similarly, juice yield and ethanol yield was also significantly superior due to juice quality parameters and juice yield; on contrary, pure organic sources not superior but challenged to provide promising millable stalk and ethanol production in a hectare (44.44 tonnes/ha and 619.75 litres/ha respectively). This shows bright future for biofuel through organic sources without threatening environmental pollution and climate change.

Keywords: organic agriculture, panchgavya, biofuel, sweet sorghum, ethanol, compost

INTRODUCTION

Organic agriculture is a systematic and encompassing approach to sustainable livelihoods as a farming system. But, to mitigate the anticipated danger of global changes in the environment and energy sustainability, organic agriculture found robust and giant leap in the modern era of farming. Intensive input based Green Revolution jeopardizes the current generation with unprecedented situation due to petroleum based chemical fertilizers and herbicides which cause loss of ecosystem, health and food.

Sweet sorghum is special purpose sorghum with a sugar-rich stalk, similar to sugarcane. Besides having rapid growth, high sugar accumulation, and biomass production potential, sweet sorghum has wider adaptability given that water availability is poised to become a major constraint to agricultural production, in coming years cultivation of sugarcane constrained by water scarcity. Sweet sorghum uses less N and water compared to maize [8], and can yield more ethanol production per acre with fewer inputs [10]. Burning petroleum for power contributes to a major portion of carbon dioxide emissions to the atmosphere, raising concerns about global climate change.According to the Federation of Indian Chambers of Commerce and Industry (FICCI), India could save nearly 80 million L of petrol annually if petrol is blended with alcohol by 10 per cent [3]. The requirement of ethanol in India to blend with petrol (10 %) is about 1000 million L and for blending with diesel (5 %) another 3000 million L per annum. Total ethanol requirement including other purposes is 5000 million L per annum. The possible ethanol production from available sugarcane molasses (8.2 million t) and other sources is 2000 million L per annum. This leaves a deficit of 3000 million L of ethanol per annum. The existing distilleries operate at 50 % efficiency and needs alternate raw material(s) to operate at their full efficiency [2].

In the United States, fuel ethanol production grew from virtually nothing in 1980 to about 8100million litres (2100 million gallons) by 2002. Although Brazil is the leading producer of fuel ethanol in the world today, ethanol use is growing faster in the United States due to environmental concerns, and a federal renewable fuels standard (RFS) appears likely that could triple ethanol use at the end of ten years, propelling the United States ahead of Brazil. However, other countries including Canada (around 100million litres or 26million gallons in 2002), France (116 million litres or 31million gallons in 2002, mostly from beet sugar), and Spain (100 million litres or 26million gallons in 2002 from grain, and an expected output of 325million litres or 86million gallons by 2006 which would place the country as the first producer of fuel–ethanol in Europe) also produce ethanol, and the European Commission has the goal of substituting 8% of conventional vehicle fuels with ethanol and biodiesel by 2020 to reduce greenhouse gas emissions [24].The underutilization of the existing molasses-based ethanol distilleries and the deficit in ethanol requirement can be made good if sweet sorghum cultivation is promoted for ethanol production.

A wealth of information is available on the beneficial effects of the individual organic manures or inorganic fertilizers. However, information on effect of organic source of N on growth, juice quality and yield with particular reference to sweet sorghum is meagre. With this background in view, a field experiment was carried out at the Zonal Agricultural Research Station, Gandhi Krishi Vignana Kendra (GKVK), Bangalore (India) during kharif 2006 under rainfed conditions, to find out the effect of organic nutrient management practices on the stalk yield and juice quality of sweet sorghum for ethanol production.

MATERIAL AND METHODS

Site characteristics

A field experiment was carried out at Zonal Agricultural Research Station, GKVK, University of Agricultural Sciences, Bangalore located at 120 580N latitude and 770 350E at 930 MASL (mean above sea level) during kharif 2006 under rainfed conditions on the red sandy loam soils with pH 6.97, organic carbon 0.62 per cent, low in available N, medium in available phosphorus and potassium of 246.50, 29.20 and 221.30 kg ha-1, respectively.

Cultural methods

In an advance, for conducting an experiment some traditional locally practiced organic nutrient sources were prepared. Panchagavya is prepared from the five products of indigenous cow i.e., cow dung, cow urine, cow milk, curd, cow ghee and additives like sugarcane juice/jaggery, coconut water and ripe banana which were used in preparation. Panchagavya proved to be an organic growth promoter and boost the plant hormones to resitance against the infectious disease and some harmful insects. It found promising in flowering of crops and resulted in higher yield production [18]. Beejamrutha was prepared by using cow dung and lime water for better vigourness and growth of plant seed as seed treatment and Jeevamrutha was prepared by using cowurine, cowdung, jaggery, Bengal gram flour and one handful of soil from the field for the soil application to enhance the microbial fauna. The organic manures viz., compost, vermicompost and neem cake was analyzed for available N content [9] which was approx. 1.12, 1.65 and 1.9 percent, respectively and manures applied equivalent to N requirement through recommended dose in amount of 8.93, 6.05 and 5.26 t ha-1, respectively as soil application. There were ten treatments laid out in Randomized Complete Block Design (RCBD) with three replications. The details are as below.

T1: 100 % recommended N through compost

T2: 75 % recommended N through compost + 25 % recommended N through neemcake (top dressing)

T3: 75 % recommended N through compost + 25 % recommended N through vermicompost (top dressing)

T4: 100 % recommended N through compost + panchagavya @ 1% (spraying at 30 DAS and flowering stage)

T5: 100 % recommended N through compost +Subhash Palekar's method [beejamrutha (seed treatment) + jeevamrutha (soil application) + straw mulch]

T6: 100 % recommended N through compost + biofertilizers (Azospirillum + Azotobacter +PSB)

T7: Subhash Palekar's method [beejamrutha (seed treatment) + jeevamrutha (soil application) + straw mulch]

T8: 75 % recommended N through compost + 25 % recommended N through fertilizers

T9: Recommended dose of fertilizers @ 100:75:40 kg N:P2O5:K2O ha-1

T10: Control

The sweet sorghum cultivar 'SSV-74' was sown in rows 45 cm spaced at 15 cm intrarow spacing on July, 2006. Irrigations were provided to maintain optimum soil moisture throughout the crop growth. Four to five days before sowing, well decomposed compost was incorporated and mixed into the soil for each plot as per the treatments. A day before sowing Jeevamrutha was sprayed at the rate of 500 litre ha-1. Panchagavya was sprayed at 1% solution at 30th day after sowing and at flowering stage.

On the day of sowing, Beejamrutha and biofertilizers (Azospirillum, Azotobacter and Phosporus Solubilising bacteria PSB) were applied as seed treatment. Vermicompost and neem cake were top dressed after eight days of sowing by opening shallow furrows at the required row spacing. Recommended dose of fertilizer at the rate of 100:75:40 kg NPK ha-1 were placed as per treatments and thoroughly mixed into the soil (fig. 1). Urea, single super phosphate and muriate of potash were used as nutrient sources. Nitrogen was applied in three equal splits, first application at the time of sowing and remaining at 20th and 40th day after sowing. The entire quantity of P2O5 and K2O was applied at the time of sowing as basal dose.

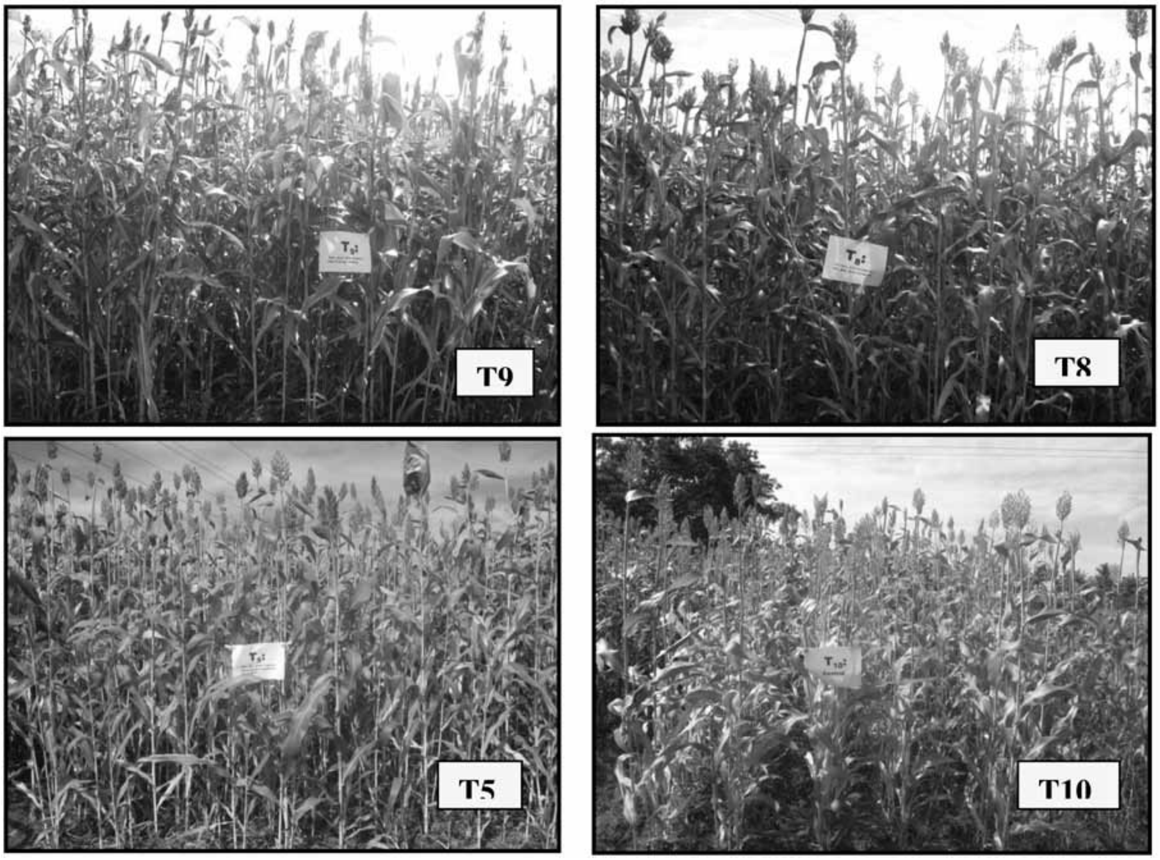

Fig.1. Growth of sweet sorghum at 75 DAS: (T9) application of recommended dose of fertilizer (100:75:40 kg NPK ha-1); (T8) application of 75 % rec. N through compost + 25 % rec. N through fertilizer; (T5) application of 100 % rec. N through compost + Subhash Palekar's method; (T10) control

Plant measurements

The biometrical (crop growth, yield parameters, millable stalk) observations were recorded at various growth stages (viz., seedling emergence, 30, 45, 60, 75 days after sowing and at harvest) of the crop.

Calculations

The yield components, millable stalk yield and total biological yield (t ha-1) juice yield (kl ha-1) and quality parameters with ethanol (l ha-1) were recorded and calculated at 90 days after sowing. The juice pH was determined by using pH meter following the standard procedure [13]. Juice brix values were recorded by using hand refractometer and the specific gravity of juice is calculated as the ratio of juice weight to juice volume and expressed in g cc-1. Reducing and non-reducing sugars in juice sample were estimated following the standard procedure [15] [11] and expressed in terms of g per 100 ml of juice; similarly the ethanol was estimated by colorimetric method [6].

Statistical analysis

Data recorded on various characters were subjected to Fisher's method of analysis of variance and interpretation of data was done according to standard method [21]. The level of significance used in 'f' and't' tests were P = 0.05, critical difference values were calculated wherever the 'f' test was significant.

RESULTS AND DISCUSSION

Effect on Growth and Yield

Different nutrient sources showed varied nature of effect on sweet sorghum millable stalk and ethanol yield. Application of recommended dose of fertilizer (RDF) i.e., T9 showed significant improvement and increased millable stalk, juice and ethanol yield

(51.85 t ha-1, 21.93 kl ha-1 and 745.62 l ha-1, respectively), however, it was on par with the application of 75 % recommended N through compost + 25 % recommended N through fertilizers (46.80 t ha-1, 18.82 kl ha-1 and 649.29 l ha-1, respectively) shown in figure 2 & 3. Inorganic fertilizer sole and in integration performed significantly well in higher millable stalk yield which was attributed to higher dry matter production per plant, taller plants, more number of internodes, length of internode and stem girth (table 1). Similar results were corroborated with the findings of previous work also [20] in silage sorghum where integration of inorganic and organic nutrient source work as ultimate source to provide immediate and subsequent nutrition requirement overall plant growth. Early seedling emergence, significantly higher leaf area index (LAI) and number of leaves in these treatments were responsible for high solar radiation interception, carbon dioxide assimilation coupled with better nutrients availability (Table 1). These results are in conformity with other relevant works [7] [22] [19] of different sorghum cultivars.

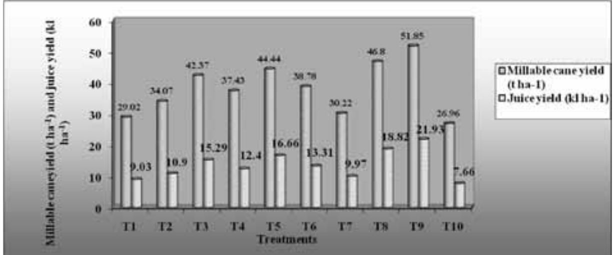

Fig 2. Millable cane yield (t ha^{-1}) and Juice yield (kl ha^{-1}) of sweet sorghum as influenced by organic sources of nutrients

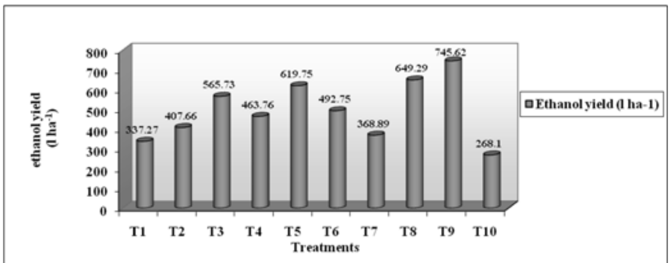

Fig 3. Ethanol yield (l ha^{-1}) of sweet sorghum as influenced by organic sources of nutrients

Our experiments have shown that organic composts have considerable potential for improving plant growth significantly and ultimately yield when used as amendment to soil (table 1) compared to control.

Millable stalk, juice and ethanol yield of sweet sorghum recorded with the application of 100 % recommended N through compost + Subhash Palekar's method (44.44 t ha-1, 16..6 kl ha-1 and 619.75 l ha-1, respectively) were intermediate as compared to RDF and integration of organics and inorganics.

Further studies reported higher millable stalk yield of sweet sorghum with urban compost at 16 t ha-1 (40.48 t ha-1) also [23].

This may be attributed to the values of growth (data not shown) and yield parameters may be due to release of nutrients slowly overall growth of plants, rest of the nutrient sources shown not satisfactory growth improvement but the effect of compost or vermicompost on plant growth depends on the source of material used for compost or vermicompost preparation, role of microorganisms and nutrient content.

Table 1. Growth and yield parameters of sweet sorghum as influenced by different organic sources of nutrients.

Treatment	Days to seedling emergence	No. of leaves at 75 DAS	Plant height (cm) at harvest	Leaf area index (LAI) at 75 DAS	Total dry matter accumulation (g plant^{1}) at harvest	Number of internode	Length of internode (cm)	Girth of stem (cm)
T1: 100% Rec. N through C	7.3	10.5	236.3	3.86	78.17	9.9	21.1	1.7
T2: 75% Rec. N through C + 25% Rec. N through NC	7.3	10.8	240.1	4.09	86.83	10.7	22.9	2.0
T3 : 75% Rec. N through C + 25% Rec. N through VC	6.7	11.1	247.4	4.83	100.83	11.1	23.7	2.1
T4 : 100% Rec. N through C + PG	6.7	10.9	240.7	4.35	88.0	10.7	23.1	2.0
T5 : 100% Rec. N through C + SP method	6.7	11.7	258.1	5.02	102.67	11.3	24.6	2.2
T6 : 100% Rec. N through C + BF	6.3	11.0	240.7	4.53	91.83	10.9	23.5	2.1
T7: SP method	6.7	10.7	237.1	3.88	85.5	10.3	22.1	1.8
T8: 75% Rec. N through C + 25% Rec. N through Fertilizers	6.3	11.9	266.2	5.78	123.33	11.4	25.9	2.4
T9: RDF (100:75:40 kg N:P2O5:K2O ha-1)	5.7	12.5	274.3	5.94	126.5	11.5	26.0	2.4
T10: Control	7.3	8.8	209.1	3.00	72.83	10.1	21.9	1.5
S.E.m±	0.4	0.6	10.7	0.24	3.66	0.4	0.9	0.1
CD at 5%	NS	1.6	31.8	0.70	10.89	NS	2.5	0.2

NS: Non significant; DAS: Days after sowing C: Compost @ 8.9 t ha-1; NC: Neem Cake @ 5.26 t ha-1; PG: Panchagavya @ 1%

(spraying at 30 DAS and flowering stage); VC: vermicompost @ 6 t ha-1; SP method: Subhash Palekar's method [Beejamrutha (seed treatment) + Jeevamrutha (soil application) + Straw mulch]; BF: Biofertilizers (Azospirillum + Azotobacter + phosphate solubilising bacteria)

Possible reason might be the short term only a season application of these compost had slow release of nutrients from these organic sources which doesn't match the nutrient demand of intensive nutrient consuming sweet sorghum even under favourable environment and soil moisture conditions but had great chance for more improvement as soil health increased under this experiment through organic sources (data not shown). Similar results are in conformity with earlier researches [16] [17] which recorded improvement in stalk yield of sweet sorghum under composts.

Effect on juice quality and ethanol

In the present study it was also observed that due to higher millable stalk, juicy and succulent stalks of stem with thicker diameter, resulted significantly higher juice extractability and juice extraction per cent (423.71 ml kg-1 and 42.3 %, respectively) with RDF (T9) which was followed by integration of fertilizer with compost (T8) (409.39 ml kg-1 and 40.2 %, respectively) (Table 2). Other previous observation also reported similar findings of higher juice yield in sweet sorghum [14] [12], whereas, few works found similar findings with 120 kg N ha-1 application [5]. The availability of N throughout the active growth period may be the cause for higher juice yield. Considering the organic nutrient sources, the observation follow the same trend of previous yield parameters and application of 100 % recommended N through compost + Subhash Palekar's method (T5) recorded intermediate juice yield which was 30.28 per cent lower than RDF application.

Table 2. Juice quality parameters of sweet sorghum as influenced by organic sources of nutrients

Treatment	Juice extraction %	Juice extractability (ml kg-1)	Brix (%)	Reducing sugar (g 100 ml-1 of juice)	Non-reducing sugar (g 100 ml-1 of juice)
T1: 100% Rec. N through C	31.2	311.24	12.0	3.88	8.05
T2: 75% Rec. N through C + 25% Rec. N through NC	32.7	329.87	12.5	3.60	8.85
T3 : 75% Rec. N through C + 25% Rec. N through VC	36.1	366.95	14.4	3.80	10.54
T4 : 100% Rec. N through C + PG	33.0	330.91	14.2	4.92	9.18
T5 : 100% Rec. N through C + SP method	37.5	375.96	13.0	3.68	9.25
T6 : 100% Rec. N through C + BF	34.3	344.40	13.8	1.36	12.36
T7: SP method	32.0	317.72	12.0	3.72	8.23
T8: 75% Rec. N through C + 25% Rec. N through Fertilizers	40.2	409.39	15.0	1.43	13.43
T9: RDF (100:75:40 kg N:P2O5:K2O ha-1)	42.3	423.71	14.0	3.50	10.38
T10: Control	28.4	250.98	13.0	1.22	11.71
S.E.m±	1.3	25.21	0.2	0.05	0.19
CD at 5%	3.8	74.89	0.6	0.14	0.55

C: Compost @ 8.9 t ha-1; NC: Neem Cake @ 5.26 t ha-1; PG: Panchagavya @ 1% (spraying at 30 DAS and flowering stage); VC: Vermicompost @ 6 t ha-1; SP method: Subhash Palekar's method [Beejamrutha (seed treatment) + Jeevamrutha (soil application) + Straw mulch]; BF: Biofertilizers (Azospirillum + Azotobacter + phosphate solubilising bacteria)

Table 2 shown higher brix (%) with RDF (14.0%) and fertilizers with compost (15.0%), which was responsible for higher ethanol production. Results are in conformity with earlier work [1], however, application of 100 % recommended N through compost alone recorded

54.77 per cent lower ethanol yield in respect of RDF. Thus, application of composts used in the studies at higher concentrations was antagonistic, rather than synergistic to plant growth. Reducing and non-reducing sugar found lower with RDF and integration with compost as compared to other treatments. Certain findings also revealed decrease in juice quality with increase in nitrogen application [4].

CONCLUSIONS

Therefore, despite better performance recorded with inorganic sources, there is still room in the concern of environmental safety for the use of organic by-products which in turn not only improve the soil health but also have great potential to increase the productivity of stalk and juice yield. In order to provide application of organic sources in the field, which could be the satisfactorily alternate solution for inorganic fertilizers in the future need further assessment of nutrient analysis in these sources and their consumption rate with any antagonistic effect.

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EFFECTS OF DIFFERENT BORON APPLICATION METHOD AND DOSES ON YIELD AND CHEMICAL COMPOSITION OF WHEAT (TRITICUM AESTIVUM L.)

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ABSTRACT

Boron (B) deficiency is widespread in the Anatolia region of Turkey. This could impact production and quality of wheat genotypes (*Triticum aestivum* L.). Greenhouse experiment was conducted to study dry weight and element contents response of Bezostiya cultivars to B addition (0, 1, 3, 6 and 9 kg B ha^{-1}) with 4 different B applications (SDC, SA, SSS, and FA) methods. We conclude that both B application doses and application method affected the RDW, SDW and TDW of wheat. The highest root (5.7 g pot^{-1}), straw (68.5 g pot^{-1}), and total dry weight (74.2 g pot^{-1}) were obtained from SDC application method. Boron application decreased leaf tissue Ca, and Mg, and increased N, P, K, S Zn, and Fe content of plant. B concentrations in plant leaves tissue were correlated to yield but, beyond the OBR for TDW of plant, tissue B continued to increase without significant increases in yield.

Key Words Boron deficiency, critical tissue B content, dry matter, macro and micro nutrient, optimum boron ratio.

INTRODUCTION

Plant species differ in their capacity to take up B, even when they are grown in the same soil. B deficiency causes grain set failure in bread wheat and barley [1]. It lowers the number of grains per spike, grain yield and grain set index in wheat via suppression of the growth of flowering organs without any apparent effect on number of spikes per m^2, number of spikelets per spike, average size of the spike, or component florets per spikelet [1, 2]. B deficiency was considered to be the main reason for sterility in susceptible wheat genotypes since B application reduced sterility from 42.6% to 4.5% [3]. Since B has important effects on reproductive organs that directly affect grain yield, the main effects of B deficiency are usually expressed during generative development rather than in vegetative plant parts [1, 4].

The Eastern Anatolian region has a total cereal production of around 9.4 million ton, constituting 7% of the total Turkish cereal production [5]. The soils in Eastern Anatolia are typical of those in arid and semi-arid regions. They have low organic matter, high free-lime content, high pH, and usually a fine texture. These properties are all well-known factors affecting the availability of micronutrients [6]. One of the challenges in wheat production in Turkey is its sensitivity to B deficiency [7, 8] and B toxicity [9, 10].

Limited studies on B deficiency of various crops including wheat suggest a critical soil solution content ranging from 0.5 mg of B kg^{-1} [11] to 1.0 mg of B kg^{-1} [12] and 2.4 mg B kg^{-1} [13], and a critical leaf B concentration of 15 mg kg^{-1}. However, additional studies are needed as soil chemical and physical properties and species selection will influence B availability to and uptake by plants possibly resulting in large variability in optimum economic B rates (OEBRs) for various crops and soils.

The objectives of this study were to (1) determine the OEBR for wheat grown on B-deficient calcareous Aridisols in Eastern Turkey, (2) determine best fertilizer application method and obtain critical soil test and tissue B values for total yield production, and (3) to evaluate the impact of B addition on tissue mineral content.

MATERIALS AND METHODS

Initial soil sampling and characterization

Soil was sampled from the Ap horizon (0-20 cm) of an Aridisol [14]with parent materials mostly consisting of volcanic, marn and lacustrin residual and transported material in Erzurum province (39° 55' N, 41° 61' E), Turkey. Soil was air-dried indoors until it could be crumbled to pass through 4 mm for the pot experiment and crushed to 2 mm for chemical and physical analyses. Particle size analysis was performed by the pipette method after pre-treatment with 35% H_2O_2 and 1.0 *M* HCl to remove organic matter and carbonates according to Gee and Bauder [15]. Bulk density was determined with the graduated cylinder method [16] and cation exchange capacity (CEC) was determined using sodium acetate (buffered at pH 8.2) and ammonium acetate (buffered at pH 7.0) according to Sumner and Miller [17]. The Kjeldahl method [18] was used to determine organic N while plant-available P was determined by using the sodium bicarbonate method of Olsen et al. [19]. Electrical conductivity (EC) was measured in saturation extracts according to Rhoades [20]. Soil pH was determined in 1:2 extracts, and calcium carbonate concentrations were determined according to McLean [21]. Soil organic matter was determined using the Smith-Weldon method according to Nelson and Sommers [22]. Ammonium acetate buffered at pH 7 [23] was used to determine exchangeable cations. Micro elements in the soils were determined by Diethylene Triamine Pentaacetic Acid (DTPA) extraction methods [24]. Samples were analyzed for extractable B using the azomethine-H extraction of Wolf [25]and a UV/VIS (Aqumat) spectrophotometer (Thermo Electron Spectroscopy LTD, Cambridge, UK). These soil characterization data are presented in Table 1.

Plant Analysis

Plant samples were oven-dried at 68°C for 48 h and ground to pass 1mm sieve. Flag leaf of each treatment were analyzed for N, P, Ca, Mg, Fe, Mn, Zn, Cu, and B content to assess the relationship between plant mineral content and soil B content and application rate. The Kjeldahl method and a Vapodest 10 Rapid Kjeldahl Distillation Unit (Gerhardt, Konigswinter, Germany) were used to determine total N [18]. Macro- (P, S, K, Ca and Mg) and micro-elements (Fe, Mn, Zn Cu, and B) were determined after wet digestion of dried and ground sub-samples using a HNO_3-H_2O_2 acid mixture (2:3 v/v) with three step (first step; 145°C, 75%RF, 5 min; second step; 180°C, 90%RF, 10 min and third step; 100°C, 40%RF, 10 min) in microwave (Bergof Speedwave Microwave Digestion Equipment MWS-2) [26]. Tissue P, K, S, Ca, Mg, Fe, Mn, Zn, Cu and B were determined Inductively Couple Plasma spectrophotometer (Perkin-Elmer, Optima 2100 DV, ICP/OES, Shelton, CT 06484-4794, USA) [27].

Pot experiment

The experiments were conducted using a randomized complete block design with four B application rates (0, 1, 3, and 9 kg ha^{-1} as $Na_2B_4O_7$. 10 H_2O) four application method ; seed contacted with dry B fertilizer (SDC), seed soaked in the B solution waited 2h (SSS), soil application (SA), and foliar fertilizer application (FA) and three replications. Initial soil B levels amounted to 0.10-0.11 mg kg^{-1}, reflecting a B deficiency at bezostiya cv. sites [11, 12, 13]. NH_4NO_3 (33 %N) and[1] K_2SO_4 (50% K_2O) were used as fertilizers in the study. Soil tests did not indicate a need for additional K so no K fertilizer was applied. Soil was mixed with the equivalent of 120 kg N ha^{-1} and 80 kg K $ha^{-}$and placed in 45 polyethylene pots (25 cm diameter and 18 cm depth) sterilized with 20% sodium hypochlorite solution (3 kg soil pot^{-1}). Bezostiya genotype, described as a winter-habit wheat genotype, released for irrigated conditions, red and 45 g 1000-seed weight, tall (102 cm), resistant to lodging, cold, and stripe rust resistant was used in this study. Bezostiya cv. was sown at a rate of 475 seeds/ m^2. Plants were grown into a greenhouse under a natural day-night cycle, 25-16°C and 55% relative humidity during the experimental period. The water content of the soil was maintained at 70% of field capacity (375 g kg^{-1}) throughout the 90 d experiments by daily additions of dionized water, and plants were harvested 90 d after planting and washed with dionized water to remove soil particles.

Statistical analysis

Data gathered at each location were subjected to analysis of variance (ANOVA) and significant means were compared using the Duncan multiple range test, performed using SPSS 13.0 [28]. Mean differences were considered significant when $P \leq 0.05$.

RESULTS AND DISCUSSION

Yield and yield parameters

Different boron fertilizer application method and doses affected the root dry weight (RDW), straw dry weight (SDW) and total dry weight (TDW) of wheat (Figure 1 and Figure 2). The highest root (5.7 g pot^{-1}), straw (68.5 g pot^{-1}), and total dry weight (74.2 g pot^{-1}) were obtained from SDC application method with optimum B ranges (OBRs) that ranged from 4.2 kg B ha^{-1} to 5.2 kg B $ha^{-1}$for SDW, and from 3.9 kg B ha^{-1} to 4.6 kg B ha^{-1} for TDW (Figure 1.). Without B addition, the average RDW, SDW and TDW were determined 3.15 g pot^{-1}, 45.3 g pot^{-1}, and 48.5 g pot^{-1}, respectively. Compared to without B fertilizer, these increases ratio were 80% and 51%, and 53% at applied at the 3 kg ha^{-1} with SDC respectively, (Figure 1).

The optimum B rates (OBRs) for TDW in our study were higher than 1.20 kg B ha^{-1} rates obtained Ross [29], 1.3 kg B ha^{-1} Oplinger et al. [30], 0.5 kg B ha^{-1} , Santos et al. [31], 1.5 kg B ha^{-1} Moniruzzaman [32] for soybean (*Glycine max* Merr. L), cotton (*Gossipium hirsutum*), alfalfa (*Medicago sativa* cv. Crioula) and bentgrass (*Agrostis palustris* Huds.), but lower than the 8.0 kg B ha^{-1} obtained by Oyinlola [33]. This result can be attributed initial soil B level (0.09 mg kg-1) soil type (Alfisol) and sunflower particularly sensitive to B deficiency and is used as an indicator crop for assessing available B in soils [34, 35].

Relationship between Yield and Tissue B Contents

Boron concentrations in plant leaves tissue were increased with increase B application doses all of the application method. The average tissue B content in the control treatments was 3.4 mg kg^{-1} DW for bezostiya cv., and this value was reached the 49.8 mg B kg^{-1} at 9 kg ha^{-1} for SDC application method. This increased to 36.6 and 30.6 and 40.1 mg B kg^{-1} for SSS, SA and FA methods, respectively. B concentrations in plant leaves tissue were correlated to yield but, beyond the OBR for TDW of plant, tissue B continued to increase without significant increases in yield (Figure 3). Gubta [36]considers wheat (*Triticum aestivum*) B deficient when B tissue concentration of plant is below 10-20 mg kg^{-1} dry wt.

Compiling results from the greenhouse and field experiments published during 10 years, Guertal [37], Santos et al. [31], Ross et al. [29]suggested that 10 mg kg^{-1}, 66 mg kg^{-1}, 44.1 mg kg^{-1} in plant tissue as critical level for boron in bentgrass (*Agrostis palustris* Huds.), alfalfa (*Medicago sativa* cv. Crioula) and soybean (Glycine max (Merr.) L), whereas Goldberg et al. [38] reported a range of 142 to 3000 mg kg^{-1} in different plant parts of melons (*Cucumis sativus* L.).

Mineral Contents in Plant

Boron application decreased leaf tissue Ca, and Mg, and increased N, P, K, S Zn, and Fe content of plant (Table 2). The concentrations of plant nutrients measured were generally within accepted critical levels except for Zn and Cu. Jones et al. [39] and Mills and Jones [40] suggested critical values for optimum bezostiya cv. growing as 1. 7-3.0% for N, 0.2-0.5% for P, 1.5-3.0% for K, 0.2- 10.0% for Ca, 0.2-1.0 for Mg, 10-300 mg kg^{-1} for Fe, 20-70 mg kg^{-1} for Zn, 16-200 mg kg^{-1} for Mn, and 5-50 mg kg^{-1} for Cu .

An increase in tissue P, K, Fe, Mn, Zn, and Cu upon B application was also reported for chickpea (*Cicer arientinum* L.) P content [41], lentil (*Lens culinaris* Medikus) K content [42], sugar beet (*Beta vulgaris* L.) Zn content [43], rice (*Oryza sativa* L.) Fe content [44] cowpea (*Vigna unguiculata*) Mn content [45], cotton (*Gossypium herbaceum*) Cu content [46], Brussels sprouts (*Brassica oleracea* L. Gemnifera) N, P, K content [47], and lucerne (*Medicago sativa* L.) N, P, K, and Fe [48].

Conclusion

Both B application doses and application method affected the RDW, SDW and TDW of wheat. The highest root , straw, and total dry weight were obtained from SDC application method. Independent of application methods, B application decreased leaf tissue Ca, and Mg, and increased N, P, K, S Zn, and Fe content of plant. We conclude beyond the OBR for TDW of plant, tissue B continued to increase without significant increases in yield. This study was conducted on calcareous soils. Similar studies with different soils and initial soil test B levels are needed to conclude if these critical soil and tissue values can be applied across the region under field condition.

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Table 1. Chemical and physical properties of the soil sample used in the study, prior to experiment for boron response trials at bezostiya cv. (mean ± SD, n = 5).

Soil Properties	Units	Value
Sand	%	30.7±2.40
Silt	%	35.9±2.30
Clay	%	33.4±2.70
CEC[a]	$cmol_{(+)}\ kg^{-1}$	23.6±2.10
Organic C	$g\ kg^{-1}$	1.4±0.30
pH	1:2.5 w/v	7.5±0.20
$CaCO_3$	$g\ kg^{-1}$	0.8±2.20
Total N	$g\ kg^{-1}$	0.9±0.10
Olsen-P[b]	$mg\ kg^{-1}$	5.2±1.70
EC[c]	$dS\ m^{-1}$	1.9±0.20
Exc. K[d]	$cmol_{(+)}\ kg^{-1}$	2.4±0.40
Exc. Ca	$cmol_{(+)}\ kg^{-1}$	12.5±2.80
Exc. Mg	$cmol_{(+)}\ kg^{-1}$	2.1±0.50
Exc. Na	$cmol_{(+)}\ kg^{-1}$	0.35±0.20
Extr. Fe[e]	$mg\ kg^{-1}$	1.83±0.20
Extr. Mn	$mg\ kg^{-1}$	2.2±0.20
Extr.Zn.	$mg\ kg^{-1}$	1.44±0.10
Extr.Cu[e]	$mg\ kg^{-1}$	1.25±0.10
Extr. B[f]	$mg\ kg^{-1}$	0.11±0.04

Table 2 Macro and micro element contents of Bezostiya cv. leaves grown in Aridisol with different B application method at various rates in greenhouse condition (mean ± SD, n=3), $mg\ kg^{-1}$.

B doses, $kg\ ha^{-1}$	N	P	K	Ca	Mg	S	Fe	Zn	Mn	Cu
					SDC					
0	3.57±0.03	0.32±0.04	3.02±0.25	0.39±0.03	0.38±0.02	0.28±0.02	19.91±2.60	12.90±1.17	12.94±2.61	3.16±0.22
1	4.00±0.22	0.54±0.12	3.02±0.25	0.40±0.02	0.44±0.02	0.35±0.02	29.01±1.70	17.60±0.00	22.13±0.72	4.68±0.58
3	4.15±0.34	0.60±0.07	4.86±0.15	0.38±0.02	0.41±0.07	0.37±0.01	46.64±0.98	22.09±0.34	20.46±1.91	4.68±0.44
6	4.08±0.22	0.75±0.04	4.86±0.15	0.35±0.02	0.32±0.01	0.38±0.00	48.21±1.70	22.09±1.89	24.21±0.72	4.42±0.79
9	3.98±0.31	0.81±0.04	4.61±0.07	0.26±0.02	0.24±0.03	0.39±.002	54.46±0.98	20.92±1.79	25.46±0.72	4.93±0.38
					SSS					
0	3.00±0.02	0.32±0.03	2.54±0.21	0.33±0.03	0.32±0.01	0.23±0.02	16.77±2.19	10.87±0.99	10.82±2.18	2.66±0.18
1	3.36±0.18	0.45±0.10	2.54±0.21	0.33±0.02	0.37±0.02	0.29±0.02	24.43±1.43	14.82±0.00	18.50±0.60	3.94±0.49
3	3.49±0.28	0.51±0.06	4.09±0.12	0.32±0.01	0.34±0.06	0.31±0.01	39.29±0.82	18.61±0.29	17.11±1.60	3.94±0.37
6	3.44±0.19	0.63±0.03	4.09±0.12	0.29±0.02	0.27±0.01	0.32±0.00	40.60±1.43	18.61±1.59	20.25±0.60	3.73±0.66
9	3.36±0.26	0.68±0.03	3.88±0.06	0.22±0.02	0.21±0.03	0.33±0.02	45.87±0.82	17.62±1.51	21.30±0.60	4.15±0.32
					SA					
0	3.27±0.03	0.30±0.03	2.77±0.23	0.36±0.03	0.35±0.02	0.25±0.02	18.27±2.39	11.84±1.08	11.79±2.38	2.90±0.20
1	3.67±0.20	0.49±0.11	2.77±0.23	0.36±0.02	0.40±0.02	0.32±0.02	26.62±1.56	16.15±0.00	20.17±0.66	4.29±0.53
3	3.80±0.31	0.55±0.07	4.46±0.13	0.35±0.01	0.37±0.07	0.34±0.01	42.81±0.90	20.28±0.31	18.64±1.74	4.29±0.40
6	3.75±0.20	0.69±0.03	4.46±0.13	0.32±0.02	0.30±0.01	0.34±0.00	44.24±1.56	20.28±1.73	22.07±0.66	4.06±0.72
9	3.66±0.29	0.75±0.03	4.23±0.07	0.24±0.02	0.22±0.03	0.35±0.02	49.99±0.90	19.20±1.64	23.21±0.66	4.53±0.35
					FA					
0	2.48±0.02	0.23±0.02	2.10±0.18	0.27±0.02	0.27±0.01	0.19±0.02	13.86±1.81	8.99±0.82	8.95±1.80	2.20±0.15
1	2.78±0.15	0.37±0.08	2.10±0.18	0.28±0.02	0.30±0.02	0.24±0.02	20.20±1.18	12.26±0.00	15.30±0.50	3.26±0.40
3	2.89±0.23	0.42±0.05	3.38±0.10	0.27±0.01	0.28±0.05	0.26±0.01	32.48±0.68	15.39±0.24	14.15±1.32	3.23±0.31
6	2.84±0.15	0.52±0.02	3.38±0.10	0.24±0.02	0.23±0.01	0.26±0.00	33.57±1.18	15.39±1.31	16.75±0.50	3.08±0.55
9	2.77±0.22	0.57±0.02	3.21±0.05	0.18±0.02	0.17±0.02	0.27±0.02	37.93±0.68	14.57±1.25	17.61±0.50	3.43±0.26

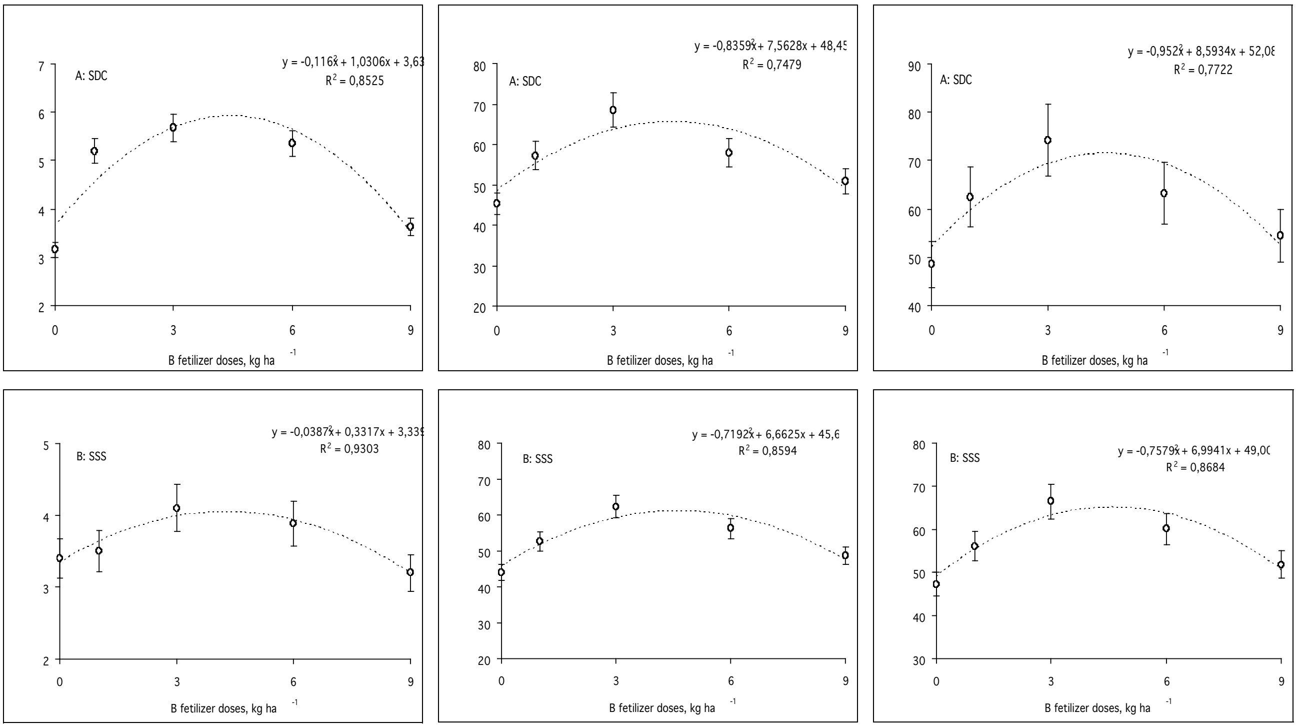

Figure 1 Bezostiya cv. wheat root, straw and total weight as affected by boron (B) applications methods; A: seed contacted with dry B fertilizer (SDC) and B: seed were soaked in the B solution waited 2h (SSS) at different ratio to a B-deficient calcareous Aridisol.

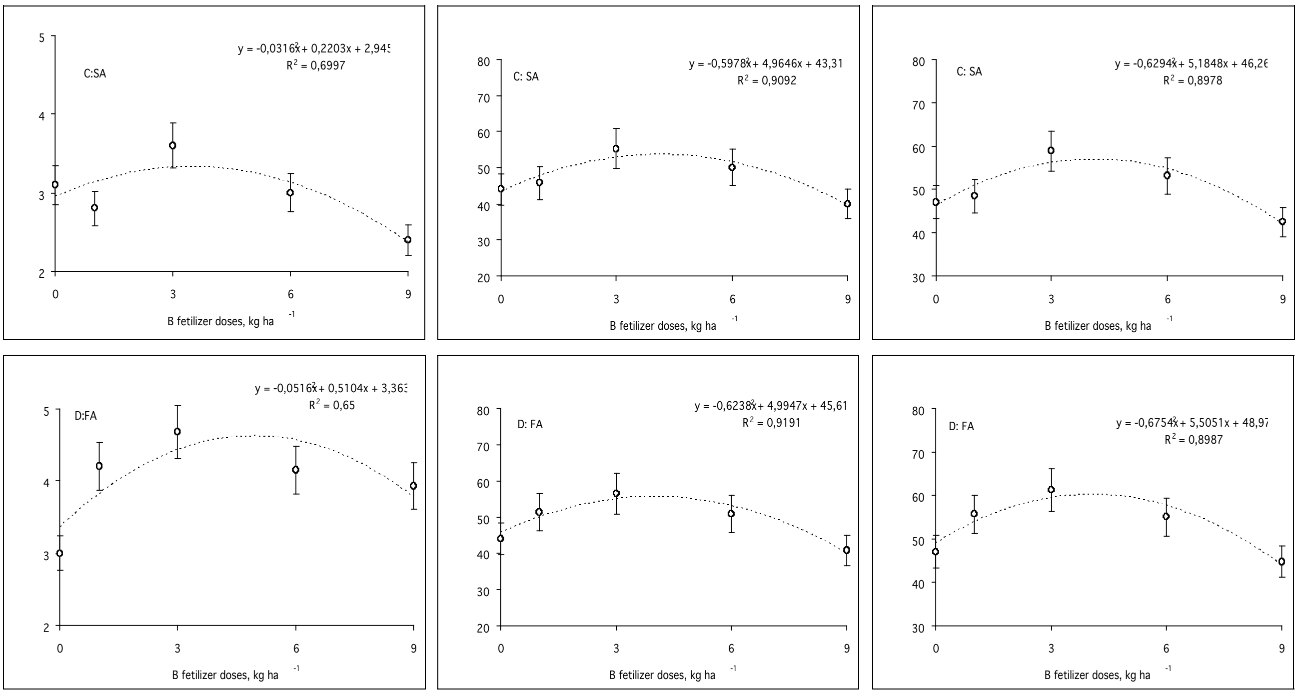

Figure 2 Bezostiya cv. wheat root, straw and total weight as affected by boron (B) applications methods; C: soil application (SA), and D: foliar fertilizer application (FA) at different ratio to a B-deficient calcareous Aridisol.

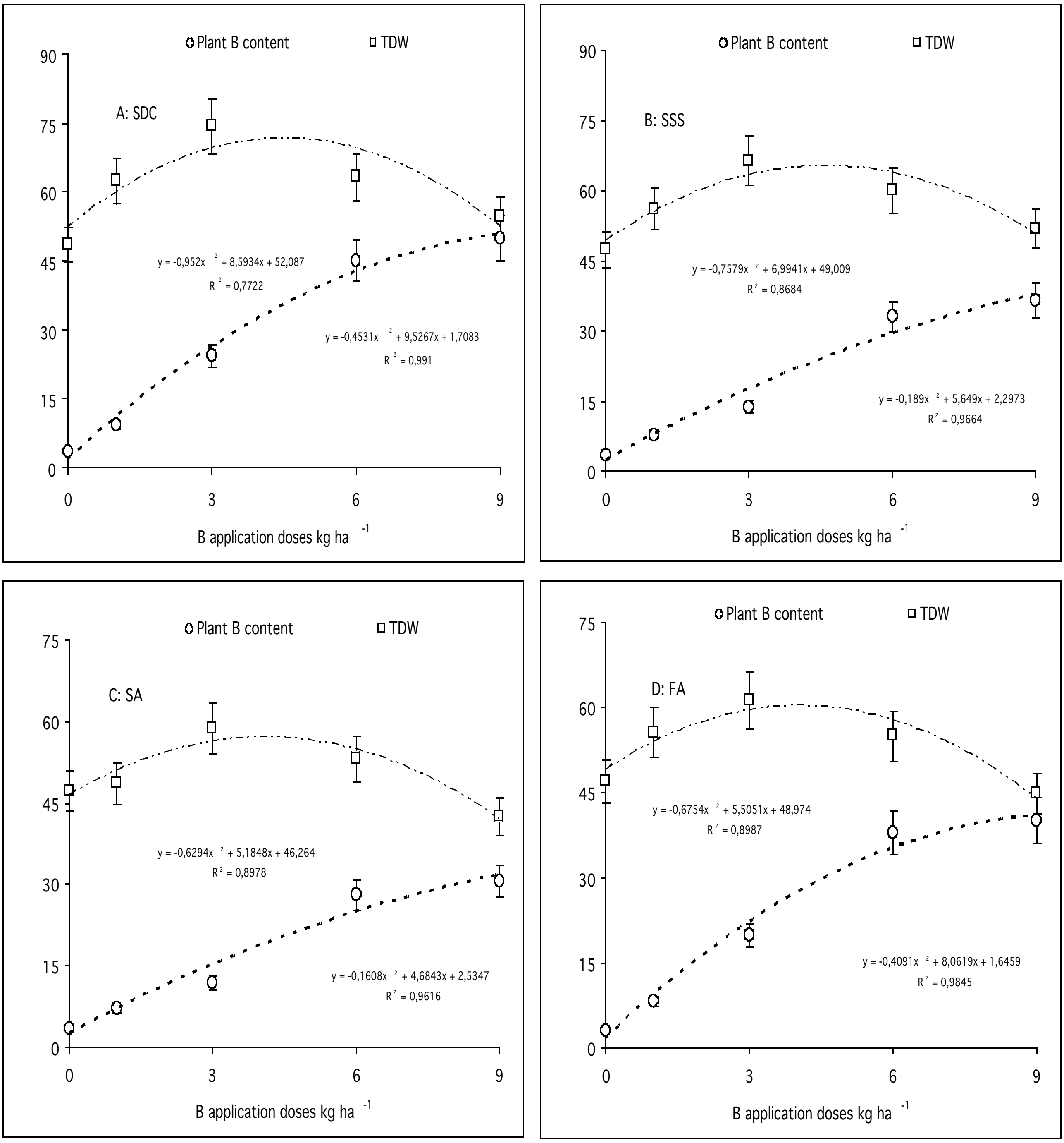

Figure 3. Relationship between boron application methods (A:SDC, B: SSS, C:SA, and D:FA) and plant B concentration for bezostiya cv. grown on a calcareous Aridisol.

DECISIONS OF LAND USE IN AGRICULTURAL AREA TO DETERMINE IN ALATA FIRST GRADE NATURAL AREA

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ABSTRACT

Because of its natural and cultural characteristics, Alata Horticultural Research Institute is taken under protection as a first grade natural area and is being under dense pressure of surrounding inhabiting housing. In the first step of the study, problem analysis of the area is done, and protection and improving strategies of agricultural areas were determined. According to the investigation results, risks resulted from different uses of agricultural areas were been revealed and solution proposals were improved. Consequently, it is exposed that agricultural areas with gene resources must be protected and inspected in terms of working activities. With the accordance of ecological planning principles, decissions of protection uses is formed and sustainable land management plan is developed.

Key Words: SWOT analysis, sustainable land management, ecological risk analysis, sustainnable agriculture in coastline,

INTRODUCTION

Alata Research Institute, the size of about 4000da has habitat diversity. Land keeps Dune-scrub-forest -agricultural ecosystems with two creeks and wetlands that occur in many water channels together and because of being controlled area it protects its structure. Since the 1940s under different names from time to time it has been countinued training, research and production activities. Approximately half of the 4000 decares part of the land has been preserved with its natural state. Agricultural diversity, such as the natural biological diversity has great importance. It is presenting the endemic, endangered and sensitive species according to IUCN (International Union Conservation Nature) criterias. The coastal dunes are used as breeding areas by the endangered sea turtles (*Caretta caretta* and *Chelonia mydas*) [1].

In spite of all these ecological values of Alata First Grade Natural Area, antropojen effects are continuing. While rapidly developing the measures to increase production and mechanization in agriculture, on the other hand, residential area in the two sides of Alata is under pressure from the secondary residential construction. The area under such intense pressure on the natural ecosystem elements (earth, geology, hydrology, climate, flora, fauna) is expected to increase adverse effects.

METHODOLOGY

The most important aim and basis of the qualitative SWOT analysis is related to issues the strengths and weaknesses, then supportting the definition of opportunities and threats. This method usually is used to determine strategies of European Regional Policy [2] [3].

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At the same time the SWOT method was also used in coastal management projects such as the Meco (Mediterranean, Coast And Cosystem) Project [4] [5].

The result of the Preliminary studies in research area, natural and cultural datas were collected and after the evaluation of First Grade Natural Site decisions, strategies have been developed for the field.

The priority method of determining the agricultural strategies ; to determine the advantages and disadvantages by applying SWOT analysis , to demonstrate opportunities, with the evaluation of available data regarding the is to provide the healthiest decision about the strategies. Then, SWOT analysis results are assessed for each strategy, and the creator of the cause of the problems,that has the negative effects on agricultural land , to identify risk on all areas.

SWOT ANALYSIS

Agricultural areas close to level land and the soil is loamy. Land slope is being 0-2% , this eliminates the water erosion problem. The Institute has served many years in agricultural regions and it is considerable in agricultural research in the country. To present research have been made in many different subjects and more than 150 projects has been finalized. These studies are among the doctoral studies.

Controlled agriculture in the research area is made possible to protect the existing water resources. But the field is located in the vicinity of the intensive agricultural areas and areas have a negative impact on existing water resources. Another negative impact on water resources is Erdemli Industrial Estate wastes that is established on the high ground water in the region.

The area has been declared as tourism area, this is the another threatment. The requests of the local management to pass the infrastructure work from agricultural land. Inputs in agriculture is higher, the farmers can not capture the desired economic comfort, to pursue other business requests, supports the use of the area for tourism.

Opportunities: many kinds and types of farming in the area have been spread through region by the instute and in this way it has adequate infrastructure and material (genetic resources). The institute is directing to region agriculture with its developed varieties and researches.

Outsourced in recent years, big-budget and national projects has developed infrastructure of agricultural. This is a great opportunity for future research will be constituted. SWOT analysis about of agricultural R & D purposes in the field had given in Table1.

Assessment of Strategy in the Study Area

The relationship between ecology and economy affects significantly land use decisions. the Because of economic interests, ecology is getting deterioration and it makes impossible to return. Research area in the coastal zone where the fertile agricultural lands, converted summer houses to get more profit and fertile farmland has been lost in national and regional scale. The result deterioration of natural structure in these regions, loss area and no longer exist the species in the natural structure [6].

Table 1. Strategy for the purpose agricultural R & D results of SWOT analysis

STRENGTHS	WEAKNESSES	THREATS	OPPORTUNITIES
Institute has a suitable location that is due to productive agricultural land and climate advantageous and serve for many years in agricultural of region and country Advanced infrastructure has (laboratories, greenhouses, buildings, irrigation facilities, expert staff, advanced connectivity in communications technology, tools, instruments and equipment, agricultural biodiversity, and so have the plant material.) It is only agricultural research organizations in the region It is foundation major agricultural region of the country is one of the It is such area of adaptation that for many subtropical and temperate climate fruits entrance fist time to the country National Gen Resources and Storage Project, and many tasks to take place for a temperate climate fruit species protection parcel creation of Vegetable and fruit of new varieties have been improve that to meet market needs 5 Apricot varieties has been improved which are the first registered in country New varieties Vegetables has been improved by at the institute and to be registered	Carried out and the resulting presentation of research done enough and in the region can be perceived as a closed box of the institute R & D investment is low that the private sector support for R & D activities to enforce the law not Specializing in retirement, or the appointment of investigators working with some of the unclaimed remains Because of state policies can not be taken new workers that to existing staff retire that insufficient qualified staff Became widespread in the world and entered our country enough new methods can not be introduced to the region, for example, (soilless culture, organic farming, compost making techniques, etc.), Agricultural areas and the natural structure of degradation of plant species loss, the dominant species emergence and of ground water pollution and quality degradation In some parts of the research area of ground water and soil depth height limitation of the farming	Around of institute is sieged the holidays area People of region prefer to tourism fo economically profitable Agricultural land loss and degradation of the natural structure as a result Rapid migration and rapid urbanization in the region Because of chemicals used in agricultural areas groundwater pollution in the region Bisection of the main agricultural areas of transportation Land and water pollution and impairment soil structure results in of Agricultural	Development of new types of projects can be done easily be that using genetic resources Organizations in the region is only that European Union harmonization laws in accordance with good agricultural practices to the region to spread and consulting Promotion of ecological agriculture and the current work of this study to increase The fulfillment of tasks loaded in agriculture conducted in Mersin with RIS (regional innovation strategy) project Country and regional economy to the development and multipartner projects for the big-budget production and the EU offer Towards becoming an international institute in the field of agriculture in the preparation of necessary infrastructure and ensuring support from political National and international congresses, the existence of the necessary infrastructure for organization

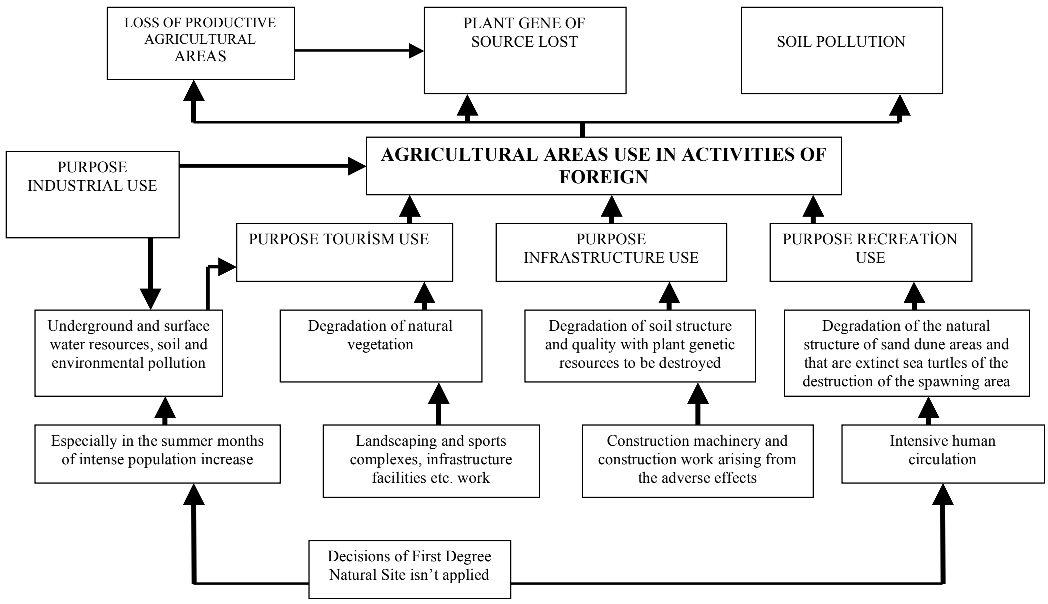

Figure 1. Tree of risk is developed for agricultural in region

The destruction of fertile agricultural land is not only problem in the region. Intensive agriculture in the region, especially greenhouses that are using drugs and hormones unconsciouly, because of insufficient infrastructure, wastes discharge without treatment to soil and streams, as a result of this soil, streams and ground water is heavily polluted.

The main risk of agricultural area has been identified use as for purposes other than agricultural area (Figure 1). Agricultural area be used for non-agricultural purposes, tourism, infrastructure, industrial and social facilities (camping, beach, etc.) as a result of using the main risks,

- loss of fertile agricultural area,
- loss of plant genetic resources in area,
- pollution of soil and water resources, is emerging as a result placement and the industry

Industry, tourism (secondary residences, hotels, etc.) use, environmental pollution, degradation of the natural structure and plant species will lead to destruction.

In addition to natural plant, different types of garden plants is located within subjects of study the Institute collection parcels are created, has wealthy agricultural genetic resources due to a combination of many different varieties . Infrastructure work to be done for different uses in some of these species will disappear, the residual will suffer.

CONCLUSIONS

Work to be done in the field of agriculture have been developed and proposals for agricultural R & D activities for the target tree was created (Figure 2).

Agricultural plans, first effective criteria of use the determination soil and water is created. It is built very the comprehensive such as control of the quality water supply and the stream with the use of agricultural chemicals. For this purpose, study in the field that the protection of agricultural area use policies for the sustainable use within the following suggestions are generated.

- Created many years ago for gene sources gardens aging collection of genetic resources is not lost for the creation of new conservation garden and under the protection of these areas must be kept
- Minimize the use of agricultural fertilizers and chemicals
- Sand dunes and wetlands must be bloked degradation of the natural structure in located study area
- Plant nutrition dissemination use of organic fertilizers and of the biological methods in the pest
- Agricultural inputs ensuring used in accordance with the principles of sustainability
- Agricultural fields and above the underground and water quality impacts and minimize the efforts made to investigate the
- Irrigation systems will be reviewed, from the long-term economic and ecological point of creation of irrigation systems

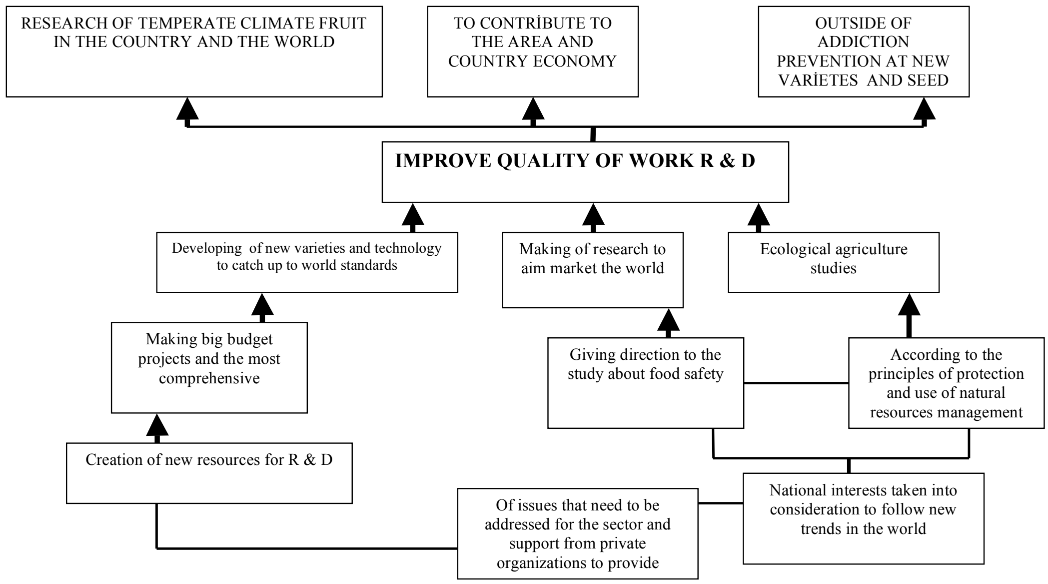

Figure 2. R & D work carried out in field target tree

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INDICATORS FOR BIODIVERSITY IN ORGANIC AND LOW-INPUT FARMING SYSTEMS

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ABSTRACT

Arable and pastoral farmland constitutes a dominant land use in Europe, covering over 45 % (180 million hectares) of the EU-25. An estimated 50 % of all Europ ean species depend on agricultural habitats [1]. Scientifically based indicators are required to reliably measure and interpret biodiversity on different farms across different countries. Organic and low-input farming systems present particular challenges to indicator application. Many of these systems are in marginal farming areas and many involve extensive land areas [2], where semi-natural habitats created by f arming exist in a mosaic with more natural habitat types. The indicators must take into account the demands of stakeholders in both organic/low-input farming systems and nature conservation. The presented Bio-Bio project has the following objectives:

1. Conceptualization of criteria for a scientifically-based selection of biodiversity indicators for organic/low-input farming systems and their associated agricultural practices;
2. The assessment and validation of a set of can didate biodiversity indicators in case studies representative for organic/low-input farming system sacross Europe (and in selected ICPC countries) taking into account regional specificities, cost effectiveness and practicality;
3. The preparation of guidelines for the implementation of appropriate biodiversity indicators for organic/low-input farming systems, and their standardized measurement, calculation and interpretation across Europe and beyond. The BioBio project will draw upon existing knowledge in the fields of biodiversity, agrienvironmental and farm economic indicators as well as environmental indicators in general.

Keywords: biodiversity, organic farming, low-input farming, indicators

CONCEPT AND PROJECT OBJECTIVES

Arable and pastoral farmland constitutes a dominant land use in Europe, covering over 45 % (180 million hectares) of the EU-25. An estimated 50 % of all European species depend on agricultural habitats [1]. Consequently, some of the most critical conservation issues today relate to changes in farming practices, which directly affect the wildlife on farms and adjacent habitats. To quantify the magnitude and direction of changes in biodiversity, policy makers and land managers are increasingly using indicators. Knowledge about types and rates of change in different areas is needed to identify the driving forces to measure the success of agri-environmental measures and to compare the sustainability of different farming systems. Scientifically based indicators are required to reliably measure and interpret biodiversity on different farms across different countries. Organic and low-input farming systems present particular challenges to indicator application. Many of these systems are in marginal farming areas and many involve extensive land areas, where semi-natural habitats created by farming exist in a mosaic with more natural habitat types. The key challenge to be addressed in the present call is the development and assessment of a scientifically-based set of indicators capable of detecting qualitative and quantitative linkages between different organic/low-input farming systems and biological diversity for Europe. The indicators must take into account the demands of stakeholders in both organic/low-input farming systems and nature conservation. This project therefore has the following major objectives: 1. The conceptualization of criteria for a scientifically-based selection of biodiversity indicators for organic/low-input farming systems and their associated agricultural practices, taking into account demands of stakeholders; 2. The assessment and validation of a set of candidate biodiversity indicators in case studies representative for organic/low-input farming systems across Europe (and in selected ICPC countries) taking into account regional specificities, cost effectiveness and practicality; 3. The preparation of guidelines for the implementation of appropriate biodiversity indicators for organic/low-input farming systems, and their standardized measurement, calculation and interpretation across Europe and beyond. The BIOBIO project will draw upon existing knowledge in the fields of biodiversity, agrienvironmental and farm economic indicators as well as environmental indicators in general (e.g. Irena, SEBI 2010, UN, OECD and national monitoring programmes). The potential of European wide (e.g. CORINE, HNV, LUCAS, FSS, FADN) and national data to yield information concerning the relationship between organic/low-input farming and biodiversity will also be assessed. The three major components of biodiversity – genetic, species and habitat diversity – will be systematically addressed. Both indirect indicators (derived from management practices, inputs and outputs, spatial metrics from remote sensing) and direct indicators (derived from genetic properties, indicator species and landscape/habitat properties) will be identified and considered for their potential to assess (i) the genetic diversity of crop and fruit tree varieties, of grassland species and of breeds of farm animals; (ii) the species diversity of farmland wildlife (major indicator species for flora and fauna, including indicator species for ecosystem services like, e.g. soil organisms maintaining soil fertility, beneficial organisms providing biological control of pests, pollinators); (iii) the diversity of habitats in agricultural landscapes related to organic/low-input farming. The indicators that are identified will be categorised using the DPSIR framework and evaluated with respect to their relevance for organic/low input farming and for nature conservation; their scientific soundness; their practicality (ease of interpretation, cost-efficiency); their suitability for biodiversity monitoring (repeatability of measurements); their geographical range (including regionspecific farming systems); and their ability to address stakeholder requirements. Indicators which comply with these requirements will be used to form a candidate set that relates organic/low-input farming to biodiversity and has the potential for broad application in major agro-ecological zones and organic/low-input farming systems in Europe. A framework for indicator interpretation will also be developed that considers the relevance of the indicator to functional biodiversity and conservation.
A standardised experimental design will be used to test the candidate indicators in case studies across Europe and later in ICPC countries. The investigation will include organic farming, traditional low input farming systems as well as new agricultural practices, i.e. soil conservation, crop rotation management, seed mixtures, mixed cropping and agroforestry. The proposed case study regions will include pannonian, alpine, boreal, Atlantic and Mediterranean grassland systems (both organic and/or low-input), rainfed organic farms under temperate and Mediterranean conditions, mixed organic farming, organic special crops (vines, vegetables) and low-input agroforestry systems (dehesa/montado, organic olive groves). Plot, farm and regional/landscape scale (where applicable) will be addressed in the case studies and candidate indicators will be measured according to a standardised protocol. Each case study will be accompanied by a set of control farms which are conventionally managed in order to investigate the ease of interpretation of indicators and to cover the range of possible values. Requirements of stakeholders representing agriculture, nature protection and the public in administration, local governments, farming community (farmer’s representatives) and NGOs will be assessed in the case

studies and in the process of analysis and interpretation of the results. The costs of indicator measurement will be evaluated. Local residents, villagers and farmers perceive the non-importable and non-marketable functions resulting from agricultural activities that enhance biodiversity and landscape in the most direct manner. The private and public economic benefits, and non-monetary value of biodiversity promoted by organic and lowinput farming will be assessed through qualitative methods including semi-structured or indepth interviewing and focus groups among farmers and local residents (Figure 1.)

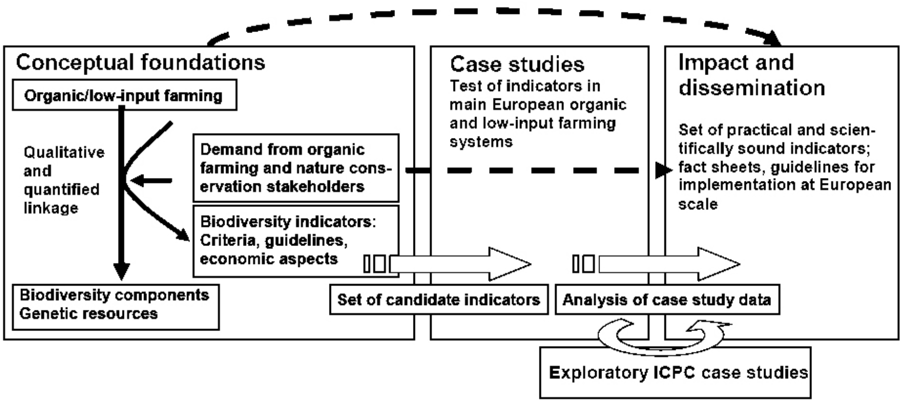

FIGURE 1. Conceptual scheme of the BIOBIO project

Following the case studies, indicators will be prioritised according to their practicality, ease of interpretation and suitability for standardised recording to enable both comparative studies (between farming systems and regions) and monitoring (repeated measurements over time) and to identify a core set of indicators for Europe. The applicability of the approach and indicator set beyond Europe will be tested in the ICPC countries Ukraine (organic arable farming), Tunisia (low input olive plantation and cork oak agroforests) and Uganda (organic and low-input subsistence farming). The objective will be to identify potential limitations of the indicator set and to propose adaptations. This can support the development of indicators which reach beyond the EU FP7 countries and can be a step towards a globally applicable indicator set for biodiversity indicators for a wide range of farming systems. The BIOBIO project will produce an indicator toolkit that will be disseminated as a handbook that contains precise guidelines for the choice of generic indicators for European organic/low-input farming systems. Fact sheets will be written providing a standardised description of the method for indicator measurement, calculation and interpretation of values. Guidelines will be given regarding the use and downscaling of existing EU-wide datasets. We will propose a sampling design that considers both spatial and temporal resolution and includes an estimation of costeffectiveness and propositions for stakeholder involvement.

LINKAGE BETWEEN ORGANIC/LOW-INPUT FARMING SYSTEMS AND BIODIVERSITY

The importance of agricultural land use for biodiversity is generally recognized (e.g. EEA; EC-Biodiversity Strategy; the Pan-European Biological and Landscape Diversity Strategy; European Commission's Communications "Directions towards sustainable agriculture" COM(1999)22, "Biodiversity Action Plan for Agriculture" COM(2001)162, "Halting the loss of biodiversity" COM(2006)216). Organic and low-input farming systems are expected to have less environmental impact than intensive agriculture, which is dependent on the standard use of pesticides and inorganic nutrient applications in the production of crops and animals. Organic farming has been defined by the European Union as "…an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes." (EC Regulation 834/2007). Organic farming positively contributes to landscape and biological diversity, for example through provision of a higher diversity of wildlife habitats [3]. Organic agriculture performs better than conventional agriculture both with regard to the species-richness of plants and bird abundance [4]. The study shows, however, that for some invertebrates such as earthworms, butterflies, spiders and beetles the trend is not always as clear. Furthermore, the variety of studies, sampling designs, methodologies and indicators make any general interpretation difficult, if not impossible. This is the reason why generic indicators have to be developed and tested with common methodologies in typical organic/low-input farming systems across Europe. The more critical farmland habitats often require a specific management that goes beyond the standards of organic farming. Nevertheless, it is a very useful contribution to raising general environmental conditions from which many farmland species can benefit. The conversion to organic farming can also provide considerable economic advantages to lowinput farming systems in marginal areas of Europe that are associated with high nature value farmland. These benefits are largely connected to policies providing payments for organic farming, which reinforces the need for an evaluation through suitable indicators. Beside organic farming systems, low-input farming systems (LIFS) are found all across Europe. "LIFS could be defined as a way to optimise the management and use of internal production inputs (i.e., onfarm resources) ... and to minimise the use of production inputs (i.e., off-farm resources), such as purchased fertilisers and pesticides, wherever and whenever feasible and practicable, to lower production costs, to avoid pollution of surface and groundwater, to reduce pesticide residues in food, to reduce a farmer's overall risk, and to increase both short- and long- term farm profitability" [5]. Relevant LIFS regarding biodiversity are mostly concentrated in regions of high nature value (HNV) farmland [6]. A definition of HNV farmland has been developed under the IRENA operation [7]: "High Nature Value farmland comprises those areas in Europe where agriculture is a major (usually the dominant) land use and where that agriculture supports or is associated with either a high species and habitat diversity, or the presence of species of European, and/or national, and/or regional conservation concern, or both." HNV farmland is distinguished by the biodiversity value of its farmed and unfarmed habitats [8]. From this point of view, HNV farming systems in HNV farmland regions are characterized per definition by a high biodiversity. According to preliminary estimates, 15-25 % of the European countryside qualifies as HNV farmland [9] [10]. LIFS are often located in marginal areas or in areas which are at risk of marginalisation due to unfavourable natural conditions for agriculture. In those regions, the major part of farm holdings qualifies as low-input farming and this will also affect the occurrence and ecological quality of unfarmed habitats (e.g. hedgerows). Measuring the contribution of LIFS/HNV to the maintenance of farmland biodiversity therefore requires a landscape approach and indicators need to relate to both individual farms and to the landscape. Increasingly, organic farming is practised in those regions where farm management often does not have to be significantly altered to comply with the regulations. Organic farms, however, also often occur in regions which are favourable for agricultural production. In most countries and regions, conventionally managed farmland is interspersed with individual organic farms. In assessing the biodiversity of those farms, a farm-scale approach needs to be implemented where indicators relate to the farm or to individual fields. In developing indicators for both organic and low-input farming systems, the farm scale therefore needs to be addressed as the central spatial unit of investigation. Regarding biodiversity, its composition and its three major compartments, i.e., genetic, species and habitat diversity [11] [12], results of research considering organic and low-input farming systems may be summarized as follows.

Genetic diversity

Farm specialisation and the general abandonment of mixed farming have led to the decline of genetic resources by the introduction of high-yielding and uniform crop varieties and livestock breeds at the expense of their diversity ('holsteineisation effect' [13]). However, genetic diversity is indispensable for the response of species and populations to selection, either natural through environmental changes or human mediated through processes such as targeted selection [14]. This has long been recognized by plant breeders who routinely screen large germplasm collections for variation in specific traits or use ecotype populations to broaden their breeding germplasm [15]. For the organic system to be economically viable, farmers are led to use (local) species, varieties and breeds that are more resistant to pests and diseases and better adapted to local environmental conditions in order to compensate for the restriction on synthetic input use ([16] and the preservation of native varieties and breeds is an important initiative of the organic movement. In France, 40% of the organically farmed soft wheat comprises varieties that are not planted on conventional farms [17]. Examples of breeds related to organic/low-input farming systems are – amongst others – the rescue of the Maremmana cattle in Italy [18] and the Herdwick sheep breed in the Cumbrian Fells (hills) in NW England ([19]. In temporary and permanent grasslands, genetic diversity may substantially influence agro-ecosystem stability and thus may contribute to yield security [20]. Besides the choice of germplasm used for establishing grassland, management practices such as fertilisation or cutting frequency may also influence genetic diversity within species and populations ([21]. Given the importance of grassland in organic and low-input agriculture, a detailed evaluation and application of appropriate indicators for genetic diversity is particularly important in these farming systems. According to IEEP [22] 'domestic diversity' [23] is out of the scope of HNV farmland criteria. Still, breeds/varieties are a key factor at the farming system level and domestic biodiversity forms a field of conservation in itself. Several indicators of the Common Monitoring and Evaluation Framework (CMEF, preparation of national strategy plans and rural development programmes of EU Member States) refer explicitly to HNV and to plant varieties and animal breeds (i.e., "Successful land management defined as the successful completion of land management actions contributing to improvement of biodiversity which is defined as the protection of wildlife species or groups of species, maintain or reintroduce crop combinations and safeguarding endangered animal breeds and plant varieties, etc."). Consequently, the livestock genetic diversity belongs to the indicator list of the OECD and the SEBI 2010 process (indicator no. 6, [24]). BIOBIO proposes to investigate the diversity of animal breeds and cultivated plant species as well as permanent grassland species of organic/low-input farming systems and to develop operational indicators for their diversity.

Species diversity

Organic farming is reported to increase biodiversity in the agricultural landscape [25] [26] [27], including, for example, carabid beetles [28] definition of HNV farming systems is closely related to the conservation of species of European and/or national and/or regional conservation concern and of high species diversity [22]. Hence low-input farming systems composing HNV farmland are per definition supposed to provide high species diversity. HNV farming systems are a particular type of farming that can be low input, but also depend on unfarmed features (e.g. bocage landscapes, small scale farmland with a high density of field margins, etc.) [29]. BIOBIO proposes to discuss species indicators that characterise organic and low-input farming systems and to evaluate possible indicators for the diversity of soil microbiota.

Habitat diversity

Reduction of diversity and complexity of habitats at different scales is a critical process underpinning loss of biodiversity on agricultural land [30]. Organic farms may have higher levels of habitat heterogeneity than non-organic farms because basic standards for organic agriculture include principles and recommendations where provisions are made to "maintain a significant portion of farms to facilitate biodiversity and nature conservation", including (among others) wildlife refuge habitats and wildlife corridors that provide linkages and connectivity to native habitats [31]. Mansvelt and van der Lubbe [32] showed that the diversity of landscape and farming systems was greater in organic farms, regarding land use types, crops, livestock, plantings (hedges, shrubs, trees). Organic crop rotations are more diverse [17] and arthropod diversity has been shown to be related to crop diversity [33]. In terms of landscape diversity, the organic types of agriculture may potentially offer one route to restoring farmland biodiversity [34]. However, data are missing that confirm this statement. At the landscape scale, low-input farming systems concentrated in HNV regions are supposed to provide a wider mosaic of different arable, grass and semi-natural habitats and landscape elements, such as field margins, hedges and grass strips, patches of uncultivated land, used at different levels of intensity (the presence of seminatural habitats is a defining feature of HNV farmland). BIOBIO will propose indicators that characterize organic and low-input farming systems at the farm and landscape scale, including unfarmed features which are related to the farming systems.

BIODIVERSITY INDICATORS AND FARMING SYSTEMS

There has been rapid development of environmental indicators to fulfil demands for international environmental monitoring programmes since the UNEP Environmental data report [35]. The increasing need to assess the ecological effects of pollution and climate change (WCED 1987, [36], ALTER-Net 2008) drove a demand for biological indicators. Indicator development at a European level has focused on regional and national scale monitoring [37], [38], [39] to assess national progress towards national biodiversity targets since the Convention on Biodiversity, Rio 1992 [40] and renewed commitments to halt the loss of biodiversity by 2010 [41] [42], EP 2004, [43] [24]. Current efforts are directed towards developing harmonised and integrated monitoring programmes across Europe using common biological indicators. Examples include the European land cover map (CORINE), common bird survey [44] and butterfly survey [45]. Indicators have been designed for Pan-European use across all ecosystems either in dedicated Long- Term Ecological Research sites [46] or in the wider countryside [47]. Much of the wider countryside in the European context is under agricultural land use. Indicators of environmental effects of agricultural policy have been developed at the regional and national scale [48], [49], [7], [43], [50], [51], [52]. These have been increasingly adapted to assess the effects of particular farming systems or agrienvironment schemes on biodiversity [53]. Although some major studies of biodiversity have been carried out at the farm scale, notably the evaluation of genetically modified crops in the UK, biological indicators have not been developed for specific farming systems. Methods have been developed to evaluate environmental impacts of farming systems based on standard agricultural statistics as indirect measures of biodiversity [54] but either for single case study farms [55] or low resolution across broad geographic areas [56]. Such methods are based on "indirect indicators" derived from management practices. Indirect indicators for biodiversity have been implemented in the evaluation of environmental impacts of agriculture, e.g. in life cycle assessment (LCA) method (e.g. Swiss Agricultural Life Cycle Assessment, SALCA), and in agro-environmental diagnosis of farms (INDIGO and SOLAGRO in France, KUL/USL and REPRO in Germany). In SALCA, impacts of agricultural practices on biodiversity are estimated at field and farm level by fuzzy-coding of published experimental or observational investigations and of expert knowledge by means of 11 species groups (e.g., birds, small mammals, spiders) [57]. In the farm based system REPRO [58] the complex relationships between farm management and biodiversity are divided in 1) structural parameters describing the area, the land use and the cropping structure, 2) fertilizer and pesticide inputs, and 3) specific indicators of process design and management features. These indicators are finally aggregated to the „Biodiversity Development Potential". Whilst those methods have been developed primarily for national applications, large datasets like FADN and FSS may be helpful in providing indirect indicators relating to input use and land-use diversity (number of crop and livestock enterprises per holding) for organic/low-input holdings at the European level. Low-input holdings can be determined in relation to the value of crop fertiliser and pesticides used and livestock feed inputs and stocking rates (the latter also applies to FSS). Some of these approaches have been applied in the IRENA framework, though not separating out organic/lowinput farms specifically. For both datasets, it would be possible to differentiate the analysis by farm type and region as part of an EU wide assessment, though the spatial resolution will be limited by the number of FADN samples per sub-region. It is envisaged that a greater level of detail will be collected with respect to organic farms for the pan EU agricultural census in 2010, but the results of the census are not expected to be available in the life time of the project and reliance will need to be placed on data collected in earlier years (FADN is collected annually, the last FSS survey was conducted in 2007). However, it will be important that selected indicators take account of European Commission (in particular DG Agri, DG Enviro and Eurostat) plans for agricultural, rural and agri-environmental development from 2010, to increase the chance of the biodiversity indicators being developed in this project being adopted. Nevertheless, indirect indicators have to be discussed and chosen with caution. As argued by [59], because of the huge number of species and the complexity of ecological processes within agricultural habitats, many potentially influencing factors may be unrecognised and not monitored. The intensity of agricultural management varies considerably across Europe [60] and the environmental heterogeneity of the European continent reduces the certainty with which predictions about the link between agricultural management on biodiversity can be made [61]. Moreover, impacts of agricultural practices are often poorly understood so that the most relevant parameters that can be practically monitored are unclear. Therefore, indicators of the actual state of biodiversity are essential. We will use the DPSIR framework ([62]; EEA, IRENA operation) to structure the indicators according to the different components of the system (Figure 2.) Coarse processes of land use/land cover, farming practice categories etc. drive the actual pressures and benefits, i.e. the concrete farm operations, which in turn act on farmland biodiversity (state/impact indicators, further mentioned as direct indicators). If indicators show negative (or positive) trends, they will stimulate a response from policy makers, from society at large and also for technical progress (new farm practices) to improve the situation of farmland biodiversity.

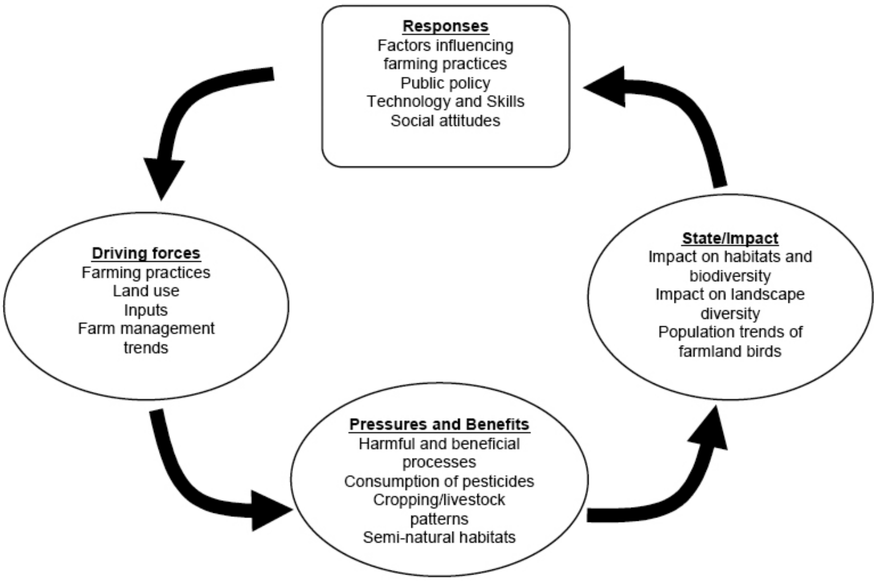

FIGURE 2. DPSIR framework for developing farming and biodiversity indicators (indicators are examples of relevant issues for agriculture).

From an econom ic perspective, biodiversity provides benefits for present and future generations by way of e cosystem services. Thes e services include production of food, fuel, fibre and medicines, regulation of water, air and climate, maintenance of soil fertility, cycling of nutrients. It is difficult to put precise m onetary values on these services worldw ide, but estimates suggest they are in the ord er of hundr eds of billion s of Euro s per year [63]. These services underpin EU growth, jobs and wellbeing. Because public benefits which derive from different landscape patterns and characterist ics including biodivers ity are im possible or irrelevant to m onetarise (e.g. sp iritual and cultural values), it is preferable to explore how farmers and local residents relate to biodiversity, wh at kind of attitudes they have, w hat kind of benefits they realize. To enhance the scientific understanding on how people perceive the benefits of biodiversity may provide input for policy recommendations. Non-monetary values attached to biodiversity can be best unfold by qualitative res earch methods, especially semi-structured or in-depth interviewing and focus groups, since these methods help exploring and understanding causal relationships by paying attention to knowledge, attitudes and feelings of the partic ipants. Sem i-structured o r in-dep th interv iews with f armers and/or th eir f amily members and em ployees provide infor mation about how they assess the biodiversity on the farm and in the surrounding environm ent. Personal and f arm/family-level benefits can be addressed in this way. Focus groups, on the ot her hand, are able to explore how a group of farmers farming in the same village or landscape assess biodiversity in a higher spatial level. Focus group participants often broaden their pers pective from individual to social well-being, which may result in a new and wider range of benefits derived from biodiversity. Extending the approach to ru ral villagers brings up yet ad ditional benefits of landscape biodiversity as perceived by the local non-farm er population. Ecosystem services, that are natural processes acting within and am ong ecosystems (including na tural and agro-ecosystems) in agriculture, are of par ticular im portance. The se inc lude b iological co ntrol of pests, po llination and decomposition processes beside the crop production itself. It is recognized that simplification of agro-eco systems caused by inte nsification of agricu ltural p ractices m ay aff ect im portant ecosystem services via the loss of biodiversity. In organic/low-input farming, services may be preserved by particular management practices and this has to be investigated with appropriate indicators including beneficial organisms for pest control such as predatory and parasitoid arthropods, pollinators such as wild bees and decomposers such as oribatid mites in soil. Due to the com plexity of all aspect s of biodiversity, there is no doubt that biodiversity in the broadest sense of the Rio Convention cannot be measured as such and it is accep ted that a single indicator for biodiversity cannot be devised [64]. Ideally indicators should be selected that express or represent both the biodivers ity as a whole AND because they are se nsitive to environmental conditions resulting from , for in stance, land use and agricultural m anagement practices. R egarding the divers ity of species, whilst som e au thors have shown that some species groups may serve as surrogates for the whole biodiversity (Coleoptera, Heteroptera, plants) in certain circum stances, m any studies revealed poor correlations between species richness in one taxonomic group and species richness in other groups ([65] Gaston 1996, [66] Lawton et al. 1998). In addition, many new approaches and term s have been developed to refine the in dicator species concept. These incl ude focal sp ecies, umbrella species, flagship species, or guilds as indicator s [67] [12]. Exa mples of co mmonly use d species groups in biodiversity m onitoring schem es a re vascular plants, birds and butterflies. Noss [12] ha s shown that it is possible to deve lop a hierarchy of indicators from gene to landscape level based on the distinction between structure, composition, and func tion. Examples of structural indicators in the context of a cultivated field are cultivated plant architecture and openness of the culture. The second group com prises compositional indicators. These can be functionally important species (i.e. keystone species or engineering specie s) and species that are sensitive to and thus indicate m anagement practices, is olation of the habitat, etc. The third group comprises functional in dicators. Th ese are indi cators of the abiotic and biotic disturbance factors and m anagement regim es that are pr esent, e.g. grazing im pact, cutting regim es. Another classification of indicat ors, which has to be consid ered, catego rises indicato rs according to three im portant m otivations to preserve and enhance biodiversity in the agricultural context [68], i.e. (i) in dicators reflecting nature protection purposes (species conservation with focus on rare and endangere d species) , (ii) in dicators ref lecting the ecological resilience (focus on genetic and spec ies diver sity) and (iii) indicato rs re flecting plant protection purposes (b iological con trol of potential pest organism s with focus on predatory and parasitoid arthropods). This last category may be extended to additional issues with respect to im portant ecosystem services in agriculture, e.g. indicators of soil health and fertility (markers for soil microbial and fungal diversity and macro-invertebrates), indicators including beneficial organisms (in addition to predatory and parasitoid arthropods) providing biological control of pests, and pollinators. Th is approach seem s to be prom ising for the purpose of developing appropriate indicators for the linkage between organic/lowinput farming system s and biodivers ity b ecause it c onsiders nature conserv ation goals (species conservation), genetic resources and other com ponents of biodiversity (ecological resilience) and economic aspects (plant protection). Accordi ng to Clergue et al. [69], the three parts m ay be extended to three main functions, respectively, i.e. patrimonial, ecological and agronomical functions. Based on the BioBio indicator s et develop ed for Europe, we will study the adaptability of those in dicators in agro-e cological s ituations of three interna tional partne r cooperation (ICPC) co untries. The involvem ent of ICPC will allow testing bio diversity indicators and protocols beyond E urope as we ll as to dissem inate knowledge and offer an opportunity to further collaboration in the fi eld of sustainable agriculture. Sustainable agriculture and biodivers ity preservation is of key im portance to developing countries where agriculture is still a m ajor sourc e of incom e and em ployment. At the sam e ti me, however, pressure on resources is increasing and so monitoring schemes to assess the sustainable use of agro-ecosystems are much needed and preser ving biodiversity (both in the wild and on domesticated plants and animals) is a prio rity. Globalisation is strengthening m ore and m ore the linkage am ong countries. It is therefore im portant for EU to care a bout the sustainability of farming practices which lead to the producti on of agricultural comm odities imported into the EU. This m eets als o the in creasing con cern of the E uropean citizens for su stainable development in develo ping countries. BioBio will rev iew the above m entioned concepts, theories an d resu lts of em pirical studies re garding biodiversity indi cators in the general context of agriculture and the specific case of organic/low-input farming in order to propose biodiversity indicators which are (i) scientifically sound, (ii) applicable at the European level and which (iii) respond to stakeholders' needs.

INNOVATION

Although B IOBIO is not intended to develop new and previously untested biodiversity indicators, the novelty in the project will consis t of: § a concise and stringen t evaluation of existing ind icator system s according to clear cr iteria relevant for organic and low-input farming systems at the European level; § the maximisation of synergies with already existing European indicator systems, be they landscap e, biodiversity or farm economics oriented, for application in the context of organic and low-input farming systems; § the developm ent of indicators that com bine m easurements at a fine spatial resolution (farm /landscape) with requirements for reporting for large geographical areas; § a practical test of bio diversity indicators across all major organic and low-input farming systems in Europe; § a practical test of biodiversity indicators in selected ICPC countries to assess the adaptability of the indicators and their wider relevance for orga nic/low-input far ming system s globally; § the assessment of private and public econom ic benefits, and non-monetary value of biodiversity promoted by organic and low-input f arming; § a systematic integration of European and local stakeholders throughout the res earch project, furthering m utual understanding between researchers and stakeho lders; § production of standardised protocols and recomm endations that will enable establishment of biodiversity monitoring across different farming systems and countries, thus laying the foundations for in creasing understanding of the links between farming practices and biodiversity at the European scale and beyond.

STRATEGIC IMPACT

BIOBIO will contribute to strengthen several European policies, namely the European Action Plan for Organic Food and Farm ing, the EU R ural Development Programme including agrienvironmental organic farm ing support, the Global Plan of Action for the Conservation and Sustainable use of Plant Gene tic Resources for Food and A griculture, the first and second pillar of the CAP and t he EC Biodiversity St rategy. The conservation value of High Nature Value farmland is acknowledged in several EU policy documents, such as the EU Regulation on rural developm ent (EC 1257/1999). HNV farm land areas will be one of the indicators (IRENA 26) to assess the Rural D evelopment Comm unity Strategy (programm ing period 2007–2013) and particularly one of the three priorities of axis 2 "biodiversity and preservation of high nature value farm ing and forestry sy stems". The European Action Plan for Organic Food and Farm ing states that " *Organic land management is known to deliver public goods, primarily environmental, but also rural development benefits and in certain respects may also result in improved animal welfare. (…) Consumers need better information on the principles and objectives of organic farming as well as the positive impact on, for example, the environment.*" Therefore, Action 1 aim s at givi ng the E uropean Commission organising greater possibilities for dir ect action in order to organise inform ation and prom otion campaigns on organic farm ing. A m ulti-annual EU-wide inform ation and p romotion campaign is to be launched " *to inform consumers, public institutions canteens, schools and other key actors in the food chain about the merits of organic farming, especially its environmental benefits, and to increase consumer awareness and recognition of organic products, including recognition of the EU logo.*" This inform ation campaign has to rely on scientific information. Previous research on or ganic farming policy in Europe, including the EU-CEE-OFP project and m ore recently the ORGAP project (www.orgap.org), which is focused on methods for evaluation the EU and national organic action plans, has identified the need for the inclusion of a wide range of soci al and environmental impact indicators, but to date precise specificatio n of these has not been possible because suitab le data sou rces and indicator definitions did not ex ist. While the E U action plan for organic food and farm ing makes reference to the dual role of orga nic far ming in providi ng public goods (e.g. biodiversity and environmental protection) and meeting market demands, in practice the focus of policy development and evaluation has been on busines s issues as these are th e easiest to monitor and evaluate. Better means to measure the impacts of organic farming would mean that its con tribution to EU policy goals could be m ore pr ecisely established, and better targeted app roaches to achiev ing th is could b e developed. The indica tor set developed in BIOBIO will make it possible to actually assess the biodiversity benefits of organic (and low-input) farming at the continental scale. This will constitute an important progress compared to the status quo, where only national and regional indi cators are available to this end. The first pillar of the CAP represents its m ain component and one of the m ain expenditure chapters of the EU. Since the 2003 reform came into force in 2005, it provides direct paym ents under the single payment scheme (SPS) to support farm income. These payments are conditioned upon the com pliance with environm ental cross -compliance requirem ents by far mers. Cross compliance requirem ents include a num ber of m easures directly aim ed or connected with biodiversity conservation (input reduction, species protection, habitat co nservation) (annexes III and IV o f reg. CE 17 82/2003). BIOBIO will indirectly co ntribute to the evaluatio n of the effects of such commitments by providing a toolbox (indicator set) for evaluating the benefits of farming systems for biodiversity. On the long run, this will support the enhancement of the general contribution of the CAP to biodiversity conservation. One of th e goals of the second pillar of the CAP is to prom ote rural development. The adoption of environm entally friendly farming systems and agri-environmental schemes accounted for about 37% of the expenditure of this pillar in the peri od 2000-2006. They provide a num ber of m easures related to biodiversity, including payments for organic and low-input farming. The available evaluation of agri-environm ental schem es generally reports weak ev idence for the effects of such measures on biodiversity due to lim ited ti me scale for th e evaluation , lack of appropriate baselines and indicators (Agra CEAS Consulting, 2005). Once the effects of organic and low-input farming systems on biodiversity can actually be assessed by indicators at the continental scale, the implem entations and the m onitoring of the effectiveness of those po licies will be facilitated. An ef fective evaluation of the ef fectiveness of agri-environmental policies is th e pre-requirement to their improvement and to the better and more efficient targeting of public funds. Although the new regulation on organic farming 834/2007 gives increased emphasis on biodiversity issues, the re is s till a n eed for these to be b etter reflected in the im plementing rules, currently under discussion, and in further developm ent of organic far ming regulations and standards in the future. A clear understand ing of the biodiversity im pacts of organic farming, and how these can be m easured, w ould facilitate also increased emphasis on biodiversity issues in the inspection proce ss, and therefore the better integration of biodiversity into organic farm ing standards. The Global Plan of Action for the Conservation and Sustainable use of Plant Genetic Resources for Food and Agriculture has been translated into several European regulations which ai m at conserving plant (and anim al) genetic resources and to promote farm ing system s whic h m ake use of a high diversity of genetic resources. BIOBIO, by developi ng operation indicators on geneti c diversity in organic and low-input farming systems, will enable the assessment of the status of in situ genetic diversity in different farming systems at the continental scale. The EC Biodiversity Strategy (ECBS) is the EU's response to the Convention on Biological Diversity and aim s '… *to anticipate, prevent and attack the causes of significant reduction or loss of biological diversity at the source. This will help both to reverse present trends in biodiversity reduction or losses and to place species and ecosystems, including agro-ecosystems, under a satisfactory conservation status, both within and beyond the territory of the European Union.*' BIOBIO will strongly support the reporting for the CBD, the European Biodiversity S trategy and the Habitat Directive by making providing an operational indicator set which is applicable to organic and low-input farming systems and are able to dem onstrate their contribution to the conservation of farmland biodiversity at the European level. The current concentration on protected areas constitutes a m ajor gap in the ex isting Comm unity con servation p olicies. BI OBIO will develop the tools to f ill this gap. It is nece ssary not o nly to have consisten t data on biodiversity but also be able to link it to drivers of change so that European policies can be evaluated and new policy instruments developed. On this point the Commission states, that "*it is necessary to strengthen efforts to identify and monitor the most important components of biodiversity as well as pressures and threats on them. Tasks and targets identified in the action plan and other measures in this area should be incorporated in the activities within the framework Community Programme on Research and Development.*". The integration of three partners from ICPC countries will allow for the transfer of know how beyond Europe and into farming and policy system s other than those in EU FP7 countries. At the sam e tim e, we expect that new knowledge will arise from the meeting of different cultures and discussions of different farm ing system s, providing an a dditional expansion of our thinking beyond the boundaries of European farm ing systems. This part of the project will be of great im portance in assessing possible lim itations of our indicat ors and thoroughly testing their flexibility for use in different ecological, social and cultura l conditions. In conclusi on, BIOBIO has been designed to utilise the com bined experien ce o f the participants' agron omic, ecolo gical and environmental exper tise and present it in a way that is relevant to the policy are na. The answers pro vided will be imm ediately applica ble to all c entral EU polic ies relating to farmland biodivers ity. The particip ation of st akeholders th roughout th e project will ensure that re levant inf ormation is also d elivered to national governm ents as well as the EU Commission.

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COMPARISON THE ENVIRONMENTAL EFFECTS OF ORGANIC/ LOW INPUT VERSUS INTENSIVE FARMING SYSTEMS ON SOIL AND NUTRIENT LOSS

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ABSTRACT

Rural areas underwent serious changes in the last 2-3 centuries. Recent changes in Eastern Europe included the change of the former socialist era to something new. This caused segregation of large fields into small farming units at the first time. Later on big enterprises started to buy and unify agricultural areas again. Some remaining spots stayed in a less intensive status with low or no nutrient use at all, farmed by small families. This and other abandonment of former fields or land use change from arable to meadow provided a possibility to make comparison of such forms of land uses (intensive and extensive farms side by side, or arable and grazing lands side by side). The comparison needs a complex research of an area (soil management with great emphasis on nutrient supply, analyses of geological background, crop rotation, botanical surveys, land use change survey and examination of grass management and planted grass species). Extensive farming can serve as a good basis for the production of healthy food [1] [2]. Potential hazards of soil loss [3] [4] do not only belong to extreme events but soil, soil nutrient and soil organic matter loss are causing yield loss in agricultural production, effect climate change [5] [6]. In the present study numerous areas were examined where low input/organic farming could have been compared with other areas under intensive farms: extensive pastures versus arable land, organic farm versus abandoned arable land; grassland versus intensive arable land etc. The results of coenological and pedological examination proved that low input and organic farms are causing less soil and nutrient loss compared to intensive farming systems. The rate of soil and nutrient loss is less intensive on organic farms; the lower third of the slopes on low input/organic farms have less lost nutrients from the upper slope thirds than those of intensive farms. Intensive farms produced 2-3 times more nutrient loss than low input/organic farms.

Keywords: low input farming, organic farming, intensive farming, nutrient loss, soil loss

INTRODUCTION

Soil eroded by water and wind erosion is a well examined area of the natural environment. However soil water erosion has not been examined in details concerning its effects on nature protected areas. In the present case we examine the rate of nutrient loss in a buffer zone of a national park to show the dimension of the problem. Differences among the erosion effects of some of the locally wide spread crops. Farming systems might play an important role in the preservation of biodiversity, especially close to natural or semi-natural areas. Choosing proper land management methods [1] [7] [8] plays an important role in preserving soil fertility [9] and avoiding erosion [3] [4] [5] [6]. Measuring the value of the landscape and – in general – the natural areas it is an increasing need to prepare a monetary portray [10] [11]. Monitoring the change of landscape patterns is another important issue [12].

Erosion is investigated in details on the Balaton Watershed because it plays a central role in the life of the country, mainly because it is the most visited area just as well as Budapest. Water quality is important to maintain attractive water for tourists and good quality for wild species in natural environment. There have been erosion researches [6], land use change researches in connection with calculation of sediment fluxes [5], soil erodibility researches [13], soil-plant-erosion research [14] and examination of connection between soil formation and degradation [15] etc. Potential hazards of soil loss [4], [3] do not only belong to extreme events but soil, soil nutrient and soil organic matter loss are causing yield loss in agricultural production [16], effect climate change and sediments are filling up ditches, lakes and smaller waterways but extremely high nutrient content is non desirable either [13].

MATERIALS AND METHODS

Introduction of the examined areas

Outskirts of Pilismarót

The parent rock of the area is dominated by Tertier sandstone and andesit tuff or agglomerate. 20 % of the sediments of the surface or near surface is loess or slope loess, appr. 40 % is Pleistocene river sand or pebbles and another appr. 40 % is Holocene, mostly river sediment. The climate is heterogeneous because it is a transition zone between moderately warm and moderately cold types. Cooler areas are to the north and south, warmer areas are to the east and west. Yearly average temperature is 9.5–10 ^{o}C. Number of sunny hours are 1950. The number of days with snow cover is 35, the average maximum snow depth is 20–25 cm. Yearly amount of the precipitation is 600–650 mm. Winds are dominantly arriving from the North-West, the average wind speed is 3 m/s. The dominant soils are Arenosols (27–28 %) formed on the calcium rich alluvium of the Danube with low soil organic matter content, raw Fluvisols (28–28 %) and with smaller proportion the Luvisols (15 %). 90% of the Luvisols are forested, their erosion is maximum medium level and erosion is not wide spread on Luvisol under forest. The examined area lies approx. 46 km north of the center of Budapest.

Káli Basin Area, Nemesgulács and Köveskál

The second sample area is situated in the Káli and Tapolca Basins, they are part of the Balaton Upland National Park. Káli Basin has very diverse geological heritage, there is basalt, sandstone, red sandstone, dolomite and limestone. The Káli Basin Landscape Protection District was formed in 1984 on 9111 ha. The area can be freely visited except some strictly protected peaty meadow areas. Examined areas can be found north of Lake Balaton, in the Tapolca and Káli Basins of the Balaton Upland National Park Directorate, near the settlements of Nemesgulács and Köveskál. Near Nemesgulács there are 4 horses grazing on 6 ha area in free grazing (0.7 horse/ha) on a *Cynodonti-Poëtum angustifoliae* grassland that is situated on a slope. Soil and plant samples were taken on the upper (UTS) and lower (LTS) third of the slope. This area formerly was used as vineyard. Near Köveskál there are 2 horses grazing on a 1 ha grassland (0.5 horse/ha) on a degraded association of *Cynodonti-Poëtum angustifoliae*. Control area was found close to the grazed grassland where *Salvinio– Festucetum rupicolae* association was found. The grassland was grazed formerly by sheep. 55 pieces of 2 by 2 m coenological quadrates were examined on each sample area. Quadrates were prepared by Braun-Blanquet method [17] [18] in July, 2007. Cover values were given in %. Total cover values were given as absolute cover, calculated for 100% were given as relative cover. Compositions of the characteristic groups of the grassland were evaluated according to [19]. For evaluation during the data processing we chose nature conservation value categories (TVK) [20] from synthetic parameters.

Putnok Hills, Alószuha and Gömörszőlős

The studied areas are in the Putnok Hills, Northern Hungarian Mountains, in the eastern part. Traditional land use methods were observed on the basis of close-to-natural state habitats. These areas are extremely important for nature conservation because valuable plant taxa may only be preserved for the future generations with sustaining the management patterns, used through hundreds of years. The plant communities and species of the studied area were fully described by Malatinszky [21]. Ancient agricultural activities on diverse habitats resulted in specially structured landscape mosaics. Besides biological and landscape diversity, adequate cultivation structure is important also in favour of preserving soil fertility and avoiding erosion. Soil is one of the most important components of the landscape. Its preservation must be our priority because it is a non-renewable resource at the scale of human lifetime. Eroded soil material may carry humus and important fertilizers (9 $kg*ha^{-1}*y^{-1}$ N, 5,5 $kg*ha^{-1}*y^{-1}$ P and 6,6 $kg*ha^{-1}*y^{-1}$ K can be lost due to erosion) from the arable lands. Detailed soil data of the Alsószuha research area is described in Centeri and Császár [15].

Pedological examinations

Soil core samples were examined and described at all sites in the 1-100 cm layer. Upper 20 cm layers were sampled for laboratory analyses. The following soil parameters were examined in the laboratory: pH(H2O), pH(KCl), CaCO3 in %, soil organic matter in %, ALP2O5 in $mg*kg^{-1}$, AL-K2O in $mg*kg^{-1}$. For examination of different slope thirds, methodology of the Hungarian Soil Protection Information and Monitoring System was used [22].

RESULTS

Pedologgical evaluation of the Pilismarót site (adjacent to the Danube-Ipoly National Park) Examination of the Pilismarót area shows the differences in basic pedological parameters among the various crops (**Table 1.**). Alfalfa is supposed to provide the best protection against nutrient runoff and maize should be the worst but in this case maize resulted better solution. This can not be explained by the effect of the plant rather with bad nutrient managements.

Sample site	**Crop**	**Slope section**	**CaCO3**	**SOM**	**AL-K2O**	**AL-P2O5**
			(%)	(%)	(mg kg-1)	(mg kg-1)
Site 1.	Winter wheat	Upper third	5.81	1.43	190.7	46.4
Site 1.	Meadow	Lower third	10.78	1.25	177.9	93.9
Site 2.	Winter wheat	Upper third	3.21	1.32	195.0	86.9
Site 2.	Winter wheat	Lower third	0.26	1.59	195.0	100.8
Site 3.	Alfalfa	Upper third	0.63	1.56	189.3	72.1
Site 3.	Alfalfa	Lower third	0	1.64	182.9	59.3
Site 4.	Alfalfa	Upper third	0.59	1.36	177.9	63.2
Site 4.	Alfalfa	Lower third	0	1.46	190.7	34.6
Site 5.	Maize	Upper third	0.70	1.72	190.7	95.8
Site 5.	Maize	Lower third	0	1.45	176.5	22.7

TABLE 1. Results of the basic soil laboratory analyses, Pilismarót, Hungary

Results of the pedological examination of the Káli Basin area, Nemesgulács and Köveskál

The results of the pedological laboratory experiments can be found in **Table 2.** In case of Nemesgulács samples were collected from the lower and upper third of the slopes, resulted differences in nutrient content.

Sample site	Description	pH (H2O)	pH (KCl)	CaCO3	SOM1	AL2-P2O5	AL-K2O
				(%)	(%)	(mg*kg-1)	
Nemesgulács	Horse pasture UTS3	7.81	7.39	14.51	4.25	164.5	214.9
	Horse pasture LTS4	7.65	7.23	1.32	4.74	374.5	441.8
	Control	7.76	7.32	14.93	3.42	222.9	259.2
Köveskál	Horse pasture	7.79	7.20	11.58	10.31	171.8	668.6
	Control	7.86	7.29	24.99	12.01	270.5	675.8

Sampling depth was 0-20 cm, [1] *SOM=Soil Organic Matter,* [2] *AL=Ammonium Lactate,* [3] *UTS=Upper Third of the Slope,* [4] *Lower Third of the Slope* **TABLE 2.** Results of laboratory examination of soil samples

There are differences in pedological background of the lower (LTS) and upper (UTS) third of the slopes. At LTS there were species with big coverage indicating nutrient rich environment and nitrogen, e.g. *Artemisia vulgaris* (**Table 3**). At UTS their proportion is significantly smaller. The change is obviously caused by the nutrients moving from the UTS to LTS together with other soil elements, such as soil organic matter, potassium and smaller particle size soil materials. These elements are not only moving from the upper part of the slope but accumulating at the bottom of it. Plant species follow changes in soil properties. Vegetation at LTS is better both for species composition and for production from the foraging point of view.

ites and slope sections	**Nemesgulács area**				**Köveskál area**			
	LTS1		**UTS2**		**Pasture**		**Control area**	
TVK values	**absol.**	**relat.**	**absol.**	**relat.**	**absol.**	**relat.**	**absol.**	**relat.**
	(%)							
E5	4.0	7.2	2.4	6.9	4.2	14.8	20.0	27.9
GY6	0.0	0.0	0.2	0.6	0.0	0.0	0.8	1.1
GY	13.0	23.3	3.8	10.9	7.0	24.6	13.4	18.7
K7	0.6	1.1	0.4	1.1	5.8	20.4	13.4	18.7
TP8	0.4	0.7	0.8	2.3	0.0	0.0	0.2	0.3
TZ9	35.6	63.8	24.8	71.3	10.4	36.6	24.0	33.4
TZ(K)10	2.2	3.9	2.4	6.9	1.0	3.5	0.0	0.0
Total	55.8	100.0	34.8	100.0	28.4	100.0	71.8	100.0

[1] *LTS = Lower Third of the Slope,* [2] *UTS = Upper Third of the Slope,* [3] *absolute,* [4] *relative,*

[5] *E=edaphic,* [6] *GY=weed,* [7] *K=accompanying species,* [8] *TP=natural pioneer,* [9] *TZ=natural with disturbance tolerance,* [10] *TZ(K)= natural species with disturbance tolerance (accompany)* **TABLE 3.** Distribution of the species with different nature conservation value categories (TVK) on the Nemesgulács and Köveskál area (Káli Basin), Hungary

Festuca rubra was the only represented edaphic species (in one quadrate). Coverage of natural species with disturbance tolerance was moderately decreasing. Low forage value was caused by the lack of valuable *Poaceae* and pulses species. There was a low total cover with 51.8%. Horses ate up the valuable plant species. Negative effects, such as trampling was also observed on the pasture. Horses have selective foraging. Based on the species composition this area is not suitable for horse pasture but it could be more effectively used for sheep pasture. The species composition and laboratory analyses proved the negative effects of the lack of nutrients. Nutrient supply could be improved by spreading mature manure. *Solidago* has a very high proportion, needs handling.

Evaluation of grazed land of the Köveskál site (Káli Basin)

There were differences between the plant species of the pasture and the control area. One of the main differences between the pasture and the control area is the strong dominance of drought tolerant species on the control area. Both areas had the representatives of species with nitrogen demand from sterile to hipertroph production sites. Pasture has a very high proportion of the species indicating nutrient rich environment that can be probably explained by overgrazing. Both control and pasture areas has the highest cover of natural species with disturbance tolerance. The biggest difference in nature conservation value categories was the decrease of association composing species on the pasture because *Poa angustifolia* (the most valuable for foraging in the association) was eaten up by the horses. The lack of the cover cause increase in weed species. On the pasture there is the biggest coverage of the natural species with disturbance tolerance. Natural competitors were missing from the association. Overgrazing and improper grazing method caused very low plant cover on the pasture. *Prunus spinosa*, *Rosa canina and Rubus caesius* indicate strong increase of shrub coverage on the control area. Their cover reaches 10% on the control while on the pasture they are not represented. Coverage of *Poacea* species is double on the control area compared to the pasture. Species composition of the pasture has changed significantly, grazing caused decrease in its production.

Pedological evaluation of the Gömörszőlős site (Putnok Hills)

In the Gömörszőlős area we compared the basic laboratory parameters (**Table 4.**) of an arable land (corn) with a dry meadow (situated on the same slope). The differences in the laboratory data suggest that there were intensive farming under the area where there was meadow in the last few years. The differences in the AL-P2O5-content of the upper and lower third of the slopes are great both on the arable land and on the meadow as well.

Surface cover	Slope	pHKCl	pHH2O	CaCO3	AL-P2O5	AL-K2O	SOM
				%	(mg*kg-1)	(mg*kg-1)	(%)
Arable land	LFH1	6,68	7,78	21,3	140,84	463,99	2,33
	LAH2	6,81	7,77	7,8	166,36	558,55	3,16
Meadow	LFH	6,71	7,33	19,3	110,14	483	3,91
	LAH	6,63	7,16	9,7	181,6	532,2	4,45

[1]LFH = upper third of the slope, [2]LAH = lower third of the slope, [***]SOM = soil organic matter **TABLE 4.** Laboratory data of topsoil in Gömörszőlős

Pedological evaluation of the Alsószuha site (Putnok Hills)

In the Alsószuha area we compared the basic laboratory parameters of an arable land (corn) with abandoned lands (12 and 30 years ago, respectively). Abandoned lands are mostly covered by grass and functioning as meadows now. As it can be seen in **Table 5.**, there are differences in the distribution of the examined soil parameters.

Surface cover	Slope	pHKCl	pHH2O	AL-P2O5	AL-K2O	SOM3
				(mg*kg-1)	(mg*kg-1)	(%)
Arable land	LFH1	5,41	6,50	32,41	162,68	2,55
	LAH2	5,96	6,70	90,07	184,35	3,28
Abandoned (for 12 years)	LFH	5,32	6,30	28,67	141,86	3,01
	LAH	5,25	6,16	20,85	118,72	2,37
Abandoned (for 30 years)	LFH	6,47	6,85	66,59	166,23	2,5
	LAH	5,70	6,37	19,58	188,04	2,86

[1]LFH = upper third of the slope, [2]LAH = lower third of the slope, [3]SOM = soil organic matter **TABLE 5.** Laboratory data of topsoil in Alsószuha

On the arable land, there are two-three times differences in the nutrient content and soil organic matter content of the lower and upper slope thirds. Differences smooth when we go to the abandoned arable land, used as pasture for 12 years. In this case we found higher soil organic matter and phosphorous content of the upper third of the slope that can not be explained only by the soil forming effects of the grassland but there must have been manuring of the grazing animals as well. There are similar, extreme results in case of the 30-years-old pasture where phosphorous content is more than triple on the upper third compared to the lower third. In case of intensive farming or simply arable land use, thanks to the higher slope angle, the "normal" way of nutrient distribution is that there are nutrient concentration at the bottom of the slope (lower slope third) caused by the combined effects of intensive soil water erosion and soil tillage erosion. In case of the abandoned farm, it is vice versa.

CONCLUSIONS

Basic pedological and botanical field studies and basic soil laboratory analysis can prove the difference in the nutrient status and the soil erosion state of the lands used with different intensities. Further biodiversity analysis and plant content analysis could prove the positive effects of low input farming.

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INFLUENCES OF ORGANIC AND CONVENTIONAL FERTILIZING AND MULCHING ON YIELD AND QUALITY OF MELON AND WATERMELON UNDER PROTECTED CULTIVATION.

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ABSTRACT

This experiment was conducted to examine the effect of commercial organic and mineral fertilizers and different mulches (transparent, black and gray) on the yield (early and total yield) and quality (TSSC% and pH) of melon and watermelon under low-tunnel for two-year period. There was not statistically difference between organic and mineral fertilizing on yield. But, TSSC% was found higher in organic fertilizing, and mulches increased yield and TSSC% compared to control, significantly. The highest early and total yield were obtained from mineral fertilizing and TSSC% value was higher in organic fertilizing combination of black mulch in melon and watermelon.

Key words : Organic farming, protected cultivation, watermelon, melon.

INTRODUCTION

Mineral fertilizing has not been effective on soil sustainability on a long-term basis. Because of it causes to soil degeneration (decline in organic matter content, higher pH, physical degradation) and environment deterioration (erosion) [1]. Healthy soil is a main component of sustainability; that is, a healthy soil will produce healthy crop plants that have optimum vigour and are less susceptible to pests. Soil health depends on using cover crops, traditional or commercial fertilizer, reducing tillage, avoiding traffic on wet soils, and maintaining soil cover with plants and/or mulches.

Organic fertilizers are more profitable in environment protection and soil sustainability, and it is used in traditional agricultural production for a long time. But, they have some negative and detrimental influences based on concerns about production quality (quality of raw vegetables), contamination (hormones, antibiotics, pesticides, disease organisms etc.), soil fertility imbalances (usage of excessive levels, large amounts of nitrogen and salts), weed problems (containing weed seed) and pollution hazards (manure eroding or leaching into ground or surface waters) [2]. Therefore, commercial organic fertilizers (concentrate liquid or solid) should be more beneficial and practical on soil sustainability in both of current and future sustainable agriculture.

MATERIALS AND METHODS

The experiment was carried out in the growing seasons of 2007 and 2008 at the Bafra plain, Samsun, Turkey. Four melon cultivars and two watermelon cultivars were used with different coloured mulch treatments under transparent plastic low-tunnel. Crop rotation system was applied in experimental area (melon, tomato, head cabbage, watermelon). Organic and conventional areas were isolated by distance of 30 m to prevent any probable pesticide or fertilizer contamination from conventional areas. Organic and mineral fertilizing (Table 1) were programmed accordance with the analysis of the soil. The N-P-K ratio was considered 13- 4-16 $kgda^{-1}$ and 17-14-20 $kgda^{-1}$ for melon and watermelon [3], respectively.

Plants were protected with certified commercial organic insecticide (Azadirachtin- NeemAzal) and fungicide (Copper sulphate - Labicuper) in organic plots, regularly. Decis (Deltamethrin) and Aliette (Fosetyl-Al) were used as insecticide and fungicide in conventional plots, respectively. Weeds were controlled through manual hoeing and hand pulling as the melon and watermelon vines spread and covered the plots to thus suppress weed growth.

Table 1. Chemical composition of the commercial organic and mineral fertilizer

	Organic Fertilizers			Mineral Fertilizers		
	Ormin-K	MOG	Biofarm	AS	PS	MAP
Source	Vegetal	Vegetal	Vegetal+Cattle	$(NH_4)_2SO_4$	K_2SO_4	$NH_4H_2PO_4$
pH	6.6	6.3	6.6	4.8	6.0	4.6
N (%)	-	3.91	3.5	21.0	-	11.0
P_2O_5 (%)	-	-	3.0	-	-	52.0
K_2O (%)	30.0	5.4	3.0	-	50.0	-
S (%)	-	-	-	24.0	18.0	-
OS (%)	5.0	35.0	65.0	-	-	-

OS: Organic Substance; AS: Ammonium Sulphate ; PS: Potassium Sulphate; MAP: Mono Ammonium Phosphate

RESULTS

Early and Total Yield (kg/m²)

Early and total yield were not influenced from organic and mineral fertilizing, statistically. Mulch applications gave the higher early and total yield than control in melon and watermelon. In melon, early an total yield was increased with mulch applications about 53-90% and 37-63% in organic and 59-100% and 35-59% in conventional areas. Early and total yield was found higher in mineral fertilizing and black mulch combinations by 2.63 and 5.39 kg/m² in Anzer F_1, respectively (Figure 1 and 2).

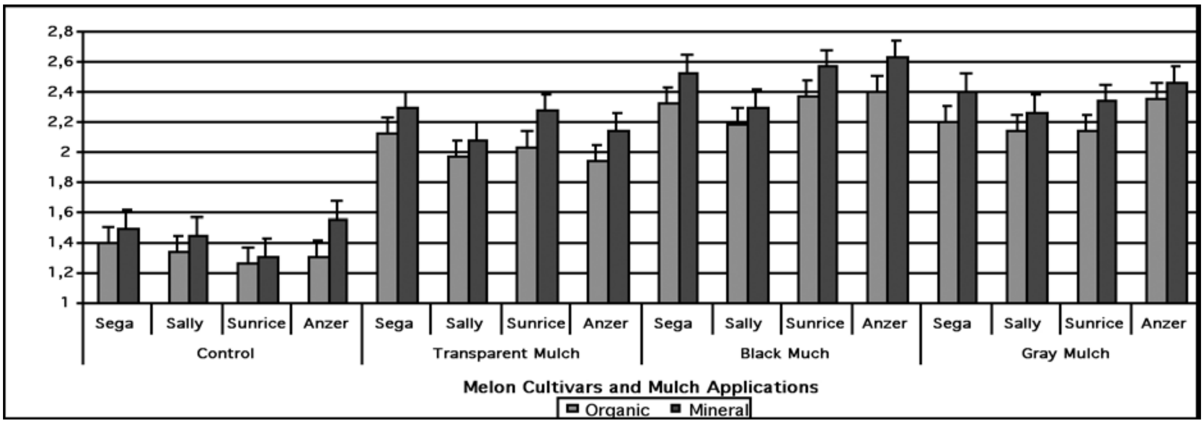

Figure 1. Early yield of melons (kg/m²).

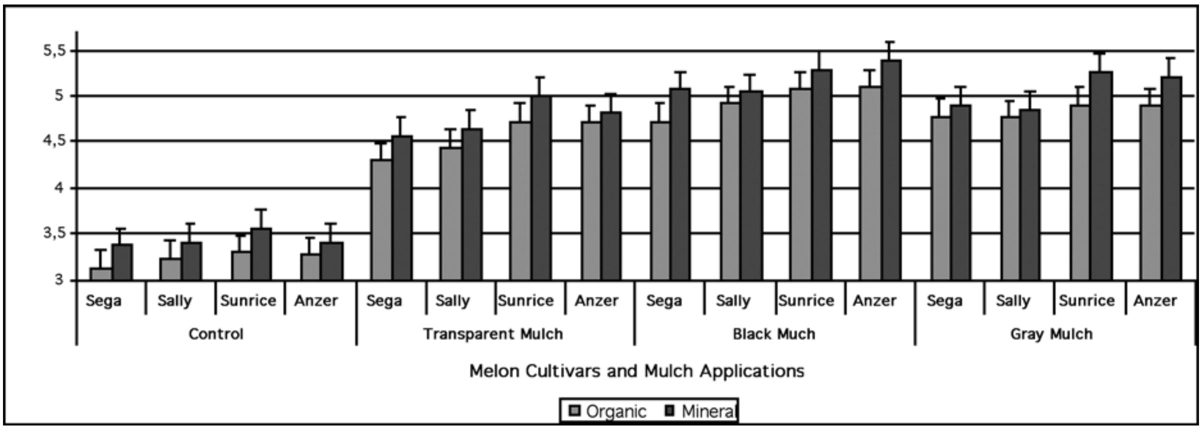

Figure 2. Total yield of melons (kg/m²).

Early an total yield was increased with mulch applications about 16-38% and 14-30% in organic and 18-39% and 20-32% in conventional areas, in watermelon. Farao F_1 gave the higher early and total yield in mineral fertilizing and black mulch combinations by 7.48 and 11.03 kg/m², respectively (Figure 3 and 4).

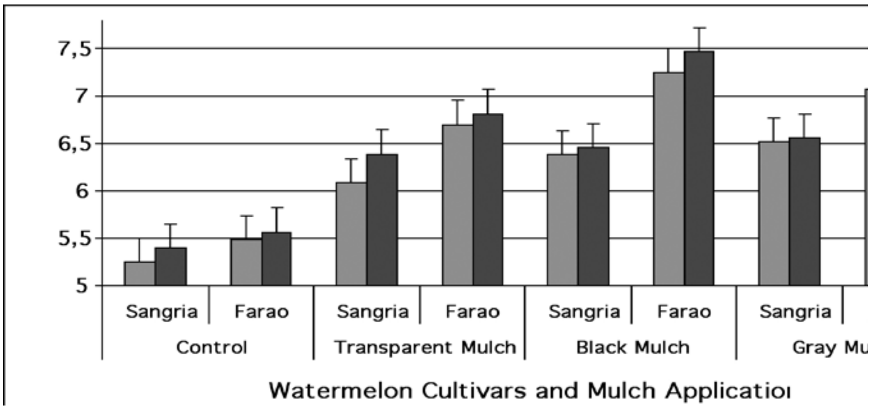

Figure 3. Early yield of watermelon (kg/m²).

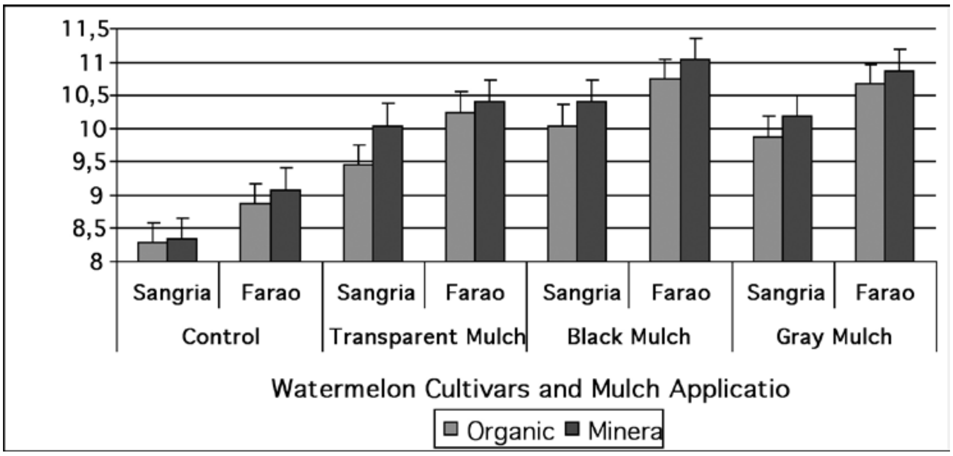

Figure 4. Total yield of watermelons (kg/m^2).

Total Soluble Solid Contents (TSSC%) and pH

TSSC% values were influenced from organic and mineral fertilizing, and mulch applications, significantly. Organic and mineral fertilizing, and mulch applications were not effective on pH. Organic fertilizing and mulch applications gave the high TSSC% than control and mineral fertilizing both in melon and watermelon. In general, TSSC% was determined 8.5% and 10.1% in organic and 8.2% and 9.3% in conventional areas for melon and watermelon, respectively. TSSC% was increased with mulch applications about 15-23% in organic and 8-20% in conventional areas. The highest TSSC% was found in organic fertilizing + black mulch by 9.2 for melon (Sega F_1) and 10.8 for watermelon (Farao F_1). pH values were changed 6.2-6.4 in melon and 6.4-6.7 in watermelon (Figure 5 and 6).

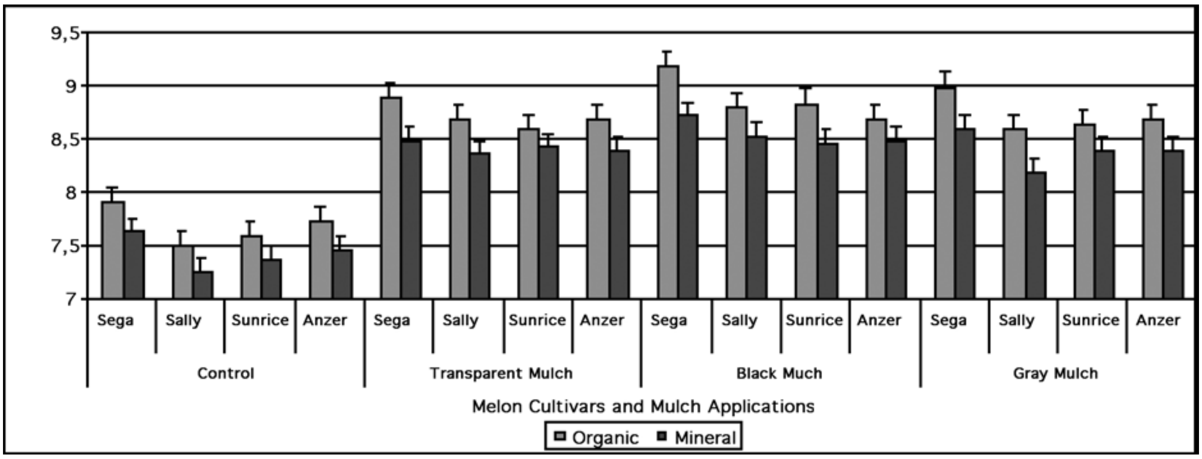

Figure 5. TSSC of melons (%).

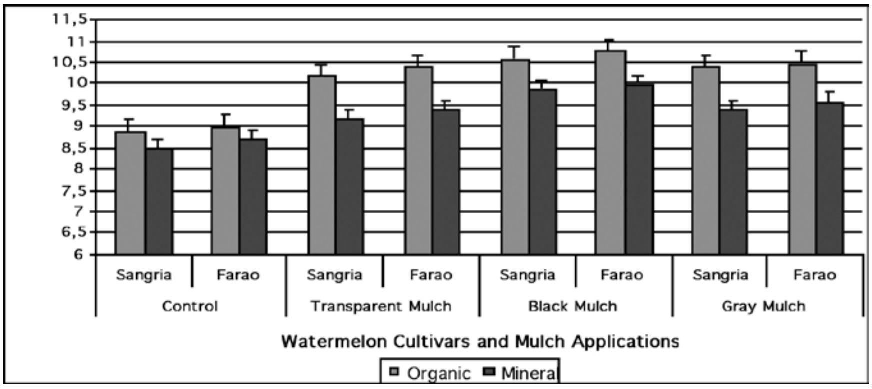

Figure 6. TSSC of watermelons (%).

DISCUSSION

The effect of commercial organic and mineral fertilizers on the early and total yield was found to be non-significant, statistically, and both organic and mineral fertilizers had similar effects. But conventional areas were found a little bit productive than organic areas. Similar result was found in melon [4]. On the other hand, fruit yields (kg/plant) were significantly higher in inorganic substrates compared with in the organic substrates in melon [5]. Watermelon and melon grown under protected organic conditions produce greater total and marketable yields than those grown under protected conventional systems, also [6].

Mulch applications (transparent, black and gray) enhanced early and total yield (early and total yield) in melon and watermelon, also. Protected cultivation (greenhouses, tunnels and mulches) is one of the effective method of intensive production of melon and watermelon [7] [8]. TSSC% contents were found significantly higher in organic fertilizing areas and pH was not influenced from applications. Faria et al. [9] obtained high soluble solid content values with the application of organic matter in melon.

Many researcher were proposed different results because of organic production is the mostly depending culture conditions (climate and region, open or protected cultivation, origin and amount of organic fertilizer, soil type) and cultivars (resistance and/or tolerance to disease, insect and weed pressure, adaptation ability of local conditions). Therefore, determination of cultivars performances under various culture conditions is necessary to comparable high yield and quality in organically grown melon and watermelon.

Finally, commercial organic fertilizer were found profitable and convenient as mineral fertilizer in melon and watermelon growing combined with mulch and plastic tunnel applications.

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THE BIOCONTROL AGENT OF MADEX® DECREASES CODLING MOTH DAMAGES IN ESTONIAN ORGANIC APPLE ORCHARDS

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ABSTRACT

The codling moth (Cydia pomonella) is a common fruit pest of pome and stone fruits worldwide [1]. Nowadays, mostly chemical pesticides are used to control its population and therefore in organic orchards this pest is a serious problem. Recently, a biocontrol product MADEX® has been developed. It contains a naturally occurring granulovirus that infects the digestive organs of the larvae [2]. The suitability of most biological control agents depends greatly on local environmental conditions and pest populations.

Therefore, we conducted a pilot study to test the effect of MADEX® on an Estonian codling moth population. The experiment was conducted in an organic orchard established in 2002 with a mix of apple tree varieties. Half of the trees were treated twice with 0.1% MADEX® solution and other half was untreated. The damage of codling moth was estimated as percentage of attacked fruits on dropped fruits twice in July and on all apples at the harvest. At the first estimation of dropped apples, there was no difference between treatments and almost 35% of apples were attacked.

One week later the damage of treated apples decreased to 14% whereas still 32% of apples from control trees were damaged. At the harvest there were more than two times more damages on untreated apple trees (19.7% attacked) compared to the treated ones (8.8% of apples attacked). These results show that MADEX® could be a promising biocontrol product to diminish the codling moth damages in Estonia. However, more studies are needed to test its effectiveness.

Keywords. Codling moth, *Cydia pomonella*, organic apple orchard, granulovirus, biocontrol.

INTRODUCTION

Codling moth (*Cydia pomonella*) is a common fruit pest of pome and stone fruits in temperate fruit-growing regions [1]; decreasing considerably the apple fruit yield [3]. In conventional orchards mostly synthetic pesticides are used to control the population of this pest. In organic orchards, however, there are very few possibilities to control this insect pest and therefore its damages are problematic.

The extensive use of broad-spectrum pesticides leads to the development of insecticide resistance and has negative environmental effects. Moreover, they are harmful to non-target insects and beneficial organisms, including the natural enemies of codling moth. Effective alternatives to non-selective synthetic insecticides are biocontrol products.

One effective biocontrol product against codling moth is MADEX®, which contains a naturally occurring granulovirus that infects the digestive organs of the larvae. This virus is shown to be a very efficient biocontrol agent since it kills the pest within 3-7 days, depending on the dose [2].

Since the suitability of most biological control agents depends greatly on local environmental conditions and pest populations, it is very important to test its suitability in every region. Therefore, the aim of this pilot study was to test the effect of MADEX® on Estonian codling moth population.

MATERIAL AND METHODS

The experiment was conducted in an organic apple orchard in Southern-Estonia. The orchard was established in 2002 with a mix of local apple tree varieties. On June 22 and July 6, 2009, half of the trees were treated with 0.1% MADEX® solution and other half was untreated. The damage of codling moth was estimated as a percentage of attacked fruits on dropped apples on July 6 and 14 and on all apples at the harvest on September 16.

RESULTS AND DISCUSSION

At the first estimation there was no difference between treated and untreated trees and almost 35% of dropped apples were damaged. The lack of positive effect of MADEX® at this assessment time could be due to short time after treatment. Although the studies show that the larvae are killed within a week, the time the pest enters the apple fruit must have been before the treatment. Indeed, the positive effect of granolovirus appeared on the assessment one week later, when the treated trees had approximately two times less damaged apples whereas the damage rate of apples from control trees remained the same as before.

At the harvest, there were again over two times more damages on untreated apples compared to the treated ones but this time the percentage of the damaged fruits was much lower (Figure 1). These results show that MADEX® could be a promising biocontrol product to diminish the codling moth damages in Estonia and it could be recommended to use in the organic apple orchards. However, more studies are needed to test if its effectiveness is constant over years.

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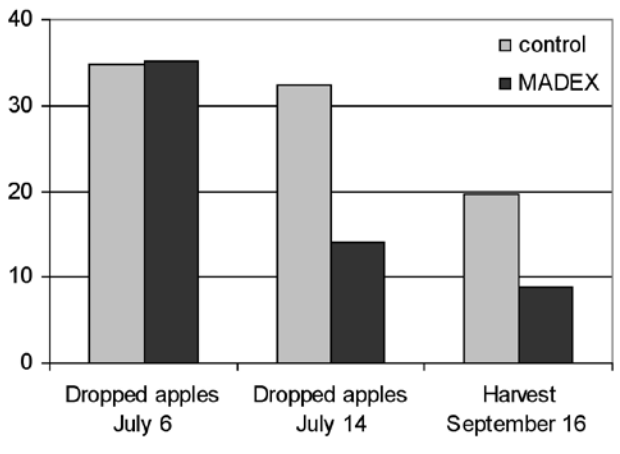

Figure 1. The percentage of apples with codling moth damage in organic apple orchard at three assessment times in 2009.

EFFECT OF MICRO NUTRIENT FOLIAR APPLICATION ON THEIR CONCENTRATION IN CORN KERNEL

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ABSTRACT

Zea mays is one of the most important food sources for human and cultivated in most countries. One subject that ignored is micronutrient elements efficiency in different soil conditions. For decreasing usage of chemical fertilizers in organic crop production and increasing micro nutrient elements rate and compensate element deficient in human life and for studying micro elements different application methods on corn a factorial experiment based on randomized complete block design with three replications was conducted during growing season of 2008 at Islamic Azad University, Tabriz Branch, agricultural research station. Treatments were six levels of micronutrients (control, ZnSO4, MnSO4, H3BO3 and complete micronutrients) as the first factor and three forms of application (soil, foliar application and spraying the kernels) as the second one. Results showed that foliar application was useful more than other application in growth and yield of corn. Complete and mix fertilizers by foliar application increased Boron concentration in corn kernel. Foliar application increased ZnSO4 concentration in kernels. Micro fertilizers application increased quality and quantity in corn. By foliar application of mix microelements Boron rate in kernel increased to 13.91 ppm that was approximately 74.96 more than the control treatment. FeSo4 and mixed fertilizers foliar application caused increasing equal 5.5% Fe and 24.52% MnSo4 in corn kernel more than control treatment. Micro fertilizers and foliar application was best method for increasing micro nutrient elements concentration in kernel and decreased human body microelements deficient.

Key words: Corn, Micro fertilizers, different Methods, nutrient concentrations in kernel.

INTRODUCTION

Corn, the most important sources of human food comes in a wide range of agricultural land is being cultivated in the world. This plant, however, production performance, nutrient needs are high to. But sometimes even with the use of nutrients to the conventional methods resulting potential function because despite the micro-nutrients to less macro nutrients plants need. Is due to their role in plant physiology at least according to the severity of the macro nutrients could affect growth and function may affect crops. But despite the importance of its role around the world often has been ignored. One of the issues that most often been exposed, nutrient efficiency of a variety of micro earth. Corn after germination to nutrient needs is high and any deficiency, plant growth and yield will reduce. Due to a small root system in the early stages of growth nutrients should be placed in the vicinity of seed (5). Macro and micro nutrients for plant nutrition are essential (2).

But why did the farms, along with low fertilizer use, the macro and micro nutrients are discharged from the soil (1). Methods now the most important micro-nutrients in the world are soil application methods. But this method has disadvantages (6). For example, because the amount used is very low micro-elements uniform application of fertilizer to the soil micro consumption is very hard (7). Nutrients absorbed by the root and shoot part. (9). But the amount of food absorbed by plants from the soil may not be enough (8). Therefore Modified Micro nutrient deficiency due to low performance of these elements in soil requires large amounts of fertilizers used in soil (3,8). Therefore, depending on the vironment of farmers in different ways other use. Application methods for food, are foliar application, Seed coat with micro nutrients are better way (8). Because of lower amounts of fertilizers are required, easy to apply and nutrients in the seedling and the production is stronger seedling growth and that cause offer better seedling (8)

MATERIALS AND METHODS

To evaluate the effect of different methods on some traits of Zea mays L.cv. Jeta an experiment was in Tabriz 2008 and based on a factorial randomized complete block design with three replications was conducted. Treatments were six type of micronutrients (control, $ZnSO_4$, $MnSO_4$, H_3BO_3, $FeSO_4$ and complete micronutrients) and three methods of application (soil application, seed coating and foliar application). The results showed that the effect of different fertilizers and methods of various micro applications, yield in connection with the 1% level was significant. Soil samples from two 4 point field profile produced according to the Soil science laboratories were sent, in May of 2008 provided land and complementary operations took the stack. Each experiment included 4 row plots were planting distance between rows 60 cm distance on seed rows and 20 cm planting depth was equal to 4 cm. Percent of micro elements in fertilizers in Table 2 is shown, also equal mixture of the other fertilizer supply and fertilizer mixture as the assembly was used. Rate used in this study used earth and to 30 kg ha and foliar application in concentrations of 5 thousand was considered (4, 10).

Harvesting operations in September separate plots for each was done. Elements concentration in seed research institute laboratory analysis of plant was measured. Analyze variance based on the basic factorial experiment design was a randomized complete block and Comparative Study of factors Duncan Test 5 percent level was used. Statistical Analysis of variance calculations include mean and Comparative Study using statistical program MSTATC and drawing diagrams by using Excel software was done.

RESULTS

Boron amount of the seed

Foliar application of fertilizer's most compact Micro contains all the significant increase in the amount of food this element has been seed. But among other methods application control were not significantly difference with the exception of fertilizer to the seed coat that ear due to the amount of food zero element, respectively (Figure 1).

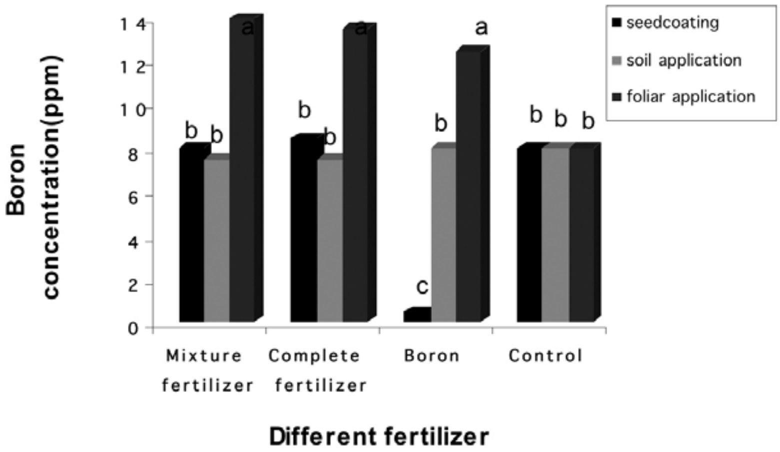

Figure1: effect of different fertilizers on Boron concentration in Seed

Amount of iron in seeds

Foliar application of iron fertilizer and complete micro fertilizer increases the amount Micro element iron in the tissues. Other treatments except the method complete micro fertilizer s oil application increased tissue iron element have been seed (Figure 2).

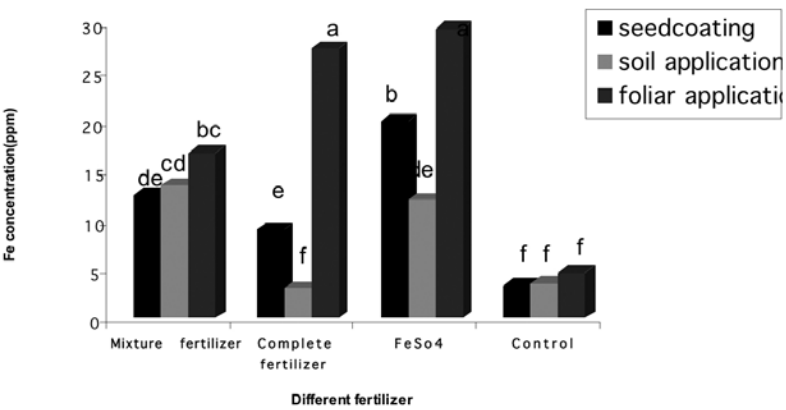

Figure2: effect of different fertilizers on FeSO4 concentration in Seed

Amount of seed Mn

Foliar application of mixture fertilizer in the most influence on the increased manganese in the tissues which unlike the results in tissue concentrations of this element has. Due to the increased attendance next effective manganese foliar and soil application complete fertilizer and Mn foliar application of seeds, respectively, But unlike other results to other treatments treatment by seed coat with a mixture of seeds and fertilizer had not significant difference by control and decrease in manganese in seeds (Figure 3).

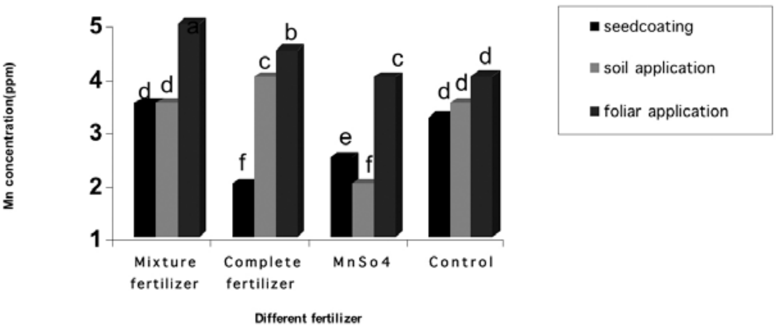

Figure3: effect of different fertilizers on MnSO4 concentration in Seed

RATE ZINC ON THE SEED

Such amount on the leaves, foliar application had most effect on the increase in the tissue .Between other treatments only complete and mixture fertilizer by foliar application and seed coating with a complete fertilizer caused significant increase in the seed. Among other treatments with no significant difference was observed in control (Figure 4).

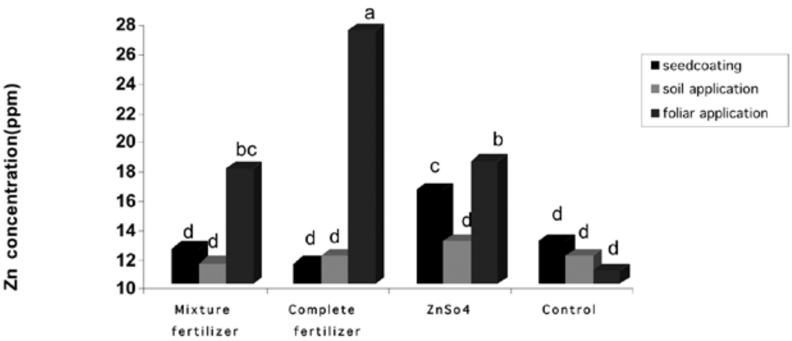

Figure4: effect of different fertilizers on ZnSO4 concentration in Seed

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CASE STUDY OF ECO/RURAL TOURISM DEVELOPMENT IN MONOSPITOVSKO BLATO

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ABSTRACT

The case study is presenting a successful story of development of eco and rural tourism in the area of Monospitovsko Blato. The Monospitovsko Blato is a swamp ecosystem in the Municipality of Bosilovo, Republic of Macedonia. The ecosystem is used for centuries from the local population for fishing, hunting and collecting medical plants. The current situation in the area of Monospitovsko Blato had shown that the usual income of the local population coming from the cultivation of horticultural crops is not satisfactory, so there is need for new and alternative sources of income. Their interest was the area to be developed in sustainable way which will attract visitor with different interests to the site. Since the site is placed in geographical position that has great potential for eco/rural tourism development, different activities were undertaken to develop and promote eco and rural tourism in the area of Monospitovsko Blato.

Key words: Monospitovsko Blato, swamp, Nature Monument, biodiversity, tourist site

INTRODUCTION

Despite the fact that Republic of Macedonia has three national parks, it is rich in mountains, springs and rivers, flora and fauna, the rural and ecotourism are undeveloped and the potential of natural beauties and rural areas is underestimated. This case study is presenting a successful story of development of eco and rural tourism in the area of Monospitovsko Blato as part of the project Development of eco/rural tourism in Municipality of Bosilovo, financed from the Neighbourhood Programme between Bulgaria and Macedonia, Grant scheme for Nature Protection, Valorisation of Cultural Heritage and Cooperation among Public Institutions at Regional/Local Level. The project activities were carried out from March 2007 to March 2008, where the Municipality of Bosilovo was the implementation body and Municipality of Garmen was project partner.

RESULTS AND DISCUSSION

The Monospitovsko Blato covers area of 400 ha and it is situated in the South-East Planning Region of Republic of Macedonia in the vicinity of village Monospitovo and it is under administration of Municipality of Bosilovo (Figure 1). The swamp is in the nearest vicinity of Koleshinski and Smolarski Waterfalls, the thermal springs Banja Bansko, 10 km from Strumica as the biggest town in the region and about 20 km from the Bulgarian border. The location of the swamp is giving good geographical predisposition to be developed in eco/rural tourist site.

Figure 1. Location of Monospitovsko Blato. Source: [5]

In 1987 it was proclaimed as Nature Monument because it is the only location in the country where the royal fern *Osmunda regalis* is growing. In the Biodiversity Strategy and Action Plan of Republic of Macedonia form 2004, revitalization, traditional utilization of biodiversity and development of ecotourism for Monospitovsko Blato were recommended and foreseen [1] [4].

Approximately 9000 citizens are living and working in the nearest environment of the swamp. There is long tradition of collection of reed from the swamp, used for weaving ragcarpets locally called rogozini. The Monospitovsko Blato is very known hunting site. The hunting is very traditional; the hunters are making reed cottages (cheki) where they are waiting for the birds. Although reduced, the fishing is still performed in traditional way with kind of a handmade canoe (shayka) and handmade harpoons (sapkani) [4].

Taking into account all above-mentioned facts, Municipality of Bosilovo undertook first steps for sustainable development of Municipality of Bosilovo through development of eco and rural tourism in the area of Monospitovsko Blato. The objective of the action was reached with several activities: training in folklore and traditions; training in handcrafts; training for capacity building of local institutions involved in cultural and environmental management; youth camp for environmental and cultural issues; theatre show with traditional and folklore motifs; research of biodiversity, publication of monograph, multimedia CD and brochure about the Monospitovsko Blato; public forum Sustainable development of eco/rural tourism in Municipality of Bosilovo and micro region of Strumica; construction of 3 km access road from village Monospitovo to Monospitovsko Blato; construction of 1 km wooden pathway, 7 wooden cottages and 2 birdwatcher towers inside the swamp which are used for walks, hunting and they contribute to the specific landscape beauty (Figure 2) [2].


Figure 2. Monospitovsko Blato landscape with wooden cottage, pathways and watchtower.

The biodiversity of the swamp is moderately reported in [2], but the monograph Monospitovsko Blato. Last marsh in Macedonia [4] is first detailed ecological and biodiversity report of the Monospitovsko Blato. Six different types of biotopes are described: marsh, swamp, wet meadows, forests, fragments of bogs and agricultural fields.

CONCLUSIONS

The described activities that were undertaken within the grant were the first and initial steps towards development of eco and rural tourism in Monospitovsko Blato. This initiative shall be further developed with establishment of action and management plan for eco/rural tourism in the area of Monospitovsko Blato and strong connection between local population and entrepreneurship.

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ORGANIC PRODUCTION OF OYSTER MUSHROOM IN THE REPUBLIC OF MACEDONIA

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ABSTRACT

Production of Oyster mushroom in the Republic of Macedonia in controlled conditions records significant improvement, mainly due to the new approach in growing technology. In this sense, organic production of oyster mushroom strongly depends on bio control. According to the basic principles of organic production there is absolute absence of any synthesized pesticide in the production process. This requires use of certified inputs used prior and after the mycelium inoculation. Neither of the inputs should be under influence of synthetic pesticide.

STUDY AREA

After the substrate preparation phase is over, it is time to insert the mycelium onto the soaked and properly cooled substrate. Average water content should be around 75-85% of water, and the temperature around 22 °C. The bags containing straw and the mycelium are stored in a room with temperature between 22-25 °C, and they stay there for a period of 3 weeks. In this period the mycelium spreads through the straw, and by the end of this period the bag, which in the beginning was yellow in color, almost turns into white. At the 21st day small colonies of mushrooms begin to emerge around the holes, previously punched on the bags. at this phase, proper ventilation and room temperature of 18-22 °C is imminent. On the other hand, the ventilation system should keep the room ventilated good enough trying to avoid high-wind flow, as it will dry the mushrooms. In opposite, due to higher CO_2 concentration instead of having nice, round and big fruits, fruits will be deteriorated in form, and small in size. Light has own part too. Too little and the form of the fruit would look like cauliflower. Too much, the specific grey color would will turn to cream. In Macedonia growers usually keep the bags for harvesting up to 3 times (around 40 days). The first pick contributes to 60% of full yield weight, and the rest remains to the latter two picks respectively. Vast majority of the mushrooms are sold as fresh.

CONCLUSION

Organic production of Oyster mushroom in Macedonia is in its first steps. Using government subsidies for organic agriculture it could become a production crop to be practiced and used by both rural and urban population. Baring in mind its nutritional values and full absence of synthesized pesticide residues it presents a niche product for hotels & restaurants in Macedonian resorts.

Tanks, cages and cranes used in the soaking and pasteurization process

Bags in chamber after mycelium innoculation

Manipulation table (on the right) and compressing unit (left)

Bags in growing areas

THE SUSTAINABLE SOIL MANAGEMENT BY USING INTEGRATED PEST CONTROL METHODS

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ABSTRACT

The integrated pest control is a concept which provides environment protection and it is represented by the fact that it does not envisage to maintain at level 0 the pest and disease infestation; it rather accepts their presence in crops up to a certain accepted level, named *economic injury threshold*, which represents the limit from which the losses due to the infestation become important from the economic point of view.

Another element is to use compatible control measures, with a synergic effect, i.e. with an enhanced effect when they are associated compared to their single use. *The methods* applied in the integrated control are the following: physical-mechanical, genetic, phyto-sanitary hygiene, crop management, biological and chemical therapy.

In the present paper we present a statistical study on the integration of integrated pest control principles and actions with the environmental principles in the case of twenty small and medium-sized farms from the county Ilfov in Romania .

Keywords: integrated pest control, sustainable soil management, phyto-pathogens infestation level (IL), numerical density (ND.

INTRODUCTION

Our studies were performed under the national research project CEEX no. 56/2008 on the theme: ”Modeling the response of agricultural holdings to the integration of economic and environmental principles through the sustainable management of soil resources”, regarding the integration of economic and environmental principles and actions and the development of certain scenarios on the sustainable soil management.

The *integrated control* concept was introduced in 1956 by B. Bartlett and in 1959 by Stern, considering it a new crop protection concept, which should take into consideration environment protection. The rational organization of the integrated crop control strategy needs to reveal the infestation level (IL) and the numerical density (ND) of the populations of harmful and useful organisms, in order to establish the treatments to be applied.

The methods applied in the integrated control are the following: physical-mechanical, genetic, phyto-sanitary hygiene, crop management, biological and chemical therapy.

The crop management measures, by their correct application, can maintain the infestation with phytopathogenic agents below the economic injury threshold (EIT), also contributing to chemical pollution prevention. The main crop management measures are the following: selection and preparation of soil for crops; soil structure improvement works; destruction of second growth plants; crop rotation; rational fertilization; selection of planting stock; plantation period and depth; plant density; maintenance works; irrigation scheme and harvesting period.

The effect of this set of measures is the modification of the ecologic conditions that favors the plants and is less favourable for phytopathogens development.

The decision on the application of a certain chemical treatment should be well considered, under all its aspects, while always having in view Hippocrate’s statement: “primum non nocere” (“first of all, not to do any harm”).

MATERIAL AND METHOD

In the present paper we present a few results of the study on the integration of integrated pest control principles and actions with the environmental principles and actions in the case of small and medium-sized farms from the county Ilfov. The analysis of the implementation possibilities of the integrated pest control methods in the soil management was based upon the information resulted from the processing of the validated questionnaires applied to 20 agricultural units from the county Ilfov.

The necessary data for the characterization of the “agricultural holding” system, of the production technologies and soil management quality were centralized and investigated on the basis of several criteria: cultivated land area, production structure, land area under organic re-conversion, organically certified land area, cropping system (extensive, intensive), conventional agricultural practices, crop rotation, crop protection systems and methods, minimum soil conservation methods, use of chemical and organic fertilizers, waste storage facilities and treatment application techniques. On the basis of these data, the management system will be characterized and a series of scenarios will be developed with regard to the farm response to the integration of economic and environmental principles in the sustainable soil management.

RESULTS AND DISCUSSIONS

According to the production structure, the investigated agricultural holdings were divided into three great categories: 11 crop farms, one animal farm and 8 mixed farms (Figure1). Out of total investigated farms, 12 farms belong to physical entities and 8 farms are legal entities.

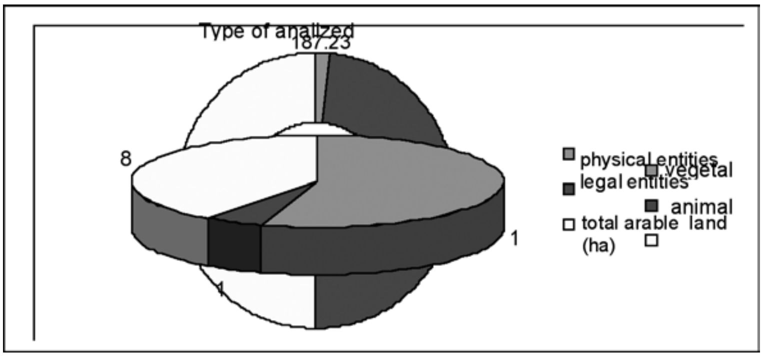

Figure1. Activity profile of the investigated farms

The arable area operated under these farms totals 5739.23 ha. Out of this area, about. 96.73%, i.e. 5552 ha, belong to the 8 legal entity farms, being represented by mixed (crop and animal) farms (Figure 2).

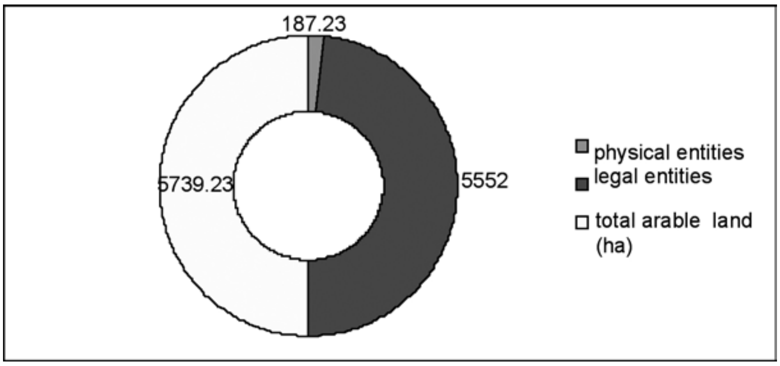

Figure 2. Distribution of arable area by the legal status of farms

With regard to the agricultural production methods that are used, out of the total number of investigated farms, only 4 farms were under organic reconversion (1 physical entity +3 legal entities), the remaining 16 farms using conventional practices.

The analysis of data referring to the agricultural practices used on these farms reveals that 94.62% of the total area was tilled with plough or disk, while disk harrowing was applied on 81.73% of total land. For weed and pest control, mainly chemical and mechanical methods were used (Figure 3).

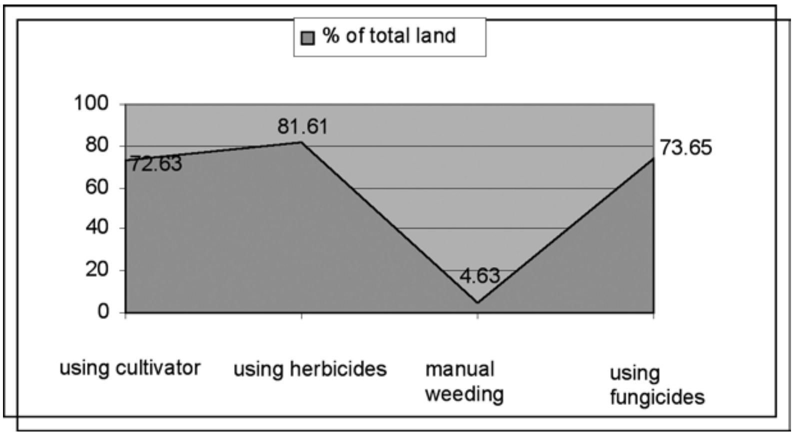

Figure 3. Different shares of weed and pest control methods

The high percentage of chemical control methods can be explained by the economic efficiency induced by the fast and maximum effect of the chemical substances applied.

With regard to the fertilization methods applied, on about 73% of total arable area chemical fertilizers were applied, 13% were fertilized with chemical and organic fertilizers, while only organic fertilizers were applied on only 1.8 ha, which represent 0.035 of total arable land under study (Figure 4). Half of the investigated farmers apply nitrogen fertilizers twice a year, the remaining farms only once a year. Only two agricultural holdings buy manure, about 50 tons each year. This is spread directly in the field under solid form.

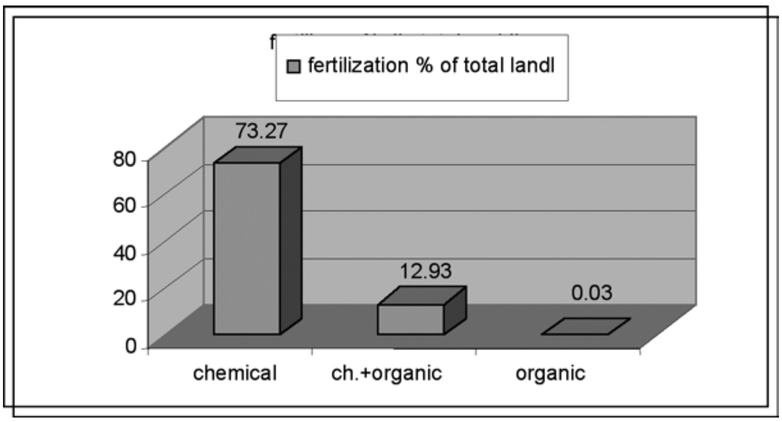

Figure 4. Situation on land where chemical and organic fertilizers are applied

It is worth noticing that when questioned on the decision on which the application of chemical or organic fertilizers was based, only 2 farms decide on the basis of soil analyses, 7 farms respect the farm fertilization plans, in 2 cases the information from the consultancy services is taken into consideration, one farm takes into consideration the information from the chemical plants, while in 17 cases the decision is made according to farmers' own experience.

In relation to the integrated pest control methods, the centralization of the data collected in the field reveal that out of the total arable land area, i.e. 5739.23 ha, the chemical control methods were applied on 2383.98 ha, which accounts for 41.54%. The pest resistant varieties were cultivated on 2331.8 ha, i.e. on about 40.63% of total arable land. The biotech methods were applied on 13.33% of the total arable area of farms. No data were reported for the biological and cultural control methods (Figure 5).

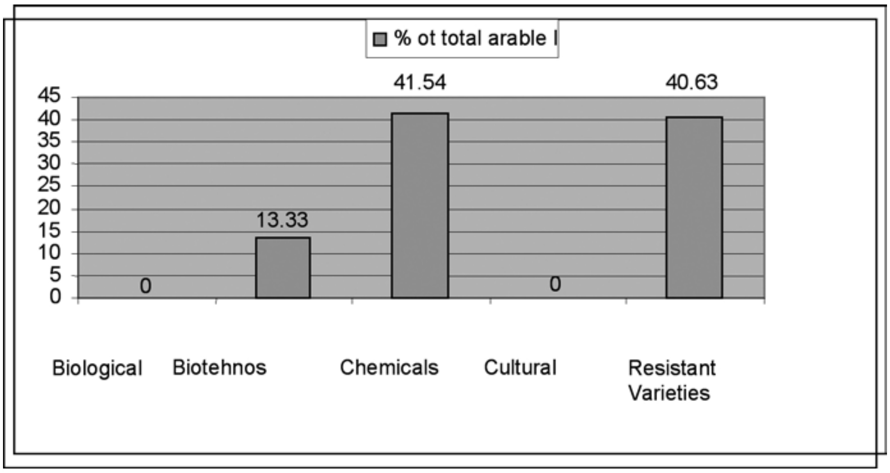

Figure 5. Share of integrated pest control methods

With regard to crop rotation, it can be noticed that on 19 farms from total investigated farms, this beneficial practice is used. The land areas under crop rotation totaled 5097.53 ha, which represents about 88.82% of total arable land. The average number of crops under crop rotation was 5-6 crops on the large-sized farms and 2-3 crops in the case of small-sized farms, with an average period of crop rotation ranging from 2 to 5 years.

With regard to the crop protection measures, out of the total arable land of 5739.23 ha / total farms, on 82.98 ha weed control was performed manually (weeding), while the mechanical method was applied on 1923.73 ha.

In order to reduce the number of predators or parasites, no biological methods were used, only chemical methods. The preventive chemical methods against insects and weed development were used on 2849.5 ha, while the curative chemical methods were used on 2394 ha out of total arable land (Figure 6).

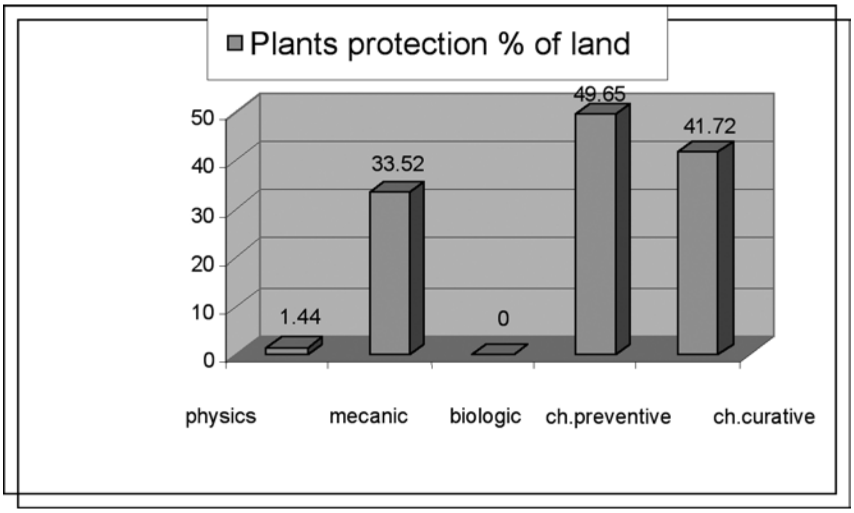

Figure 6. Situation of crop protection methods applied

The pesticides were applied by a sprayer on an area of 4046.88 ha and the treatments by air were applied on 1410 ha of the total arable land.

To the questions referring to the decision basis for the application of treatments, the answers were the following: 3 for the treatment schemes; 3 for consultancy services; 2 for mass-media forecasts; 7 for consultancy from the part of pesticide suppliers; 2 for decision-making only when the economic injury threshold was reached; 17 for farmers' own experience.

OUTLOOK

- The overall analysis of the agricultural practices used on the investigated farms in the county Ilfov proves that in most cases, the management of soil resources on organic principles basis is rather deficient. The organic fertilization and the mechanical weed control are applied on quite small areas compared to the chemical treatments, even in the case of the 4 farms that are under organic conversion.

- The excessive application of the chemical fertilizers (2-3 times per year), in the absence of an evidence on soil treatments and analysis, may result in a series of future problems related to soil pollution, water pollution and even the pollution of agricultural products.

- The use of large amounts of pesticides each year are harmful for the fauna and flora on the respective areas, generating great health risks both for people and for animals. They may even induce cancer risk when their toxic, remanent and non-biodegradable effect is not taken into consideration.

- In order to reduce the hazardous effects of the chemical treatments the following recommendations should be followed: use of low toxicity fungicides; application in the right doses; diminution of the number of treatments; application of treatments only on warning; use of selected products and of those with low remanence; use of complex products; handling of chemicals and application of treatments only by authorized staff.

- Consequently, the integrated control strategy should take into consideration its intrinsic objectives, the main elements of the integrated control and the right choice of the most efficient and non-polluting methods.

- The implementation measures of the integrated pest control methods in the sustainable soil management are the following:

1. permanent knowledge of the phyto-sanitary condition of crops and the establishment of the key-diseases specific for each crop;
2. establishment of the economic injury threshold (EIT – critical limit of infestation), i.e. of the level from which the value of losses exceeds the control treatment costs. EIT has different values according to: biology of pathogen agent (virulence, spread speed); biological value of crop; commercial value of crop;
3. protection and stimulation of useful flora and fauna;
4. use of non-chemical means for disease control (crop management techniques, biological means);
5. use of chemical control only when the case, i.e. only at warning – in this case it is recommended to use selected products that destroy specific pathogens and are not harmful to the useful flora and fauna;
6. avoiding the chemical substances with high remanence and use of minimum recommended doses;
7. implementation of modern techniques of chemicals application (eg. electrostatic application);
8. development and use of new pest and disease resistant hybrids.

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PRODUCTION AND MARKETING OF ORGANIC AND CONVENTIONAL HONEY IN TURKEY

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ABSTRACT

Organic beekeeping has become very important and developing sector in Turkey's beekeeping recently. Enforcements of organic honey (flower honey and honeydewhoney) production has started to increase in 1985 for producing high quality, healthy and non-residiual bee products. Besides that conventional beekeepers in Turkey aim to produce highly qualified honey.

Organic honey production has certificated and controlled practices without artificial nutrition and pest applications in natural flora. In Turkey there are 93 organic beekeepers who have 11207 organic beehives and they produce organic honey. App. 70% of organic honey production is supplied from Mugla, also 16% of this production from Izmir. In 2008, conventional and organic honey production of Turkey were 81364 and 181 tonnes, respectively.

The aim of this study is to discuss production and marketing of organic and conventional honey in Turkey with the other countries as comparative. The marketing channels for honey and the other bee products have been discussed and marketing margins have been examined. The original sample that the data collected from organic and conventional beekeepers in Kemalpasa Cambel village of Izmir province have been discussed. Further, the production and marketing problems and solutions for organic and conventional beekeeping have been given at the level of province and national.

Key words: Organic and conventional honey production, economic analysis, profitability, honey marketing, distributions channels.

INTRODUCTION

Honey and other bee products are included in the fast growing products group in the world. Many problems from production to marketing may be faced in the beekeeping activity whose importance increases in rural development and among animal husbandry enterprises. According to the data of 2008; honey production is 83,164 tons and beeswax production is 4,539 tons [11].

The organic beekeeping which aims the production of more healthy and qualified honey in Turkey has begun recently. The organic honey production is still very limited being 181 tons in 2008. Desired level has not been attained both in conventional and organic honey export. However Turkey will take a counted place among countries on condition that beekeepers are trained about both certificated organic honey production and inresidual, reliable and qualified conventional honey production, the importance of "clean" honey production in the sense of social health is put forward, the price difference paid for organic honey is made more desirable, those who deal with conventional beekeeping produce more qualified and reliable honey consciously [3]. From this point of view marketing margins are observed in the study by putting forward the developments in organic and conventional honey production and marketing structure in Turkey. In the national basis and in the scope of research carried out in Izmir production and marketing problems are considered and some kind of solutions is offered.

DEVELOPMENTS IN ORGANIC AND CONVENTIONAL HONEY PRODUCTION OF TURKEY

The total 1.3 million tons honey production in the world, 6.12% is produced by Turkey in the average of 2005-2007 period [15]. Turkey takes the third rank in honey production coming after China and Argentina. Although the number of beehives is one-half of Turkey, apart from high honey production, beeswax, propolis and royal jelly production is produced in Argentine as well [10]. When beekeeping statistics of 2008 are observed in Turkey; the number of beehives have increased to 4.89 million with 1.31% increase and honey production has risen to 81,364 tons with 10.05% increase. Beeswax production has increased 4,539 tons with 18.30% increase [11]. These data do not include the statistics of organic beekeeping. Organic honey production is 181 tons in the same year. The conversion period from conventional beekeeping to organic beekeeping is one year and the number of producers in the conversion period of 2008 is 188 and the quantity of honey production is 200.46 tons.

When the data of 2008 is regarded, it draws attraction that in the current situation including the transition period, 281 beekeeping operations carry out organic beekeeping in 27,380 beehives in total, and averagely 97 beehives are given to per beekeeping farm.

Organic honey produces is produced generally in Izmir and Mugla provinces. These two provinces cover almost 25% of Turkey's total honey production. When the average of 2006-2008 is considered; 35.71% of the beekeepers producing organic honey in Turkey settle in the Aegean Region and these beekeepers produce 74.52% of the organic honey production in Turkey [1]. The organic beekeeping in Turkey is carried out according to the principles of *Organic Agriculture Laws* [13].

3.3 millions of beehives have been registered in Turkey up to now [6]. For the further periods it is decided that those who have beehives below 50 shall be registered as well. In this way; bar-coding processes will be accomplished by registering all the beehives in a short time. Turkey has a great potential for beekeeping being rich in natural structure and nectar sources. However; the production of organic honey is limited since the colonies feed on sugar and sugar syrup traditionally, the yield per beehive is low so the cost is high due to some problems in colony management, bee diseases and pests are widespread and the chemicals used for prevention leave residual on colonies and bee products, the price difference between conventional honey and organic honey change between 10% and 20% yet this difference is still inadequate for the beekeeper [8].

ORGANIC AND CONVENTIONAL HONEY MARKETING CHANNELS IN TURKEY

2/3 of the honey production in Turkey is marketed as extracted honey and 1/3 is marketed as honeycomb. Various marketing channels from producer to consumer are there in honey market. These marketing channels are producer-consumer, producer-wholesaler-retailer-consumer, producer-exporter or producer-cooperative-exporter.

Organic honey production is very low and exportation of organic honey is very limited in Turkey. Marketing structure of organic honey is similar to the marketing structure of conventional honey. While 1% of the world's honey market is composed of organic honey, the share of honey among organic products in Turkey is 0.67% [2]. The organic honey is sold by beekeepers directly to consumer in glass jars as well as it is packaged in cans by wholesalers and sold to big firms.

Cooperatives are not efficient in the marketing of conventional and organic honey in Turkey. Countries which import conventional honey from Turkey are Germany; taking the lead, Saudi Arabia, France, Holland, N.C.T.R., Kuwait and Italy and Spain in recent years. Beginning with 2007 Turkey has exported extracted honey to France, Holland and N.C.T.R. [12]. When the honey exportation is regarded in the sense of extracted honey and in honeycombs; it is determined that more than 80% of the honey exportation has been on extracted honey. The highest rate of extracted honey exportation was recorded in 2002. According to the latest information; 283 tons of honey was directed to exportation at price of 1.6 million $ in 2008.

Countries which import organic honey from Turkey are Germany, England, Norway, Singapore, Japan and Italy. 14.09% of the organic honey production in 2007 has been exported. The rest of it is bought by various firms and sold throughout the country after being packaged with the trademarks of them. Organic honey is produced as table and industrial honey just like conventional honey. There is a fast growing market for organic honey in the world. Generally the exportation of both types of honey is done in metal barrels of 300 kg (in bulk). High transportation costs, expensive material, labelling costs and the origin of honey are effective such trade being widespread especially in world honey market.

The prices of organic honey are higher than conventional honey in Turkey that limits national consumption. The retailer price of organic honey is around 35.40- 36.70 TL/kg (TL= Turkish Lira) in 2005 whereas the retailer price of conventional honey is 15 TL/kg. In the same study it is found that the price of organic honey is 2.44 times more than the price of conventional honey [14]. It is determined that consumers pay 30-35% more money for organic honey compared to conventional honey in Canada [9]. When the producer price of organic honey is taken into regard; only a little amount of the price paid by consumer is left to producer. Organic honey is sold in glass jars in the organic product shelves of hypermarkets (Tesco Kipa, Carrefour, Tansas, Migros etc.) and natural products stores or speciality product shops. Moreover as a new trend; there are organic product shelves in some saloons/gardens which serve breakfasts. According to a case study carried out in Izmir, the marketing margin changes between 25-40%, when the organic honey is directly sold to consumer by the producer [5]. Similar result was found in an another study carried out before [7].

ORGANIC AND CONVENTIONAL HONEY PRODUCTION AND MARKETING IN IZMIR PROVINCE

In a study carried out in Izmir shows that the average organic honey yield per beehive is 25 kg and conventional honey yield is 11 kg in 2004. According to the results of 2006, average organic honey yield per beehive is 11.38 kg and average conventional honey yield per beehive is 11.77 kg. It is determined that in condition of beehive management and weather conditions are convenient, the yield in organic beekeeping increases. Beekeepers have emphasized that there are many advantages of organic honey production such as producing "clean and safety" products with the rate of 32% followed by high price with the rate of 28%. In addition, it is specified that marketing opportunities of organic honey production are convenient. Beekeepers have also emphasized that there are disadvantages of organic honey production. Precisely, the most important one is the problem of accommodation with the rate of 25%. It is followed by low yield (20.83%), disease control, drug inadequacy and price (12.50%). Other disadvantages of organic honey production are beehive replacement, certification price, inadequate bee evolution, high cost, and environmental pollution [5].

According to this research results; beekeepers use more than one marketing channel. 53.13% of these beekeepers sell the honey as a retail in the market; this is followed by 25.00% with wholesalers and 9.38% exporters. The packaging of the honey shows difference according to being organic or conventional. While all beekeepers, selling organic honey, use cans or jars as a package, 80% of the conventional beekeepers use only cans and 20% use cans and jars.

Producers specified that the criteria consumers seek for while purchasing honey is quality with the rate of 26.69%. This is followed by the appropriate price (25.00%) and purity of the honey (23.44%). The producer price of extracted honey is calculated as 15.00 TL/kg and the producer price of conventional honey is calculated as 7.80 TL/kg. While 60.00% of the beekeepers expressed that the price is excepted, 40.00% decided that it is below the desired price.

It is calculated that the net income of producers, which deal with conventional beekeeping, is 30.77 TL per beehive, this amount is higher for organic beekeepers (446.06 TL) in 2006. The reason of that is high organic honey price and the production of other bee products. But since the organic certification price is financed by the research project , it is not included in the calculations of this research. However, when it is regarded that 5-6 TL certification cost is paid per beehive [4], it is resulted that the net income is still higher for organic beekeeping and it can be feasible if appropriate market is found.

CONCLUSION

Although Turkey is an important honey producer, it doesn't play an efficient role in the world market. For the beekeepers converting from conventional to organic honey production, they should be fully-equipped from production to marketing. In this sense, it is necessary to carry out technical training both on organic and conventional beekeeping for producers and planning cooperation extention facilities. One of the most important solutions is contract beekeeping into practice as soon as possible. Supportive forces must be ameliorated to the conditions of today for this sector, which has not seen any support up to the year 2003. Carrying out beekeeping in the frame of some specific rules causes increase in the cost items. An effective marketing organization is necessary for the organic beekeepers to sell their products in the proper price in Turkey. Moreover it is a necessity to create a trademark for conventional and organic honey in Turkey and exportation opportunities should be developed.

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MICROBIAL PERSPECTIVE OF ORGANIC FOOD PRODUCTS: A COMPARISON WITH CONVENTIONAL FOOD PRODUCTS

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ABSTRACT

Because of the growing demand for organic food products, food processors have begun to manufacture organic processed foods. Compared to conventionally processed food, consumers often perceive these alternatively processed products safer and of higher quality. However, little is known about the microbiological status of organic food products, therefore it is important to examine the food safety aspects of organic products and to look for potential differences with conventional products. Vegetables, fruits, bakery, dairy and meat products will be discussed. Therefore, this study will focus on information related to the presence of microbial load in organic and conventional food products.

Keywords: Organic, safety, microbiology, pathogens

INTRODUCTION

The organic food market has grown substantially over recent years across the globe [1]. Good manufacturing practice is as important in organic food manufacture as in non-organic food manufacture. Current food safety regulations equally apply to organic food production [2]. The microbiological aspects of food have been studied intensively for many decades. Microbial food safety differs fundamentally from chemical food safety. While chemical residues and additives typically enter the food chain at more or less predictable steps, microbes can enter at any step. They grow and die and interact with the food in ways that are at best empirically described, but less understood in detail [3]. A number of studies have focused on chemical safety of organic products, but the number of studies about microbiological safety of organic products are still limited [4] [5]. The aim of the present study was first to examine the food safety aspects of organic products and secondly to look for potential differences with conventional products, focusing on microorganisms.

Vegetables

A continuous rise in the number of outbreaks of human diseases associated with the consumption of vegetables has been observed during the last few decades [6]. There are a number of reports indicating that raw vegetables may harbour potential foodborne pathogens [7]. Vegetables can become contaminated with such pathogenic organisms while growing, during harvest, from post-harvest handling, or during distribution [8]. McMahon and Wilson [8] declared that there were no *Salmonella*, *Campylobacter*, *E. coli*, *E. coli* O 157, *Listeria* in any of the organic vegetables examined. *Aeromonas* species were isolated from 34% of the total number of organic vegetables examined. Sagoo *et al*. [9] could'nt isolate *L. monocytogenes*, *Salmonella*, *Campylobacter* and *E. coli* O157 in organic vegetables and the low incidence (1,5%) of *E. coli* and *Listeria* spp. Soriano *et al*. [10] reported the isolation of *E. coli* from restaurant prepared lettuce. Outbreaks of food poisoning associated with *E. coli* O157 has been related to the consumption of vegetables and salads [11]. *Salmonella* species have been isolated from a range of vegetables [12] and *Salmonella* food poisoning outbreaks have been associated with the consumption of plant foods such as tomatoes [13]. A previous survey in Northern Ireland showed that 2% of conventionally farmed ready-to-eat vegetable products contained *Listeria* spp. [14]. Moreira et al. [15] found no significant differences in the initial populations of yeast, molds and psychrotrophic, mesophilic and lactic acid bacteria.

Mukherjee et al. [16] performed the most comprehensive study comparing microbiological safety of organic and conventional produce. They reported that no samples contained the pathogen *E. coli* 0157:H7 and only 2 organic samples contained *Salmonella*. Generic *E. coli* was detected in 9.7% of the organic samples and in 1.6% of the conventional samples. Lettuce was the produce item containing the highest rates of generic *E. coli* contamination. Certified organic lettuce did not show any generic *E. coli* in the 10 samples collected while no certified organic lettuce had 12 positive results out of 39 samples (30.8%), and 1 of 6 conventional lettuce samples (16.7%) was positive. In 2006, *E. coli* O157:H7 was identified as the source of a severe spinach-linked epidemic in the U.S., and in 2007 outbreaks involving lettuce infested with the same pathogen were reported in the Netherlands and in Iceland [6].

Arthurson *et al*. [6] evaluated whether organic production poses a risk on food safety, taking into consideration sources of pathogen transmission (e.g. animal manure). They determined that while detection of *E. coli* in almost all manure samples was not unexpected, a considerable amount of samples proved positive also for *Campylobacter* and *Staphylococcus*.

The use of animal manure as fertilizer presents potential microbiological risks if the manures have not been properly composted, they can contaminate foodstuffs. While both conventional and organic agriculture frequently use animal manure for fertilization, manure use is more widespread in organic production since organic producers cannot use synthetic fertilizers. Köpke et al. [17] also mentioned that the increased use of raw manure for fertilization in organic production may constitute an elevated risk of transferring human pathogens from livestock onto vegetables. In a repeated field trial with lettuce, numbers of coliform bacteria were not higher in treatments with manure relative to those using mineral fertilizer [17]. Reducing risk factors during production and handling of fresh plant produce has been suggested as the most efficient way to improve the safety of vegetables regarding microbe-mediated contamination [6].

Dairy Products

Organic milk production has increased rapidly in many European countries during the last decade [18]. The hygienic quality of organic milk has been shown to differ from that of conventional milk. The total bacterial count in organic milk has been found to be similar to, or lower than, that in conventionally produced milk [19]. Hamilton (2001) reported that organic milk had lower somatic cell counts than conventional milk. Luukkonen et al. [20] reported that Finnish organic milk contained significantly a lower total bacterial count than conventional milk. Organic milk had a similar, or higher, somatic cell count than conventional milk. Differences between the hygienic quality of organic and conventional milks could result from differences in milk production and housing systems. For example, Regula et al. [21] found that the total bacterial count in milk from cows kept in loose housing was significantly lower than that from cows which were stalled while housed

Meat Products

The safety of meat has been a concern for both consumers and researchers. There are some studies comparing safety status of organic and conventional meats. Ludewig, Palinsky and Fehlhaber [22] did not find any sign for safety problem and significant differences between organic and conventional meat products. Van Overbeke at al [23] also found no significant differences in prevalence of Salmonella between organic and conventional broilers at slaughter. On the other hands, Heuer et al. [24] reported that *Campylobacter* spp. were isolated more (100 %) from organic than conventionally reared flocks (37 %). Another study showed that there was a significantly higher prevalence of *E. coli* but not of *S. aureus* and *L. monocytogenes* in organic poultry meat as compared with conventional poultry meat [25]. Miranda et al [26] determined that *Enterococcus* mean counts from organic chicken meat were significantly higher than those obtained from conventional chicken meat or conventional turkey meat. Nou et al [27] reported that Salmonella was most frequently isolated pathogen from organic poultry samples, as were Campylobacter from conventional poultry. Jackson et al [28] indicated that commercial brands of organic frankfurters showed greater growth by inoculated *Clostridium perfringens*. Several other studies showed that meat and meat products from organic and conventional production do not indicate any difference with respect to their microbiological condition [29].

CONCLUSION

Consumers demand for high quality and safe food products that are produced with minimal environmental pollution. The number of studies about safety of organic foods is limited, more research is needed to identify safety status of organic foods to justify the consumers' ideological motivation to choose organic over conventional products.

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ENERGY CONSUMPTION IN ORGANIC, CONSERVATION AND CONVENTIONAL SYSTEMS: IMPLICATIONS FOR SUSTAINABLE RESOURCE MANAGEMENT

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ABSTRACT

A review has conducted to compare energy use in organic vs. conventional agroecosystems. Results showed that in conventional systems, highest energy was consumed for production and application of agrochemicals, while in organic systems, mechanical practices for cultivation is the highest fraction of energy input. In organic farms, 53% of total energy input is spent on cultural practices. Furthermore, studies indicated that energy input in organic production is up to 38% lower then conventional production. Comparison of organic and conservation systems revealed a similar trend; in studying three strategic crop production systems energy use value in organic system has been lower then conservation system.

***Keywords*:** Energy use, labour, sustainable agriculture

INTRODUCTION

The conservation of natural resource is the most important key for a sustainable agriculture. The lower economic supports oblige farms to increase efficiency to reduced production costs [8]. A conventional agriculture system relies heavily on the consumption of non-renewable fossil fuels. Consumption of fossil energy results in direct negative environmental effects through release of CO_2 and other combustion gases. However, use this of resources energy has been positive effects like: increased yields and reduced risk of crop production. Yet, large amounts of cheap fossil energy have direct and indirect negative impacts on the environment that can suggested to soil and water degradation, less diversified nature and reduced land global warming. Thus reconsideration in methods and practices agriculture crop production considering of energy use high efficiency is necessary. For implementation in agriculture of the general concept of sustainability, agronomists have proposed several solutions such as integrated arable farming systems and low input or organic farming [6] [10].

Effective energy use in agriculture is one of the conditions for sustainable agriculture production. And farm economic condition, fossil fuels preservation and air pollution reduction are included next stages. Energy analysis can be divided into two parts as direct and indirect energy. Direct energy is directly used at the farm and on field for crop; but indirect energy is not directly consumed at the farm can be suggested to fertilizers and pesticides production in factory [5]. Thus, both direct and indirect are required for optimum production.

Analysis of energy consumption in agricultural systems

Many studies have been conducted about agricultural energy use [4] [7]. In some of them, energy analysis is only one part and more investigated the assessment of environmental impact. But, also extensive reviews is accomplished about energy consumption efficiency in different agriculture systems. In This part will be discussion about energy use comparison in crop production in organic and conventional systems. One of these studies is suggested to analyze energy consumption in two organic and conventional apricot production systems in Turkey [2].

This study was conducted in the Malatya Province. The production of organic apricot, on average, is 12,800 tones in Turkey. About 91% of this production is obtained in the Malatya Province. Ten farmer pairs, each of which consists of one organic and one conventional farm for average 10 ha of apricot plantation, were selected in five different regions the Malatya Province with varying agro-ecological conditions. In order to be eligible for selection for section, organic farms had to: (a) have a history of at least three years under organic management (b) don't have more distance with conventional farm; and (c) organic and conventional farm have similarity of altitude and crop production. Data were collected for a three years period (2002-2004) via repeated semi-structured interview with producer and corroborated with farm visit and official statistics some organization such as Agricultural Directorate, importers and exporters and Union of Apricot Sales Cooperative were also utilized.

The energy equivalents of the inputs used in the apricot production are illustrated in **Table1**. The data of energy use have been taken from a number of sources, as indicated in the table. The sources of mechanical energy used on the selected farms included tractor power and Diesel. The total energy was computed on the basis of total consumption (ha^{-1}) in the different operations.

Table 1. Energy equivalents of different input and output values used in organic and conventional Apricot production

Equipment/input	Energy coefficients (MJ/unit)	References
Human labor (h)	1.96	[9]
Machinery (h)	62.70	[9]
Chemical fertilizers (kg)		
Nitrogen	60.60	[9]
Phosphorus	11.10	[9]
Potassium	6.70	[9]
Farm manure (kg)	0.30	[9]
Pesticides (kg)		
Insecticides	199	[3]
Fungicides	92	[3]
Herbicides	238	[3]
Diesel-oil (l)	56.31	[9]
Electricity (k W h)	11.93	[9]
Irrigation water (m3)	0.63	[11]
Output (kg)		
Apricot fruit	1.90	[9]
Apricot pits	9.00	[1]

The results showed that organic systems 645.9 h of human labor and 14.7 h of machinery power per hectare were applied to produce apricot in the experimented area. Nearly 53% of the total human labor was spent on cultural practice such as soil cultivation, irrigation, pest control, pruning etc.), and the remainder was spend on harvesting. Cultural practice have biggest production share (66%) Of total machinery energy used on organic apricot production and soil cultivation (26.5%) and transpiration (7.4%) is next steps respectively. The total energy consumed in the organic apricot production was about 13800 MJ/ha. From this amount, diesel consumed the most energy (45%), followed by fungicide (25.5%), human labor (9.2%) and electricity (7%). The diesel energy was mainly utilized for operation tractors to perfume the various farm operations. In this study, average three yields of apricot fruit and apricot pits were 12,404 kg/ha and 776 kg/ha, respectively. Thus, the total energy out put per hectare for organic production was 30,555 MJ. Therefore, the energy ratio for organic apricot production was 2.22. Whereas, the total energy input for conventional apricot was more than 22800 MJ/ha. Most energy consumption in conventional system was fertilizers (8900 MJ/ha), diesel (7445 MJ/ha) and pesticides (3261 MJ/ha), respectively [1]. Total energy output on conventional apricot production was found as 33,166 MJ/ha. Thus, the energy ratio of organic apricot production was calculated as 1.45. Satory *et al* [8] were studied to energy use efficiency of organic and conservation agriculture systems in a 3-years period soybean, maize and wheat rotation. Conservation operations system including crop residue management, reducing the tillage intensity and integrated crop protection were considered, while for the organic system the use of chemical fertilizers and pesticides was not allowed. For both systems, the residue management was performed by using a straw chopper after harvesting and adopted tillage practices had reduced depth and intensity: in the conservation system, chisel ploughing was performed during autumn and disk harrow was carried out for maize and wheat during winter. After organic fertilizer distribution, in organic farm system the mould board ploughing was performed in maize and wheat in order to incorporate them, while in conservation farm in wheat the organic fertilizer was incorporated whit disk harrowing. In organic farm fertilizer was applied during the autumn-winter period. In the conservation farm system, the inorganic phosphorous was applied in autumn in soybean, and inorganic fertilizers were distributed in the autumn (phosphorous and potassium) and in spring (nitrogen) in maize, whiles, in wheat organic manure was applied after sowing.

The weed control was done in conservation farm by integration the row crop cultivation with herbicides applications in maize and soybean, and only by herbicide distribution in wheat, while in organic farm this objective was attained both during seedbed preparation with rotary harrowing and after sowing with row crop cultivations in maize and soybean and mechanical crop protection in wheat. In this 3-years rotation, total input per unit surface area in the conservation farm system for the 3-yr rotation was 50% greater then in organic farm system and for individual crops was 30%, 68.7% and 58.8% higher for soybean, maize and wheat, respectively, than the organic farm system.

The large energy requirement of conservation farm resulted from chemical input, especially fertilizers, whilst most energy in organic farm came from mechanization, with small difference depending on the crop considered. The conservation farm, 70% energy requirement depending was from fertilizers. It was from soybean which had the lowest energy requirement. Mechanical operation was 10% of the total energy requirements in the conservation farm system and 42% in the organic farm system with a maximum of 70% in organic farm soybean. The use of the mould board plough after manure application caused a higher requirement for energy in organic farm compared to conservation farm that used chisel ploughing. *Figure 1* depicts the energy inputs in different field operations in the two farming systems.

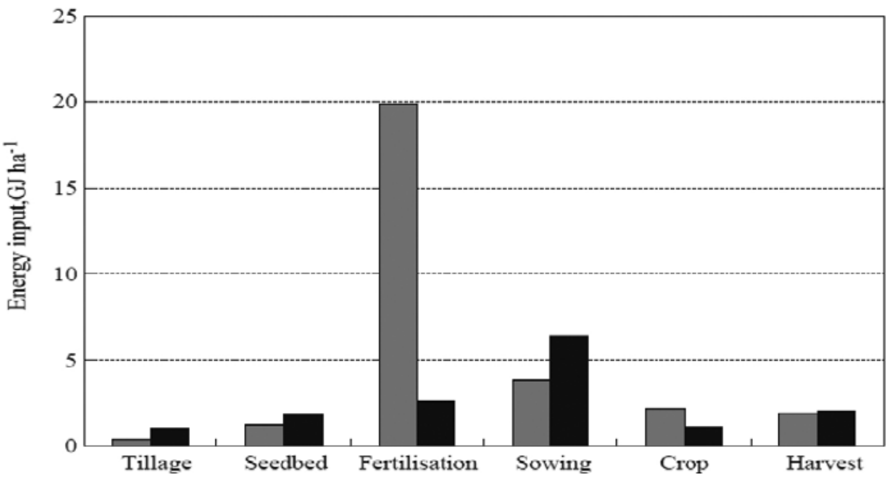

Fig. 1. Main energy input grouped by field agronomic operations for conservation farming ■, and organic farming ■: the energy amount required for crop protection includes herbicides applications and mechanical weeds control

Energy output and energy use efficiency in both systems

The energy output was higher in the conservation farm than the organic farm system, because of the higher yields. In the conservation farm system, the energy output was 41%, 85% and 60% greater for soybean, maize and wheat, respectively, than those obtained in the organic farm system. The net energy per hectare was 58% greater in conservation farm then organic farm. However, energy use efficiency was higher in organic than conservation farm. The higher energy use efficiency shown in organic farm may be due to the reduction chemical input although more frequent mechanical operations were required.

The two farming systems compared in this study showed similar production cost. The fertilizers, insecticides and herbicides had a significant effect in the conservation farm with a cost of +10% of the total economic balance. In organic farm, the highest cost was related to labour with a cost greater than 60% compared to the conservation farm system, other important cost were tillage (40%) and seed cost (18%). The results of this study showed that wheat production costs in both systems was nearly, that showed input chemical costs in conservation farm and tillage operation in organic farm have neutralized each other. However, in soybean, the cost was higher in conservation farm (24%) than organic farm. maize production cost was higher in organic farm (10%) due to the numerous tillage events before and after sowing for weed control. Overall, the main costs in conservation farm are related to the purchasing of synthetic material (fertilizers, insecticides and herbicides) whilst in organic farm are related to mechanical operations.

CONCLUSION

In general, the results of this study shows energy consumption in organic systems to less than 50% of systems are conventional and even conservation system. More energy consumption in conventional agriculture, mainly due to excessive application of chemical fertilizers that is required more energy for production and transport them. Therefore, if can applied other alternative, such as biological fertilizers, animal manure and green manure. Will occur significant Changes to reduce energy consumption in the agriculture. Moreover, prevent of nonrenewable resources depletion and reduced environmental pollutions due to application of this chemical input which have abundant effects on natural environment and agro-ecosystem decline, is significantly reduced.

Should be pointed out that organic agriculture, due to ban the use chemical fertilizers and syntactic pesticide, major part of energy consumption through mechanical and machinery application. But should be noted that correct management actions, such as optimum crop rotation, choice best time cultivation, fertilization management, irrigation management and prevention operation of new weeds enter, can be reduced energy consumption in accordingly system.

Perhaps not expected that yield in organic production equivalent or more than conventional system, also don‘t forget that due to reduction of total cost and high price of organic products, overall, obtained of net profit in this production systems usually is more then conventional agriculture systems.

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NATURAL ASTAXANTHIN SOURCES FOR ORGANIC AQUACULTURE

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The pink/reddish color of the flesh of salmonids, lobsters, shrimps and crayfish is a consumer demand both for farmed and wild species. This colorization is gained through the carotenoid astaxanthin because these animals are unable to biochemically synthesize astaxanthin and they rely on dietary supplements. Astaxanthin is the principal carotenoid for salmonids and gives attractive pigmentation in the eggs, flesh, and skin. In addition to its effect on color it has a potential as an antioxidant and protector of fish eggs against the effects of UV light. It also acts as a precursor of Vitamin A in some fish species [1].

Currently, chemically synthesized astaxanthin and canthaxanthin are widely used but only natural astaxanthin obtained from natural sources is permitted in the diets for organic aquaculture. According to OFF Organic Aquaculture Standards; “To describe a fish or shellfish as organic it must have been reared and farmed in accordance with an approved Organic Aquaculture Standard and the hatchery, farm and feed suppliers involved must be registered and certified by an organic certification body on an annual basis” and “The use of synthetic pigments in the diet of organic salmonids is not permitted. Natural astaxanthins from shrimps and krill are part of the normal diet of wild salmon, which gives them their typical pink color. Natural astaxanthin obtained from shrimp meal and natural yeasts are permitted in the feed for farmed salmon because they are essential antioxidants and necessary for the health of the fish” [2].

Common sources of natural astaxanthin are the green microalgae *Haematococcus pluvialis- Chlorella* sp., *Chlorococcum* sp.*;* the red yeast *Phaffia rhodozyma;* crustacean byproducts and extracted oils of crayfish and krill; the other microorganisms like the marine bacterium *Agrobacterium aurantiacum- Halobacterium salinarium,* halophilic archaea [3] [4]. Each natural pigment source has its own limitations and they cannot yet compete strongly with the synthetic carotenoids. While crustacean meals and wild strains of *Phaffia rhodozyma* have relatively low content of astaxanthin, *Haematococcus pluvialis* has high astaxanthin (0.2 to 2%) content but there are some difficulties in commercial production with large amount. The astaxanthin in Haematococcus is approximately 70% monoesters, 25% diesters and 5% free pigment. This esterified composition is similar to that of crustaceans, the natural dietary source of salmonids, and is readily metabolized [4]. The primary limitations to utilizing *Phaffia rhodozyma* as a commercial astaxanthin source is the low astaxanthin levels found in wild-type isolates but several companies have developed astaxanthin-hyperproducing strains that produce >10,000 μg per g yeast in industrial fermentors.

In this review, natural astaxanthin sources and their use in aquaculture are presented.

Key words: astaxanthin, organic aquaculture, *Haematococcus pluvialis, Phaffia rhodozyma, Agrobacterium aurantiacum,Halobacterium salinarium*

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STRATEGIES REGARDING THE ENVIRONMENT MANAGEMENT AND PROTECTION IN ROMANIA

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ABSTRACT

In Romania, the concept of "SUSTAINABLE DEVELOPMENT" was accepted, especially during the market economy transition period. This was possible because Romania adopted the international development concepts, by elaborating the sustainable strategies for managing its natural resources, with an emphasis on "the need to stop the natural capital degradation in the transition period and to preserve it in the perspective of economic development". Natural resources, as forms of raw and energy materials, both conventional and unconventional ones, both renewable and non-renewable, are the "natural capital", an essential part of Romania's wealth. The use of these resources can be made better or worse, according to the technologies that can be used in the process and to their availability. An example is "Recycling or reusing" materials and products, whose technological value was exhausted (metals, plastic, glass, old machines and equipment, etc.) and which normally cannot be absorbed and degraded in the natural ecosystems.

Keywords: sustainable development, rational use of natural resources, recycling or reusing actions, natural ecosystems.

INTRODUCTION

"The sustainable development" can only be achieved by means of improving the interactions between four systems, namely:

- The economic system, producing material goods.
- The human society; the human factor must be at the centre of all actions and interactions.
- The environment.
- The technological system, which supports the other three through human intelligence.

The synergy of the interactions between these systems is achieved starting from the improvement in the use of the existing resources and from finding other ones, especially unconventional ones, more easily assimilated to ecosystems, but carrying more human intelligence.

In order to do this, the whole strategies for the rational use of resources are based on a correct management of the environment, and all the world peoples are involved in achieving them.

COMMENTS

The concept of "SUSTAINABLE DEVELOPMENT" was accepted especially during the market economy transition period. This was possible also because Romania, who wanted the European integration, was in a way forced to adopt the new international development concepts, along three directions:

1. Assessing Romania's resources of all kinds.

2. Elaborating the strategies for managing these resources, with an emphasis on "the need to stop the natural capital degradation in the transition period and to preserve it in the perspective of economic development".

3. "Recycling or reusing" materials and products, whose technological value was exhausted (metals, plastic, glass, old machines and equipment, etc.) and which normally cannot be absorbed and degraded in the natural ecosystems.

From the point of view of their creation and use, raw materials resources fall into two categories:

• Non-renewable raw materials resources.

• Renewable raw materials resources.

Nowadays it becomes very important the implementation of programmes and projects regarding the rational use of resources and the protection of the environment led to the highly abusive and polluting use of important non-renewable resources such as oil, gas and coal, and renewable resources, among which the soil, forests, waters underwent significant degradations that are difficult to recover and that will influence the long-term life of the country.

The objectives of the rational use of resources and environment protection programmes in Romania are located in three stages, namely:

1. Long-term programmes.

2. Medium-term programmes.

3. Short-term programmes.

Each of the action programmes includes two stages, namely:

• A first stage:

- identifying and inventorying the problems, the objectives mentioned above;

- designing and assessing these objectives.

• A second stage:

- achieving the proposed objectives, or, in other words, implementing the projects in the territory.

Drafting the strategies regarding the environment management and protection in Romania in our view should include 3 project categories, namely:

1. Projects regarding the rational use of non-renewable resources necessary in industry. The following objectives should be proposed:

a. to eliminate all energy intensive, polluting and uneconomical industries, which operate at high consumption levels.

b. to refurbish the industries.

c. to establish new technologies that use only a minimum of non-renewable resources and that target renewable resources.

2. Projects regarding the rational use of renewable resources aimed at developing agro-ecosystems and at their rational use, in the sense of creating a sustainable development starting from the development of agriculture and the rural space.

The main projects that should be implemented urgently are the following:

a. projects regarding the preservation of the soil and its superior use;

b. projects regarding the superior use of water resources and the elimination of all pollution sources;

c. projects regarding the optimisation of land improvement activities, repairing the irrigation, draining and desiccation, soil stabilising, forestation systems in order to optimise the factors in the natural environment;

d. projects regarding the correct sizing of agricultural businesses and of the necessary inputs in the operation of technological processes in agriculture.

3. Projects regarding the rational use of the workforce.

The following projects seem to be necessary here, such as:

a. training the workforce by means pf creating solid consulting centres;

b. adapting secondary education, higher education and post-graduate education to the market demand;

c. creating distance learning facilities for various specialisations, on only one condition, effectiveness in triggering the private initiative process, marketing and management in various forms of the development in agriculture and other ecosystems in general;

d. creating a well-organised information system, with international implications;

e. adapting the Romanian legislation to the European Community and to the international one.

OUTLOOK

Briefly, the strategies regarding the environment management and protection in Romania should include 3 project categories, namely:

1. Projects regarding the rational use of non-renewable resources necessary in industry.

2. Projects regarding the rational use of renewable resources aimed at developing agro-ecosystems and at their rational use, in the sense of creating a sustainable development starting from the development of agriculture and the rural space.

3. Projects regarding the rational use of the trained workforce.

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THE SUITABILITY OF NITROGEN ISOTOPIC FINGERPRINT IN LETTUCE AS AN INDICATOR OF FERTILIZATION REGIME

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ABSTRACT

The use of nitrogen isotopic fingerprint ($\delta^{15}N$) in lettuce as a potential marker for identifying organic produce was tested on pot grown lettuce (*Lactuca sativa* L.), fertilized with synthetic and/or organic nitrogen fertilizer (single or split application). The study was based on the hypothesis that conventionally grown crops have significantly lower $\delta^{15}N$ values compared to those grown organically, since synthetic fertilizers have lower $\delta^{15}N$ values compared to organic fertilizers due to different fertilizer production processes. The $\delta^{15}N$ values of plants treated with different fertilizer differed significantly when fertilizer was applied in a single application. However, additional fertilization did not cause significant alteration of plant $\delta^{15}N$. Obtained results indicate that $\delta^{15}N$ of lettuce tissues could be used as a marker to reveal the history of nitrogen fertilization, but only in the case of a single fertilizer application.

Keywords: nitrogen, stable isotopes, fertilization, organic produce, *Lactuca sativa* L.

INTRODUCTION

Organic products attain high prices on the market hence there are concerns among users about mislabelling conventionally grown crops as "organic". The possible use of nitrogen isotopes to differentiate between crops grown with or without inputs of synthetic nitrogen is based on the hypothesis that the application of synthetic nitrogen (N) fertilizers with $\delta^{15}N$ values close to 0‰ will result in the $\delta^{15}N$ of plants grown in conventional regimes being lower than those in organic regimes (+10 to +20‰) due to different fertilizer production processes [1]. The aim of presented study was to test weather N fertilizer type and timing of fertilizer application leave specific $\delta^{15}N$ fingerprint in lettuce tissues (*Lactuca sativa* L.) which could be used as a potential marker to reveal the use of prohibited use of synthetic N fertilizers in organic farming. The effect of split N fertilization with combined usage of synthetic and organic fertilization, which might enable farmers to cover up the use of synthetic fertilizers, on plant $\delta^{15}N$ was also studied.

MATERIALS AND METHODS

A greenhouse pot experiment with lettuce (*Lactuca sativa* L.) was performed at the Biotechnical Faculty of Ljubljana, Slovenia. Natural commercial organic fertilizer with $\delta^{15}N$ of +14.8 ‰ was used as organic input and $Ca(NO_3)_2$ with $\delta^{15}N$ of +5.7 ‰ was used as synthetic fertilizer. Lettuce was sown into plug trays, containing Klasman tray substrate, individually transplanted into pots (7.5 kg of sandy loam soil) 35 days later and grown for 50 days. Seven treatments were applied in a completely randomized factorial design: a single basal organic fertilization of 40 mg N kg^{-1} soil (Organic), a single basal synthetic fertilization of 40 mg N kg^{-1} soil (Synthetic), a basal synthetic fertilization of 20 mg N kg^{-1} soil followed by an additional organic fertilization of 20 mg N kg^{-1} soil (Synth.+Org.), a basal organic fertilization of 20 mg N kg^{-1} soil followed by an additional synthetic fertilization of 20 mg N kg^{-1} soil (Org.+Synth.), a basal synthetic fertilization of 20 mg N kg^{-1} soil followed by an additional synthetic fertilization of 20 mg N kg^{-1} soil (Synth.+Synth.), a basal organic fertilization of 20 mg N kg^{-1} soil followed by an additional organic fertilization of 20 mg N kg^{-1} soil (Org.+Org.), and unfertilized control. Additional application of N fertilizers was performed after sampling at 30 days after transplanting (DAT). Aboveground lettuce was destructively sampled at 20, 30 and 50 DAT. Samples were dried at 60°C, ground to fine powder, homogenized and weighed into tin cups for $\delta^{15}N$ determination using a PDZ Europa ANCA-SL elemental analyzer linked to a 20:20 continuous flow IRMS. The accuracy was checked with certified reference materials: USGS 34, IAEA-N-22 and in-house plant reference material. All samples were analysed in duplicate and $\delta^{15}N$ values were accepted when sample standard deviation was ≤0.2 ‰. Results are reported in δ-notation in units of permil (‰) with respect to atmospheric nitrogen (air) according to the Equation 1:

$$\ln Yield_{it} = (a_0 + a_1 t) + \sum_j b_j \ln X_{jit} + w \ln C \qquad (1)$$

where R denotes $^{15}N/^{14}N$ and the standard denotes atmospheric nitrogen with a $\delta^{15}N$ value of 0 ‰. Data were verified statistically with the Factorial ANOVA using the Statistica 6.0 package. Significant differences are given at the 95 % level.

RESULTS AND DISCUSSION

The $\delta^{15}N$ of plants receiving organic fertilizer (single or split application) were significantly higher compared to the treatments with different N sources (i.e. synthetic fertilizer and soil), reflecting the higher $\delta^{15}N$ values of organic fertilizer-N (14.8‰) compared to that of synthetic fertilizer-N (5.7‰) and total soil-N (6.4‰) (Fig. 1). At final harvest, $\delta^{15}N$ of plants receiving single application of organic fertilizer was 9.6‰, and $\delta^{15}N$ of plants receiving split applications were 8.0‰ and 7.2‰ for Org.+Org. and Org.+Synth. Treatments, respectively. $\delta^{15}N$ of plants receiving single application of synthetic fertilizer was 5.3‰, whereas $\delta^{15}N$ of those receiving split applications were 5.2‰ and 6.0‰ for Synth.+Synth. and Synth.+Org. treatments, respectively. However, lettuce fertilized with synthetic fertilizer (single or split application) were significantly depleted with ^{15}N compared to unfertilized control plants (with $\delta^{15}N$=7.2‰), indicating that nitrogen derived from the synthetic fertilizer was so abundant in the soil that plants predominantly assimilated N from synthetic fertilizer over soil-N [2].

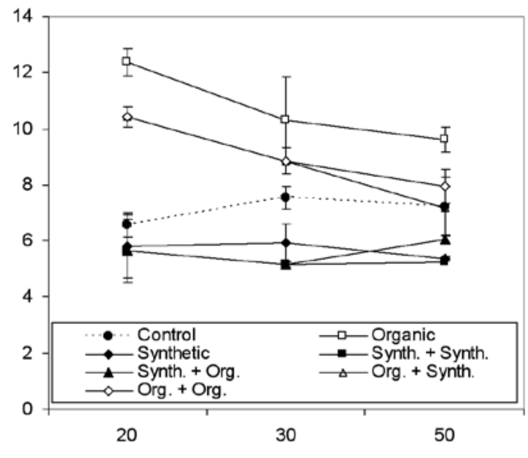

Figure 1: Lettuce $\delta^{15}N$ under different treatments at 20, 30 and 50 days after transplanting (DAT). Data are means ± SD for n = 3 plants per treatment.

Significantly higher $\delta^{15}N$ values were found in lettuce receiving one time application of organic fertilizer compared to those receiving split application, reflecting the proportionally greater contribution of organic fertilizer-N to total plant-N in the single application [2]. In contrast, no significant difference in $\delta^{15}N$ was found between lettuces receiving synthetic fertilizer as a single or split application. Additional fertilization did not cause significant alteration of plant $\delta^{15}N$, neither when isotopically similar (Org.+Org., Synth.+Synth.) nor when isotopically different (Org.+Synth., Synth.+Org.) additional N sources were applied. Decreasing of plant $\delta^{15}N$ with time was found in organically fertilized plants (single and split application with basal organic fertilization), which indicates increased contribution of soil-N to plant-N with time [2] [3] [4]. Decreasing of $\delta^{15}N$ with time in the treatment with basal organic and additional synthetic fertilization additionally indicates also the contribution of synthetic fertilizer-N. The $\delta^{15}N$ of plants treated with synthetic fertilizer on the other hand was relatively constant and indicated the $\delta^{15}N$ of synthetic fertilizer-N during the whole plant growth. The addition of organic fertilizer to basal synthetic fertilization did elevate the mean $\delta^{15}N$ value of lettuce tissues for about 0.7‰ as compared to synthetic fertilization but the difference between the treatments is not significant

CONCLUSION

Obtained results indicate that $\delta^{15}N$ of aboveground plant lettuce tissues could be used as a marker to reveal the use of synthetic N fertilizer when it is applied in a single application, however in the split fertilizer application, the addition of synthetic fertilizer to the basal organic fertilization and vice versa could not be confirmed by this method.

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PROCESSING TO THE FRUIT-JUICE OF ORGANIC CAPERBERRY (CAPPARIS SPP.) FRUITS

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ABSTRACT

Capparis spinosa L. var. *spinosa* and *Capparis ovata* Desf. var. *canescens* (Coss.) Heywood fruits were collected from Konya and Mersin (Mut) provinces in August 2002, respectively. Physico-chemical properties (dimensions, % weight of peel and seed, % pulp yield, pH, titration acidity, protein, oil, total invert sugar, saccharose, total sugar, ash content) and mineral content of organic fruits were determined. The mineral contents of caperberries pulps were established by using Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES). Most favourable rate of selected concentrations (5, 10, 15 and 20 % pulp(w/v)) of pasteurized and unpasteurized samples for both species were defined. The physical, chemical, microbiological and sensory properties of the pasteurized and unpasteurized products were determined in every 3 month for 12 months period.

5 %, 10 % and 15 % concentrations of the products were preferable. Maximum shelf life of unpasteurized juices was 6 months and acceptibility of pasteurized ones was best until 9 mounts. Pulps contain many of important minerals for human nutrition. K, Ca, P, Mg and Na were established as major elements of both species. Sensory evaluations showed that pasteurization was a better process, and 5 %, 10 % and 15 % concentrated pasteurized samples had acceptable sensory values until 9 th month. It can be concluded that *Capparis spinosa* L. var. *spinosa* is more fruitful than *Capparis ovata* Desf. var. *canescens* (Coss.) Heywood for unit amount.

Keywords: Organic caperberry, *Capparis spinosa* L., *Capparis ovata* L. *Capparis* spp., Capparidaceae, fruit juice, storage

INTRODUCTION

Caperberries, belonging to Capparaceae family, are the fruits of perennial shrubs of the genus *Capparis*. Caper flower buds, root, fruits and young shoots are used as foodstuffs. It is a plant of tropical/subtropical and arid areas. Capers has several uses for its especially medicinal and aromatic properties (Baytop 1984, Akgül 1993, Akgül 1996, Özcan et al. 1998).

The world production of capers has changed with time, approximately 10.000 tons are produced annually and the main producers and/or manufacturer/exporter countries are Spain, Morocco and Italy. Turkey has become a major exporter of capers in last decade, and exports 3000-5000 tons of fermented caper (Özcan 1999a, Özcan 2002). In 2000, Turkey exported caperberries; raw, cooled raw (13.200 kg) and conserved (4.352.266 kg) (Anonymous 2000).

Various parts of the plant such as buds and young shouts are used in food, drug and cosmetic industry. There is no information about production of caperberry juice. But Özcan (1999b) and Özcan (2002) were described the production process of the caperberry marmelade and also determined chemical properties, microbiological properties and mineral contents.

Processing of caperberries as juice, means new raw material and a product to introduce to food industry.

The aims of this study were to produce fruit juice from caperberry fruits, to determine the physical, chemical and microbiological characteristics of the product and to present a new product to consumer.

MATERIALS AND METHODS

1.Material

Both fruits belonging to *Capparis ovata* and *Capparis spinosa* were harvested in August 2002, from Konya (Selçuklu) and Mersin (Mut), respectively. Plants were identified in Biology Department of Selcuk University as *Capparis spinosa* L. var. *spinosa* and *Capparis ovata* Desf. var. *canescens* (Coos) Heywood. Samples were carried to laboratory in cool bags and processed to fruit juice according to process schema in Figure 1.

2.Methods

Dry material and protein content was determined according to Özkaya and Kahveci (1990). Titration acidity and ash content were done according to Anonymous (1972) and Anonymous (1975), respectively. Oil contents were determined according to Doğan and Başoğlu (1985) by using soxhelet aparatus. pH, invert sugar, saccharose, total sugar and refractive index were also determined according to Cemeroğlu (1992). Mineral contents of pulps were established by ICP-AES (Varian-Vista) according to Skujins (1998). Dimethyl sulfide (DMS) content was determined by GC (Perkin-Elmer 8600, HS-6B), headspace method according to AOAC (1984) and Özcan et al. (1998).

pH, acidity and refractive index were determined per 3 month time periods for one year (Fleming et al. 1984, Özçelik 1992, Özcan 2001). Microbiological and sensory evoluations were done according to Fleming, et al. (1984) and Özcan (2001), also for the same time period. The statistical package programmes as Minitab 1991 and Mstat C 1980 were used for multivariative variance analysis test at ($p<0,05$) and Duncan test.

RESULTS AND DISCUSSION

Physical properties of *C.ovata* and *C. spinosa* fruits were determined as length (37,6 mm-55,4 mm), width (20,6 mm-22,7 mm), weight of fruit (8,9 g – 16,0 g) , % pulp yield (44,94 % - 44,38 %) and % dry material (20,0 % - 19,9 %) and shown in Table 1. Also, some chemical properties of the pulps were given in Table 2. All physical properties of *C. spinosa* was higher than *C. ovata* but % pulp yield and % dry material was lower. 1000 gr of both caperbery species yield approximately 450 gr pulp with 15 % dry material.

pH values, acidity and % dry material was nearly similar for pulps of both fruits but protein content, % oil content, invert sugar, saccharose, total sugar and ash content were higher for *C. spinosa* and DMS was not detected in *C. ovata* while *C. spinosa* was 130 μg/kg (Table 2).

Özcan (1999 b) was reported % dry material, protein content, ash content and pH values of *C. spinosa* and *C. ovata* fruits as 17,3 %-17,59 %, 18,33 %-23,67 %, 6,31 %-6,25 % and 4,32-4,28, respectively. Özcan (2002) reported 270 mg/kg ascorbic acid, 9754,2 mg/kg K, 2817,6 mg/kg P and 563 mg/kg Zn in caperberries marmelade and also, water content, protein content, oil content, ash content, acidity, pH value, total sugar, invert sugar and saccharose content as 16 %, 4,06 %, 0,12 %, 0,5027 %, 0,19 %, 5,97, 73,6 %, 8,8 % and 64,8 %, respectively. Caperberry pulps contain many of minerals important for nutrition (Table 3). According to table, major minerals of both fruit pulps were K, Ca, P, Mg and Na. Difference of mineral contents with other literatures must be due to the differences of harvesting year, climatic conditions, soil properties and concentration differences between the fruit content and pulp as a derivative.

Results of Duncan test of caperberry fruit juices' chemical analysis were given in table 4-7 according to spice difference, type of thermal process, rate of concentration and storage period, respectively. *C. spinosa* shows more acidic character while refractive index values were similar (Table 4). pH, acidity values of pasteurized samples showed more acidic character than unpasteurized samples (Table 5). Increase of concentration trough 20 %, pH and titration acidity increased but refractive index was stable ($p<0,05$) (Table 6). Acidity showed an increase trough the storage period, but titration acidity became stable by the 9 th mounth. By the incrase of the acidity trough storage period refractive index showed an important decreasing, this may be a result of microbiological activity (Table 7). pH values of the caperberries are higher than some of fruits. Acar and Gökmen (2000) reported that generally pH values of fruit juices changed between 3,0 - 4,0, but our results were changed between 4,23 - 6,01. This is one of the main difference from other fruits.

According to the microbiological growth of samples trough twenty months, pasteurized juices has no sprout until 12 th month. Total bacteria and mould-yeast count was increased very much until 6th month for unpasteurized samples, so no microbiological and sensory evoluation were applied after than because of the lost of consumption properties. No coliform bacteria was detected for all samples. Generally, no unexpected microbial effect was detected for pasteurized samples by the storage period. Acar and Cemeroğlu (1998) reported that antimicrobial effect of sorbic acid firstly appears on mould-yeast growth. It was thought that by the growth of mould-yeast, pectin was decomposed, as a result turbidity and viscosity was decreased.

Sensory evoluation results were shown in Table 8-11. Colour, taste, odour and turbidity values were best for pasteurized samples (Table 8). By the storage these properties were decreased trough 12 th month. Degree of this decreasing which may be thought as unacceptability of samples were higher after 9 th month (Table 9). One of the most important properties was sulphur-like off-flavour which pasteurization prevented and increased the acceptibility. By the storage period, this property was changed in opposite way. Glucoides hydrolises by fermentation so this may be a result of increase of off-flavours.

Rate of concentrations were affected taste ($p<0,05$). Taste was worst for 20 % concentration but 15 % concentration was acceptable (Table 10). Statistically turbidity was impotrant ($p<0,05$) for spice variance according to sensory evoluation but these results were not too much differing (Table 11).

According to sensory evaluation pasteurization was a good process. Sample with 5 %, 10 % and 15 % concentrations were accepable sensory values until 9 th mounth. By the storage, acidity of unpasteurized samples was higher, so this may be a result of some microbiological activity.

Unpasteurized samples were not acceptable after 6 months. 5 %, 10 % and 15 % concentrating was preferable for both termal processing. According to note of panelists *C. spinosa* was more fruitful than *C. ovata*. In addition, fruit juice of 15 % concentrated, pasteurized *C. spinosa* may be tought as the best product and has suitable properties until 9 months self life.

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Table 1. Physical properties of caperberry fruits[a]
(mean ±SD, n=2)

Spice	Length (mm)	Width (mm) [b]	Weight of fruit (g)	Weight of peel (g)	Weight of seed (g)	Pulp yield (%)	Dry material (%)
C.ovata	37,6±6,26	20,6±3,73	8,9±4,29	2,8±0,52	2,1±0,43	44,94	20,0±1,02
C.spinosa	55,4±6,74	22,7±2,14	16,0±3,3	5,3±0,30	3,6±0,21	44,38	19,9±1,12

[a] 50 fruits were measured.
[b] Average of two points measurement.

Table 2. Some chemical properties of caperberry pulps
(mean ±SD, n=2)

Spice	pH	Titration acidity (%)	Dry material (%)	Protein content (%)	Oil content (%)	Total invert sugar (%)	Saccharose (%)	Total sugar (%)	Ash content (%)	DMS (μg/kg)
C.ovata	6,2±0,02	1,5±0,01	15,2±0,11	2,1±0,6	1,0±0,6	4,6±0,1	33,4±1,2	38,0±0,6	0,60±0,03	-
C.spinosa	6,26±0,26	1,53±0,07	15,34±0,07	2,77±0,2	1,21±0,1	5,6±0,1	40,6±0,7	46,2±1,1	0,89±0,01	130

Table 3. Mineral contents of caperberry pulps (mg/kg)

Minerals	*Capparis ovata*	*Capparis spinosa*
Ag	2,7	0,5
Al	14,6	35,3
B	18,4	22,9
Ba	2,2	2,2
Bi	0,9	0,1
Ca	1060,4	953,8
Cd	0,2	0,1
Co	0,2	0,1
Cu	16,0	18,7
Fe	47,4	38,1
K	17958,4	23780,0
Li	0,1	0,1
Mg	912,9	964,6
Mn	15,4	18,4
Na	212,9	264,9
Ni	2,7	3,1
P	1640,9	1594,5
Se	2,5	3,6
Sr	10,1	11,4
Ti	0,1	0,9
Zn	12,7	11,0

Table 4. Duncan test of chemical properties of caperberry fruits juices according to difference of caper species (n=2)

Species	pH	Titration acidity (%)	Refractive Index (n^{20}_D)
C.*ovata*	5,153a	3.322b	11,460a
C.Spinosa	4,875b	3.971a	10,880a

Table 5. Duncan test of chemical properties of caperberry fruits juices according to type of thermal process (n=2)

Type of thermal process	pH	Titration acidity (%)	Refractive Index (n^{20}_D)
Unpasteurized	5,793a	2,054b	08,190b
Pasteurized	4,234b	5,240a	14,150a

Table 6. Duncan test of chemical properties of caperberry fruits juices according to rate of concentration (n=2)

Concentrations (%)	pH	Titration acidity (%)	Refractive Index (n^{20}_D)
5	5,142a	2,708d	10,110a
10	5,073ab	3,160c	10,860a
15	4,958ab	3,956b	11,720a
20	4,884b	4,755a	11,990a

Table 7. Duncan test of chemical properties of caperberry fruits juices according to storage period (n=2)

Storage periods (month)	pH	Titration acidity (%)	Refractive Index (n^{20}_D)
1	6,019a	3,873ab	15,538a
3	4,992b	3,108c	10,713ab
6	5,026b	3,524b	12,900ab
9	4,648c	3,974a	10,638b
12	4,438d	3,754ab	06,063c

Table 8. Duncan test of sensory evaluations of caperberry fruits juices according to pasteurisation (n=5)

Type of processing	Color	Taste	Odour	Turbidity
Unpasteurized	09,995b	07,160b	08,190b	09,045b
Pasteurized	14,985a	12,835a	14,150a	13,425a

Table 9. Duncan test of sensory evaluations of caperberry fruits juices according to storage period (n=5)

Storage periods (month)	Color	Taste	Odour	Turbidity
1	19,375a	13,650a	15,538a	18,925a
3	11,038b	09,643ab	10,713ab	10,438b
6	13,925ab	10,913a	12,900ab	11,213b
9	11,613b	10,538a	10,638b	11,000b
12	06,500c	05,425b	06,063c	04,550c

Table 10. Duncan test of sensory evaluations of caperberry fruits juices according to concentration (n=5)

Concentrations (%)	Taste	Odour
5	11,250a	11,990a
10	10,410ab	11,720a
15	09,500ab	10,860a
20	08,830b	10,110a

Table 11. Duncan test of sensory evaluations of caperberry fruits juices according to Difference of caper species (n=5)

Species	Turbidity
C.ovata	10,245a
C.spinosa	12,225a

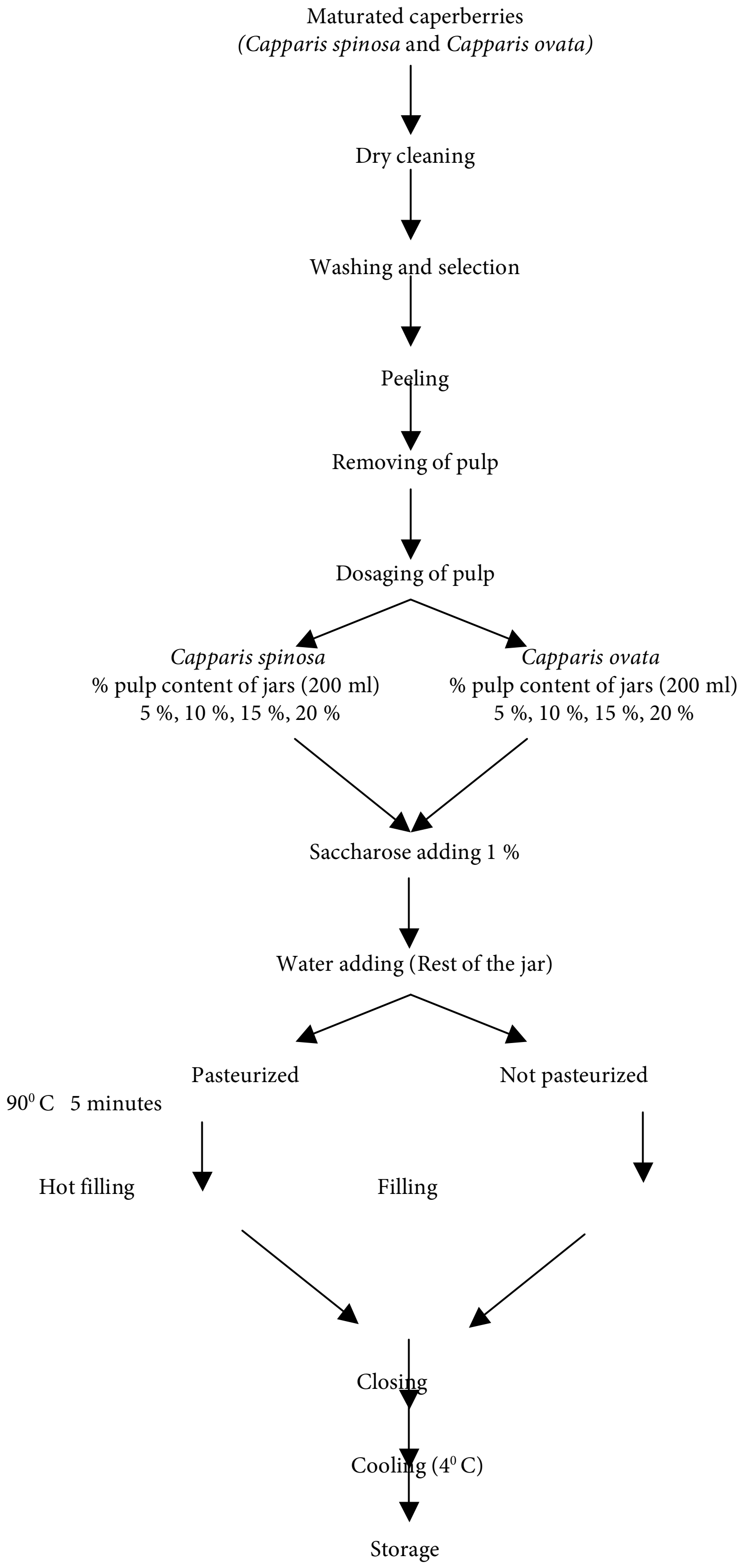

Figure 1. Process schema of caperberry fruit juice

THE TOTAL PHENOLIC, CITRIC ACID, TARTARICACID CONTENTS AND SOME NUTRITIONAL CHARACTERISTICS OF PEPINO (SOLANUM MURICATUM AITON) FRUIT GROWING AS ORGANIC IN MERSIN

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ABSTRACT

The dry matter, crude protein, crude oil, crude fibre, ash, L, a and b color values, titratable acidity, pH, total phenolic, citric and tartaric acid values of pepino fruit were determined. The mineral elements (Al, B, Ca, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P, Se and Zn) of fruit were analysed by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES). The citric and tartaric acid contents were analysed via HPLC equipped. Ca (3256.96 mg/kg), K (43465.60 mg/kg), P (7907.32 mg/kg), Na (1496.13 mg/kg) and Mg (2541.12 mg/kg) were established as major minerals in fruits. These results show that pepino fruit may be useful for the evaluation of dietary information in important food crops.

Keywords : pepino, *S. muricatum*., proximate composition, organic acid, HPLC, minerals.

INTRODUCTION

Pepino (*Solanum muricatum* Aiton) is a small, herbaceous plant or bush with a woody base and fibrous roots. It is belong to Solanaceae family, and also known as mishqui, melon pear and pepino dulce. Pepino is of interest as a crop for horticultural diversification in intensive horticulture systems. The pepino is a horticulture crop from the subtropical and temperate grown for its edible fruits (Gonzales et al., 2000, Prohens and Nuez, 2001, Huyskens-Keil et al., 2006, Anonymous, 2007 a).

The fruit also show considerable diversity in size and shape. The colors also vary completely purple, solid green or green with purple stripes, or cream colored with or without purple stripes. The flesh is greenish to white and yellowish-orange. The plant likes a sunny or semi-shaded, frost-free location, sheltered from strong winds (Anonymous 2007 a).

The fruit is sweet and fragrant, high in vitamins (Redgwell and Turner, 1986) and may have hypertensive and anti-tumors effects (Ren and Torg, 1999; Prohens and Nuez, 2001). Pepino is a sucrose accumulator fruit (Schaffer et al., 1989), and post harvest ripened fruits are less sweet than those ripened on the plant (Prohens and Nuez, 2001). The volatile constituents of some clones of pepino (*S. muricatum*) fruit were isolated by simultaneous distillation-extraction and analyzed by gas chromatography – mass spectrometry (GC-MS) (Rodriguez-Burruezo et al., 2004).

The pepino is a very versatile fruit and can be consumed in different ways depending on its maturity stage. When ripe, it has a flavors resembling the cantaloupe melon (Sweet, 1986; Ruiz et al., 1992; Ahumada and contwell, 1996 Gonzales et al., 2000). At this stage it is consumed as a refreshing dessert fruit, or as an ingredient of fruit salads. It can also be used in meat, fish or seafood dishes (National Research Council, 1989), for preparing juices, preserves, ice creams and Jams (Morley-Bunker, 1983). When it is in an earlier ripening stage it can be used as a vegetable in stews (Esquivel and Hammier, 1999).

The aim of this study was to determine the some physical and chemical properties, organic acids and mineral contents of pepino (*S.muricatum*) fruits harvested at mature stages growing in Büyükeceli-Gülnar-Mersin where has a very important fruit growing climatic (semi-subtropical) conditions in Turkey.

MATERIAL AND METHODS

MATERIAL

Pepino plants grow in Mersin (Büyükeceli-Gülnar) province in South Turkey. Fruits were harvested in mature stages, and selected according to uniformity in colour, shape and size as well as for lack of injuries and foreign odour (Huykens-Keil et al., 2000; Huykens-Keil et al., 2006).

METHODS

Physical and Chemical analysis

L,a and b color values of pepino fruits were assessed with HunterLab color meter (Gonzales et al., 2000).

The fresh weights of 20 fruits were determined. The chemical properties (dry matter, crude protein, crude oil, crude fibre, ash, titratable acidity, pH, total phenol, tartaric and citric acids) of pepino fruit were analysed according to AOAC (1994) methods. Nitrogen was established by Kjeldahl analyses, multiplied by 6,25 and determined as protein (AOAC, 1994).

The total oil content was determined in accordance with AOAC (1994) method. Crude oil was obtained from finely dried crushed fruit (ca 20g) extracted with petroleum ether (Merck- Darmstadt) in a Soxhlet apparatus; the remaining solvent was removed by vacuum distillation. The extracted oil was stored at 4 C in tubes with anhydrous sodium sulphate.

Total phenolic content was measured by the Folin-Ciocalteu assay (Kahkönen et al.1999). Quantification was performed with the hydrolysed samples. Results were expressed as mg/of gallic acid /g dry samples.

For organic acids extraction, approximately 500 g of each frozen sample were used and each replicate was used separately. 1 g of homogenized sample was weighed and powdered with liquid nitrogen in a mortar and mixed with 20 ml of aqueous meta-phosphoric acid (3%) at room temperature for 30 min using a shaker. This mixture was filtered and made up to 25 ml with the same solvent, then used for HPLC analysis.The high-performance liquid chromatographic apparatus (Shimadzu LC 10A vp, Kyoto, Japan) consisted of an in-line degasser (DGU-20A5), pump and controller coupled to a photodiode array detector (Shimadzu SPD-M20 A) equipped with an automatic injector (20 µL injection volume) interfaced to a PC running Class VP chromatography manager software (Shimadzu, Japan). Separations were performed on a 250 mm 4.6 mm i.d., 5 µm, reverse-phase Inertsil ODS3 analytical column (GL Sciences, Japan) operating at 30^{o}C (column oven CTO-10AS vp) with a flow rate of 0.5ml/min. Detection was carried out with a sensitivity of 0.1 a.u.f.s. between the wavelengths of 200 and 360 nm. Elution was isocratic with 0.5% aqueous meta-phosphoric acid. Components were identified by comparison of their retention times to those of authentic standards under analysis conditions and UV spectra with an in-house PDA library. A 10 min equilibrium time was allowed between injections. All the samples were directly injected to the reverse phase chromatography column. For the stock solution of the organic acid standards, L-ascorbic acid, malic acid, tartaric acid and citric acid, were dissolved in methanol at a concentration of 1 mg/ml. All samples and standards were injected three times each and mean values were used (Kafkas et al.20006).

Determination of mineral contents

About 0,5g of dried and ground pepino fruit was put into burnig cup with 15 ml of pure NHO3. The sample was incinerated in a MARS 5 microwave oven at 200 C. Distilled deionized water and ultra high-purity commercial acids were used to prepare all reagents, standards, and pepino samples. After digestion treatment, samples were filtrated through whatman No 42. The filtrates were collected in 50 ml Erlenmayer flasks. The mineral contents of the samples were quantified against standard solutions of known concantrations which were aralyzed concurrently (1998).

Working conditions of ICP-AES:

Instrument, ICP-AES (Varian-Vista); RF Power, 0,7-1,5 kw (1,2-1,3 kw for Axial);Plasma gas flow rate (Ar),10,5-15 L/min. (radial) 15 " (axial);Auzilary gas flow rate (Ar),1,5 "; Viewing height, 5-12 mm; Copy and reading time, 1-5 s (max.60 s); Copy time, 3 s (max. 100 s).

Statistical analysis

Results of the research were analysed for statistical significance by analysis of variance (Püskülcü and İkiz,1989). This research was performed by three duplicates with a replicate.

RESULTS AND DISCUSSION

The L value of pepino fruit skin showed a loss of the green color (Table 1). Regarding the b value, a strong increase was established in yellow tones. Our results were found similar with results of Gonzales et al., (2000).

The physical and chemical properties of pepino fruit are shown in Table 1. Fresh fruit weight, dry matter, ash, crude protein, crude oil, titratable acidity, pH, tartaric acid, citric acid, total phenol, crude fibre values of fruit were established. Fresh weights were determined as average 173 g. Proximate compounts (%) were: protein (1.70), ash (1.81), dry mater (12.8), crude oil (0.22), crude fibre (2.7). In addition, pH, total phenol, tartaric and citric acid were established as 5.46, 117 mg/100 g, 0.1232 mg/L and 2607.5 mg/L, respectively.

The average total phenol content of conventionally grown and frozen Marion berries , strawberries, and corn were 412, 241, and 24,7 mg/100g of fresh weight, respectively (21). A growing body of evidence indicates that secondary plant metabolites play critical roles in human health and may be nutritionally important (21,22). Kafkas et al. (2006) reported that the chemical composition and quality characteristics of nine promising hybrids and two varieties of strawberries were evaluated for their quality attributes during ripening. Total organic acid contents of experimental varieties had varied between 11.90 g/kg to 23.47 g/kg. The main organic acid was citric acid and its concentrations varied between 9.15 and 20.27 g/kg frozen weight in the ripe period (Kafkas et al., 2007). The amounts of citric, malic and ascorbic acids were reported as 3.21 , 1.11 and 0.19 g/kg of FW in strawberry fruits by Perez et al. (1997). Ascorbic acid content of strawberry raged from 0.37 to 1.04 g/kg (Kafkas et al., 2007). A minimal content of ascorbic acid was found in kiwi fruits of Gaivard cultivar; in juice 5.44, skin 1.14 and pulp 4.20 mg/g (Kvesitadze et al., 2001).

The mineral contents of pepino fruit were determined by ICP-AES (Table 2). Fruits were found to be rich in some minerals such as Ca (3256.96 mg/kg), K (43465.60 mg/kg), P (7907.32 mg/kg), Na (1496.13 mg/kg) and Mg (2541.12 mg/kg). Also, K, P, Na and Se and Mg concentrations were higher than that of terebinth (*P.terebinthus*) [Na, 906.64 mg/kg; K, 1364.19 mg/kg; P, 801.88 mg/kg; Mg,318.39 mg/kg] (Özcan,2004). Demir and Özcan (2001) established 890,5 mg/kg Mg and 146,7 and 133,3 mg/kg Ca in Hadim and Kastamonu rose fruit samples, respectively K, P, Ca values of fruit were clearly higher according to findings of Demir and Özcan (2001). Calcium is the major component of bone and assists in teeth development (Brody, 1994). The Mg, Fe and P levels are adequate. Some inorganic elements which may contribute to biological processes, but which have not been established as essential are bromine, cadmium, lead and lithium (Macrae et al., 1993a). Cadmium and lead are best known for their toxicological properties. Lithium is another element with beneficial pharmacological properties in the treatment of macic depresssive disorders (Macrae et al.1993b). Decreasing of these toxic element contents is an advantage. The highest mineral contents were P, K, Ca, Mg, Na and Fe. This work attempts to contribute to knowledge of the nutritional properties of these seeds. In addition, knowledge of the mineral contents, as condiments at various baked products is of great interest.

As a result, the differences in physical properties of fruits having about the same size were probably due to environmental conditions in conjunction with the analytical methods used (Guil et al.1998). In addition, moisture, crude protein, ash, crude fibre, organic acid and crude oil contents of fruits are affected chiefly by variety and growth conditions. These findings may be useful for dietary information, which requires prior knowledge of the nutritional composition of edible fruits. The consumption of pepino fruits is rising around the world owing to the increasing popularity of natural products. According to results, it could be said that pepino fruits have a rich source of a number of important that provide a very useful effect on human health. It may be useful for the evaluation of dietary information in important food crops.

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Table 1. Color, physical and chemical properties of pepino fruits*

Properties	Values
L	62.06±0.51
a	4.67±0.17
b	18.95±0.47
Dry matter (%)	12.8±0.12**
Weight (g)	173±15
Crude oil (%)	0.22±0.02
Crude protein *%)	3.21±0.63
Crude fibre (%)	2.7±1.14
Ash (%)	1.18±0.33
Total phenol (mg/100 g)	17.320±1.13
Titratable acidity (%)	0.08±0.02
pH	5.46 ±0.11
Citric acid (mg/L)	2607±43.4
Tartaric acid (mg/L)	0.1232±0.0042
Brix	57±1

*Nx6.25 **mean ± standard deviation

Table 2. Mineral contents of pepino fruits*

Minerals	Values(mg/kg)
Al	90.46±5.44**
B	27.23±1.19
Ca	3256.96±132.41
Cu	17.17±1.64
Fe	79.73±3.27
K	43465.59±117.11
Mg	2541.12±27.15
Mn	7.39±1.223
Mo	1.14±0.32
Na	1496.13±11.24
Ni	1.66±0.08
P	7907.32±21.01
Se	2.23±0.04
Zn	29.67±2.28

*Drymatter **Mean ± standard deviation

COPEPODS AS AN ALTERNATIVE LIVE FEED IN MARINE LARVICULTURE

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ABSTRACT

Organic aquaculture focuses on best environmental practices, a high level of biodiversity, preservation of natural resources. Organically grown fish should be matured without the use of pesticides, dyes and antibiotics. Thus, organic fish farming requires spesific standards. It was declared by the Sustainable Organic Finfish Hatchery Standards 2004 that only naturally occuring live feeds would be produced and organically derived manures and fertilizers would only be permitted. Although hatchery feeds represents a tiny fraction of total lifetime of feeding, live feeds are very essential for larval survival and growth.

A major bottleneck in the cultivation of many marine fish species for commercial purposes is the lack of suitable food for the first feeding of larval stages. With a rapid expansion of the aquaculture sector, increasing interest in new species and the culture of ornamental species to replace wild fisheries, requirements arise that cannot be met by traditional live feeds. The traditional feeds, *Artemia* and rotifers (*Branchionus* spp.) are not always effective foods due to their size, biochemical composition and swimming behaviour. Some enrichment methods are needed for their biochemical composition.

Marine copepods, the principle diet for most marine fish larvae in nature, are rich in fatty acids. Due to their superior nutritional value, researchs has been focused on investing copepods as an alternative live feed in recent years.

INTRODUCTION

Copepods constitute a first vital link in the marine food chain leading from primary producers to fish, in nature. In the open water marine environment, calanoids dominate the herbivorous zooplankton and provide the food chain base for practically all marine fish larvae and planktivorous fish. In esturies and coastal areas, harpacticoids are an important constituent in the diet of larval and juvenile fish, such as flatfish and salmonids (Stottrup 2003, Stottrup 2006).

The critical importance of fish larvae successfully capturing live prey during their first few days of life has been a concept central to aquaculture production and fisheries recruitment for many years. Copepods and their nauplii are the dominant prey of many first feeding fish larvae, often making up as much as 90-100% of their diet. (Chesney 2005, Stottrup 2006).

Live feed usage in marine fish hatcheries has lead to a rapid expansion in aquaculture sector since the 1980s. In the investigations in live feed area, it was determined that natural and cultured copepods provide additional desirable characteristics such as size and nutritional value to fish larvae rather than rotifers and *Artemia* nauplii that are the two common live food organisms for early life stages of marine fish in hatcheries and have played a supplemental role in larval rearing (Stottrup and McEvoy 2003). In recent years, with the understanding of copepods importance as live feed in marine fish hatcheries, aquaculture researchers have focused their interests in rearing new culture species with very small larvae such as marine ornamental species or species difficult to rear on the traditional live prey, rotifers or *Artemia* nauplii, or with a small mouth size such as grouper (*Epinephelus* sp.), dhufish (*Glaucosoma* sp) and red snapper (*Lutjanus argentimaculatus*) (Doi et al 1997). Raised copepods as well as harvested zooplankton contain biochemical characteristics that make them a good alternative or supplement live food for larval rearing. Copepods are already used semi-extensively on an industrial scale. They are also part of the natural fish preys present in aquaculture ponds and promising results from some sustainable intensive cultures have been reported (Drillet et al 2006, Engel-Sorensen et al 2004).

COPEPODS USED IN CULTIVATION

Although more than 11500 species of copepods have been classified, the number of species that are cultured at larger scales relevant for rearing fish larvae are very few and in the three order of the copepods, the Calanoida, Harpacticoida and Cyclopoida (Mauchaline 1998). Researchers have received most attention to calanoida that are most abundant in the pelagic environment. The mostly cultured calanoid species belong to the genera *Acartia, Calanus, Centropages, Eurytemora* and *Temora*. These copepods are small, with relatively short generation times and a wide thermal and salinity tolerance and easily adaptable to laboratory conditions. Among the primarily epibenthic harpacticoid copepods, species belonging to the genera *Euterpina, Tigriopus and Tisbe* to be ideal candidates for cultivating in large cultures. Very few cyclopoid species have been reared in laboratory. *Oithona* spp. and *Apocyclops* spp. appear to be the best candidates and they are relatively easy to culture over several generations and ideal as food for marine fish larvae (Stottrup 2003, Stottrup 2006). The choise of copepods for cultivation depends on geography, size of the predator (fish) and whether culturing will take place indoors or outside (Kleppel et al. 2005)

CULTURE METHODS FOR COPEPODS

Extensive systems In extensive culture conditions, copepods are collected by the several types of filtering device that have been developed for this purpose, from nature, from fjords or inlets where natural densities are high and used directly as live prey, inoculated into outdoor tanks on land to produce live zooplankton for fish larval rearing, or harvested and frozen, dried or freeze-dried for later use as an inert diet. Enclosed or semi-enclosed areas such as fjords can be directly use for rearing marine fish in North Europe countries. Potential predators in the enclosed system were initially killed of with rotenone.

The phytoplankton production is enhanced by adding fertilizers and where possible water-flow to maintain a high and stable production of zooplankton. Copepod starting culture is derived from resting eggs or are collected from the sea and transferred to the enclosures. Fish larvae are then transfered to these enclosures at densities 0.01-1.32^{-1}, during the larval rearing prey densities should be maintained in the range of 200-500 l^{-1} and if it is needed additional prey may be added. Disadvantages of this type of system include the inability to control production, food level and predators.

Production in outdoor ponds and large tanks is carried out in Europe and Asia for the culture of cod, grouper, turbot. In these systems filtered sea water were used and phytoplankton can be monitored by adding nutrients. In Norwey, prey densities were about 10-300 l^{-1} and 1.4-2.8 fish larvae are added to ponds, resulting in the production of 3.8-40 cod juveniles m^{-3}. An advantage of outdoor pond and tanks, is the possibility of culturing zooplankton at least one generation before using them as food. Because many parasites such as trematods and cestods use copepods as intermediate hosts. By using first generation nauplii as food for fish larvae, the risk of parasite transfer will reduce (Stottrup 2003, Stottrup 2006).

Intensive systems Several attempts to mass culture copepods in intensive systems have been undertaken with varying success and have resulted in the development of different systems for particular species of copepods. Most calanoid species fed by phytoplankton which can be filtered from the water, although it was demonstrated that it was possible to use rice bran for feeding. A combination of at least two algal species with high n-3 polyunsaturated lipid content and of a size that can be utilized by both the feeding naupliar stages and the copepodits and adult stages, probably comprises an adequate diet for culture. Aeration is required to maintain phytoplankton in suspension. In copepod culture it is preferable to choose species with similiar thermal-salinity optima in rearing conditions, although copepods adapt themselves different temperature- salinity regimes.

Contamination of copepod cultures by bacterial blooms, ciliate infections, other copepods may pose a problem. It should be cared to use different siphons for each tank to avoid contamination. Light regime in cultures should be at least 12 h of light. These culture techniques for calanoids are similiar to the other copepod groups, harpacticoid and cyclopoid. The main difference is in the culture tank sizes and their shapes. In calanoids, large volumes and cyclindrical tanks are required and a high tank height to tank diameter should be preferred in order to reduce the surface area to be siphoned and thus the loss of copepods. In benthic harpacticoids needs available surface area than the culture volume. It was reported that in four trays, 40x60 cm sized contained 3 litres of filtered sea water, 300000 nauplii day^{-1} was produced and it corresponds to daily output of 100000 nauplii per litre. Also filtered, non treated sea water and artificial sea water may be used and a whole range of inert food is acceptable to harpacticoids (Stottrup 2003, Stottrup 2006).

USE OF COPEPODS AS LIVE PREY FOR MARINE FISH LARVAE

Copepods have superior nutritional value resulting in normal pigmentation and development and eliminating the need for enrichment, their optimal lipid to protein content for fast-growing fish larvae preventing dietary lipid overloading. Fatty asid composition in copepods allow the larval fish to cope better with stressful condition superior than traditional live feeds (*Artemia* and rotifers) even after enrichment. Copepods are valuable source of lipids, essential fatty acids (DHA, EPA and ARA), protein, amino asids, easily assimilated carotenoids, minerals and enzymes. They could be an inexpensive fishmeal and an alternative or supplement to *Artemia* nauplii or rotifers. Copepods contain high levels of vitamin C and may be an important source of vitamin C in fish larvae. Copepods have no alternative live food because of size for very small first-feeding fish larvae. All stages of copepods are suitable as food. Harpacticoid copepods may serve as tank cleaners, thus helping to maintain tank hygiene. Copepods are an important source of exogenous digestive enzymes that improve digestion of prey in early-stage fish larvae in which the gut is not fully functional and their swimming behaviour helps algal cultures in suspension in green-water systems. Copepods provide improvement in larval condition and a higher resistance to disease (Stottrup 2006, Drillet et al 2006, Treece and Davis 2000, Stottrup 2000).

CONCLUSION

Copepod nauplii offer a diverse size spectra and nutritious prey that can meet the specialized needs of small fast-growing fish larvae. Rearing methods are needed for the mass propagation of suitably small copepods as live prey that can meet the needs of these species and be practical for broad-scale application by commercial aquaculture businesses (Chesney 2005).

Copepoda is rich in species and a lot of candidates potentially relevant for aquaculture are still need to be discovered. A basic knowledge of physiological processes and population dynamics of a species is a prerequisite for the development of rearing techniques (Stottrup 2000). Extensive cultivation of copepods has been shown to be biologically and economically feasible and has been adopted in commercial hatcheries.

However scaling-up small scale intensive techniques is complicated and the development of economically viable, large-scale culture systems for calanoid or harpacticoid copepods remained to be demonstrated. Intensive production systems for copepods remains open for the next century. It would seem sensible to concentrate copepod-rearing efforts on planktonic, estuarine species, which are naturally adapted to variable conditions and tolerant to rearing at high densities (Stottrup 2000, Stottrup 2006).

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IMPACT OF CLIMATE CHANGE ON AGRI-ENVIRONMENT OBSERVED WITH NEW TECNOLOGIES

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ABSTRACT

Land use and land cover changes are important aspects of global environmental changes. They are controlled by natural factors and are affected by new technological. This paper describes to investigate future land use by studying a wide range of scenarios defining climate and agri-environment changes. In recent years, dust storms were investigated for transport and deposition processes and for their strong impact on the concentration levels and composition of atmospheric aerosol. Effective management and monitoring of soil resources require spatial data at various scales in order to incorporate land use patterns, geomorphology, topography, and hydrologic and vegetation parameters. Remote sensing may be the only feasible means of providing such spatially distributed data at multiple scales and on a consistent and timely basis. Quantify basic nutrient transformation and transport processes and their controlling factors in agricultural systems. Assess the influence of soil resource management strategies on C and nutrient cycles in agricultural ecosystems. Develop nutrient management practices to improve nutrient efficiency and protect environmental quality [8]. The results of an investigation of the utility of LiDAR (Light Detection And Ranging) for recovering ecological variables are detailed. Therefore, measurement of forest attributes and evaluation of their variety is often advocated as a good indicator of biodiversity in the context of conservation management [1]. The Normalized Difference Vegetation Index (NDVI) is the most extensively used satellite-derived index of vegetation health and density. Since climate is one of the most important factors affecting vegetation condition, satellite-derived vegetation indexes have been often used to evaluate climatic and environmental changes at regional and global scale. Mechanisms that initiate land degradation include biophysical, chemical and biological processes [6].

Keywords: Climate change, aerosol properties, soil management, LiDAR techniques, NDVI, vegetation cover.

INTRODUCTION

Of an estimated 2 billion metric tons of dust that move some distance in Earth's atmosphere each year, approximately 75% originates from the Sahara and Sahel regions of Africa [10]. Natural deposition is mainly originating from pulses of mineral dust from North Africa into the Mediterranean region [4] and from marine aerosols delivered by the Mediterranean Sea. The biogeochemical impact of desert dust also remains a matter of discussion regarding its contribution for different major and minor elements to terrestrial and marine systems and especially its potential fertilizing role for remote oceanic areas by supplying micronutrients as phosphorus and iron [2].

1 Effects of Saharan dust inputs

Rainwater chemistry was monitored during a two years period (Nov. 2003 – Oct. 2005) for quantification of the atmospheric input over a small (70 km^2) rural Mediterranean watershed. Major ions contents (HCO_3, Cl, NO_3, SO_4, Ca, Mg, Na, and K) were determined by IC, nutrients content (PO_4^{3-}, NO^{3-}, NO^{2-} and NH^{4+}) determined and trace element contents (Al, B, Ba, Cd, Cr, Cu, Co, Li, Mn, Mo, Ni, Pb, Rb, Sr, U, V and Zn) by ICP-MS [13]. It has been further shown that besides the photochemical production of Fe(II) as well as producing some other essential nutrient elements like Zn, Mn along with PO_4^{2-} [14]. This natural source of bioavailable iron is very essential since for many years iron deficiency suggested to be a limiting oceanic micronutrient in some oceanic regions, away from lands [7]. Mineral analyses of the used Saharan desert soil sample are composed of 55% quartz, 17% calcite, 4% clay, 23% gypsum and 1% feldspar [15]. These results were agreed with literature [16].

2 Aerosols and climate effect

Aerosol particles have been found to play a key role in human health, in pollution problems and in global climate change. The quantity of dust has the potential to induce regional and ecosystem responses such as red tides or degradation of coral reefs due to infestation of foreign fungal or microbial populations. Saharan or mineral dust has recently been implicated as a significant force factor in regional climate changes, specifically in influencing local precipitation patterns [11].

3 Agri-environment and soils

Agri-environment schemes have management options for habitat re-creation and restoration. Before offering such agreements, detailed information on soils is often necessary to identify whether a particular site is suitable and, if it is, to determine the most appropriate target habitat to aim for. Regular soil analysis should be undertaken as a vital part of good [12]. Furthermore, soils are an integral part of the biosphere, interacting with the biogeochemical and physical climate systems, affecting productivity, carbon fluxes, and biodiversity. Space and airborne sensor systems, with their synoptic and repetitive coverage of the land surface, are increasingly being relied on to characterize and map the spatial variation of soil physical and biogeochemical properties for environmental and natural resource management purposes. LiDAR, an emerging remote sensing technology that directly measures the three-dimensional distribution of plant canopies, can accurately estimate vegetation structural attributes and should be of particular interest to forest, landscape, and global ecologists [5].

EXPERIMENTAL PROCEDURES

1 Monitoring requirements

Airborne LiDAR is an ideal tool for surveying regional scale projects. Predicting mineral aerosol distributions is a difficult task due to the episodic nature of the sources and transport. Mineral aerosols are suggested to play an important role in climate forcing by altering the radiation balance in the atmosphere [9]. The Normalized Difference Vegetation Index NDVI and other related vegetation indices have been shown to be directly related to many ecosystem parameters and processes such as leaf area index, biomass, production, and absorbed photosynthetically active radiation. Characterizing a regional climatology of aerosols and clouds and their relationships to forest cover is important to understanding the interaction of ecosystems and the atmosphere [16].

CONCLUSIONS

Qualitatively, NDVI generally show the proper sense of change in greenness. Management of forest ecosystems at landscape scales means projecting, evaluating interactions and cumulative impacts on many resources at a time. Characterizing a regional climatology of aerosols and clouds and their relationships to forest cover is important to understanding the interaction of ecosystems and the atmosphere. LiDAR remote sensing only recently has become available as a research tool, and it has yet to become widely available. In addition to their ability to assess dust structure and optical properties with high vertical resolution, LiDARs should play a major role in future operational dust model validation and assimilation activities if observations are performed in regular time intervals and with reasonably good density and distribution of stations in the horizontal located over a particular region.

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EFFECT OF WATER STRESS ON ZEA MAYS PARTS ALLELOPATHIC POTENTIAL IN DIFFERENT GROWTH STAGES ON AMARANTHUS RETROFLEXUS GERMINATION AND GROWTH

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ABSTRACT

By using allelopathic effects of plants one of the aspects of weeds control in fields is production of organic crops in sustainable agriculture. In this reason a trial to evaluating allelopathic effect of different parts of maize in different growth stages under water stress on germination and growth of Amaranthus retroflexus has been done. This research had been done in laboratory and greenhouse hydroponicaly. For providing different maize parts extracts maize have been planted in fields of Islamic Azad University of Tabriz in Iran in two level of irrigation (irrigation per 7 and 14 day). Then maize materials get from different parts of maize (root, shoot, leaf, stem, control), in different growth stages (growth, flowering and filling). Then from this material water extracts in 10 percent concentration provided. In this research factorial based completely randomized design with three replication used.

Results showed that germination of seeds of this weed was one of the susceptible traits surveyed in this research. So that seeds germination decreased by 871% in response to water extracts of maize leaf in flowering stage. In this trait leaf extract had highest allelopathic effect on seeds germinations. Also extracts get from flowering stage of maize had more allelopathic effect on seeds germination. Least allelopathic effect of maize parts was for root extracts.

Drought also increased allelopathic effect of all parts in laboratory experiment. In greenhouse leaf water extracts of maize leaves had highest allelopathic effects on amaranthus retroflexus leaf area and in stress factors control level caused a decrease by 90%. Water extracts of roots had no effect in control of stress factor. But in condition of drought maize roots extracts decreased leaf area by 55%. In leaf area also water extract get from flowering stage had more allelopathic effect.

Leaf water extracts of maize in stress factors control level also decrease biomass by 66%. Leaf water extracts of maize also decreased seed yield of Amaranthus retroflexus weed. So that this plant parts extracts in control level of stress factor decreased yield by 83% than control. This decrease in seed yield of this weed can lead to a decrease in competition of weeds in field in next years. Totally water extracts of leaf had more allelopathic effect on traits surveyed.

Drought also increased allelopathic effects of plant parts of maize. At all except for root water extracts in irrigation level, all parts decreased Amaranthus retroflexus seed germination, leaf area, biomass and seed yield. Thus by using maize and sustain its residues in crops rotation, germination and growth of Amaranthus retroflexus have been decrease and have been useful organic crop production.

Keywords: allelopathy, maize, drought, growing stages, Amaranthus retroflexus

INTRODUCTION

Weeds consist of one percent of plant species, but they can cause harsh negative effect on crops (Singh et al, 2006). To this allelopathic interaction of crops and weeds maybe seems to be small, but this interaction by changing copmpitition have intensive effect (preston et al, 2002). In spite of importance of this interaction, many of researches concentrated on allelopathic effect of crops on weeds. but certain weeds allelopathic affect of crops on are useful and extinct competitive weeds (narval et al, 2005).

Allelopathic affect of plants first depend on genotype (Xuan et al, 2005). But concentration of this compounds can be influenced by developmental stages of plants (namedo, 2007) and environmental conditions such as water stress (Noguchi, 1999). Also production of allelochemicals depend on plant different parts (Lopez et al, 2009). Leaves and their remains usually are most important sinks and roots have less allelopathic effect in comparison to leaves (Turk and Tavaha, 2003).

Maize allelopathy received less attention in comparison to other crops (Minorsky et al, 2002). Of most important evidence, obtained by Noguchi (1999). He extracted 6 allelopathic compounds (wang et al, 2005).

The goal of this investigation was to evaluate allelopathic effect of different maize parts obtained in different growth stages in different water regimes on germination and growth of amaranthus retroflexus.

MATERIAL AND METHODS

This investigation has been done in 2008-2009 growing season in laboratory and greenhouse trials in Islamic azad university of tabriz, iran.

Maize planted in field under two watering regimes: 1- irrigation each 7 day 2- irrigation each 14 day. In different growth stages, maize different parts harvested in different growth stages, dried and milled. Then 10 and 20% water extracts prepared. Maize parts factor consisting of roots, leaf, stem, total plant extracts and control. Growth stages factor also consisting of growing stage, tasseling and filling of maize kernels stage. This investigation has been done in factorial based on randomized completely design in three replication.

Laboratory investigations carried out in germinator. Germination tests carried based on ISTA roles for 10 days. Green house surveys also carried on hydroponically in perlite and based on completely randomized design. Hoagland nutrient solution used to supply nutrients required by amaranthus retroflexus plants. Traits measured were shoot height, biomass, leaf area and seed yield.

RESULTS AND DISCUSSION

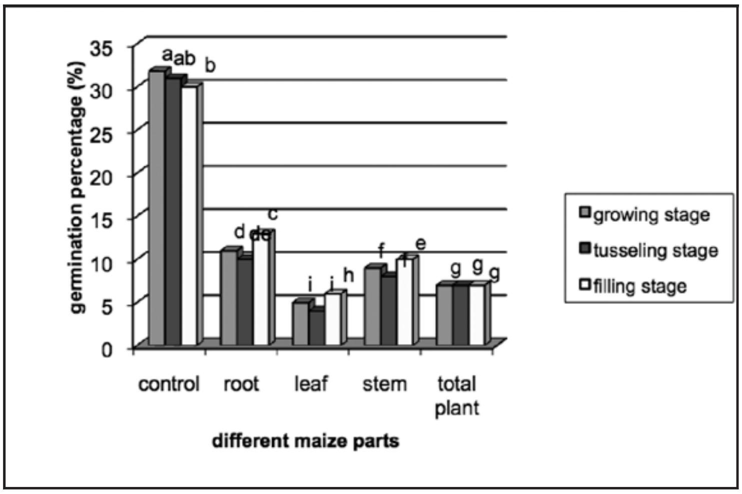
Significant differences observed in all unilateral and reciprocal effects in 1% level in germination trait. In leaf area, different watering level and extracts different of different maize parts had meaningful effect in 1 % level. Effect of extracts get from different growth stages also was significant in 5% level.

Reciprocal effect of watering level in extracts of different maize parts was significant in 1% level. In shoot dry weight, watering level and extracts of different maize parts in 1% level and reciprocal effect of watering level in extracts of different maize parts in 5% level had meaningful effect.

GERMINATION PERCENTAGE

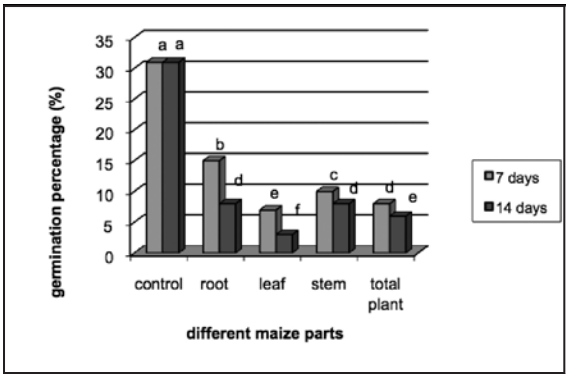
Leaf water extracts of maize get from two growth and developmental stages of growth and tusseling had more decreasing effect on germination than other treatment levels and decreased germination percentage by 84 and 87 % than control, respectively. Turk and Tawaha (2003) also pointed out that leaves and their remains are most important sink of allelochemicals. In this investigation after leaves, extracts of total plants and stem, respectively have more allelopathic on germination. Germination along with growth and establishment of seedling have dynamic role in plant communities (Fernandez et al, 2008). Thus this reduction in germination percentage of Amaranthus retroflexus seeds due to maize allelochemicals has dynamic role and lead to a reduction in weeds interaction.

Figure 3-1: effect of extracts of maize different parts from different growth stages on seed germination



According to figure 3-2 it observe that drought stress increased allelopathic effect maize different part extracts. So that leaf extract under water stress lead to more 13 % depression in germination percentage than leaf water extract in full watering regime.

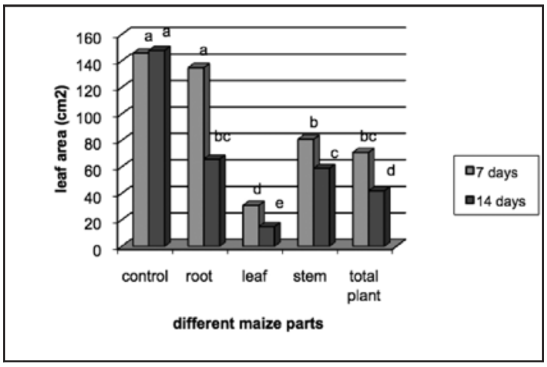
Figure 3-2: effect of different maize parts extracts under different watering regime on seed germination



Shoot height

According to figure 3-3 maize leaves extracts under drought stress have more allelopathic effect on Amaranthus retroflexus shoot height. After this treatment, leaf water extracts under full irrigation have more decreasing effect on shoot heights. But more increase in allelopathic effect of extracts observed in root extracts. Root extracts under full irrigation had no affect on Amaranthus retroflexus shoot heght, nonetheless root extracts under water stress decreased shoot heights by 42 % than control. There are some reports that some allelopathic compound release only on drought conditions. Fritz et al (2007) also pointed out that remains of plants growing under drought stress showed more allelopathic affect.

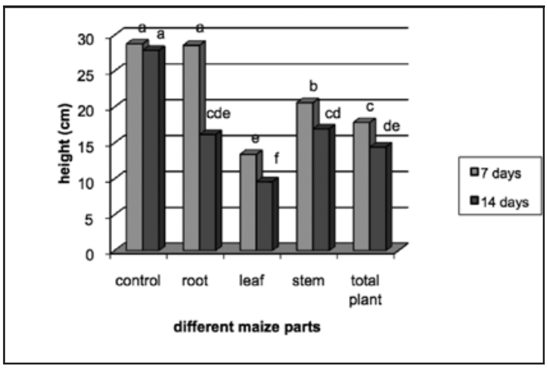
Figure 3-3: effect of different maize part extracts under different watering regime on shoot height



Leaf area

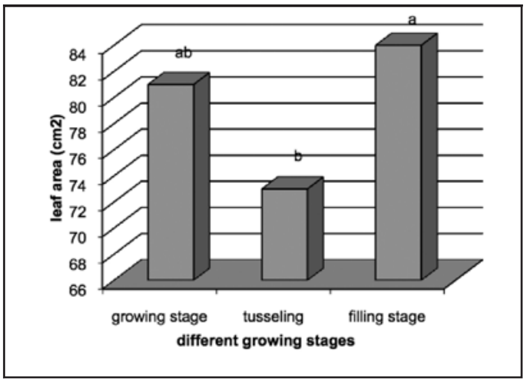
According to figure 3-4 leaf water extracts of maize under drought stress and leaf water extracts of maize under full watering decreased LA more than other treatments, respectively. Root water extracts under full watering don't decreased leaf area, but root extracts under drought stress decreased leaf area by 55 % than control. Based on observation drought stress can lead to an increase in Allelochemicals such as monoterpens, clorogenic acids, hydroxamic acid and phenolic acids concentration (Reigosa et al, 2006).

Figure 3-4: effect of different maize parts extracts under different watering regime on leaf area



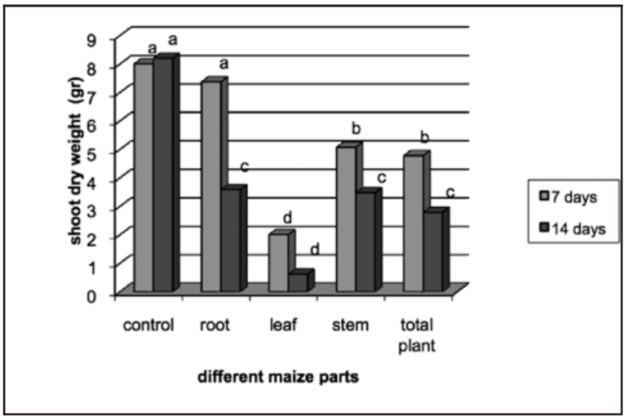
According to figure 3-5 there is no differences in allekopathic effects of extracts obtained from growing and kernels filing stages, but extracts from tusseling stages have more allelopathic affect than extracts from other developmental stages. Thus according to this that there was no differences in different growth stages alleloparhic affects, there was traits that showed a response to allelopathic extracts from different growth stages. Researchers pointed out phonological stages of releasing plants can have an affect on allelochemicals production (Reigosa et al, 2006)**Figure 3-5:** effect of extracts from different growth stages on leaf area

Shoot dry weight



According to figure 3-6 leaf extract under drought stress decreased shoot dry weight more than other treatments. This treatment decreased shoot dry weight by 70 percent than control. After this treatment, water extracts of leaves under full irrigation was the more allelopathic extracts on shoot dry weight. Root water extracts under full irrigation had no decreasing affect on shoot dry weight at all, but under drought stress root extracts caused a reduction by 34 % than control in shoot dry weight.

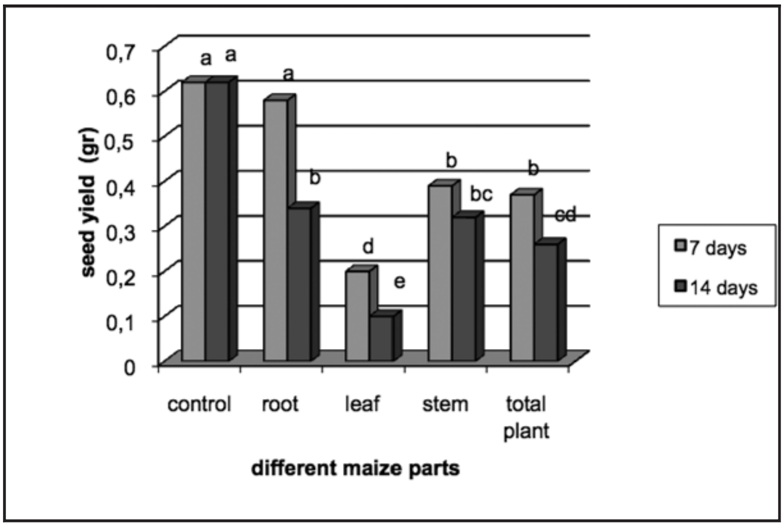
Figure 3-6: effect of different maize parts extracts under different irrigation regime on shoot dry weight



Seed yield

Drought has no effect on allelopathic affect of stem water extract on seed yield (figure 3-7), but allelopathic affect of other parts increased due to drought stress. Leaves water extracts has more allelopathic affect on seed yield. Root extracts in full watering has no effect on this traits, but root extracts under drought stress increased allelopathic affect of roots. Important thing about this trait, is decreasing seed production rate. Because high production rate of seeds in weeds is one of reasons for successfulness of weeds (Maharjan et al, 2007). In amaranthus retroflexus each plant can produce 100000 seed (Costea et al, 2003). In this reason this reduction will be a great chance to crops successful production in fields.

Figure 3-7: effect of different maize part extracts under different irrigation regime on seed yield



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AGROECOLOGICAL CROP PROTECTION IN ORGANIC AGRICULTURE: THE CASE OF CUCURBIT FLIES IN REUNION ISLAND

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ABSTRACT

Cucurbit flies are considered as the main pests in organic farms in Reunion Island. Three species cohabit : Bactrocera cucurbitae, Dacus ciliatus and Dacus demmerezi and cause 90% loss of Cucurbit yield [1]. Damage to the crop is due to oviposition by females in fruit and to the development of larvae inside the fruit. Agroecological crop protection, which is suited to organic agriculture, is an approach based on three components: sanitation, habitat manipulation and biological control [2]. It can be applied to fly management in organic farming using the following seven practices.

Monitoring

- Populations of flies are monitored during the year using male-lure baited traps without insecticide, in order to evaluate the critical period for management.
- Levels of population fluctuate during the year, with a peak during cropping season (November to April).

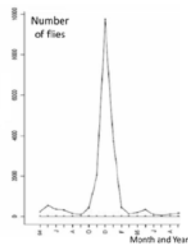


Fig 1: Number of *B. cucurbitae* (black) and *D. demmerezi* (red) caught in cue-lure traps during 1994 and 1995 on Reunion Island.

Sanitation

- Each fruit is able to host many fruit fly eggs and larvae.
- A preventive solution is to pick and place infested fruits into an "**augmentorium**", a tent-like structure designed to sequester flies and to allow the escape of parasitoids in the farm environment.

Trap plants

- Adults of *B. cucurbitae* shelter and roost in vegetation bordering crops [3].
- **Corn** appeared to be the most attractive and appropriate trap plant for controlling Cucurbit flies.

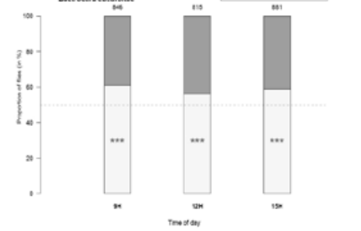


Fig 2 : **Proportion of *Bactrocera cucurbitae* on corn and cane grass tested in field cages.** Number of flies observed noted above the bars. The binomial tests (5%) with Ho: proportion of flies on corn (Pc) = 0 and H1: Pc >50% (*** = P<0.001)

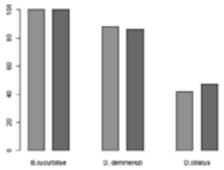
Attract & Kill

- "**Synéis-appât**", acceptable in organic agriculture, is a combination of an attractant and feeding stimulant, and spinosad (biological insecticide). It can be applied on border plants (corn) as spot spray to attract Cucurbit flies and to kill them. Our studies showed that "Synéis-appât" was effective on the three species of flies, especially on *B. cucurbitae*, and has no effect on parasitoids.

Male Annihilation Technique

- Under the Male Annihilation Technique (MAT), many male-lure baited traps (same as they are used for monitoring) are used to catch the maximum number of males and to disrupt the equilibrium of the population.
- The trap is a **plastic bottle** containing a parapheromone (cue-lure), but no insecticide. It is designed to allow the entrance of flies but prevent their exit.

Fig 3 : **Mortality rates in field cages for males (blue) and females (pink) *Bactrocera cucurbitae, Dacus demmerezi* and *Dacus ciliatus* due to « Syneis-Appât » sprayed on corn leaves.**



Biological control

- *Psyttalia fletcheri* (Braconidae, Opininae) is a parasitoid established on Reunion Island.
- It contributes to the control of the Melon Fly and its impact can be significant only if there is no chemical insecticide pressure (i.e. in organic farming).

Agroecological practices

- Agroecological practices, such as intercropping or minimum tillage, aim to improve the vegetal biodiversity and the health of the soil, two key-components of the sustainability of agroecosystems.
- These practices allow the development of Conservation Biological Control.

ACKNOWLEDGEMENTS

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PRINCIPLES AND BENEFITS OF SOIL ECOLOGICAL CULTIVATION

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ABSTRACT

Ecological cultivation of the soil corresponds to the healthy and high quality foods requests. Also, it provides the protection of natural resources on long term for the benefit of future generations. In order to practice the system of soil ecological cultivation is important to reduce the environment pollution due to the agricultural works. The organic soil is the focus, therefore, maintain and increase soil fertility is very important. Base soil fertility is life in the soil. Soil fertility, soil productivity that is a decisive attribute, whose level in using drops. A general principle applies to organic farming is that land should be as unobtrusive, but conditions in our country is hardly give up plowing. Minimum and direct sowing systems requires appropriate equipment, heavy investment and trained.

Keywords: soil ecological cultivation, organic soil, organic farming.

INTRODUCTION

The organic soil is the focus, therefore, maintain and increase soil fertility is very important. Base soil fertility is life in the soil. Soil fertility, soil productivity that is a decisive attribute, whose level in using drops. It therefore needs to recover first from fattening, ensuring a chain of specific effects of organic farming: healthy soil - healthy plants - healthy animals - healthy people.

Work done correctly makes life in the soil and provide needed space for plant roots, contributing to: improve soil structure, raising and reducing compaction, incorporating crop residues and organic fertilizers, weed control, preparing the germinative bed.

Ground work to ensure a stable structure with a maturity and an appropriate resilience to neutralize some restrictive factors: excessive rainfall, heavy rains, the settle by agricultural machines, washing the fine soil and nutrients, formation of crust, siltation.

COMMENTS

A general principle applies to organic farming is that land should be as unobtrusive, but full of weeds conditions in our country is hardly give up plowing. Minimum and direct sowing systems requires appropriate equipment, heavy investment and trained.

Given these conditions of differentiation, the specific objectives of tillage may be:
- Adjustment of physical characteristics, chemical and biological, whiles creating optimal conditions for seed incorporation, their germination and the subsequent growth of plants;

- Maintaining and enhancing soil fertility restoration and regularly show raising layer soil incorporation of crop residues left after harvesting the plants, manure, green fertilizer, natural deposits of mineral fertilizers, amendments, etc.;

- Weed control and some diseases and pests that development cycles in relation to the ground;

- Enhancement effect of other technological elements, plant vigor and efficiency of fertilizers, irrigation water, crop rotation is closely related to how prepared the soil, root system of young plants grow more easily in a loose layer, than in one compact, and so work is more intense micro-worked soil.

Economic efficiency of a culture is closely linked to how they are executed and why is the work of soil quality. Ground work is the technological component through rationalization leads to a substantial reduction in fuel consumption as soil preparation requires 35-65% of the total energy consumed in a culture technology.

Organic farming is a different model from the conventional intensive agriculture, but also too traditional of subsistence agriculture. Organic farming is creative, instructive, scientific and advanced, allowing correction of serious environmental problems and social care, and resolve imbalances facing the current agriculture and farmers in general.

Most important characteristics of plants are encouraging organic cultivation, maintenance and reproduction of natural functions of soil. Organic cultivation differs significantly from the conventional and intensive methods and effects. Ground work is mainly intended immediate effect a series of positive role from the very ground work objectives: basic work, preparatory work for the bed germinative maintenance of fields. Often, however, when the work is inadequate, the effects of ground work can be immediate negative or lasting effect, remaining.

Reduce traffic on the ground and making works best when the soil (in the technological and humidity) are important condition for more efficient cultivation in environmental system.

Soil as part of the ecosystem, a biological system is open and lively from the presence of micro-organisms and is dynamically located in an exchange of energy and substance with the environment, but the main repository of organic matter. Accumulated in soil organic matter has a role on the development of most processes and soil properties. Also, soil organic matter, is one of the most important reservoirs of carbon (organic or mineral), which in turn is transformed under certain conditions, with a certain intensity, atmospheric carbon dioxide, a potential source for accelerating greenhouse effect. This important resource soil is in constant interaction with human activities in the agricultural and applied technology. Carbon stored in soil through photosynthesis may be released as $CO2$ by mineralization or decomposition.

The transformation of matter is defined by a complex biological process: humification - mineralization. Much of the loss is due to anthropogenic carbon, for example through the work and soil erosion. The relationship between agriculture and the loss of carbon is complex, but it is clear that there is a link between agriculture and climate change. Raising physical layer through the work of arable soil, removing the main production and replace it with fertilizers help to change the system. Annual removal of biomass crops is a removal of carbon and nutrients in agricultural ecosystems. After repeated cycles of removal of biomass from the system, the soil is poor in nutrients and organic elements.

Soil conservation practices are those which not only reduce soil erosion but be required to increase soil carbon content. Best management practices for sequestration are related to cultural remnants, such as conservation work directly sowing, minimal work, mulch soil, appropriate rotations, cover crops, eliminating grubbing summer, application of organic fertilizers and compost, optimizing fertilization soils.

Plant debris left on the soil surface or incorporated surface where soil conservation systems, contribute to increased biological activity and is an important source of $CO2$. It restores soil structure and improves the overall drainage of the soil, allowing faster water infiltration into soil. The result is a more productive soil, better protected against wind and water erosion and requires less fuel to prepare the bed germinative.

The advantage of organic cultivation of the soil is to achieve a balance between crop production and environmental protection, which can be guaranteed to prevent environmental imbalances, with possible negative influence on the results of production even further.

Favorable effects of soil induced by environmental work are extending the optimal range of humidity, a workability better structure and better soil drainage.

OUTLOOK

The objectives of soil protection in Europe adopted a work can be applied to organic soil and our soil, whether that effect is applied correctly all necessary measures:

• reducing tillage intensity and aggression, respect for the right soil to be covered with vegetation all year, stopping capillarity to the soil surface (dependent crops by mechanical work to maintain soil structure and layers of vegetable soil protection) anti-erosion systems of work soil, land suitable slope;

• use of agricultural machines with bodies which raise and small soil by tapping and selling of land on the line of least resistance, not by cutting, compression and compaction (specific conventional system), reducing road traffic and performance at a crossing in many technological operations;

• increasing the capacity of absorption and accumulation of water (to avoid soil erosion, stabilization of pore continuity, avoid the settle soil humus content optimization, preserving structural stability);

• diversification of agricultural practices (crop rotation with winter summer, those with annual multi-annual).

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EFFECTS OF PHOSPHOROUS SOLUBILIZING BACTERIA ON TURNIP FORAGE PRODUCTION AT LIMITED IRRIGATION SYSTEM

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ABSTRACT

Phosphorus is an essential element which plays a key role in plant growth and development and is the major nutrient after nitrogen (N) that limits plant growth [4]. Because of soil pH most of the phosphorus applied as fertilizer (75 to 90%) will not be available to the plant due to iron, aluminum and calcium complexes [7]. A significant number of soil rhizosphere bacteria and fungi known as PSM micro-organisms are able to convert the non absorbable mineral soil phosphorus to available form which is readily absorbed by plants [3]. The applications of these micro-organisms have proven to increase the yield in most of crops [9]. In terms to this fact these bacteria are known as Plant growth promoting rhizobacteria. The application of these bacteria in the soil increases germination rate, root growth, crop yield, and pest control, leaf area, chlorophyll content, drought resistance and biological activities in the soil [5].

Nuel et al (1996) reported a direct relationship between IAA and Cyt production by PGPR and Canola and lettuce growth [6]. One of the most important challenges to produce food (especially in arid and semi arid regions of the world) is the shortage of reliable water resources in the world [2]. While the available water resources are constant, the population of the world is increasing annually. In this respect we need to increase the water as well as land use efficiency in our crop production practices [1]. Because of irrigation water shortage, water stress through limited irrigation systems should be imposed to some extent on the plants during the growing season. The main goal of these practices is to increase the water use efficiency by less water application in each irrigation as well as elimination of irrigations with the least efficiency.

Limited irrigation will tend to decrease yield per unit area, however, the increment in planted area and maximizing the crop yield per unit of water consumption in long term will lead to more crop production [8].

The objective of this project was to determine the effect of sole and mixed application of chemical and biological phosphorous fertilizer on plant growth and yield of turnip under limited irrigation conditions.

MATERIALS AND METHODS:

This research was conducted in Research Farm of College of Agriculture, University of Tehran, in Karaj/Iran during 2009. The experimental treatments were arranged as split plots were five levels of irrigation treatments were assigned to the main plots and four levels of fertilizing systems to the subplots. A randomized complete block design with four replications was employed to analyze the data. The experimental treatments are listed as follows: Irrigation treatments including IR_0 (no irrigation), IR_1 (Irrigation at sowing time), IR_2 (Irrigation at sowing time + commencement of tube formation), IR_3 (Irrigation at sowing time + commencement of tube formation + commencement of flowering) and IR_N (normal irrigation). Fertilizer treatments including F0 (no phosphorous fertilizer), Fch (100% chemical phosphorous fertilizer according to soil test), FB (seed inoculation by *pseudomonas putida* bacteria strains 41 and 168) and 50%Fch+FB (50% chemical phosphorous fertilizer + seed inoculation by *pseudomonas putida* strains 41 and 168). The phosphorous was provided from Ammonium phosphate source (250 Kg/ha according to soil test) which was applied in strips 5 cm apart from the seed. The phosphorous biological fertilizer comprised of two pseudomonas strains 41 and 168 which was provided by Soil and Water Research Institute of Iran. The seed was immediately planted after inoculation by bacteria (in the rate of 50 gr/kg seed) on March 3rd, 2009. The harvesting was done on June 26th. Harvest samples were collected from 1 square meter quadrates per plot after elimination of border effects. All the plant and yield attributes of turnip (eg. shoot weight, root weight, total forage yield, shoot/ root ratio and etc.) were measured.

RESULTS AND DISCUSSIONS:

Irrigation treatments, fertilizing systems and their interaction effects was significant on turnip shoot, root and total forage production ($p<0.01$). At all irrigation levels the application of 100% chemical fertilizer produced the highest turnip shoot dry matter (Figure, 1). Fifty percent reduction in chemical fertilizer application led to significant reduction in turnip shoot dry matter even if biological fertilizer was applied. However, the comparison of results at different irrigation treatments indicated that the maximum efficiency of shoot yield per unit chemical fertilizer application was achieved at 50%Fch+FB. These results indicate that there is a synergistic effect between biological and chemical fertilizer in respect to shoot dry matter production which could lead to lower application of chemical phosphorous fertilizer if biological fertilizers are applied with them. The maximum root yield was obtained in IR_N which followed a decreasing trend as the number of irrigations decreased. The application of biological fertilizer at IR_3 and IR_N led to the maximum root yield production indicating that pseudomonas bacteria is more active and more favorable in better soil moisture conditions (figure, 2). The total forage yield followed the same trend as root and shoots production as affected by different irrigation systems. At all irrigation systems the highest total forage yield was obtained from 100% chemical fertilizer (Figure, 3). At IR_3 and IR_N irrigation treatments no significant differences were observed between 50%Fch+FB and sole biological fertilizer applications. These results indicate that the application of 100% chemical fertilizer increases turnip forage dry matter under all soil moisture conditions, however, under more favorable soil moisture (IR_3 and IR_N), there is a possibility that by sacrificing of 20 (IR_3) to 10 percent (IR_N) of the yield we can substitute the chemical fertilizer by the biological one which is a significant movement towards the sustainable agriculture.

Figures:

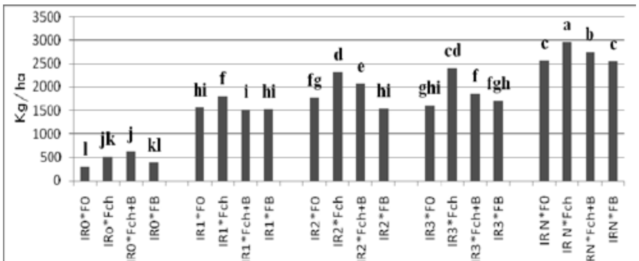

Figure 1: Interaction effects of irrigation and fertilizer treatment on turnip shoot yield

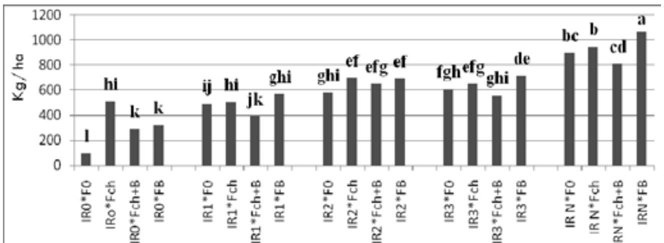

Figure 2: Interaction effects of irrigation and fertilizer treatment on turnip root yield

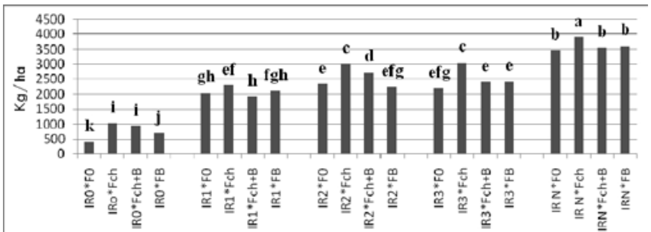

Figure 3: Interaction effects of irrigation and fertilizer treatment on turnip total yield

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POSSIBILITIES AND LIMITATORS OF ORGANIC BUFFALO MILK PRODUCTION IN THE BLACK SEA REGION, TURKEY

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ABSTRACT

The total buffalo population of Turkey has decreased rapidly, in recent years. According to geographical regions, the Black Sea is the main area of the country to obtain organic milk from Anatolian buffaloes. The region presents some positively facilities to farmers. Especially, suitable water sources and abundant grasslands can be utilized for organic production. And also, no synthetic, chemical or hormonal materials using is attractive by consumers. However, relatively low milk yield per day, no artificial insemination application in mating, reduction in watery areas owing to global warming, preferring dairy cow rearing by farmers and no organization on marketing in the region can be regarded as the main limitators. To solve these problems, conducting pilot studies by research centers or universities and also establishing a cooperative similar to cattle breeders association should be performed as logical approaches.

Keywords: Organic husbandry, Buffalo, organic milk, Black Sea region.

INTRODUCTION

Today, people demand high quality and safe food in many countries. Organic husbandry addresses this demand, and has the potential to improve the health and welfare status of an animal, and to diminish environmental pollution of agricultural production [3]. Consumers in EU believe that organic food is free from residues, produced in an environmental- friendly manner and in consideration of animal welfare, has better taste, and is more healthy [13].

It can be regarded as an approach to sustainable farming that has special principles and practices on management of the farms and marketing [4]. According to organic principles, animal production should take account of naturalness, authenticity, animal welfare and agro-biodiversity [9]. Animals must be fed on organically produced feeding stuffs, preferably from the farm itself. Also, indoor area is supplemented by an outdoor area that must be at least 75% of the indoor area [5]. At the same time, organic production and marketing constitute a traceable process that has its own international regulations, and the organic products have to be registered, controlled and certified by independent inspection and certification institutions at all stages of this process [7]. Roughly, world-wide certified organic production takes place in 130 countries, half of which are developing countries [5]. According to these concepts, some livestock species such as water buffalo has been regarded more focuses for organic husbandry. In fact, the basic reasons in elevation of buffalo raising during recent years may be explained by the popularity of Mozzarella cheese, and the absence of quatos in the European Community for this production. In addition, buffalo milk is more expensive than bovine milk at least 2 fold, in many countries [11]. In our knowledge, there is no sufficient report on organic milk production from Anatolian buffaloes.

In this paper, organic water buffalo milk production possibilities and preventive factors has been discussed

ORGANIC LIVESTOCK PRODUCTION IN TURKEY: FACILITIES AND BARRIERS

The market for organic products is strong, especially in Europe, North America and Oceania, but demand for organic products that cannot be grown in developed countries has resulted in the development of international trade in organic food and has led to developing countries such as Turkey, which has suitable ecological conditions, becoming a producer and exporter of organic products and foods to developed countries. Figure 1 shows that organic agriculture developed rapidly in Turkey (1990- 2006) [7].

Figure 1. Number of organic producers and area under organic management in Turkey.

Today, the product range mainly includes fruit and vegetables. Organic animal production is still low, but there has been much private sector interest and investment and it is expected that production will be increased to cover both foreign and domestic demand [7].

Turkey has suitable ecologic conditions and export potential for organic production, however, the share of Turkish organic products in the world market is considerably low [4]. The production of by-products coming from organic farming (cheese, yoghurt, etc.) was started in 2004. Such that, produced organic milk of Turkey in 2006 was reached to 3 thousands t, approximately [8]. In this respect, it can be suggested that more focuses should be performed on dairy organic production in order to increase export.

As seen from Table 1, organic farming activity has a boosting trend related to time.

Component	2005	2006	2007
Farmers	131	128	165
Cattle	775	1238	3842
Small ruminant	10056	10469	16603

Table 1. Numbers of the farmers performing organic husbandry and animals [8]

The total organic agriculture area in Turkey is only 0.14%. That's to say, in spite of managing extensive husbandry in many location of the country, organic production potential by climate or pasture structure of the country is not assessed efficiently. However, Turkey presents among the first 30 countries those have the most organic farming areas of the world [4]. Ecologically; honey, egg, beef and milk are produced in Turkey. Of these products, only honey is exported. In 2002, 40 t organic milk was presented to market, and this level was elevated to 137.5 t in 2004. Organic milk production has been performed only in Gumushane [8]. In Gumushane province, Dogan Organic Products Company has played an important role on organic dairy sector. Such that, milks from the farm and contracted farmers are processed into various milk products on the premises [6].

Organic farming is more "environment-friendly" than conventional management, nevertheless, in organic production, same amount milk is taken by exploiting a larger pasture area [13]. No sudden alternations are observed in organic milk production [10]. Besides, organic husbandry proves more efficient than do conventional husbandry in converting roughage into milk. Furthermore, average multiparity percentage is higher in organically managed cows. Also, it can be expected higher reproductive performance in organic dairy husbandry [11]. Organic milk production, practiced by EU or national regulations on organic farming, has impacted in recent years on livestock system, animal feeding, forage management, reproduction behavior, and animal health [13]. Organic farming provides many challenges for good herd management. However, good animal health and welfare is definitely shown not to come as a "natural consequence of conversion to organic farming", but rather through an increased effort to implement good care-taking routines into daily management [16]. Significantly less frequently performed post-milking teat dipping in organic system [12] should be regarded in the farms. Due to restriction of feeding type in dairy farms by EU regulations, correct balance of minerals and trace elements must be constantly achieved [13]. However, some researchers [14] clearly indicate that balancing energy and nutrient content of the ration with animal requirements is done under limitations. In practice; dry period mastitis is relatively often seen in organic herds [16], however, in many countries, organic milk is mainly produced in hill farming [13].

Cattle number of Turkey was reduced by 1.58% in 2008 when compared to earlier year. In this amount, reduction was 1.60% for bovine, and in contrast, elevation was 1.88% for Anatolian buffaloes. Distribution of cattle population of Turkey is seen in Table 2. A reduce in the number of buffaloes according to last decade is associated with lower production traits of buffalo cows in comparison to bovine cows, substitution of draught animals with tractors and the poor market demand for buffalo products [2]. Total 40-60% of buffaloes population are raised in the middle of Black Sea region [20]. In the region, some pilot studies have been started to improve eco-system and to move on buffalo rearing by Ministry of Agriculture and Rural Affairs and Ministry of Environment and Forestry. In this Project, only buffalo owners with at least 20-30 heads in each herd should be regarded for obtaining more productivity [8].

Trait	Maximum	Minimum
Lactation milk yield (kg)	1070.5±279.9	709.6±23.0
Lactation length (d)	269.2±70.0	222.0±44.2
Calving interval (d)	434.3±57.1	365.2±17.5
Service period (d)	112.5	70.8
Gestation length (d)	326.5±5.8	317.0±51.5

Table 2. Some milk and reproductive traits of Anatolian buffaloes [20]

The water buffalo is called by different names such as Dombay, Camiz, Camis, and Komus in Turkish [2]. Besides, Anatolian water buffaloes are mainly used for milk and meat production in this region of Turkey. The creamy part of milk fat of these animals is popular accompanies to famous Turkish desert. Some basic traits of Anatolian water buffaloes obtained from different investigations are given in Table 2.

When we considered that a fundamental principle of organic cattle breeding is harmonism of the production with ecological balance, organic production via Anatolian buffaloes may be seen a facility for the Black Sea region. Such that, Kizilirmak and Yesilirmak deltas of Samsun province present rich sources to sustainable husbandry by their substantial eco-system structures. In the region, buffalo population spend significant portion of the year on the pasture and freely takes nourishments from range areas [8]. In fact, it can be assumed that only roughe based feeding is one of the basic concept of organic cattle husbandry. Thus,mentioned method above can be assumed as suitable for organic husbandry, however, it can be expected decreased milk production due to unsupported feeding [17]. Furthermore, poor reflecting characteristic for estrus determination and hardness in predicting ovulation time are the main reasons for applying artificial insemination as a difficult condition in water buffaloes [18]. Buffalo milk has a great importance as human food by its integrident (Table 3). Structurally, buffalo milks include more dry matter, fat and protein, but lesser water than bovine milk [1]. It can be process to many products such as butter, yoghurt, cream and ice cream. In our country, wholly amount of buffalo milk obtained in Afyon region is used as fold cream, which is referred as *lule* in Turkish. Buffalo delight made from buffalo milk in Bafra region is assumed as an important taste.

Ruminant	Water	Dry mater	Protein	Fat	Lactose	Trace mineral
Buffalo	**82.0**	**17.7**	**4.1**	**7.8**	**4.8**	**0.7**
Bovine	87.5	12.4	3.4	3.6	4.6	0.7
Sheep	82.9	17.2	5.4	6.2	4.5	0.8
Goat	87.1	13.0	3.7	4.1	4.4	0.8

Table 3. Integridents of buffalo milk in comparison to other ruminant milks (%)

However, unscientific methods using in daily activities, relatively low milk production in comparison to bovine and no artificial insemination applying in mating are other important limitators for managing organic buffalo milk production in Turkey. Besides, in recent years, reduction of watery areas of the country due to global warming may be added to preventive factors. Furthermore, it may be expected more watery area loss in the future, and thus, it would be not a surprise that number of population of Anatolian buffalo in the country has become a dramatic level. If water buffalo farmers do not organized in an umbrella setup as Cattle Breeders Association, no any progress may be expected in organic buffalo milk in the Black Sea region and also in the country. Organization of the farmers will be beneficial for presenting organic milk to consumers according to safe food principles. In this respect, one should not forget that Italian farmers sells “mozzarella cheese”, a product made from buffalo milk, to be 3-4 fold higher prices [15]. Also, lack of the recording in buffalo farming in the region can be assumed as a limitative factor to progress in organic milk production. Besides, routinely product testing in obtained materials is seen a logical approach for achieving safe organic milk products from buffaloes. This application may prevent many disorders in the production cycles in an early time. Organic milk products processing operations should also be established to ensure more gain in marketing. In this view, research institutes and universities located in the region can be seen as the technical head-quarters.

CONCLUSION

Turkey has a significant livestock population and land area to produce and process organic farming, especially for water buffalo raising. In spite of some existed limitators in production stages, organizing farmers under a cooperative or foundation is firstly advised to success efficient production and marketing.

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THE ORGANIC MILK PRODUCTION, ITS PROPERTIES AND PRODUCTION IN TURKEY

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ABSTRACT

Organic milk is certified milk obtained from organic feeding-healthy animals and is only used to allow chemical matters in processing, packaging, transporting and storage stages. Organic milk production is possible with quality organic agriculture and organic animal production. The production of organic raw milk is essential for organic production of other dairy products such as cheese, yoghurt. In organic milk product, the strategies applied on animal nutrition have positive affect on environment. In this review, production of organic milk, its properties and differences from conventional milk production and organic milk production in Turkey were summarized.

INTRODUCTION

Recently consumers demand high quality, safe food produced with minimal environmental losses, under optimal conditions for animal health and welfare. Organic production systems are designed to produce optimum quantities of food of high nutritional quality by using management practise which aim to avoid the use of agro-chemical inputs and minimize damage to the environment and wildlife. [1, 2]. Plant and animal growth regulators, sentetically compounded fertilizers, pesticides, livestock fed additives, antibiotics, hormones, preservatives, colorings or artificial additives are not used in organic food production or processing [3]. Organic milk production is one of the fastest improving segments of organic agriculture in the world. By the end of the 20th century, about 3% of European farmers had converted to organic farming in response to a growing market for organic products [4]. In some countries, such as Austria and Switzerland, the market share of organic milk is already approximately 10% of the total milk market [5]. The organic milk production and milk products in the United States improved to 37% between 1998–2003 [6]. Austria has the highest percentage of dairy cows in organic herds followed by Switzerland and Scandinavian countries. Germany and Netherlands are the other two important countries for milk production, but have a lower percentage of organic farms [7].

The properties of organic milk

Organic milk production differs from conventional production because the organic production is based on the organic principle aims. Organic milk production systems are based on ecologically based practices that virtually prohibit the use of antibiotics and hormones in the cows and the use of synthetic chemicals in the production of cattle feed. Organic milk production systems also attempt to accommodate the animals' natural nutritional and behavioral requirements, for example ensuring that dairy cows have access to pasture. These requirements add to production cost and create obstacles to widespread adoption, such as higher managerial cost and risks of shifting to a new way of farming, and significant time and costs associated with the transition to organic production [8, 9].

One requirement of organic milk is that the cows are not treated with antibiotics. In non-organic milk production if a cow needs antibiotics it is treated and then returned to the herd once tests show that it is antibiotic free. If a cow in an organic herd needs to be treated with antibiotics, it is not allowed to return to the herd for 12 months. In addition organic milk cows must have access to pasture. Another requirement of organic milk is that the cows cannot be treated with BGH – bovine growth hormone, which increases milk production. Also organic animal can only be fed grain or grass that is not treated with pesticides [10]. Calves have to be fed on their mother for at least a week, and they are then reared on organic milk for at least 12 weeks. Calf rearing pens must have suitable non-edible bedding and they must be cleaned regularly. Rotating calf paddocks regularly can assist scour and parasite management [11]. All the standards and regulations of organic farming specify similar rules for milk production and, in particular, for feeding of dairy cattle. Thus, all feed must be obtained by organic farming, without the use of artificial fertilizers or pesticides, predominantly on the same farm [5].

Recently in studies on the composition and hygienic quality of organic milk, the gross composition of organic milk has been reported to differ from that of conventionally produced milk [12]. Many of these researchers report that the differences in gross composition are mainly the result of different feeding systems. The hygienic quality of organic milk has also been shown to differ from that of conventionally produced milk. The total bacterial count in organic milk has been found to be similar to, or lower than, that in conventionally produced milk. Also somatic cell counts of organic milk found lower than conventional milk [13, 14]. Production of milk causes environmental side effects, such as emission of greenhouse gases and nutrient enrichment in surface water. Organic milk production has reduced environmental side effects compared to conventional milk. Also organic milk production is a way to reduce pesticide use and mineral surplus in agriculture [15].

Organic milk production in Turkey

Turkey has a suitable position for organic agriculture because of its different ecosystems and rich biodiversity. Organic agriculture in Turkey was structured according to the demands that came from the exporters, traders or farmers from Europe. The organic agriculture started with dried fruits and nuts (fig, grape, apricot, and hazelnut) and was limited to eight products in 1984–1990. Due to increasing demand, after 1990, the number of farmers and products increased steadily in organic agriculture. The organic animal production started developing in the last 2-3 years, except beekeeping that has a longer history [16,17]. Legal liability related to organic farming has been given to The Republic of Turkey Ministry of Agriculture and Rural Affairs [18]. The first organic milk in Turkey was produced by private sector in Kelkit, Gümüşhane in 2005. In this year, 1350 tons of organic milk was produced in this farm[19]. This organic milk farm is one of the highest capacity farms in Europe. The organic milk production of Turkey represented to 2.875 ton, while total milk production was 11.3 million tons in 2007. This corresponds to 0.025% of total milk production [6]. The essential conditions of organic milk production have grown up healthy animal and organic farming. In terms of the organic animal production and organic agriculture, Turkey has a certain potential and this potential should be evaluated. If organic farming and livestock is improved, organic milk production will increase in Turkey. The farmers must be informed and encouraged about organic milk production.

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EFFECT OF DIFFERENT AGRICULTURAL WASTES ON MUSHROOM QUALITY CHARACTERISTICS OF PLEUROTUS SAJOR-CAJU

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ABSTRACT

In this study, the effect of different agricultural wastes on mushroom quality characteristics of *Pleurotus sajor-caju* was investigated. The spawns of *P. sajor-caju* was inoculated on some organic wastes which were consisted of grape pruning waste, wheat straw, paddy straw, sesame straw, sawdust: wheat bran (2:1), grape pruning waste: wheat bran (2:1), wheat straw: wheat bran (2:1), paddy straw: wheat bran (2:1), sesame straw: wheat bran (2:1). Mean mushroom weight, cap width, stem length and diameter, dry matter and proteins contents of mushrooms for each treatment were determined.

The highest mean mushroom weight was obtained from sesame straw: wheat bran (2:1) with 19.05 g while the lowest mean mushroom weight was obtained from wheat straw with 13.71 g. It was determined that protein contents of mushrooms from substrates with bran were higher than the ones from substrates without bran.

Key Words: Agricultural waste, *Pleurotus*, mushroom, quality.

INTRODUCTION

Oyster mushroom (*Pleurotus sajor-caju*) is an edible mushroom having excellent taste and flavour. *Pleurotus* spp. are third most cultivated edible mushrooms in the world [2].

Pleurotus sajor-caju is known as the wood-saprophytic fungus. Naturally, it grows on the dead branches of broad leaf trees especially such as poplar and willow. In artificial cultivation, log, sawdust or different organic wastes can be used as the culture substrate. The cultivation of *Pleurotus* spp. on various agro-residues such as wheat straw, paddy straw, coir pith, maize stover, cotton waste, sugarcane bagasse and mixtures of these wastes has been tried by various workers [3] [7] [8] [12] [13] [15]. Supplementation of wheat bran and rice bran in the cultivation of mushroom increased mushroom yield and protein content of fruit bodies [9] [16].

Pleurotus species have the advantages of good adaptability, short growth cycle and ease of artificial cultivation among the cultivated mushrooms. The fruit bodies of *Pleurotus* species are not very often damaged by pests and diseases [8].

The substrates used in mushroom cultivation have a great influence on yield and nutritive value of mushrooms. In this study, the effect of different agricultural wastes on mushroom quality characteristics of *Pleurotus sajor-caju* was investigated.

MATERIAL AND METHOD

1. Fungal and raw materials

P. sajor-caju ATCC 32078 was obtained from Agromantar Company (Denizli, Turkey).Wheat straw, paddy straw, sesame straw, sawdust, viticulture wastes were used as either single substrate or mixed with wheat bran at a ratio of 2:1 on a dry weight basis.

2. Substrate preparation and cultivation conditions

The spawn was prepared with wheat grains that had been hydrated to a moisture content of 50 % by weight. Hydrated grains were placed in polypropylene bags and sterilized at 121 ^{o}C for 1 h. After sterilization, it was inoculated with mycelia of *P. sajor-caju* ATCC 32078. Inoculated bags were incubated at 25 ^{o}C in a dark room until mycelia had completely covered the bags.

All materials except sawdust were chopped into small pieces (3-5 cm) and soaked in water for overnight. Excess water in the substrates was allowed to run off until moisture content 70 % (±5) was reached. Following this treatment, substrates were placed in polypropylene bags and sterilized at 121 ^{o}C for 1 h. All substrates were under aseptic conditions inoculated with 2 % (w/w) spawn. The inoculated substrate was incubated at an ambient temperature of 25 ^{o}C (±2) and relative humidity of 60 % - 70 %. After primordia formation, the bags were kept at 20 ^{o}C ±1 with a 9 h photoperiod and 85-90 % relative humidity.

It wasn't used any pesticide during the cultivation. Hygienic measures were carried out regularly to prevent and control of pests in growing room. Irrigation during the cultivation was done twice in a day.

3 Analysis methods

All fruiting bodies were harvested and weighed. Mushroom samples were dried to a constant weight at 65 °C, and then weighed and milled for dry matter amount and protein analysis. The nitrogen content of mushroom was determined according to Kjeldahl method [5].Crude protein was calculated by multiplying the nitrogen values by a factor of 6.25.

4. Statistical analysis

The variables statistically analyzed using the statistical package SAS 8.2 [14]. The determinations were done in triplicate and the variance analysis was performed using the least significant difference test.

RESULTS AND DISCUSSION

The mushroom weight, cap width, stem length, dry matter and protein content of *P. sajor- caju* on different substrates are given in table 1. The differences in all parameters except cap width were statistically significant (P= 0.05).

The biggest mushrooms were obtained from sesame straw:bran (2:1) (19.05 g), whereas wheat straw gave the smallest fruits with 13.7 g. *P. sajor-caju* grown on substrates supplemented with wheat bran produced higher mushroom weights than substrates without bran. It was determined that mean mushroom weight in *P. sajor-caju* was 5.84-13.0 g [11] and 3.85-11.52 g [4].There was not statistically important difference for cap widths on substrates. Wheat straw: bran (2:1), viticulture wastes: bran (2:1), and sesame straw: bran (2:1) had the biggest stem length with 4.26, 4.15 and 4.11 cm, respectively while paddy straw gave the lowest stem length. The similar results were also reported in other studies [4]. [11]. It was determined that cultivation conditions especially intensity and period of light affected mushroom stem length and thickness.

Viticulture wastes:bran (2:1) gave the highest dry matter with 13.08 % while wheat straw, viticulture wastes, paddy straw, sesame straw, sawdust bran (2:1) and paddy straw:bran (2:1) gave the lowest dry matter (7.95, 8.15, 8.34, 8,65, 8.52, 8.75 %, respectively). It was stated that dry matter content of *P. sajor-caju* was 9.01 % cultivated on paddy straw and on different substrates ranged from 9.52 % to 10.52 % [10] and 12.64 % in *P. sajor-caju* [6]. The highest protein values were obtained from wheat straw:bran (2:1), sesame straw:bran (2:1) and paddy straw:bran (2:1) (38.6, 38.3 and 37.2 %, respectively) while wheat straw and paddy straw had the lowest protein content with 20.4 % and 21.1 %, respectively. The similar results were reported protein contents of *P. sajor-caju* being 14.0 % and 31.6 % on jute wastes and paddy straw [1], 31.9- 42.5 % on different wastes, 33.10 % [10] and 17.4 % on sugar cane wastes [7]. It was reported that crude protein content in the fruit bodies of *P. ostreatus* increased with an increase in the ratio of wheat bran [16]. According to Table 1, *P. sajor-caju* grown on substrates supplemented with wheat bran produced higher crude proteins than substrates without bran as wheat bran contains low molecular and soluble carbohydrates which are easily used by mushroom mycelium. Wheat bran proved excellent as additives to the substrate. The fruit bodies of *P. sajor-caju* grown on substrates with bran had higher crude protein content and dry matter content than grown on substrates with no bran. It can be concluded that the supplementation of bran had a positive effect on mushroom qualities of *P. sajor-caju*.

Substrates	**Mushroom weight (g)**	**Cap width (cm)**	**Stem lenght (cm)**	**Dry matter (%)**	**Protein (%)**
Viticulture wastes (VW)	17.31 bc	7.49	3.19 c	8.15 d	26.6 c
Viticulture wastes: bran (2:1) VW:B (2:1)	17.66 abc	7.39	4.15 a	13.08 a	35.9 b
Wheat straw (WS)	13.71 e	7.11	2.98 dc	7.95 d	20.4 e
Wheat straw: bran (2:1) WS:B (2:1)	17.96 ab	7.28	4.26 a	11.49 b	38.6 a
Paddy straw (PS)	16.26 cd	7.30	2.85 d	8.34 d	21.1 e
Paddy straw: bran (2:1) PS:B (2:1)	17.45 bc	7.30	4.02 ab	8.75 d	37.2 ab
Sesame straw (SS)	15.62 d	7.25	3.29 c	8.65 d	22.8 d
Sesame straw: bran (2:1) SS:B (2:1)	19.05 a	7.45	4.11 a	9.77 c	38.3 a
Sawdust: bran (2:1) S:B (2:1)	15.54 d	7.12	3.75 b	8.52 d	28.2 c

Table 1. Effect of Different Agricultural Wastes on Mushroom Quality Characteristics of *Pleurotus sajor-caju.*

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IMPORTANCE OF ORGANIC VEGETABLE OIL PRODUCTION

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ABSTRACT

Vegetable oils play an important role in human nutrition. While vegetable oils such as sunflower, soybean and canola are produced after a series of complex refining process, some like olive, sesame, poppy seed oils are produced without refining and consumed after minor processes. Many of the pesticides and herbicides are considered to be harmful for human health. In addition to these agro-substances, trace metals and heavy metals can be found in oil plants when the soil they were grown is contaminated. Whereas the concentration of harmful compounds may decrease after refining process, some oils are consumed in their natural state.

Keywords: Organic vegetable oil, pesticides, heavy metals.

INTRODUCTION

Pesticides used in agricultural products have been negatively affected human health with each passing day. Most discussions of the potential risks posed by pesticides in the diet focus on the development and interpretation of risk assessments rather than on documented cases of human illnesses.

Frequently, evidence supporting the relative safety of pesticide residues is based on the results of regulatory monitoring programs demonstrated that most food samples analyzed do not contain detectable levels of residues and that violation rates are quite low. Due to the relatively low exposure of consumers to pesticide residues in foods, it is the opinion of the majority of health professionals involved in food safety that the risks of pesticide residues are far lower than risks from issues such as microbiological contamination, nutritional imbalance, environmental contaminants, and naturally occurring toxins. Still, the risks from pesticides in the diet are not zero; examples of consumer poisoning from misapplication of pesticides have been documented, while pesticides may still pose theoretical risks from long-term exposure to consumers due to the scientific impossibility of proving otherwise [1] [2] [3] [4].

WHY ORGANIC VEGETABLE OIL

Pesticides are used to increase agriculture production throughout the world. Studies have shown that a majority of the pesticides applied eventually reach the soil surface, where they gradually spread, translocate to other environments, or eventually degrade. Translocation to oil-bearing plant seeds has also been demonstrated.

Edible oils produced after a series of refining processes (extraction, degumming, neutralization, bleaching and deodorization) and presented to consumers. As a result of this process impurities are removed from oil [5] [6]. Processing studies have shown that neither solvent extraction nor bleaching affects the pesticide levels in oils; however, it was found that pesticides are removed by volatilization during deodorization. The use of deodorizer distillates in animal feeds has been forbidden because of the pesticide content.

Trace amounts of metals are absorbed by plants during the growing season and during fats and oils processing; most are harmful to product quality and human health and reduce the efficiency of the process. Trace quantities of copper, iron, manganese, and nickel substantially reduce the oxidative stability of fats and oils, whereas calcium, sodium, and magnesium reduce the efficiency of the refining, degumming, bleaching, and hydrogenation systems. The metals' effects can be diminished by the use of chelating agents at various processing points to sequester the trace metals. The most widely used chelating agents are citric and phosphoric acids [5] [6] [7] [8]. Solvent extraction and mechanical pressing are the most common methods for commercial oil extraction. Mechanical pressing is allowed by the organic food industry; however, solvent extraction with petroleum distillates, such as hexane, is not allowed. Recently, cold press or screw pres oils have been commercially available because of the consumers' desire for natural and safer food products. The sesame oil, black seed oil, olive oil, flax seed oil, poppy oil and cocoa butter obtained with screw or cold press methods contain many useful components. Refining process was not applied in the production of such oils. Thus they are rich in useful components and do not contain the remains of possible process [9].

MAJOR REASONS TO CONSUME ORGANIC FOODS

1. Safe, nutritious, unadulterated food.
2. No artificial chemicals, pesticides, and fertilizers.
3. Absence of antibiotics and growth-promoting drugs.
4. Environmentally friendly.
5. Produced without GMOs.
6. Places great emphasis on animal welfare.
7. Reduces dependence on nonrenewable resources.
8. Based on modern and scientific understanding of ecology.
9. Based on soil science and ensures soil fertility by crop rotation.
10. Better taste [10].

ADVANTAGES OF ORGANIC FOOD PRODUCTION

1. There is a continuously growing demand for organic foods driven primarily by consumer perceptions of quality and safety (25–50% increase each year).
2. The establishment of regional (EU) and international (Codex) guidelines for production, processing, labeling, and marketing of organic foods has been the key step in the international harmonization of requirements for organic foods.
3. The organic label is not a health claim; it is a process claim. No clear trends have been established in terms of organoleptic quality differences between organic and conventional food.
4. Because of lower chemical usage in organic food production, we have to apply better principles of storage and transport to guarantee freshness of the product.
5. Future research must focus on critically designed experiments to reveal the nutritional quality of organic food as compared with conventional food [2] [10] [11] [12].

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AGROECOLOGICAL CROP PROTECTION IN ORGANIC AGRICULTURE: THE CASE OF TEPHRITID FRUIT FLIES ON REUNION ISLAND

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ABSTRACT

Agroecological crop protection, which is adapted to organic agriculture is a system based on three components: sanitation, habitat manipulation and biological control. This approach is applied to the management of Tephritid Fruit Flies on organic farms on Reunion. The six components of this scheme are: (i) monitoring (insecticide-free traps), (ii) prophylaxis (picking and storing infested fruits), (iii) assisted push-pull (attracting flies on refugia plants and "attract and kill" with bait sprays), (iv) male annihilation technique, (v) inundative and conservative biological control, and (vi) other agroecological practices. These were designed and then successfully implemented on four organic farms. In the near future, this approach will be utilized in the control of other pests and diseases in organic agriculture on Reunion. Results obtained in this study indicate that it can be successfully adapted to other organic agricultural conditions in both tropical and temperate countries.

Keywords: Tephritidae, Agroecological crop protection, organic agriculture, Biological control, Reunion Island

INTRODUCTION

Cucurbit flies are considered the main pests on organic farms on Reunion Island. Three species co-occur: *Bactrocera cucurbitae, Dacus ciliatus and Dacus demmerezi* and cause 90% loss of Cucurbit yield [1]. Damage to the crop is due to oviposition by females in fruit and to the development of larvae inside the fruit. Agroecological crop protection, which is suited to organic agriculture, is an approach based on three components: sanitation, habitat manipulation and biological control [2]. It can be applied to fly management on organic farming using seven practices: monitoring, sanitation, trap plants, attract and kill technique, male annihilation technique, biological control, and biological practices.

MATERIALS AND METHODS

Monitoring

Populations of flies are monitored during the year using male-lure baited traps without insecticide, in order to evaluate the critical period for management.

Sanitation

Each fruit is able to host many fruit fly eggs and larvae. A preventive solution is to pick and destroy the infested fruits. A survey was conducted among farmers in order to design a structure to store infested fruit.

Trap plants

Adults of *B. cucurbitae* shelter and roost in vegetation bordering crops [3]. The attractiveness of corn (*Zea mays*) and cane grass (*Pennisetum purpureum*) was compared in field cage conditions for two fly species: *B. cucurbitae* and *D. demmerezi*.

Attract and kill

"Synéis-appât", permitted in organic agriculture, is a combination of an attractant and feeding stimulant, and spinosad (biological insecticide). It can be applied on border plants (corn) as a spot spray to attract Cucurbit flies and kill them. In order to evaluate the efficiency of "Synéis-appât" on the three Cucurbit fly species, we measured their mortality rates of the due to this treatment, in cages.

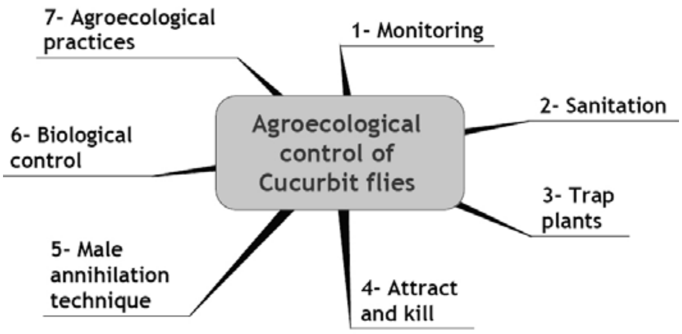
Male annihilation technique

Under the Male Annihilation Technique (MAT), many male-lure baited traps (same traps as used for monitoring) are used to catch the maximum number of males and to disrupt the equilibrium of the population. The trap used until now, is composed of male-lure to attract males and with an insecticide to kill them. Recently, however the insecticide use has been prohibited. We wanted to design a new trap without insecticide. We designed several models of traps without insecticide and counted the number of flies caught under each model.

RESULTS AND DISCUSSION

Designing an agroecological Fruit Fly management package

We designed a technical scheme of management of Cucurbit flies, it contains seven practices:



Implementing elementary pest management components

Monitoring. Population levels fluctuate during the year, with a peak during cropping season (November to April) (figure 1).

Sanitation. We created an "augmentorium", a tent-like structure designed to sequester flies and to allow the escape of parasitoids into the farm environment.

Trap plants. Corn appeared to be the most attractive and appropriate trap plant for controlling Cucurbit flies (figure 2).

*Attract and kill***.** Our studies showed that "Synéis-appât" was effective on all three species of flies, especially on *B. cucurbitae*. Further, it has no adverse effects on parasitoids.

Male annihilation technique. The trap used is a plastic bottle containing a parapheromone (cue-lure), but no insecticide. It is designed with four little apertures to allow the entrance of flies but prevent their exit.

Biological control. An introduced parasitoid, *Psyttalia fletcheri* (Braconidae, Opininae) is now well-established on Reunion and contributes to the control of the Melon Fly. However, its impact is only significant when there is no chemical insecticide pressure (i.e. in organic farming). We privileged conservative biological control is privileged; it consisted of practices that allowed the establishment of parasitoids (beetle bank…).

Agroecological practices. Agroecological practices, such as intercropping or minimum tillage, aim to improve the diversity of plants and the health of the soil, two key-components of the sustainability of agroecosystems. These practices allow the development of Conservative Biological Control.

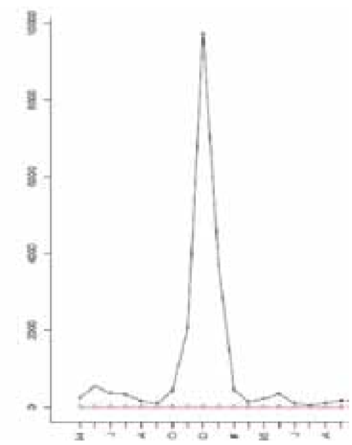


Figure 1. Number of B. cucurbitae (black) and D. demmerezi (red) caught in cue-lure traps during 1994 and 1995 on Reunion.

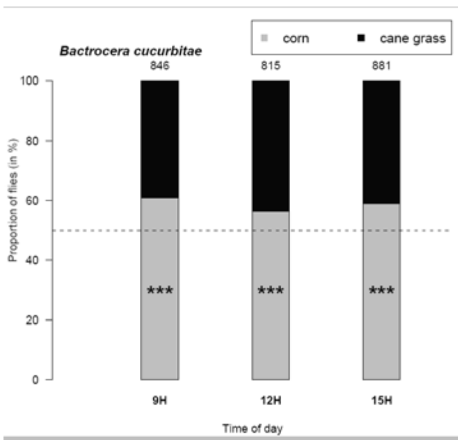


Figure 2. Proportion of Bactrocera cucurbitae on corn and cane grass tested in field cages. The number of flies observed is noted above the bars. The results of binomial tests (5%) are marked with asterisks; Ho: proportion of flies on corn (Pc) = 0 and H1: Pc >50% (*** = P<0.001)

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STATUS AND DEVELOPMENT OF ORGANIC AGRICULTURE IN THE REPUBLIC OF MACEDONIA

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ABSTRACT

Traditional way of production in agriculture had never disappeared in the Republic of Macedonia. Such production still exists in remote areas, where human influence over the nature did not succeed to harm the environment as in the area where intensive agriculture is practiced. Although until 2005 there was no certified organic production, through current governmental support program much has been done in order to promote rural areas potential in organic agriculture.

Keywords: EU Reg. 2092/91, EU Reg. 834/2007, traditional production, support program, harmonized legal framework

INTRODUCTION

This poster gives overview to the previous and current Legislation fully harmonized with latest EU regulation on organic agriculture. It also gives perspective over the National support program through the years, and the reflection of such program to the development of organic agriculture in Macedonia.

RESULTS AND DISCUSSION

The development of organic agriculture begun in 2004 after the First National Law on Organic Agriculture [3] was adopted by the National Assembly. It was based on EU Reg.2092/91 [2] and since then many efforts were give in order to introduce to Macedonian farmers the opportunity they have thus transforming the handicap into advantage (Figure 1). The number of certified grower records is increasing (Figure 2), mostly in crops with less demand for technology like medicinal herbs, indigenous species and specific fruits (Figure 4, Figure 5).

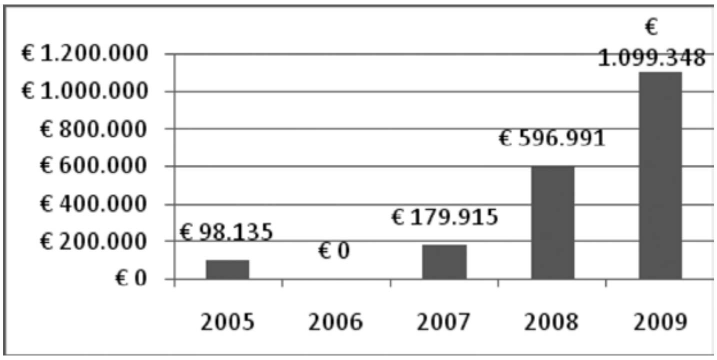

Figure 1. Level of government subsidy for organic production over the years.

In 2006 with assisted by Swiss' SDC & FiBL a National Strategy and Action Plan 2008-2011 [5] has been developed. That document was the turning point for driving the development of the organic agriculture, as primary goals were set as well as the identification of the rest of the participants who have their role in the development process (Figure 1).

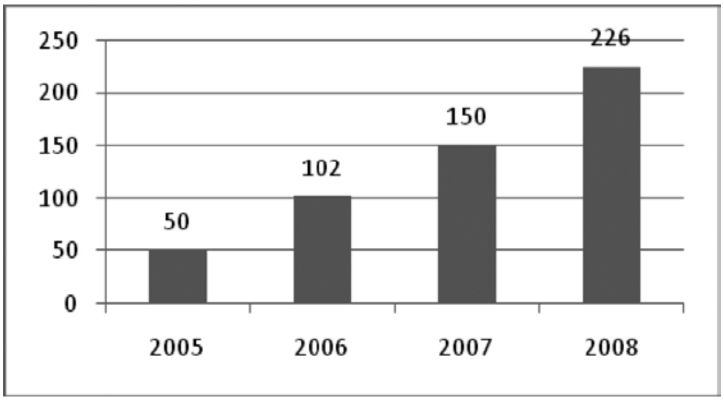

Figure 2. Increasing trend of number of organic farms

After EU had issued the new regulation (EU Reg. 834/2007 [1]) Macedonia decided to follow the path by preparing a new, fully harmonized with EU Regulation Law on Organic, which makes The Republic of Macedonia the only country in the Western Balkans (not EU member) having fully harmonized legal framework [4].

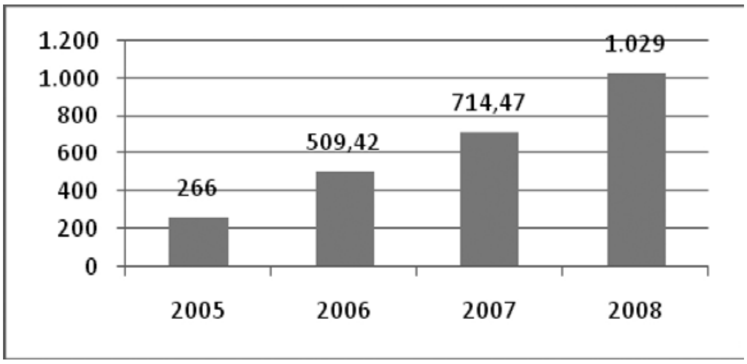

Figure 3. Certified area under organic production (ha).

On the other hand the number of growers reached a critical level as the volume of production is big enough to pose a problem for the grower and small enough to be considered as serious trading partner (Figure 3).

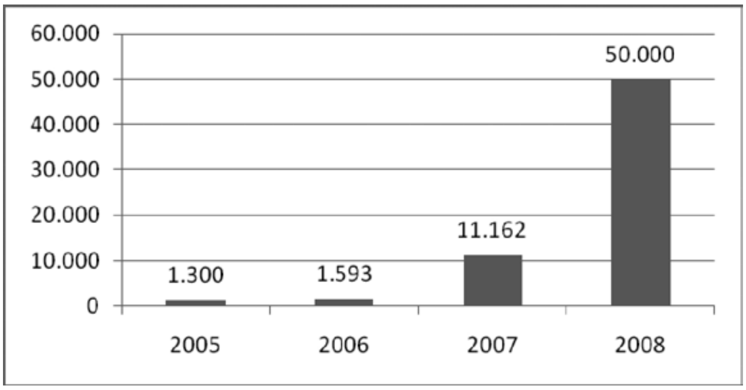

Figure 4. Area under organic pastures, indigenous species and fruits (ha).

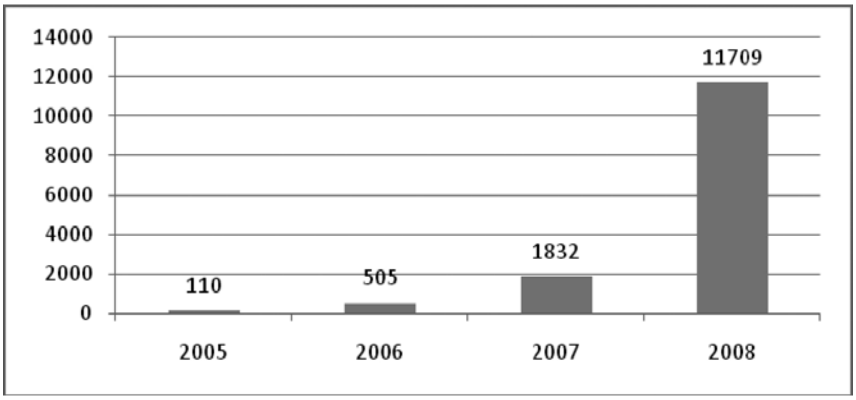

Figure. 5 Number of bee-hives certified as organic.

3. CONCLUSIONS

It is imminent for the farmers and the Government too, to understand the necessity for creating suitable development rather than subsidizing support program, as the marketing agencies are demanding ready-to-sell product.

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ARE SOME WHEAT CULTIVARS BETTER SUITED TO ACHIEVE HIGH QUALITY IN ORGANIC SYSTEMS?

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ABSTRACT

Consumers purchase organic food because these products are perceived to have superior quality attributes over conventional foods. A field study compared five Canadian spring wheat cultivars grown organically and conventionally for yield, breadmaking quality and nutrient content. Results suggest protein levels and breadmaking quality at least equal to conventional systems can be achieved in organic systems. Composted manure appeared to supply micronutrients to the organic system for improved levels of grain nutrient content. Cultivar choice is important in determining grain quality, especially nutrient content in organic systems.

Keywords: Spring wheat, breadmaking quality, grain nutrient content, fertility amendments

INTRODUCTION

Some consumers purchase organic food because they perceive the products to have superior quality attributes over conventional foods [1]. Despite perceived benefits of consuming organic foods, organic certification is based on the process used to produce the good, not on the product itself. This suggests that organic products may not be superior to conventional ones [2]. Research into nutritional differences of organic and conventional products has not yielded consistent results [3].

Soil, climate, crop type and cultivar, management practices and post-harvest factors can all affect the nutritional quality of crops [4]. Our objectives were to determine the effect of spring wheat (*Triticum aestivum* L.) cultivar choice on yield, breadmaking quality and grain nutrient content in organic and conventional cropping systems in order to design systems that produce consistently high food quality.

MATERIALS AND METHODS

We conducted a field study 2005-2007 to compare five western Canadian spring wheat cultivars (AC Elsa, Glenlea, Marquis, Park and AC Superb) grown under organic and conventional management systems for yield and grain quality. The study was located in Edmonton, AB, Canada (55°34´N, 113°31´W), on two nearby sites with similar soil types. Yield, grain protein levels, flour yield and grain Cu, Mn, Zn, Fe, Mg and K concentrations were determined on harvested grain.

Proc Mixed in SAS v.9.0 was used to analyze the combined experiment as a split plot, with management system as the main plot and cultivar as the subplot, replicated in time (year). The data were also analyzed separately by management system combined over years. For both analyses, years and blocks were considered random and management system and cultivar were considered fixed effects.

RESULTS

Organic yields were roughly half of conventional yields (2.74 vs. 5.02 t ha-1, respectively) (Table 1). AC Superb yielded the highest and Marquis the lowest in both systems. Grain protein levels were higher in the organic system compared to the conventional system. Flour yield was significantly higher in the conventional system than the organic system.

In the combined analysis, there were significant management × cultivar interactions for Cu, Mn, Zn, Fe, Mg and K (Table 1). AC Elsa grown conventionally had higher levels of grain Cu than A.C. Elsa, Marquis and Park grown organically. For Zn, Fe and Mg, organic grain had generally higher nutrient levels than conventional grain. Organically grown Glenlea had superior grain Mn, Zn, Fe, Mg and K concentrations to other organically and conventionally grown cultivars.

Cultivars varied significantly ($P<0.05$) for grain Mn, Zn, Fe, Mg and K. Glenlea had the highest grain Zn and Fe contents, while Superb had the highest grain Mn and K contents. Management system had no significant effect on grain nutrient content.

Within the organic system, Glenlea had the highest levels of Zn, Mn, Mg, K and Fe, followed by the most recent cultivars AC Elsa or AC Superb. In the conventional system, a number of different cultivars had the highest levels of grain nutrients (Zn – Marquis, Mg – Park, K - AC Superb and Fe – AC Elsa).

Cultivar	Yield	Grain protein	Flour yield	Cu	Mn	Zn	Fe	Mg	K
	(t ha^{-1})	(%)	(%)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
Organic									
AC Elsa	2.80	16.8	72	2.83	29	49.1	57.3	1278	3296
Glenlea	2.78	17.2	69	4.02	35.4	56	63.5	1390	3443
Marquis	2.38	16.0	69	2.83	29.4	49.2	56.5	1352	3110
Park	2.65	16.7	71	2.75	29.4	48	53.8	1375	2989
AC Superb	3.11	16.3	70	3.02	33.7	46.6	61.3	1376	3259
F test$_{cultivar}$	***	***	***	***	***	*	***	**	***
SE$_{cultivar}$	0.796	0.350	1	0.469	4.98	6.73	5.02	62.2	173.6
Conventional									
AC Elsa	5.09	16.0	74	4.99	31.1	44.2	50.72	1285	2995
Glenlea	5.57	14.5	73	4.02	31.3	39.9	47.42	1171	3101
Marquis	4.04	15.6	71	4.00	32.6	46.3	47.48	1299	2886
Park	4.66	15.3	72	4.50	31.9	44	43.39	1306	2770
AC Superb	5.73	15.0	74	3.64	33.6	37.2	45.73	1289	3296
F test$_{cultivar}$	***	***	***	ns	ns	***	**	***	***
SE$_{cultivar}$	0.421	0.17	0.6	0.709	3.81	1.26	4	61.5	78.8
Combined									
Organic mean	2.74	16.6	70	3.09	31.3	49.8	58.4	1354	3220
Conv. mean	5.02	15.3	73	4.22	32.1	42.3	46.9	1270	3009
F test$_{management}$	*	**	*	ns	ns	ns	ns	ns	ns
SE$_{management}$	0.631	0.24	0.7	0.515	4.36	4.56	4.33	59.1	129.2
F test$_{cultivar}$	***	*	*	ns	***	***	***	**	***
SE$_{cultivar}$	0.467	0.8	0.8	0.523	3.93	3.63	3.63	44.2	97.1
F test$_{m*c}$	**	ns	ns	**	**	***	***	***	***
ns= not significant (P≥0.10), * significant at P<0.10, ** significant at P<0.05, *** significant at P<0.01, SE=standard error									

Table 1. Yield, Breadmaking Quality and Grain Nutrient Content for Wheat Grown Organically and Conventionally in Edmonton, AB in 2005, 2006 and 2007

DISCUSSION & CONCLUSIONS

There has been a trend towards lower protein in cereal grains produced organically [3]. Applications of composted dairy manure in the organic system (combined with lower yields) appeared to supply nutrients for improved levels of grain protein and nutrient content [5]. However, this experiment demonstrates that both organic and conventional systems can produce high quality wheat.

Significant management × cultivar interaction effects indicate that the choice of wheat cultivar to maximize grain nutrient levels is dependent on the management system. Glenlea grown organically had the highest grain nutrient levels compared to cultivars grown both organically and conventionally.

Both systems of management are capable of producing high quality grains. Wheat cultivar choice within a management system is an important determinant of crop nutritional quality. Further studies are required to determine the impact of other agronomic cropping practices and identify best management practices within organic and conventional systems for final crop quality.

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QUALITY AND SAFETY DIFFERENCES BETWEEN ORGANIC AND CONVENTIONAL MEAT AND MEAT PRODUCTS

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ABSTRACT

There is an increasing consumer demand for organic meat and meat products all around the world. Studies based on consumer opinion have shown that organic products are perceived as being more healthy, natural, and tastier than conventional products. In this study, the nutritional value (protein, fat, minerals and vitamins etc.) of organic meat and meat products will be described comparatively with that of conventional meat and meat products. In addition, safety of organic meat and meat products will be discussed. Consumer attitudes to quality and safety of organic meat and meat products will also be discussed.

Keywords: Quality, safety, organic, conventional, meat products

INTRODUCTION

Worldwide, meat is by far the most consumed food product of animal origin. Several factors contribute to the popularity of meat products, of which sensory, dietary and economic factors are the most significant. Meat, health, safety and quality have been given an increased focus. The increasing consumer demand for good tasting, healthy, safe and environmentally friendly produced meat and meat products has put demand on producers. In that sense, consumer demand for organic meat and meat products has grown in recent years. To meet that growing demand, manufacturers have developed and marketed organic meat and meat products and retail markets specializing in organic products have developed. Therefore, organic meat and meat products are growing category of products in market. Nowadays, cattle, pigs, sheep, chickens and other poultry are organically raised and their meat and meat products are sold in market. High consumer demands for organic meat and meat products increased the number of the scientific investigations to determine quality and safety differences between organic and conventional meat and meat products. In this regards, nutritional (protein, fat, minerals and vitamins contents), chemical (nitrite and nitrate etc.), microbiological and sensory properties of organic meat and meat products were investigated and the results were compared with conventional counterparts.

Physicochemical and Nutritional Charecteristics of Organic and Conventional Meat and Meat Products

Consumers are attracted to organic meat and meat products by the perception of a superior nutritional profile in comparison with conventional once. Therefore it is important to investigate the composition of organic and conventional meat and meat products to identify differences that could show the consumer whether organic meats are better. There are a few studies compared the total lipid content of organic and conventional meat and meat products [1] [2] [3] [4]. It was reported that organically-bred cows have more lean meat than their conventional counterparts [2]. Hovewer, this was not the case in pigs [5]. Brown et. al. [6] also indicated that the lower percentage of fat was measured in organic chicken breast fillets compared to breast fillets of conventionally raised chickens. On the other hands, it was shown that meat from organically-grown cows has more polyunsaturated fatty acids [1]. Castellini et al. [7] showed that chickens of the same strain raised under an organic husbandry system have meat containing 2-3 times less abdominal fat with 2–3 times less fat in the filet and almost 2 times less fat in the leg. Moreover, they reported that the n–3 fatty acid content in the filet was significantly higher with no difference for saturated fatty acids. Brown et. al. [6] indicated that chicken breast fillets produced from organic system have a lower pH. However, no significant differences were observed in this study for water holding capacity and instrumental colour values between conventional and organic. Grashorn and Serini [8] indicated that proportion of breast meat was lower in organic chickens, skin and meat was more yellow, grilling losses were lower and texture values were higher. Researcher reported that content of dry matter, crude protein, ash, fat and n-3 fatty acids was higher in organic chicken meat. Sensory panellists assessed organic broiler meat as tougher and tastier. They concluded that organic chicken meat had slightly better quality compared to conventional chicken meat. Sebranek and Husak [9] reported that conventionally raised chickens had a more yellow appearance for breast, thigh and skin compared to organic carcass components. Meat from conventional broilers were found to be more tender than those of organic chickens according to the results of both instrumental texture measurements and sensory evaluations. The authors indicated that organic chicken breasts and thighs had significantly higher percentages of polyunsaturated fatty acids, including n-3 and n-6 fatty acids compared to conventional chickens. Kim et al [10] reported that the organic chicken breasts had a higher cooking loss, and waterholding capacity, and a lower shear force compared to the conventional chicken breasts. Researchers found higher a* and b* values and myoglobin contents in the organic chicken breasts compared to the conventional chicken breasts. Higher polyunsaturated fatty acid (PUFA) and unsaturated fatty acid contents, and a higher PUFA-saturated fatty acid ratio in the organic chicken breasts was also reported in this study. Husak, Sebranek and Bregendahl [11] reported that protein content of organic breast and thigh meat was greater than conventional in the raw and the cooked meat comparisons. The pH of breast meat from organic broilers was higher than conventional. Organic breast and thigh meat was less yellow than conventional. The authors indicated that organic breasts and thighs were lower in saturated and monounsaturated fatty acids and higher in polyunsaturated fatty acids than conventional broilers. Shear force measurements were less for both breast and thigh meat from conventional broilers relative to organic broilers. Sensory panel results indicated that thighs from conventional broilers were more tender and less chewy than thighs from organic broilers, whereas other sensory properties did not differ. The authors concluded that a difference in the fatty acid composition was the largest difference observed between retail broilers in this survey.

Castellini et al [4] [7] [12] reported that organically produced poultry meat is leaner but it has a shorter shelf-life. The authors indicated that a higher TBARS level in organic meat could be the result of a higher content of Fe ions that catalyze peroxidation and to a greater degree of unsaturation of intramuscular lipids [4] [7]. Since a higher lipid oxidation not only limit the self-life of the organic product but have a negative affects on sensory evaluation, different strategies should be adopted to minimize this problem such as avoiding unnecessary carcass processing, reducing storage time and providing high levels of antioxidants. The intake of compounds with an antioxidant activity (like tocopherols, carotenoids and polyphenols) shall be considered crucial for increasing animal antioxidant defence [13].

Grela and Kowalczuk [14] analyzed nutrient contents and fatty acid profile in meat from fatteners managed and fed under the conventional and organic production conditions as well as in chosen pork-butcher‘s meat products from organic fatteners. They reported that the meat obtained from organic fatteners showed a slightly higher nutrient contents compared to those managed at the conventional production system. A percentage of full fat flax seeds (5%) in organic diets contributed to an increased linolenic acid level in lipids of the longissimus and adductor muscles as against the animals fed conventional diets supplemented with 2% soya bean oil. They also indicated that pork-butcher‘s meat products such as back bacon sausage, pork hunter sausage, smoked bacon and kabanos dry pork sausage, smoked bacon had the most favorable nutritional fatty acid composition for human consumption. Nuernberg et al [15] investigated the effect of different diets (the protein sources: rape seed and other grain legumes in organic farming system and soya meal in conventional farming system) on the growth, meat and fat quality of finishing lambs. They reported that the growth of the lambs was better under conventional feeding conditions compared to organic farming whereas the meat quality was not different between both feeding systems. They concluded that there was no advantage of organic farming according to the nutritional point of view. Lebas et al. [16] reported that muscle pH and fat score were slightly higher in organically reared than in conventionally reared rabbits. Combes et al. [17] reported that Organic rabbit meat was more tender than conventionally reared rabbit meat. Pla [18] indicated that organic rabbit meat had less protein, fat, saturated and monounsaturated fatty acids but higher polyunsaturated fatty acids and the ratio of polyunsaturated: saturated fatty acids which is better from the nutritional perspective. The author also reported that the proteins in the organic meat were richer in methionine and cystine.

Very limited information about mineral content of meat and meat products is available. Castellini et al. [4] [7] indicated that organic chickens grown in open fields compared with housing have somewhat higher iron levels. Barbieri, Macchiavelli and Rivaldi [19] compared organic and conventional salami, dry cured hams and cooked hams for mineral contents and they reported that organic products contained higher levels of Fe, Zn, Ca, Se, and Cu.

Safety of Organic and Conventional Meat and Meat Products

There is a widespread belief that organic meat and meat products are substantially healthier and safer than conventional ones. There are some studies comparing safety status of organic and conventional meats. Ludewig, Palinsky and Fehlhaber [20] investigated a total of 85 organic and 66 conventional meat products and they reported high total aerobic plate counts and high lactic acid bacteria counts in products, hovewer, they did not find pathogens like Salmonella. They did not observed significant differences between organic and conventional meat products. They concluded that there were no signs for food safety problem in products tested. Van Overbeke at al [21] found no significant differences in prevalence of Salmonella between organic and conventional broilers at slaughter. In contrast, they reported that Campylobacter infections at slaughter were significantly higher in organic broilers. They concluded that the respiratory health status is beter in organic broilers but that organic flocks were more often infected with Campylobacter than were conventional flocks. Heuer et al. [22] also reported that *Campylobacter* spp. were isolated from only 37 % of the conventionally reared flocks, the organism was present in 100 % of the organic flocks. They reported no difference in susceptibility patterns of isolates for antibiotic between organic and conventional systems. Another study investigated the presence of *Escherichia coli*, *Staphylococcus aureus* and *Listeria monocytogenes* in 55 samples of organic and in 61 samples of conventional poultry meat. This study concluded that there was a significantly higher prevalence of *E. coli* but not of *S. aureus* and *L. monocytogenes* in organic poultry meat as compared with conventional poultry meat. Bacteria isolated from organically farmed poultry samples showed significantly lower development of antimicrobial resistance against several antibiotics [23]. Miranda et al [24] determined that Enterococcus mean counts from organic chicken meat were significantly higher than those obtained from conventional chicken meat or conventional turkey meat. In this study, *Enterococcus faecalis* was found to be the most common species isolated from organic chicken, whereas *Enterococcus durans* was found to be the most common species isolated from conventional chicken and turkey. However, the authors indicated that antimicrobial resistance of enterococci isolates from organic chicken meat were less than enterococci isolates from conventional chicken meat to ampicillin, chloramphenicol, doxycycline, ciprofloxacin, erythromycin and vancomycin. Nou et al [25] investigated the presence of Salmonella, Campylobacter, and Listeria in retailed organic and conventional poultry products. They isolated Salmonella, Campylobacter, and Listeria from 28, 49 and 45 percent of poultry samples, respectively. In this study, Salmonella was most frequently isolated from organic poultry samples, as were Campylobacter from conventional poultry. They reported that

Salmonella and Campylobacter isolates from organic poultry were more susceptible to the antibiotics than those from other sources. The author concluded that the high incidence of Salmonella, Campylobacter and Listeria contamination associated with alternatively processed poultry samples indicates the need for continued improvements of rearing and processing technologies to further reduce bacterial contamination of those products. Jackson et al [26] indicated that commercial brands of organic frankfurters showed greater growth by inoculated *Clostridium perfringens* than that observed for conventionally-cured control frankfurters. They concluded that organic processed meats may require additional protective measures in order to consistently provide the same level of safety from bacterial pathogens that is achieved by conventionally-cured meat products. Several other studies showed that animal products from organic and conventional production do not indicate any difference with respect to their microbiological condition [27] [28] [3].

Another food safety concern is various residues which may exist in meat and meat products. Gidini et al [29] reported that organochlorine compounds and heavy metals were detected in both conventional and organic samples at low concentrations. Hovewer, the researchers were not able to make an accurate comparison between organic and conventional meat because of the limited number of samples. Pikkemaat et al. [30] reported presence of antibiotics in kidney and meat. They indicated that detected residues were below the European Commission maximum residue limits, except for valnemulin, cloxacillin and dicloxacillin in kidney, and valnemulin, cefapirin, cefalexin, kanamycin, cloxacillin and dicloxacillin in meat. On the other hands, Hoogenboom et al [31] reported no residues of antibiotics in kidneys and meat of 20 organic pigs, sampled at the slaughterhouse. They also indicated that levels of arsenic, lead, mercury and cadmium in meat and in kidney were below the European Union limit of 1mg/kg.

Nitrate and nitrite are a matter of concern for public health due to possible formation of nitrosamines which are among the most powerful natural cancer-promoting moities. For that reason, nitrate and nitrite contents of meat and meat products are an important issue in food industry. Modern conventional food processing uses a wide range of chemicals that inevitably leave residues in the product. Magrinya et al [32] investigated the effects of the celery concentrate and nitrate addition on residual nitrate and nitrite, instrumental CIE Lab color, oxidative stability and overall acceptability in fermented dry-cured sausages after ripening and after storage. They concluded that as the two nitrate sources behaved similarly for the parameters studied, nitrate-rich celery concentrate was a useful alternative to chemical ingredients for organic dry-cured sausage production. Barbieri, Macchiavelli and Rivaldi [19] reported that there was no significant difference in residual nitrite content between organic and conventional salami, dry cured hams and cooked hams while nitrate was lower in organic compared to conventional salami. On the other hands, Lucke [33] suggested that the use of nitrite at levels sufficient for curing colour and aroma formation should be permitted for the processing of meat from organic production. The author emphasized that since prohibiting the use of nitrite would bring shelf life and safety limitations, expanding the market for organic meats would be difficult. Since nitrite plays important role in cured meat quality and safety, quality and safety issues need to be carefully to make processing changes in manufacturing organic processed meats.

Sensory Characteristics and consumer attitudes

A few studies have been carried out to compare sensory charecteristics of organically and conventionally produced meats. Angood et al. [34] reported that organic lamb had better eating quality than conventional lamb in terms of juiciness, flavour and overall liking. They concluded that organic products was preferred more by consumers as "taste better". Revilla et. al. [35] evaluated 40 *L. dorsi* muscles (raw and grilled) from suckling lambs raised under both organic and conventional systems using trained panel with a sixteen-member and consumers panel with 140. The results of this study indicated that the appearance of the organic meat was more fibrous, darker, and with a lower aroma intensity than the conventional counterpart, but with no differences in homogeneity or juiciness. In grilled meat, the organic samples had less subcutaneous fat, less fatness, a less fibrous texture and less aroma intensity, but also less juiciness. Regarding overall appreciation, the consumers gave higher scores to the organically produced samples. Brown et. al. [6] indicated that in the trained taste panel, chicken breast fillets produced from conventional system were rated higher for tenderness and juiciness. Flavour and overall liking meat from chicken produced in the conventional system was more preferred compared to meat from the organic systems.

CONCLUSION

The organic farming and organic food markets are growing fast and consumers want to have more information on these products. The results of studies in literature revealed some advantages of organic meat and meat products such as containing more polyunsaturated fatty acids compared to conventional counterparts. Since the number of studies in this area is limited, more research is needed to identify differences between organic and conventional meat and meat products to justify the consumers' ideological motivation to choose organic over conventional products. At the same time, since health benefits of organic meats are of great interest and importance to the public, specific health effects should be identified by nutrition studies under well controlled conditions.

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RAISING AWARENESS ACTIVITIES IN ORGANIC AGRICULTURE: THE CASE OF IZMIR PROVINCE

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ABSTRACT

The aim of this study is to investigate raising awareness activities in organic agriculture in Izmir. In this context, it was considered the activities of universities, public institutions, local governments, private sector and non-governmental organizations that are contributed for raising awareness. In terms of raising awareness of the situation of organic sector in Izmir, were evaluated by using SWOT analysis.

Results show that the province of Izmir can benefit enough from the strengths of raising awareness activities in organic sector. Organic product market and International Ecology Fair that will be held this year are very important for Izmir. New organic agriculture support payment in Turkey is also serious opportunity for Izmir organic agriculture in terms of raising awareness. In this way, İzmir will create an example for Turkey in terms of organic agriculture.

Keywords: Organic agriculture, raising awareness, SWOT analysis, Izmir.

INTRODUCTION

In recent years, the interest in organic agriculture is increasing. Organic agriculture's economic, environmental and social benefits have attracted the attention of the non-governmental organizations, universities, local governments, public organizations and media organs in the recent past. However, the number of the raising awareness activities such as producer and consumer oriented education programs, projects, exhibitions and informative seminars has increased. All these developments have begun to affect countries' national agricultural policies and international civil society organizations' programs.

The suitability of the ecological conditions of Aegean Region for organic farming is accelerated the development of organic agriculture in that region. Organic agriculture in Turkey has first begun with the production of raisins and dried figs in one of the most important agricultural center Izmir in Aegean Region. Izmir, between other provinces in Aegean Region, comes in the first place, in terms of the number of producers whom producing organic agricultural products and production area. Export of organic agricultural products is being performed from the port of Izmir, and large part of the certification company for organic products is located in Izmir province.

This study have been attempting to put forward improving of awareness activities in organic agriculture in Izmir, which is the place that organic agriculture began first and also most developed province in Turkey in organic agriculture. In this context, the activities that are thought to contribute to the development of organic agriculture; of universities, public institutions and agencies, local governments, private sector and non-governmental organizations related to organic agriculture has been taken. Also, in terms of raising awareness of the situation of organic sector in Izmir, were evaluated by using SWOT analysis. Raising awareness activities and results of SWOT analysis were evaluated together to bring some suggestions for the future.

AWARENESS AND ORGANİC AGRICULTURE

Importance of environment with environmental problems has emerged for the first time after II. World War, as a result of industrialization and thought that it's interested only the region that has been linked. People living outside the region which problems arise are not interested in environmental problems and also didn't require an effort for the solution of the subject. However, at first glance environmental problems appear to be local were actually regional even after understanding the results that have world-wide consequences, the environmental consciousness began to wake up in global terms. So, what is consciousness or awareness? Consciousness is a very important feature that separates as a kind of humans from other living things. The concept of consciousness can be defined, to be aware of yourself and the environment or to know or to know as you know. Awareness is seen directly in the whole of the consciousness and working depth to the entire mind. Awareness as a whole is, to become aware of consciousness, to recognize and to understand. Mind is dealing with the events and awareness is concerned with the mind itself. In short, awareness implies vigilance in observing some thing or experience and alertness in drawing inferences from what one observes. Environmental consciousness is the actions related to environment which the living space of human beings and all living things. When we have taken into consideration that consciousness is discontinuous, it is emerging that these actions should be moved to the awareness dimension. Therefore, it shouldn't be forgotten that the environmental dimension is vital for humans and other living things and it should be converted to supraliminal behavior in the form of action to avoid the interruption of environmental actions. Although there is variety of uses for the concept of environmental consciousness, it also present itself as the area where policy is most intense. It is particularly important in developing countries, to build awareness in communities and institutions. Organic agriculture also is of great importance while the world food production was interrogated, in the last period. The activities for increasing awareness of organic agriculture will play an important role for a community to know organic agriculture as detailed. In awareness study to be carried out in organic agriculture; constitute the target groups such as farmers and producer groups, consumers, those who deal with trade in organic products, processors, retailers, government and school children in all age. The success of any campaign to increase awareness is important in terms of involving all actors and working together for the success of activities. Raising awareness programs extend from information and advertising campaigns to the professional and community education programs, newspaper articles and advertisements, professional publications, training and low-cost promotional sales. In terms of producer awareness, the objective is not only the producer's start to organic agriculture but also to ensure its sustainability. According to raise awareness in organic agriculture, conferences and seminars can be organized, with organizing farmer fairs the information generation process related to organic agriculture can be improved and demonstration activities can be performed at village-level intended to show how to install organic systems and to produce and manage organic inputs. Demonstrations for the activities of producers' raising awareness are very important. Educational activities which have an important role in organic agriculture will be done to encourage producers such as compost production are very important. Besides, printed documents such as posters that can be easily understood by farmers and adorned with pictures, flyers and brochures are also available.Farmer's awareness for organic agriculture is also important for environmental awareness. Likewise, it is explained that organic farmers expressed a greater awareness of and concern for environmental problems associated with agriculture [10].

In the development of organic agriculture, consumer awareness is also important as producer awareness. Chang and Zepeda (2005) also suggest that increasing consumers' awareness of organic farming and certification, as well as the availability of organic foods, may be the most effective way of moving organic foods into mainstream. Personal responsibility includes making informed consumer choice. And that requires consumer knowledge and awareness about competing products. Knowledge and awareness have other direct and indirect effects on attitudes toward consumer products, and willingness to pay a price premium (Fig.1) Awareness and knowledge about organic products, play an important role in consumers' purchasing decisions. If an individual cannot clearly differentiate between organic or conventional products, a price premium on the organic product can affect the individual's purchasing decision in favor of the cheaper product. In European Union countries, many organic consumers identify organic products based on the organic labels and/or organic logos attached. Consumers generally perceive an organic label as assurance that the product is organic. Thus, deceptive or inaccurate labeling can convey the wrong signals to prospective buyers. After all, it is important to note that knowledge and awareness about organic products may not necessarily translate into direct purchase because of barriers that could limit the ability of consumers to transform such knowledge and perceived demand into actual demand [11].

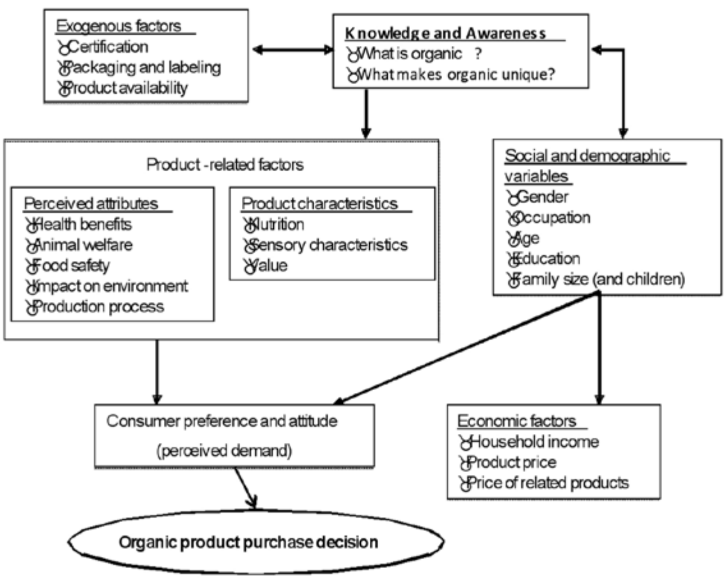

Fig.1. Conceptual framework of factors that affect organic consumer attitudes and purchase decisions (11, p.196).

It is stated that consumer knowledge and awareness will continue to be important in the organic food market in two respects [11]. First, there is still a segment of the potential market that is not yet informed about organic foods. A second dimension to the knowledge and awareness puzzle is the possibility that those who do not consider organic products may have a general knowledge about them, but do not have enough detailed information to clearly differentiate the unique attributes of organic from conventionally grown alternatives. It is also clarified that the consumers simply need to be educated on what organic farming and products are all about and more so what the benefits of consumption are. The general feeling was that if consumers knew the facts, they would definitely prefer to consume organic products as opposed to nonorganic [4] Knowledge and awareness about organic products can affect attitudes and perceptions and, ultimately, buying decisions. If the skepticism about organic products stemming, in part, from reported cases of mislabeling and fraud are assuaged, perceptions about the inherent characteristics of organic may translate into increased actual demand.

RAISING AWARENESS ACTIVITIES

Status of Organic Agriculture in Izmir Province

Organic agriculture activities in Turkey were first started in Izmir in the Aegean Region. Izmir has an important place in the development of organic agriculture in Turkey due to exportation of the majority of organic products from Izmir port and location of the large portion of organic products certification companies and organic agricultural exporting companies and Aegean Exporters' Association and Association of Organic Agriculture Organization. 84 varieties of organic products are produced in 21 districts of the province of Izmir [1]**.** Izmir comes first in terms of product diversity. The number of the producer, making organic agriculture in the branches of crop and animal production is 1159. 12.19% of Turkey's organic agriculture producers are in Izmir province. The share of the organic agricultural farms in total agricultural farms in the province of Izmir is 1.57%, whereas this rate is 0.31% when it was examined for Turkey [7, 8]. When the status in terms of the land of organic agriculture was evaluated in the province of Izmir in 2008; the land of organic agriculture is 23355.84 hectares. 16.48% of the area is located in Izmir province in the land of organic agriculture in Turkey. The rate of organic farming is 0.64% of total agricultural land in Turkey, while the rate is 7.46% in Izmir province. In 2008, the number of producer in crop production during the conversion to organic farming in Izmir is 303 and the conversion land is 2267.86 hectares. The 5.28% of producers' in transition period and the 9.02% of land of the organic agriculture in Turkey are in Izmir [7, 8]**.**

Raising Awareness Activities in Izmir

Raising awareness activities in Izmir is carried out by many organizations. Among these institutions which regulates and supports the activities, ETO, Izmir Metropolitan Municiplity, Izmir Directorate of Agriculture, Ege University Faculty of Agriculture, Research Institutes, Izmir Governor's Office, Aegean Exporters' Association, Izmir Chamber of Commerce, Aegean Region Chamber of Industry, Certification Companies, Izmir Development Agency, Chamber of Agricultural Engineers, Izmir Chamber of Agriculture, Tariş, Izmir Board of Trade, Environment and Forestry Provincial Directorate, Environment and Forests Foundation, etc. are taking place.

Event Name	Partners of The Event	Activities
-A Sustainable Example in Socio-Economic Development: Organic Farming Project in Peninsula [9].	- Izmir Metropolitan Municiplity - Izmir Directorate of Agriculture -Ege University Faculty of Agriculture,Dept.of Horticulture -Turkish Association on Organic Agriculture (ETO)	-Producer training -Training seminars for schools -Establishment of the organic product market (Balçova)
-Organic Production Project of Ege University Faculty of Agriculture [3].	-Ege University Faculty of Agriculture,Dept.of Horticulture	-Practical organic agriculture information for students and local producers and field day.
-Development of a Clustering Policy Project (Izmir Organic Food Cluster) [6].	-Undersecretariat of the Prime Ministry for Foreign Trade (Executive) - Aegean Exporters' Association, ETO, Ege University, Izmir Board of Trade, Aegean Region Chamber of Industry (EBSO), Certification Companies, Izmir Development Agency, Izmir Directorate of Agriculture	-Some purposes such as the creation of reliability of Izmir organic sector and provision of the efficient supply chain and distribution channel for organic products was targeted. In this context, several meetings are held.
-Start Organic Agriculture at Tahtalı Dam Protection Field.	-ETO -Izmir Directorate of Agriculture -Izmir Governor's Office, -Izmir Metropolitan Municiplity -Ege University Faculty of Agriculture	-Training and extension activities for the producers.
-Acting Organic by Thinking Organic	-ETO -Izmir Chamber of Agriculture	-Producer training -Intercollegiate article competition -Several meetings
-9. Organic Products and Environment Fair 6-10 May 2010 [5]	-ETO (Association of Organic Agriculture Organisation) - İZFAŞ(Izmir Fair Trade Inc.) -ASDF Fair.	-With the participation of associations of sector, certified organic production companies in different sectors and certification agencies will be provided the contribution of raising awareness in organic agriculture and the market.

Table 1. Raising Awareness Activities for Organic Agriculture in Izmir

All these organizations are contributing to raise awareness about organic agriculture sometimes by participating in activities directly or indirectly, sometimes by taking part in or supporting activities in the province of Izmir. A portion of the relevant activities of these institutions are summarized below.

Izmir Directorate of Agriculture, Izmir Metropolitan Municiplity

The establishment of the organic open-air street market is aimed in Karşıyaka and Bornova district after Balçova. Training works are underway for organizing activities at street markets related to consumer information about organic logo, certificate and label issues. In addition, the works about awareness in organic products related to municipal police, middleman and retailer in the market are going on. All the municipalities and chambers and Directorate of Wholesale Food Market take part in this study.

University

There are some researches completed or are still in progress which Ege University Faculty of Agriculture, Dept. of Horticulture, Dept. of Plant Protection, Dept. of Agricultural Economics, Dept. of Soil Science, Dept. of Animal Science, Dept. of Agricultural Machinery and Dept. of Farm Structures and Irrigation are conducted as a partner of different institutions and organizations or solely, examining organic agriculture in technical and economical review. These projects are funded by Tariş, Ege University Scientific Research Projects Fund, TUBITAK, Environmental Foundation, State Planning Organization, Ministry of Agriculture and Rural Affairs, European Union 7.Framework Programme budget. As well as projects, there is an Organic Agriculture Program in order to train well equipped technical staff for the needs of sector and trained staff about organic agriculture within Ege University Ödemiş Vocational Training School.

Control and Certification Organizations

In Turkey, seven of twelve organic agriculture control and certification organizations (ECOCERT, BCS, IMO, ETKO, CU, ICEA, CERES) authorized by Ministry of Agriculture and Rural Affairs are situated in the center of Izmir. These organizations don't have any training and service activities directly to the farmer. However, they contribute the trainings, projects, researches, courses and meetings conducted by other institutions.

Organic Agriculture Companies

Organic inputs that producers need are provided by organic companies and to adopt new agricultural techniques and applications more quickly they schedule demonstrations. They are arranging oversea trips for selected leader producer who does organic agriculture, also, it is provided for the leader producer to increase their gained experience about organic agriculture. These companies are located in close relations within the universities, Provincial Directorate of Agriculture and other institutions and organizations and participating meetings, courses and panels. They are contributing some of university projects and helping to establish testing area in the land of their contract producers. In addition, they arrange several informational meetings in villages to provide the transition of organic agriculture for the producers who don't make organic agriculture.

SWOT ANALYSIS FOR ORGANIC SECTOR OF IZMIR PROVINCE IN TERMS OF RAISING AWARENESS

Swot Analysis: This technique is used to identify the strengths and weaknesses of organization, technique, process or situation and the opportunities and threats arising from the external environment of the examined sector. SWOT matrix is a stage of a strategic vision after analyzing the system's internal and external factors. In the process of examining the system by SWOT analysis method, internal environment factors related to system is investigated to reveal what was going on for the system's success or the strengths and weaknesses of the future belongs of the system. External analyses are the methods applied, to reveal the system facilities and threats to the system.

Strengths	Weaknesses
- The great interest and support of both metropolitan and district municipalities to organic agriculture - The center of ETO is in Izmir - 16% of the land of organic agriculture in Turkey is in Izmir province - The farmer is being sensitive and open to crop diversity - Consumers' awareness in health issues - The demand for organic products because of summer houses in the district - Organizational goodwill and tolerance - Interest and support of media - High interest of schools	- Currently, lack of an organic product market - No continuity of organic products in supermarkets - Lack of farmer's organizations - Not sufficiently farm size - The producer's chemical using habit - Difficulty of reaching organic inputs - Existing pesticide and fertilizer dealers have distribution network according to the conventional products
Opportunities	**Threats**
- 9. Organic Products and Environment Fair will be held in Izmir - New Organic Agriculture Support Payment (20 TL per decar) - Organic agriculture and organic input production credit for the discount interest rate - A large number of researches about organic agriculture carrying out by universities - Izmir's agro-tourism potential - Advanced food processing industry	- Lack of adequate support - Fertilizer subsidies for conventional agriculture - Prices for organic products - Economic crisis - Insecurity about certification - Producers' difficulties for transition to organic production

Table 2. SWOT Analysis for Organic Sector of Izmir Province in terms of Raising Awareness

SUGGESTIONS

Suggestions for Beneficiary of the Strengths

Izmir organic sector largely takes advantage of the strengths about raising awareness. Municipality, ETO, university, Provincial

Directorate of Agriculture can show a joint effort about raising awareness. However, it is needed to provide continuity of these efforts. It is very important to better assess the province of Izmir elementary schools' and high schools' interest about organic products training and sensitivity, in terms of promoting a wide audience, even if it notifies less demand for organic products. In Izmir, the farmers are open to crop diversity. In terms of raising awareness of producer, must benefit from the experience.

Suggestions for Transition of Weaknesses to Strengths

Already, there is no organic product market. However, significant progress has been made on this issue. After troubleshooting of reconstruction, it is planned to open the market place up to May 2010. As well as organic market place, in terms of ensuring the continuity of organic products in supermarkets, measures must be taken in the direction of better supply chain. The organization of producers would bring more benefits in terms of transition to organic agriculture and also, being more caring and supportive of producer organizations are critical in terms of conduct and success of awareness activities. This situation will have eased the problems of small lands as well as the high cost of certification problems. It is needed to be strengthening organic inputs distribution network as facilitating the producers' access to organic inputs and in this regard the producers need to be informed. Consumers need to be informed not only organic products but also organic agriculture and certification.

Suggestions for the Evaluation of Opportunities

Izmir town offers many significant opportunities in terms of agro-tourism. In this district, development of agro-tourism can be evaluated in the direction of organic products demand increase and better recognition of organic products. Briefings to serving breakfast organizations in the area of peninsula project are also considered to be important in this respect. In Aegean region, farm size is usually small. These farms are needed for the redirection of increasing organic agriculture activities.

It is a very important opportunity for organic agriculture that the International Ecology Fair will be held in Izmir this year. Enough to take advantage of this opportunity, in addition, dealing with production, processing and trading companies, all public have to participate the fair as much as possible. This participation is also critical in terms of environmental awareness.

"New Organic Agriculture Support Payment" dated 16.01.2010, is serious opportunity for Izmir organic agriculture. Support payments be made to farmers for organic farming 20 Turkish Liras per decar. This support will make it possible to complete taking advantage of the opportunity with the support of the education of producers and can be useful for the producer of Izmir province. Better opportunities will be created if the researches make by Aegean University are capable for the needs of Izmir, within the conjunction of the institutions operating in organic agriculture and through the results to be transferred each other.

Suggestions for the Threats

Instability of organic product price, in terms of raising awareness is a threat interest of all actors in organic products sector. The price-premiums are high for the consumers and this affect the demand negatively. When combined with the economic crisis, consumers' willingness to pay is decreasing. Organic products market may offer more affordable product to the consumer to a certain extent. In addition, through training and local authorities, greater communication with consumers will raise consumer's awareness and by eliminating the negative attitude will increase the demand for organic food. Despite the recent support given per decar, it can not be said given support to organic agriculture is sufficient. This constitutes disadvantage in terms of raising awareness activity especially for producers. It is necessary to go over the policy especially subsidies for chemical inputs that focused on conventional agriculture. To encourage for organic product producers at least similar subsidies for organic inputs must be applied. Nevertheless it is important to finance and support for organic agriculture researches and certification.

RESULT

The province of Izmir, can benefit enough from the strengths of raising awareness activities in organic sector. However, these activities have to be supported with raising awareness campaigns which will strengthen the sector's weaknesses and assess the opportunities, although Izmir organic sector will become stronger. Thus, Izmir will create an example for Turkey in terms of organic agriculture.

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EVALUATION OF THE TRADITIONAL TURKISH HOUSES FROM THE POINT OF VIEW ECOLOGICAL DESIGN

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SUMMARY

The architecture is contemporary and stable from the intelligent interpretation of the materials and structure used, reflecting the way of life of the community to the location and building and environment relations to be integrated point of view. When the traditional architecture is analyzed in a intelligent way it could be seen that the ecological building approach has been adopted too many years before and the balanced solutions with the climate have been achieved. The ecological architecture aims the reducing the required energy by selection of the proper material and structure to minimum and taking the properties of the territory of the building, climate conditions in the design in to consideration, providing the maximum efficiency of the energy used. The concept of the maintainable architecture created as the solution to the environment problems is routed to the traditional architecture as the system of the thinking. When the buildings which are taken in the consideration of territorial data, claimed conditions and natural environment, it has been understood that they have the similarities to the criterion of sustainability in the design.The technological developments which were accelerated after the industrial revolution caused the loss of the affect of the traditional structure created by the accumulations of centuries. In the design and application of the structures built in our accommodations today and the climate conditions are not taken into account. The harmony which was developed by the traditional architecture was diminished by the time and different climate regions were started to be structured by the building having the properties of same form, the order of location, crust and material. Turkish House location organization, material and component selection and order of location, are samples from environmental and climate factors evaluation as well as intelligent using of the structure system components. Today the production and design procedures of the buildings are started to be interrogated. It was accepted that adaptation of the data obtained from Traditional Turkish House samples to the current design and application procedures as a correct process. The Traditional Turkish Houses are the best samples explaining the values oriented to the human, explaining the traditional Turkish Architecture which has been made in a sustainable manner. By starting from that point of view it has been aimed formation of the traditional architecture according to the climate properties of the buildings sustainable design criterion and evaluation according to the relations between the traditional and ecological architecture.

Keywords: Traditional Architecture, Ecological Architecture, Ecological Design Criterion, Turkish Houses.

INTRODUCTION

Ecological concept, which seems to belong today's world, is in fact being applied since Vitrivius and can be seen in traditional structures. The main purpose in traditional architecture is to comply with it, not rule over it. In parallel with this, sustainability in today's architecture is accommodating itself to nature and also the act of designing according to comfort conditions with sophisticated technology and materials without harming nature. The need for a more comfortable living and the utilization of technology brought about environmental problems. Solution seeking related to these problems continually remain on the agenda in order to enable mankind to coexist with nature without harming it. The emergence of consumption society with industrial revolution, utilization of new techniques in building sector caused energy to seem like inexpensive and tireless and an increase in energy consumption. As a result of these, sustainable architecture concept, which aims to minimize the energy requirement of a structure in its settlement, design and material selection taking into consideration the available land data, climatic information and natural environment, came to light. Ecological concept in urban design and in building scale is one of the most important objectives of energy and environment conservation. Adapting the data taken from the traditional architecture examples to today's design and application methods can be regarded as a correct method. The determinant criteria in housing design complying with sustainable architecture principles are land data, climate data, building form, spatial organization, building shell, material selection, utilization of non-exhausting energy sources and sanitation system.

TRADITIONAL TURKISH HOUSE

Turks have a rooted housing tradition since long. As the Turks living in the east of Asia mainly adopted nomadic lifestyle, they lived in tents that could be easily set up and detached. Western Turks chose settled life and constructed housings accordingly. In definition, Turkish House is a Turkish culture product seen within the borders of Ottoman Empire and in regions influenced from this culture and shaped in various ways according to traditions, economic conditions, regional-natural data and application techniques (Ergin,1994). According to another definition, it is a house type that reflects a shape and plan suitable to the living culture and customs of traditional Turkish family and that has met the needs of Turkish people for centuries (Ünügür,1979). Turkish house is the result of special conditions; but, it is a unique and unprecedented design with its plan arrangements that could accommodate it to various conditions, enable it to be used in urban houses and palaces with the ability to meet even some modern requirements. It is based on a modular system. The smallest unit of this module is a room and there are service areas beside and in front of it. There are some features distinguishing traditional Turkish House from other house types. These are plan scheme, multi-storey, roof type, front properties and building techniques. Plan Scheme: Turkish House has shown development according to various plan types in different and remote areas in terms of its climatic and cultural locations. These differences emanate from the necessity to comply with local materials and climate conditions and the adoption of local customs. But, there are some unchanging properties in Turkish House plan type. Rooms: You can sleep, sit, bathe, dine and even cook in every room of Turkish House. All the rooms have the same qualities. The qualities of rooms do not change though their size differs (Günay 1989). Hall: Hall in Turkish House is the most significant element influencing the design of the house and connecting rooms to each other. Hall is a feature distinguishing Turkish House from other house types. The place and form of hall in the structure determines different plan types: Plan Type with no Hall, Plan Type with Outer Hall, Plan Type with Interior Hall, Plan Type with Middle Hall.

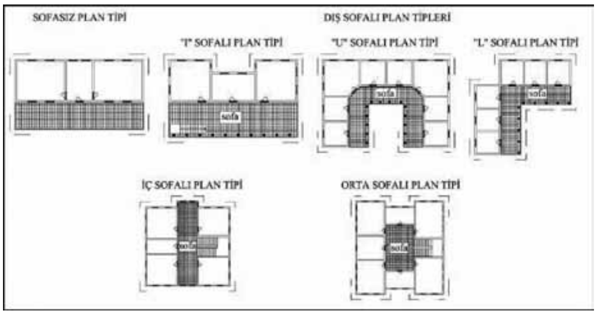

Figure 1. Plan Types with Hall(AKTUNA, M,2007)

Multi-Storey and Roof Type: While Turkish House is generally single-storey, its floors increased in the course of time. The main floor is kept as high as possible from ground to benefit from natural light, sun, air and landscape. The roofs are hipped roofs inclined towards four directions and they have large eaves. Frontal Properties and Building Technique: In Turkish House, fronts reflecting the functionality of the plan to outside are built. The changes in plan scheme also affected fronts. While windows were not built in ground floors to hide the interior area from the streets, bay windows getting over the streets are built in upstairs. Climate and natural light needs played a role along with social and cultural features in the emergence of corbels (Özbek 1985). The most common building techniques are fillings between timber framings or lath-and-plaster.

EVALUATION OF THE TRADITIONAL TURKISH HOUSES FROM THE POINT OF VIEW ECOLOGICAL DESIGN

Turkish House developed in 17^{th} and 18^{th} centuries in Ottoman Empire and scattered to a wide geographical region. Not only Turks, but also the societies living within the borders of Ottoman Empire contributed to finding the architecture solution most suitable to vegetation, topography, climate and economic conditions (Sözen ve Eruzun, 1992). According toSedad Hakkı Eldem (1984), "Turkish House is a house type distinctive with its unique features, formed within the borders of old Ottoman Empire and Rumelia and Anatolia Regions and continued for about five hundred years."

Figure 2. Turkish house bay windows and shadowy, solar controlled streets

Today's world, climate conditions are not taken into consideration in the design and application of the buildings. It is evident that; harmonies created by traditional architecture have vanished in the process of time. Structures with the same form, location order, shell and material qualities have begun to increase in different climatic zones. But, the amount of energy used in these structures for air conditioning is very high. Ecological architecture aims to minimize the energy requirements of the structures in the placement, design and material selection of architectural structures by taking current land data, climatic data and natural environment into account. Nature-compliant traditional architecture examples give ecology lessons to today's architecture. Architecture structures that shape the buildings according to climate and environment and minimize the additional air conditioning costs as successful as seen today, can be taken as examples for instance. In our country having regions with different climatic conditions, traditional architecture examples differ according to climate conditions. Paying regard to climate conditions, Turkish Houses are assessed in terms of physical sustainability under topics like the harmonies provided in the settlement and design of the structures, ecological settlement criteria and ecological design criteria.

Land and Climatic Data:

Turkish Houses in different climatic zones differ in terms of establishment method. But these differences are seen as the relations of rooms and the common fields between the rooms. It is clear from the traditional Turkish House settlements that; suitability to land and topography is important and structure design is performed in a way to thoroughly protect the central area between rooms. Houses are surrounded with high walls and insulation to exterior climate and sound is achieved. High courtyard walls and corbels in both sides of the street create shadowy areas throughout the day.

Figure 3. Turkish houses in different climatic zones

Building Form and Spatial Organization:

Rooms in Turkish House do not differ according to their functions, all of them can be used for the same ends. The change of use generally takes places as moving to winter room in the south in winters and summer room in the north in summers. External environment is static. Suitable effects and values like view, light and wind should be contained in the rooms. They are directed at squares or mosques according to the place and needs. Solutions are developed to protect the occupants against climate and heat changes. If the external environment is hot, the whole room gets open to external influences and cooled. The most suitable area for cold is selected in the plan and cross-section and it is chosen as winter room. Moreover, courtyard brings a protective impact both in hot and cold climates. Rooms have a sitting places called as divan in front of a single wall or sometime more walls. And there are cupboards known as yüklük (cupboard for beddings) and çubukluk (cupboard for tobacco pipes) on the walls. There is a cooker in one corner of the room. There are niches and shelves on the walls beside it. Along with preventing the view from the outside, windows have frameworks that provide a well solar control element as well. When we analyze some examples living until today, it is found out that; there is a large room known as eyvan (iwan) and it has thick walls and high ceilings in accordance with climatic conditions (Alsaç). The upstairs where people generally live are larger and brighter with bay windows, corbels, big windows and balconies in cities. Stairs are used to get to these places.

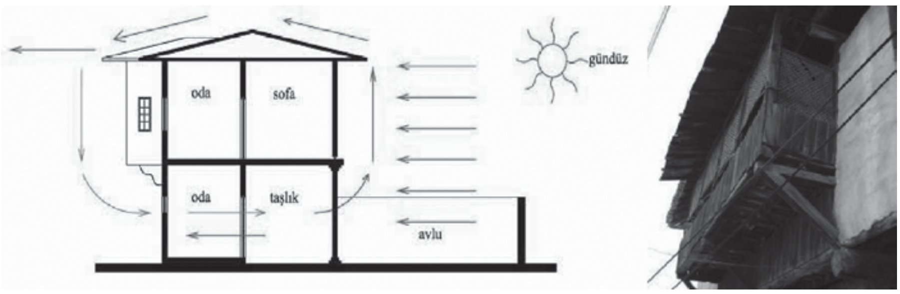

Figure 4. Air movement and solar control and ventilation in structure surface (AKTUNA, M,2007)

Turkish house is generally located within a garden. This section, which is of importance in terms of lifestyle and family order, also determines the other functions in the house. Garden, which is like a courtyard closed to outside with walls, is a place where fruits and vegetables are grown. The water needs of the house are fulfilled through the well in the garden. The rooms of Turkish house are multipurpose locations. They become a dining room when "sini" (meal serving trays) are placed at the center, they become a bedroom when beddings in the cupboards are laid to the ground. People sit inside these rooms, manage various domestic affairs and welcome guests. Furnitures are generally fixed in Turkish houses. Furnishings like diwan, cupboards, cookers and shelves are generally fixed and they are designed and installed together with the house. The flooring of the rooms is generally made of earth, bricks or wood and after putting a mat on it, rugs or carpets are laid. One of the cupboards is used as a bathing place. The house may have a bath in the ground floor or in the basement.

Building Shell and Material Selection:

Climate is an important factor. In suitable climates, window bay is protected with a single cover and glass sashes are not required. But, in harsh climates, opening of the whole sash is prevented in order to abstain from heat loss. There is a lintel shaped like an ornamental arch in the sections of the wooden doors looking at the hall. And, heat loss of the room is prevented by hanging a cotton curtain to this arch where the sash leans on in cold weathers. Turkish house generally consists of a single floor or two floors made of wood over a substructure with mud-walls or brick-walls. The foundation of flooring is generally left simple in Turkish Houses. It has always been important to settle it like "fixed on the ground". Considering both the foundation and construction components, it is evident that; certain basic principles are applied without change. Ceilings are one of the most significant elements. As the outer parts of houses are plain, ceilings are ornamented. Wooden window sash opening types change depending on regions in Turkish Houses.

Figure 5. Traditional Turkish house garden and the well inside it

Traditional architecture examples have survived until today as works in which people provided solutions suitable to their climatic and environmental conditions by trial and error for ages and reflected their own lifestyles, cultures, customs and traditions.

CONCLUSION

The increase in industrialization and utilization of technology to provide a more comfortable life have brought along environmental problems. Solution searches for environmental problems are constantly put on the agenda in order to enable men to coexist with nature and not harming it. Emergence of consumption society with industrial revolution, utilization of new techniques in building sector caused energy to be seen as inexpensive and tireless and an increase in the energy consumption. The impacts of history, culture and social life continuing for centuries, can be seen in the shaping of Turkish houses. When traditional Turkish House is analyzed within the context of sustainable design criteria, it is found to be planned according to land settlement properties, topographical suitability, direction selection, green fabric and climate data. It is understood that; houses are designed by taking climatic and environmental conditions into account from their settlements and designs. When ecological design strategies are in question for Turkey, reviewing how the traditional settlements and structures in Anatolia are designed under cultural, topographical and climatic conditions and adapting them to today's conditions can be regarded as a correct approach. Taking all these criteria into consideration, sustainable design strategies are known to be practiced in the traditional settlements and houses in Anatolia for ages. In conclusion, it is clear that; architects aiming at ecological design should analyze traditional architecture and interpret the building strategies used in this architecture with today's technology and materials and design buildings and settlements consuming limited energy sources as low as possible in order to remove environmental and energy problems and leave a habitable world to next generations.

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IMPACT OF ORGANIC FARMING ON GLOBAL WARMING – RECENT SCIENTIFIC KNOWLEDGE

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ABSTRACT

It is not clear if conversion to organic farming is an option for reducing the impact of farming on global warming. For the purpose of assessment, available literature was evaluated. Different results of the impact of organic farming concerning greenhouse effect were found among the various sources (Bockisch et al. 2000, Fritsche & Eberle 2007, Flessa et al. 2002, Nemecek et al. 2005, Hülsbergen & Küstermann 2007, Haas et al. 2001, Smukalski et al. 1992, Korbun et al. 2004, Taylor 2000, Williams et al. 2006, Köpke & Haas 1995). The different conclusions of the studies depend on the products observed, the systems observed (system borders) and the structure and intensity of the systems (low or high external input and output).

It can be concluded that organic farming is less relevant to the greenhouse effect than comparable conventional farming systems. The higher emission of greenhouse gases in conventional systems is caused by purchased feedstuff from overseas, mineral fertilizer and pesticides. The higher yields per ha and animal unit are usually not able to compensate these negative impacts. Nevertheless, there are options for both conventional and organic farming to improve towards more climate-friendly farming patterns. For example, IP (integrated production systems) are comparable with organic farming systems (Nemecek et al. 2005). Organic farming has to be developed as well to reduce climatic impacts through higher output per hectare or per animal and higher energy efficiency in the whole product chain. An important factor is the Corg level of the soils (Mäder et al. 2002, Capriel 2006, Hoyer et al. 2007, Penman et al. 2003, Köpke 2006). Renewable energy can help to reduce fossil energy in farming and processing (SRU 2007, Rahmann et al. 2008). Mechanisation does not conflict with the goal of being more climate-friendly (Nemecek et al. 2005).

Keywords: *Global warming, organic farming*

INTRODUCTION

The anthropogenically induced climate change has increased the world temperature in the last hundred years by between 0.6 and 0.7 °C. All food production contributes to greenhouse gas (GHG) emissions. In 2005, German agriculture had a share of 108 mio t $CO_{2\text{-eq}}$, respectively 6.3 % of all German GHG emissions (worldwide agriculture contributes 13 %) (UBA 2007, Rahmann et al. 2008). Agriculture plays a large role in the GHG emissions of methane (44 mio t of CH_4) and N_2O (41 mio t) (Tab. 1). Mineral fertilizer (N_2O) and ruminant digestion (CH_4) are the main source of agricultural emissions. GHG emissions of livestock production have enormous global relevance (Steinfeld et al., 2006). In Germany, 30 % of the GHG emissions from agriculture can be allocated to dairy cows (Osterburg et al.; 2009). Food production is a function of consumption. In recent years, food production and consumption contributed 16 % of the total emissions per capita (1.6 t $CO_{2\text{-eq}}$) (ÖKO 2007).

The challenge of food production is to reduce the greenhouse gas emissions per product and not production unit (minimize $CO_{2\text{-eq}}$ emission per kg milk and not per cow or kg wheat and not per hectare). With this parameter it is not clear yet if organic farming has less impact on climate change than conventional farming.

Tab. 1 German agriculture-related GHG emissions in 2005 (mio t $CO_{2\text{-eq}}$)

Emission source	CO_2	CH_4	N_2O	Total
Livestock digestion	-	18.3	-	18.3
Organic fertilizer (manure)	-	5.0	3.1	8.1
Emissions from soil utilisation	42.4	-0.6	42.4	8.2
Soil carbonizing	1.7	-	-	1.7
Fossil energy use	6.7	0.0	0.1	6.8
Mineral N-fertilizer production	5.2	0.3	8.6	14.1
Total agricultural emissions	56.0	23.0	54.2	133.2
Total German emissions	885.9	51.4	66.4	1003.7

Source: compiled from UBA 2007

A literature review has been carried out to identify the present state of knowledge and to define scientific challenges to reduce emissions and develop and adapt organic farming under climate change (Rahmann et al. 2008). The assessment and the development should not ignore the multi-functionality of agriculture (preservation of biodiversity and biotopes, landscape, food security and safety, tradition and culture, protection of soil, water and air, animal welfare).GHG impact of organic farming in Germany

Organic farming is considered a low input - low output system (organic standards of the EU are defined in the regulations 834/2007/EC and 889/2008/EC). Because mineral fertilizer and chemical pesticides are prohibited, and feed additives and concentrate feeds are limited (low/medium input- low/medium output farming), the efficiency/output per hectare resp. animal is less than in conventional farming (medium/high input – medium/high output farming). Less animal units can be kept per hectare due to limitations in dung units (170 kg manure-N per hectare and year; 889/2008/EC). In Germany, organic farms keep only 0.69 livestock units (500 kg live weight) per ha and conventional farms 0.89 (2005/06; BMELV 2007). Different GHG balances have to be expected compared to conventional systems. Recent system comparisons still rely on single farm comparisons (Thomassen et al. 2008), special regions (Haas et al. 2001) or give raw estimates on productivity and on management differences between the farming systems (Basset-Mens et al. 2009). It is still unclear if lower productivity of organic systems in general has adverse effects on the GHG balance of the products. A literature review has been carried out to identify the recent knowledge (Rahmann et al. 2008). Comparative studies on crop production (Tab. 2, Tab. 3), animal husbandry (Tab. 4, Tab. 5 and Tab. 6) at the farm gate and place of purchasing food products (consumer level; Tab. 7) have been found. Some studies are done in countries adjacent to Germany but with comparable ecological and socio-economic framework conditions (e.g., Scandinavia, Great Britain, Switzerland). Comparison studies on arable crop production show big differences between organic and conventional (Tab. 2) as well as between different crops (Tab. 3). The studies show that organic farming has a clear advantage in terms of low GHG emissions per hectare. This is not the case if the GHG per product unit (e.g. kg) is considered. There is a overlapping between organic and conventional production. The GHG emission per kg legume crops is comparable to conventional production. This is due to the fact that legume crops like peas and beans do not need much fertilizer (mineral fertilizer contributes greatly to GHG emissions) in conventional systems like in organic farming, but achieve better production yields with the use of pesticides (pesticides have a low contribution to GHG emission). Overall, organic farming has low GHG emissions but integrated production is not very far from this level.

Tab. 2Emission of organic (EU standards) and conventional crop production in Germany (Index 100; numbers below 100 = organic has an advantage)

		Organic (EU) vs. conventional [a]	Organic (EU) vs. Integrated production [b]
Fossil fuel			
per hectare	non-legume crops	27 - 47	44 - 82
	legumes	72 - 94	72 - 94
per product unit	non-legume crops	29 - 92	69 - 133
	legumes	53 - 63	53 - 63
CO_2			
per hectare	non-legume crops	47 - 67	68 - 100
	legumes	88 - 102	88 - 102
per product unit	non-legume crops	74 - 127	100 - 164
	legumes	54 - 63	54 - 63
CH_4			
per hectare	non-legume crops	9 - 25	24 - 61
	legumes	66 - 91	66 - 91
per product unit	non-legume crops	14 - 35	7 - 83
	legumes	95 - 126	95 - 126
N_2O			
per hectare	non-legume crops	1 - 4	1 - 12
	legumes	74 - 88	74 - 88
per product unit	non-legume crops	1 - 69	3 - 150
	legumes	45 - 60	45 - 60
[a] high input – high output; [b] medium input – medium/high output (IP; integrated production)			

Source: Bockisch et al. 2000

Tab. 3GHG impact of organic and integrated production for different arable crops per hectare (kg $CO_{2\text{-eq}}$ ha^{-1} a^{-1}) and product unit (g $CO_{2\text{-eq}}$ kg DM^{-1}) in Switzerland

		Integrated production (IPintensiv)	Organic production (Bio Suisse-Standard)
Winter wheat	**ha**	4,126	3,424
	kg	692	913
Winter barley	**ha**	3,941	3,137
	kg	605	804
Potatos	**ha**	5,428	3,852
	kg	653	764
Rape	**ha**	3,817	2,946
	kg	1,304	1,549
Cow beans (feed)	**ha**	3,217	3,929
	kg	978	1,335
Peas (feed)	**ha**	3,209	3,443
	kg	961	1,300

Source: Nemecek et al. 2005

The British DEFRA study (Tab. 4) was discussed controversially throughout Europe. The result of the discussion was that a "single element" approach cannot be the relevant level for farming system comparison studies. The whole farming system has to be considered in assessments. This was done in the model calculation for dairy cows by Dämmgen and Döhler (2009) (Tab. 5). Organic dairy farming had lower GHG emission than conventional systems. The weak points of such results are the missing detailed data set. Model results are as good (or bad) as the data behind them. This is obvious, if the results of several studies are compared (Tab. 6). It shows that the range of the results is so wide, that reliability is not given.

Tab. 4 Energy utilization and GHG impact of livestock keeping in UK (per t of product)

		Energy utilization [MJ t^{-1}]	GHG emission [$CO_{2\text{-eq}}$ t^{-1}]
Milk	**Conventional**	25,200	10,600
	Organic	15,600	12,300
Beef	**Conventional**	27,800	15,800
	Organic	18,100	18,200
Pork	**Conventional**	16,700	6,360
	Organic	14,500	5,640
Lamb	**Conventional**	23,100	17,500
	Organic	18,400	10,100
Poultry meat	**Conventional**	12,000	4,570
	Organic	15,800	6,680
Eggs	**Conventional (cage keeping)**	13,600	5,250
	Organic	16,100	7,000

Source: Williams et al. (2006)

Tab. 5 Emissions from dairy farming depending on the farming method (kg $CO_{2\text{-eq}}$ cow^{-1} a^{-1})

Greenhouse gas	conv., stable silage, slurry	conv., pasture, silage, slurry	conv., pasture, straw bed	organic, pasture, straw bed
CH_4 (Digestion)	91.8	92.9	92.9	92.9
CH_4 (Stored)	18.2	15.1	4.4	4.4
CH_4 (Diesel)	0.0	0.0	0.0	0.0
Sum CH_4	110.0	108.0	97.3	97.3
N_2O (Stored)	0.94	0.77	0.83	0.83
N_2O (Fertilizer)	2.80	3.24	3.30	1.60
N_2O (Indirect)	2.88	3.86	3.88	4.19
N_2O (Fertilizer-manufacture)	0.13	0.12	0.12	0.00
N_2O (Diesel)	0.09	0.08	0.08	0.14
Sum N_2O	6.83	8.07	8.21	6.75
CO_2 (Fertilizer)	69	72	72	0
CO_2 (Fertilizer manufacture)	101	92	92	0
CO_2 (Diesel)	231	210	210	353
Sum CO_2	401	375	375	353
Sum greenhouse gases [tons $CO_{2\text{-eq}}$ cow^{-1} a^{-1}]	5.36	5.62	5.42	4.94

Source: Dämmgen and Döhler 2009

Tab. 6:GHG emission of milk production – results of several studies

Source	Unit	Conventional	Organic	Relation
Energy				
Abel, cit. in Taylor 2000	MJ t^{-1} milk	2,180	740	2.9 : 1
Scheitz, cit. in Taylor 2000	MJ t^{-1} milk	3,360	1,640	2.0 : 1
Bockisch et al. 2000	MJ/ animal	18,675	8,113	2.3 : 1
	MJ t^{-1} milk	2,721	1,474	1.8 : 1
Haas et al. 20001	MJ t^{-1} milk	2,700	1,200	1.9 : 1
Grönroos et al. 2006	MJ t^{-1} milk	6,390	4,410	1.4 : 1
Meul et al. 2007	MJ t^{-1} milk	4,385 2,576	-	
CO_2				
Bockisch et al. 2000	kg CO_2 cow^{-1}	1,395	764	1.8 : 1
	kg CO_{2-eq} t^{-1} milk	203	140	1.4 : 1
Haas et al. 2001	kg CO_{2-eq} t^{-1} mik	177	88	2.0 : 1
Weiske et al. 2006	kg CO_{2-eq} t^{-1} milk	129	83	1.6 : 1
CH_4				
Bockisch et al. 2000	kg CO_2 cow^{-1}	no data	13.96	
	kg CO_{2-eq} t^{-1} milk	no data	2.52	
Haas et al. 2001	kg CO_{2-eq} t^{-1} milk	706	846	1 : 1.20
Weiske et al. 2006	kg CO_{2-eq} t^{-1} milk	516	635	1 : 1.23
Sneath et al. 2006	kg CO_{2-eq} t^{-1} milk	9.6	8.1	1.18 : 1
Hensen et al. 2006	kg CO_{2-eq} cow^{-1} d^{-1}	16.1 (slurry) 32.2 (straw)		
N_2O				
Bockisch et al. 2000	kg CO_2 cow^{-1}	no data	10.23	
	kg CO_{2-eq} t^{-1} milk	no data	2.17	
Haas et al. 2001	kg CO_{2-eq} t^{-1} milk	417	365	1.14 : 1
Weiske et al. 2006	kg CO_{2-eq} t^{-1} milk	645	676	1 : 1.05
Abel zit. in Taylor 2000	kg CO_{2-eq} t^{-1} milk	611	538	1.13 : 1
Scheitz zit in Taylor 2000	kg CO_{2-eq} t^{-1} milk	778	691	1.12 : 1
Bockisch et al. 2000	kg CO_{2-eq} t^{-1} milk	no data	145	
	kg CO_{2-eq} t^{-1} milk	no data	27	
Haas et al. 2001	kg CO_{2-eq} t^{-1} milk	1,300	1,299	1 : 1
Casey & Holden 2005	kg CO_{2-eq} t^{-1} feed	1,156		
	kg CO_{2-eq} t^{-1} ECM	1,500		
	kg CO_{2-eq} t^{-1} ECM	195		
Weiske et al. 2006	kg CO_{2-eq} t^{-1} milk	1,290	1,394	1 : 1.08

Source: compiled by Rahmann et al. 2008

The impact of farming should not only consider one factor (e.g., GHG emission). For example, biodiversity, animal welfare, landscape and economics are further factors. For all these multi-functional factors, organic farming has big advantages compared to medium/high input – medium/high output conventional farming.

High market prices for organic products are an important factor. For example, the yield per hectare for winter wheat production is 42 % lower in organic farming than in comparable conventional farming systems (3.96 t ha^{-1} vs. 6.87 t ha^{-1}) (harvest year 2005). But organic winter wheat had a market price of 196.60 € t^{-1}, conventional only 95.10 € t^{-1}. Organic milk is usually 0.07 to 0.14 € kg^{-1} higher than conventional milk (2005/06: 0.36 vs. 0.24 € kg^{-1} ECM). Price differences are the reason that organic farms earn more money than comparable conventional farms (2005/06: 321 € vs. 304 € ha^{-1} a^{-1}, 21,446 € vs. 20,180 € $labourer^{-1}$ a^{-1}). Overall, organic farms had, with 321 € ha^{-1} in 2006, higher profits than comparable conventional farms (304 € ha^{-1}). The return for labor was, with 21.446 € LU^{-1} in organic farming, higher than in conventional farming (20.180 € LU^{-1}) (data from test farm survey results oft he German ministry of agriculture; BMELV 2007).

The previous tables show farm gate results. Transport, processing and trade of the food products are not considered at this level. Fritsche & Eberle (2007) calculated the GHG emission of food at the « place of purchase ». They used the GEMIS model (Globales emission model for integrated systems) (Tab. 7).

Tab. 7GHG impact of food products at retailer level (g $CO_{2\text{-eq}}$ kg^{-1})

	Conventional	Organic
Vegetable (fresh)	150	127
Vegetable (tinned)	509	477
Vegetable (deep frozen)	412	375
Potatoes (fresh)	197	136
Fried Potatoes (deep frozen)	5,714	5,555
Tomatoes (fresh)	327	226
Bread	655	547
Cookies	931	831
Poultry (fresh)	3,491	3,033
Poultry (deep frozen)	4,519	4,061
Beef (fresh)	13,303	11,371
Beef (deep frozen)	14,331	12,398
Pork (fresh)	3,247	3,038
Pork (deep frozen)	4,275	4,064
Butter	23,781	22,085
Yoghurt	1,228	1,156
Cheese	8,502	7,943
Milk	938	881
Curd (fresh)	1,925	1,801
Cream	7,622	7,098
Eggs	1,928	1,539

Source: Fritsche & Eberle Conclusion

Organic farming has an advantage in less GHG emission per hectare. The prohibition of mineral fertilizer, chemical pesticides and restrictions in concentrate feed led to lower yields per hectare. Therefore the advantage of organic farming in lower GHG emission is not clear yet. Without doubt, the primary energy utilization is a clear difference between organic and conventional farming. Obviously there is an overlapping of the impact of organic and conventional farming systems in GHG emission. Best practice is necessary to avoid too high emissions. Organic farming cannot claim much less GHG emission and must develop organic farming systems to identify main sources of emissions and to reduce them. Science can help. Action fields are:

- optimised nutrient management
- improved seeds and breeds (higher yields, more resistance crops, water and nutrient efficient)
- better machine utilization
- reduced cropping measures (no/less tillage systems)
- improved dung storage and application techniques
- improved plant protection
- optimized feedstuff rations for animals (especially ruminants)
- renewable energy technology
- improved processing and trading
- changes in consumption habits

Research project „Climate effects and sustainability of organic and conventional farming systems - examination in a network of pilot farms“ Because it is still unclear if lower productivity of organic systems in general has adverse effects on the GHG balance of the products, a Germany-wide study started in 2009. Representative assessments on 40 organic and 40 adjacent and comparable conventional farms in four German regions (North: coastal region, maritime climate; East: continental climate, large farm structure; South: Alpine grassland farms and productive areas in the pre-alpine region; West: low mountain areas, Lower Rhine Basin, continental climate) will be assessed in 2009 – 2012 for GHG emissions. The study considers soil, plant production, animal husbandry and manure handling. Half of the pilot farms (20 organic and 20 conventional farms) are dairy systems. The data are put into the models of REPRO (Hülsbergen et al. 2000) and GAS EM (Dämmgen et al. 2002).

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THE EFFECTS OF DIFFERENT PLANT NUTRITIONS ON ORGANIC LEEK (Allium ampeloprasum L.) SEED PRODUCTION

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ABSTARCT

The objective of this study was to compare growing of leek seed yield and quality in organic and convantional agricultural conditions. The effects of different organic plant nutritions combinations such as; green manure (GM), GM+farmyard cattle (FC), GM+FC+seamoss (SM), GM+FC+biostimulant (BIO), GM+humic acid (HA), GM+NPK, GM+olive mill compost (OMC) were searched on seed yield and quality properties of İnegöl 92 leek variety.

The effects of different plant nutrition on seed yield (kg/da), 1000 grain weight (g), number of 1 g seeds, (%) standard germination rate (%), controlled deterioration rate and (%) seed moisture contents were investigated. The results showed that, there were no significant differences between different plant nutrition treatments on organic leek seed yield and quality properties which are 1000 grain (3.2 g), number of 1 g seed (304.0-319.6), yield (76.5-91.5 kg/da), standard germination ratio (87.81-93.75%), controlled deterioration ratio (%81.81-89.00) and seed moisture contents (11,43-12,33%).

These all results were very important for showing no differences seed yield and quality between organic and conventional agricultural conditions. Because of that result, the Institute was firstly started organic certificated vegetable seed production in Turkey. From this point of view the results was encouraged us for starting organic seed production program at 7 vegetable specieses and 13 varieties in the Institute and planned same complicated research program on organic vegetable seed production.

Keywords: Organic seed, vegetable, leek (*Allium ampeloprasum* L.)

INTRODUCTION

Seed production has been done in Atatürk Horticultural Research Institute since 1974 in vegetable department. 33 different open pollinated vegetable varieties have been developed by classical breeding programs and certificated seed production is done on this varieties in this department by the department stuffs. The obtained seeds are sold to growers, private seed companies and researchers. Organic agriculture studies were started at the Institute in 1998 for getting data on organic fruits and vegetable production for growers who want to start organic farming. Past twelve years good data were got out on fresh fig, kiwi fruit, strawberry, tomatoes, spinach and leek production [11]. The vegetable department stuffs integrated all experiences and started the first organic vegetable seed production programme on tomatoes (cv. Invuctus Lot 335). Seed production season is longer than fresh vegetable production season. This time is twice longer for the biennial plants as leek. Leek whole life cycle is completed in 12-14 months [19] [10] [13]. As a result, plant diseases and insects have more time to attack the crop during seed maturation [16]. For these reasons, organic certificated seed production improvement very slow and the number of vegetable species which can available organic seed is very low at the practice [12]. Seed yield, 1000 grain weight, seed number per see of 1 g properties are used for yield quality in the seed production [23]. Standard germination ratio (%), controlled deterioration test and moisture content (%) characters are used for determining of seed quality [18].

Seed yield is changeable depend on variety, plant density, growing condition and nutrition source in leek. Leek seed yield is 60 kg da^{-1}, seed number per seed of 1 g is 350-400 and standard germination ratio is 30-90 % [10] [17]. 1000 grain weight of leek seed is 2.2-5.0 g and seed yield is 40-80 kg da^{-1} in South Marmara Region [21].

The aim of this study was to characterise organic leek seed production by selected parameters of seed quality and yield in the South Marmara Region where mainly fresh leek and seed production is realized in Turkey.

MATERIALS AND METHODS

Experiment was conducted in the organic field of Atatürk Central Horticultural Research Institute in Yalova stated in south of Marmara Region. The cultivar was used İnegöl 92 which is widespread and well adapted in this region. It is an open pollinated variety and suitable for fresh consumption and processing industry. Fava bean (*Vicia faba* L.), Eresen-87 cv. was used as a green manure (GM) plant, 20 kg da^{-1}.

The soil analyses was done before sowing fava bean on 12 Nowember/2004, cut and mixed the soil at 25-40%flowering stage on

13 April 2005 [1]. The soil samples were taken for determining soil structure from the experiment field before treatment of plant nutrition. At the soil analysis, the following parameters were determined: pH, in water ratio 1:2,5 [3], EC was measured at the same water ratio by the EC meter, the organic matter (OM) by the modifier Warkey-Black method [4], assailable P_2O_5 by the Olsen method, changeable K_2O and $CaCO_3$ by the [2] protocol. These analyses were done the Institute plant nutrition and soil laboratory and values are given Table 1. The experiment was planned in Randomized Block Design with 4 replications. A parcel area was 8.25 m^2. Plant density was 15 plant per m^2. Three plant rows ordered at the parcel and the middle raw's plants were used for measuring and tests.

The doses and quantity of the plant nutritions are at the Table 2. Inorganic N was treated as Ammonium Sulfate (AS) form before plant transplantation and Ammonium Nitrate (AN) form after 45 days of transplantation. Inorganic P was treated Triple Super Phosphate (TSP) form and Inorganic K was treated Potassium Sulfate (K_2SO_4) before the transplantation. Farmyard cattle (FC) was treated after GM mixing in the soil on 12 May 2005. Seamoss (SM) and Biostimulant were treated after 20 days of transplantation and repeated each after 20 days until seed maturity time. Humid acid was treated before transplantion in the soil.

Year	pH	OM (%)	P_2O_5(ppm)	K_2O (ppm)	$CaCO_3$ (%)	EC (mmhoscm^{-1})
2005	7.8	2.4	26.5	261.0	-	0.14

Table 1. Soil analyses results in the organic seed production of leek trials before plant nutrition treatments

OM: Organic matter, **EC:** Electrical conductivity

Treatments	Inorganic NPK	FC (tons da^{-1})	OMC (tons da^{-1})	SM (g da^{-1})	BİO 250 (cc da^{-1})	HA (kg da^{-1})
Doses	AS 22,5 kg da^{-1} AN 22,5 kg da^{-1}	4,5	3,6	70	20	10
	TSP 15 kg da^{-1}					
	K_2SO_4 10 kg da^{-1}					

Table 2. The doses and quantity of the plant nutrition are at the trial (2005)

In the study, the seed to seed method was used [10]. The seeds were sown in the seedling in pasteurized soil by vapor on 10 June 2005. Hand irrigated system was used and during the growing of leek seedlings, the foliage of young plants was cut twice for getting thick and strong pseudostem before the transplantation to the field. The young plants were attacked by *Thrips tabaci*. Laser (Spinoza effected substance) which is an organic certificated prepared was used for prevented carrying of trips to the field. Transplantation is done on 20 July 2005. Weed control was done manually.

The mature seeds harvest was done twice on 25 August and 1 September 2006 when mature umbels showed a third of open and come out the seeds naturally. All drying processes of the harvested umbels were completed according to Turkish Organic Farming Legislation [9]. Cleaning of seeds was done manually and carefully for protecting mixing of the treatments and replications seeds. Seed yield parameters as seed yield (kg da^{-1}), 1000 grain weight (g) and seed number per seed 1 g were determined by ISTA specifications [6]. Standard germination tests (NST) were done ISTA protocol [7]. Four replicates of 100 seeds were sown in petri dishes and kept at 20°C for fifteen days. On the final day, normal and abnormal seedling were counted according to ISTA specifications [7] and were expressed as a percentage. Controlled deterioration tests (CDT) were designated by ISTA specifications [5]. Two replicates of 1.0g seed per treatment were adjust to 19% MC (moisture content) using the filter paper method heat sealed in aluminium foil packets, and equilibrated at 10˚C for 24 hours. Then seed samples were deteriorated in a water bath at 45˚C for 24 hours. Following the ageing period, seeds were germinated as standard germination test. Seed yield trials was done in Atatürk Horticultural Research Institute vegetable laboratory in Yalova and seed quality trials were realized in Aegean University Seed Technology Application and Research Institute laboratory in İzmir. Statistical Analysis; ANOVA and Duncan's multiple range test with a 95% confidence interval ($P <0.05$) was used to compare the means of all treatments.

RESULTS

The seed yield was found changeable depend on treatments of plant nutritions (76.5-91.5 kg da^{-1}), but the statistical differentiates is not significant (Table 3). The highest yield was obtained from GM+NPK and the treatments GM+FC+BİO, GM+FC and GM were followed it. The lowest seed yield was got from GM+HA (76.5 kg da^{-1}). The statistical differentiates was not found significant between plant nutrition on 1000 grain weight (3.2-3.3 g) and seed number per seed of 1 g (304.0-319.6) properties. Normal standard germination rate was found between 85.12-91.31%. The highest NST rate was got GM+HA and the lowest GM+NPK (Table 3). Abnormal standard germination rate was changed between 2.43-3.94% and total standard germination rate was 93.75-87.81% depend on different plant nutrition treatments. Controlled deterioration test values were found between 76.8-85.83%. Seed moisture content values were determined between 11.70-12.05%. The statistical differentiates was not found significant between seed quality parameters (Table 3).

Treatments		GM	GM+ FC	GM+FC+ BİO	GM+ FC+SM	GM+ NPK	GM+ HA	GM+ OC	CV (%)
Seed Yield (kg/da)		87.2	88.0	88.9	83.5	**91.5**	76.5	84.6	14.27
1000 seed weight (g)		3.2	3.3	3.3	3.3	3.3	3.2	3.2	3.54
Seed number per seed of 1 g		319.6	313.2	310.3	304.0	305.0	309.8	312.4	2.75
Standard germination (%)	Normal	86.43	85.69	88.87	88.06	85.12	88.68	**91.31**	3.99
	Abnormal	3.00	3.94	3.19	2.69	2.75	2.75	2.43	40.56
	Total	89.31	89.62	92.06	90.75	87.81	91.43	93.75	
Controlled deterioration test (%)	Normal	79.25	76.08	80.42	83.94	78.90	80.94	**85.83**	6.37
	Anormal	5.19	5.72	4.35	4.12	4.18	4.14	3.17	39.57
	Toplam	84.43	81.81	84.77	88.06	83.08	85.08	89.00	
Moisture content(%)		11.95	12.05	11.70	11.89	11.81	11.96	11.82	2.43

Table 3. Seed yield and quality properties values

DISCUSSION

Seed yield of all plant nutrition was determined between 76.5-91.5 kg da $^{-1}$. The lowest seed yield was found GM+HA treatment but this one also higher than average leek seed yield (50-90 kg da $^{-1}$) [16], similar to the result was taken in South Marmara region (70-80 kg da $^{-1}$) [21] and a little lower than (78.4 kg da $^{-1}$) [20] 1000 grain weight was found 3.2-3.3 g and slightly lower than those obtained by [20]and higher than the results reported in Denmark in a organic seed production (2.7 g) [14]Seed number per seed 1 g property was obtained 304.0-319.6. This value is slightly between limits of [22] (310-380) and lower than the limits of [10] (350-400). This mean is that the per seed size was found bigger in this study (Table 3). The NSG values are higher than 75% [17] slightly higher 72.5-87.7% [14], and slightly lower than 93.4% [20]. All values of normal controled deterioration were found higher than [17] and this is the lowest limit for the original seed certificate system for leek [8]. The seed moisture content is very important for determining of seed storage quality and the suitable seed moisture content is 10-12% before the storage [15]. Seed moisture content of all plant nutrition treatment are between this limit without GM+FC that was found slightly higher (12.05%) than [15]. These all results were very important for showing no differences seed yield and quality between organic and conversional agricultural conditions. Because of that result, the Institute was firstly started organic certificated vegetable seed production in Turkey. From this point of view the results was encouraged us for starting organic seed production program at 7 vegetable specieses and 13 varieties in the Institute and planned same complicated research program on organic vegetable seed production.

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LOCAL ORGANIC WASTES AS GROWING MEDIA FOR ORGANIC CUCUMBER AND TOMATO TRANSPLANTS

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ABSTRACT

Local organic wastes can be used as media for transplant production. An experiment was carried out to investigate the possibility of incorporating composted licorice root, palm leaf coir and cocopeat in different combinations with perlite and vermicompost plus organic fertilizers for organic cucumber and tomato transplant production. Results were compared to commercial mix (80% peat moss + 20% perlite) as control. Treatments had significant effects on germination percent and rate, height, stem thickness, number of leaves, leaf area, aerial wet and dry weight, and concentration of N, P and K in aerial parts in cucumber as well as tomato except for its germination percent. The most economical and best combination were obtained from palm leaf coir (60%) + perlite (20%) + vermicompost (20%) plus organic fertilizers, according to the final transplant characteristics, concentration of N, P and K in aerial parts, and stand establishment.

Keywords: Vegetable transplant, Palm coir, Organic waste, Tomato, Cucumber

INTRODUCTION

Organic agricultural wastes could be difficult to dispose if those are in big quantities. Proper management may help to solve this issue. One of the best known methods is to compost and utilize them as media and soil amendments [1]. Organic vegetable production involves using organic growing media, seed and transplant. Organically grown transplants required are rarely commercially available and are usually produced on-farm from locally available, inexpensive substrates [3]. Proportion of each component in a mix may affect the physical and chemical properties of media, seedling characteristics and stand establishment.

MATERIAL AND METHODS

In order to evaluate the possibility of using local organic wastes as organic vegetable transplant production media, an experiment was carried out incorporated composted licorice root and palm leaf coir in different combinations with perlite and vermicompost plus organic fertilizers for organic cucumber (*Cucumis sativus* cv. Khassib) and tomato (*Lycopersicon esculentum* cv. Thuraya) transplant production (**Table 1**).

Table 1. Composition of media components (%) using different organic substrates.

Media	Perlite	Palm leaf coir	Vermi-compost	Composted Licorice root	Peat moss	Organic fertilizer*1	Chemical fertilizer*2	Comments
A1	20	-	-	-	80	-	+	Control
A2	20	80	-	-	-	-	-	
A3	20	80	-	-	-	+	-	
A4	20	70	10	-	-	-	-	
A5	20	70	10	-	-	+	-	
A6	20	60	20	-	-	-	-	
A7	20	60	20	-	-	+	-	
A8	20	70	-	10	-	-	-	
A9	20	70	-	10	-	+	-	
A10	20	60	-	20	-	-	-	
A11	20	60	-	20	-	+	-	

* Applied after two-leaf stage.
1 SeaMagic (Ocean Seaweed Co. Canada) + Delphan Plus (Trade Corp. Spain) + Vitorg (Green Co. Italy)
2 NPK (20:20:20) + Trace elements

RESULTS AND DISCUSSIONS

According to results, leaf number, leaf area, aerial fresh and dry weight, and concentration of N, P and K in aerial parts in cucumber and tomato transplants were significantly higher in A7 combination (palm leaf coir (60%) + perlite (20%) + vermicompost (20%) plus organic fertilizers) than other organic media but not the control (**Figure 1**).

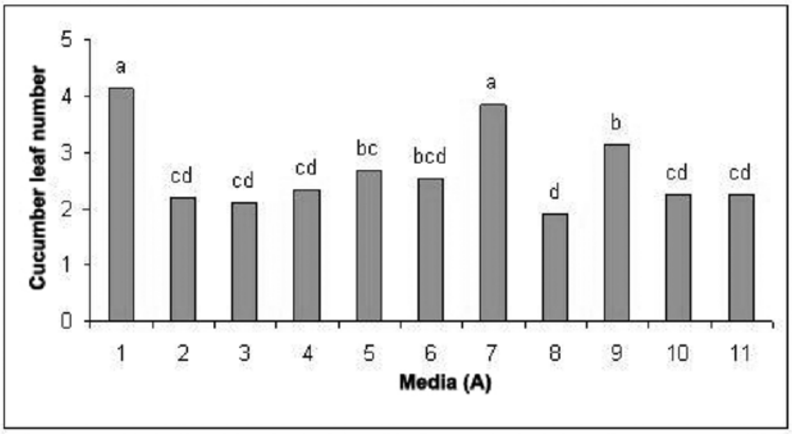
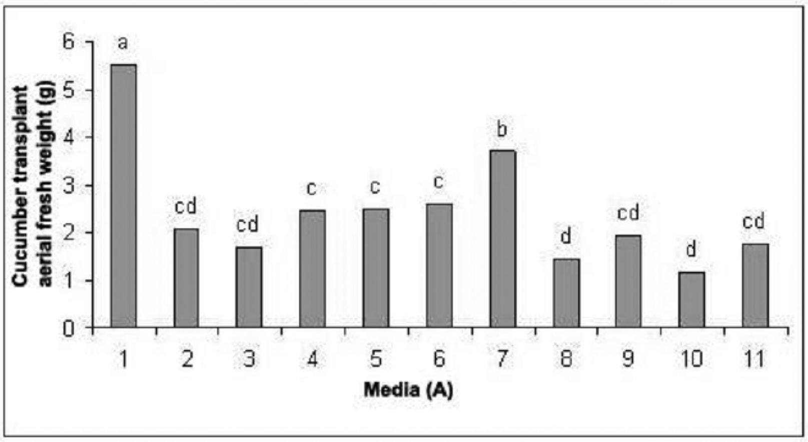


Figure 1. Effect of media composition on cucumber transplant leaf number (above) and fresh aerial weight (below).



As previously shown [2], vermicompost may improve the quality of organic media mixture. It has been shown that 10-20% vermicompost in a mix may support transplant nutritional requirements [4]. Since the A7 mixture has optimum C/N ratio, higher soluble solids, total nitrogen, phosphorus and potassium than other combinations, more quality cucumber and tomato transplants are produced.

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AN ORIGINAL SANITATION TECHNIQUE FOR THE MANAGEMENT OF PESTS IN ORGANIC AGRICULTURE IN REUNION ISLAND

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ABSTRACT

In Reunion Island, Tephritid Fruit Flies are the main pests of fruit and vegetable crops, causing severe yield losses in Organic Farming. Instead of the curative approach to reducing existing populations, this study focused on an original technique of sanitation utilising a tent-like structure called an "augmentorium" aimed at controlling Tephritid Fruit Flies. This structure sequesters adult flies emerging from infested fruit while allowing the parasitoids to escape, via a net placed at the top of the structure. The study tested different net mesh sizes in the lab in order to include the most effective one in an augmentorium prototype adapted to the conditions of Reunion Island. The efficacy of the mesh finally retained in the tests (hole area 1.96 mm²), proved to be perfectly effective with 100% of sequestration of adult flies (*Ceratitis capitata*, *Bactrocera cucurbitae*, *Bactrocera zonata*). In addition, 100% of the parasitoids (*Fopius arisanus* and *Psyttalia fletcheri*) could escape from the mesh if they choose to do so. Organic farmers were enthusiastic about using the augmentorium prototype. Implications for the use of augmentorium in Reunion Island are discussed.

Keywords: augmentorium, sanitation, pest management, organic farming, Tephritidae, Reunion Island

INTRODUCTION

Fruit Flies (Diptera, Tephritidae) are one of the most dangerous groups of pests of Agriculture around the world [1] [2] [3]. In Reunion Island, they are the main pests of vegetable and fruit crops [4] [5]. Three species attack Cucurbitaceae: *Bactrocera cucurbitae* (Coquillett, 1899), *Dacus ciliatus* Loew, 1862 and *Dacus demmerezi* Bezzi 1917). One is a pest of Solonaceae: *Neoceratitis cyanescens* (Bezzi, 1923). Some attack fruits (mango, *Citrus*): *Bactrocera zonata* (Saunders, 1842), *Ceratitis rosa* (Karsch, 1887), *Ceratitis capitata* (Wiedemann, 1824) and *Bactrocera catoirii* Guérin-Méneville, 1843.

In cucurbit crops, the damage from the flies can reach 100% of the yield [6] and chemical protection, which has been used now for a few decades, is no longer effective [7]. Furthermore, chemical control has some collateral and negative effects on health, biodiversity (particularly on natural enemies and pollinators) and the environment. For this reason, the two most important parasitoids of Fruit Flies established in Reunion Island, *Psyttalia fletcheri* (Sylvestri) and *Fopius arisanus* (Sonan), currently have a limited impact [8] [9].

There is now a demand for sustainable pest management and the approach of agroecological crop protection looks relevant in agroecosystems [10]. Based on three main components, sanitation, habitat management and biological control, agroecological protection is convergent with the point of view of sustainability much sought-after in organic farming [11]. Preventive measures against pests, such as prophylaxis, are welcome by organic farmers, especially because their spatial and temporal understanding is larger than the field and longer than the growing cycle of the crop. It is accepted that each infested fruit thrown on the ground is a source for the emergence of several tens of adult flies able then to infest the crop [12]. In this respect sanitation against Fruit Flies is one of the key techniques considered for the management of their populations [7].

This preventive approach has been studied in Hawaii against fruit flies [13], especially in the last decade by the use of augmentorium [14] [15] [16]. An augmentorium is a tent-like structure placed in a field. Farmers can regularly drop infested fruit into it. The aim of the augmentorium is to sequester adult flies emerged from infested fruit while allowing the escape of parasitoids, via a net placed at the top of the structure. To implement the technique of the augmentorium in Reunion Island, a first basic prototype was recently designed [17].

In order to answer the current local demand from organic farmers, the aim of the present study was to measure the efficacy of the mesh of different nets, which plays a key role, against different species of fruit flies (for sequestration) and for different species of parasitoids (for release). This study is an original contribution to the knowledge of the efficacy of a new tool for sanitation available in organic farming. This study could also be a first step towards implementing sustainable pest management based on preventive protection in horticultural crops.

MATERIALS AND METHODS

The experiments were conducted in Reunion Island in the first half of 2008 in the laboratory and with the facilities of CIRAD in Saint-Pierre.

Technical selection of a net for the augmentorium

Preselection of the net. The dimension of the mesh of the net is one of the main keys for effectiveness of an augmentorium (i.e. sequestration of flies and escape of parasitoids). Taking account of the availability of nets on the market in Reunion Island, three types of nets were preselected for the size of the mesh. The net used in Hawaii was added as a standard in the experiment. The characteristics are the followings:
- mesh # 1. Availibility: Store Mr Bricolage, Saint-Pierre (Reunion Island), manufacturer reference 170551, glass fiber covered with PVC, sustainability index: 4, stated size 1 mm x 1.5 mm (grey);
- mesh # 2. Hawaiian standard mesh; availibility: Phifertex Wire Products Inc. (Tuscaloosa, Alabama); unknown manufacturer reference; glass fiber covered with PVC, unknown sustainability index, stated size 1.2 mm x 1.3 mm (grey);
- mesh # 3. Availibility: Store Déco et Jardin, Saint-Pierre (Reunion Island), manufacturer reference 171512, polyethylene, sustainability index: 2, stated size 1.9 mm x 1.9 mm (green);
- mesh # 4. Availibility: Store Mr Bricolage, Saint-Pierre (Reunion Island), manufacturer reference 174532, high-density polyethlene, treated with anti-UV additives, sustainability index: 3, stated size 1.9 mm x 1.9 mm (green). Mesh # 2 and mesh # 4 have the same stated size, but the mesh forms are different. Figure 1 shows pictures of the four mesh nets tested.

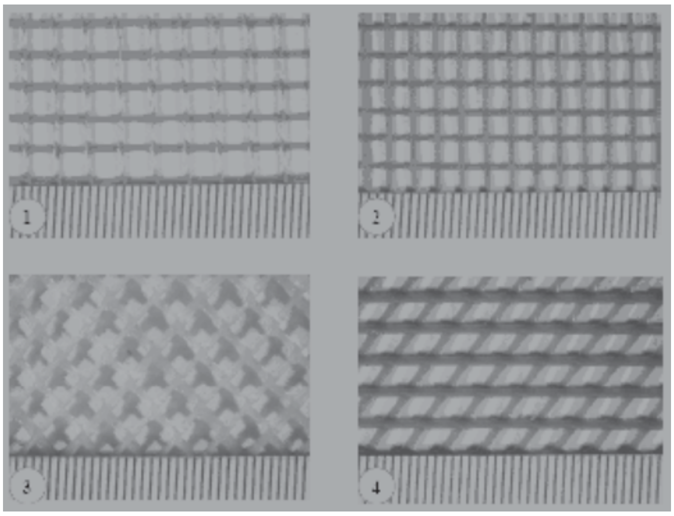

Figure 1. Different mesh sizes pre-selected for the experiment (scale: 1 graduation = 0.5 mm)

Measurement of the size of the mesh of the net. The mesh of the four types of nets was observed with a binocular microscope and was photographed. The area of the mesh hole was measured by length and by width using Adobe Photoshop software (CS3 version).

Technical ranking of the net. The four types of mesh nets were compared using 5 technical indicators: dimension of mesh (area of the mesh hole), rigidity of the mesh and mecanical resistance, availability of the mesh (facility to locally find and buy the net), cost of the net, colour of the mesh (the colour can influence some biological parameters). The objective was to compare the 4 types of mesh using these indicators. For each mesh, each indicator was marked on a scale from 1 (very bad), 2 (bad), 3 (average), 4 (good) to 5 (very good), using the Hawaiian mesh demonstrated to be effective there [15] [16] as the standard.

Biological material

Flies. Three species of Tephritidae (*B. cucurbitae*, *C. capitata*, *B. zonata*) reared in Cirad laboratories were used for experiments. The two *Bactrocera* species were considered because they are the most dangerous species on vegetables and fruits respectively, *C. capitata* because it is the smallest Tephritid species present in Reunion Island (i.e. if this fly cannot pass through the mesh, all the other species of flies cannot also pass). Pupae of wild flies were collected in June 2000 from infested fruits. Adult flies obtained from these samples were reared under controlled conditions: 25 ± 2°C, 70 ± 20% RH, and a photoperiod of 12:12 (L: D) h. They were given free access to granulated sugar, enzymatic yeast hydrolysate (ICN Biomedicals, Aurora, OH) and water. Three times a week, for 1 h, fruit (different

according to species of flies), were used as an oviposition substrate. The fruit were then placed in a plastic box (6 cm x 9 cm x 18 cm), containing dehydrated potatoes. The plastic box was placed inside a larger plastic container (25 cm x 12 cm x 8 cm), the bottom of which was covered with a layer of sand to allow pupation of mature larvae. The pupae were then collected, and, from the beginning of emergence, adults were kept in 40 cm x 40 cm x 40 cm cages.
Parasitoids. Colonies of parasitoids (*Psyttalia fletcheri* and *Fopius arisanus*) were established in 2003 in the CIRAD Reunion Entomology Laboratory from a batch of parasitized fruit fly pupae. Emerging adults were subsequently offered eggs of flies. The main colony was reared in a 110 cm x 60 cm x 60 cm plastic screened cage at 25 ± 2°C, 70 ± 20% RH and a photoperiod of 12:12 (L: D) h. The adults were given free access to water on a moistened sponge and to a mixture of honey/agar 15% (1:1). Both species of parasitoids (*P. fletcheri* and *F. arisanus*) reared in Cirad laboratory were used for the experiments.

Efficacy of the mesh for sequestration or escape of insects

Experimental device: In the lab, boxes with a top were covered with the mesh to be used to test the effectiveness of the four mesh types (figure 2). Each mesh box was placed in a larger cage in order to keep insects (flies and parasitoids) inside. Known numbers of pupae (un-parasitized pupae or parasitized pupae) were placed inside the mesh boxes before the experiments and the numbers of sequestrated or escaped insects were observed.

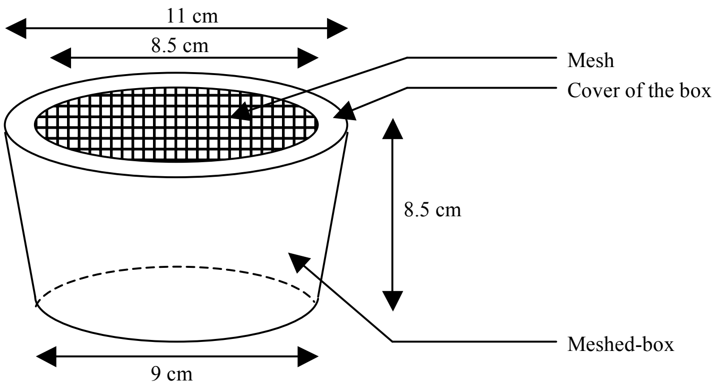

Figure 2. Mesh box used for efficacy assessment (fly sequestration, parasitoid escape)

Qualitative and preliminary tests. Two types of qualitative tests were performed before the quantitative tests. First, we wanted to verify that adults of *P. fletcheri* (the biggest parasitoid of the two studied species) could escape out of the box, with the four types of mesh. Two replications of this test were done and in each experiment, the number of *P. fletcheri* in the mesh box and the number of *P. fletcheri* in the cage were counted. Secondly, we tested the desire, or not, of flies and of the parasitoids to exit from a box with a large scale mesh covering (6 mm x 6 mm). Two replications were done with adults of each species of fly and parasitoid.

Quantitative tests on non-parasitized pupae of flies. For each fly species, four mesh boxes (one per type of mesh) were constructed. The four mesh boxes were placed in the same larger cage. For *B. cucurbitae* and *C. capitata*, 50 pupae were placed in each mesh box and there were two replications. For *B. zonata*, three replications were achieved, as there were more pupae available (100 for two replications, 200 for the third one). For each species, the numbers of flies retained (dead or alive), and the number of non-emerged pupae in the box were counted each day for three weeks. The number of flies which passed through the mesh could thus be calculated.

Quantitative tests on parasitized pupae of flies. Experiments were conducted on pupae of *B. cucurbitae* parasitized by *P. fletcheri* and on pupae of *B. zonata* parasitized by *F. arisanus.* For each parasitoid/fly pair, four types of mesh boxes were tested (one per type of mesh). Each mesh box was placed in a large separate cage. For each pair, three replications were achieved (two with 100 parasitized pupae and one with 250). The total number of emerged parasitoids in the mesh box and the number of parasitoids which escaped from the box were counted each day for three weeks.

Analysis and presentation of the results

The results for the technical mesh ranking, for the qualitative tests in the lab and for the quantitative efficacy of the mesh for sequestration of the three species of flies, are presented in figures or tables and statistical tests undertaken.

For the tests concerning the escape rate of parasitoids out of the mesh boxes, we fitted a Generalized Linear Model with Probit as a link function for each species of parasitoid ($f^{-1}(p)$ = mesh + replication). A like hood ratio test, based on a Chi-squared test, was performed to identify the significant factors. A Tukey's HSD test was then performed to find which mesh performances were significantly different. All tests were done with R software (version 2.7.0, R Development Core Team, 2008, Vienna, Austria).

RESULTS

Technical comparison of the nets and their mesh

Table 1. Mesh sizes (measured using Adobe Photoshop software, CS3 version)

Mesh	length (mm)	width (mm)	length of the diagonal (mm)	area of the hole (mm^2)
1	1.6	1.4	2.0	2.24
2	1.3	1.2	1.7	1.56
3	2.0	2.0	1.5	2.25
4	2.5	1.4	1.4	1.96

Table 1 gives the measurements of length, width, length of diagonal and surface of the mesh of the four types of nets. Table 2 shows a comparative analysis of technical and economic parameters for the 4 mesh types. For these parameters, the fourth net (rank 1) represented the best compromise: available, cheap, size, good general quality.

Table 2. Technical and economic characteristics of the four tested nets and overall rank of interest. 1 (very bad), 2 (bad), 3 (average), 4 (good), 5 (very good)

Technical and economical characteristics	mesh #1	mesh #2	mesh #3	mesh #4
size of the mesh	3	5	4	5
rigidity of the net	3	4	3	4
availability of the net	5	1	4	5
quality/cost ratio of the net	4	2	3	5
overall rank	2nd	4th	3rd	1st

Efficacy of the mesh for sequestrating flies

The qualitative tests showed that each species of fruit fly tested could escape out of the mesh box with large (6 mm x 6 mm) holes. The results of the different quantitative tests of sequestration of the three species are presented in table 3. No statistical analysis of these results has been done because the rate of sequestration was 100% in all cases. The four mesh types were equally effective in sequestering *B. cucurbitae* and *B. zonata*, the most dangerous species in vegetable and fruit crops respectively. The perfect efficacy obtained against *C. capitata* implies that the mesh nets are also effective against the other fruit fly species present on Reunion Island (because *C. capitata* is the smallest one).

Table 3. Number of pupae, flies emerged from pupae and non-escaped flies for each fly species, replication and mesh. The date indicates the day when the pupae were placed in the box

Replication	Mesh	Date	Number of pupae per box	Number of flies emerged from pupae	Number of flies non-escaped	Percentage of sequestration
Bactrocera cucurbitae						
1	1	June 3rd (2008)	50	50	50	100
	2		50	50	50	100
	3		50	48	48	100
	4		50	50	50	100
2	1	June 3rd (2008)	50	50	50	100
	2		50	49	49	100
	3		50	48	48	100
	4		50	50	50	100
Ceratitis capitata						
1	1	May 21st (2008)	50	50	50	100
	2		50	45	45	100
	3		50	44	44	100
	4		50	46	46	100
2	1	May 21st (2008)	50	46	46	100
	2		50	50	50	100
	3		50	40	40	100
	4		50	43	43	100
Bactrocera zonata						
1	1	May 7th (2008)	100	78	78	100
	2		100	76	76	100
	3		100	80	80	100
	4		100	72	72	100
2	1	May 7th (2008)	100	76	76	100
	2		100	74	74	100
	3		100	68	68	100
	4		100	72	72	100
3	1	May 11th (2008)	200	152	152	100
	2		200	176	176	100
	3		200	156	156	100
	4		200	156	156	100

Efficacy of the mesh for releasing parasitoids

The eight qualitative tests done with *P. fletcheri* showed that if the parasitoids wanted to escape from one of the four types of mesh, they could. However, in the second type of qualitative tests, we noticed that sometimes they stayed in the mesh box, even those with large holes (figure 3).

Table 4 gives the quantitative results for the two species of parasitoid for each replication. The mean results are presented in figures 4 and 5.

Table 4. Number of parasitized pupae, parasitoids emerged from parasitized pupae and escaped parasitoids for each parasitoid/fly pair, replication and mesh. The date indicates the day the parasitized pupae were placed in the box

Replication	Mesh	Date	Number of pupae parasitized per box	Number of parasitoids emerged from parasitized pupae	Number of parasitoids escaped	Percentage of escape
Psytallia fletcheri/ Bactrocera cucurbitae						
1	1	May 2nd (2008)	100	47	12	25.6
	2		100	55	30	54.6
	3		100	24	18	75.0
	4		100	59	39	66.1
2	1	May 7th (2008)	100	48	8	16.7
	2		100	89	72	80.9
	3		100	90	48	53.3
	4		100	91	65	71.4
3	1	June 11th (2008)	250	190	136	71.6
	2		250	190	103	54.2
	3		250	197	140	71.1
	4		250	185	123	66.5
Fopius arisanus / Bactrocera zonata						
1	1	May 7th (2008)	100	3	3	100.0
	2		100	4	4	100.0
	3		100	2	2	100.0
	4		100	2	2	100.0
2	1	May 7th (2008)	100	14	12	85.7
	2		100	14	7	50.0
	3		100	19	18	94.7
	4		100	15	15	100.0
3	1	May 11th (2008)	250	30	29	96.7
	2		250	17	16	94.1
	3		250	30	22	73.3
	4		250	26	25	96.1

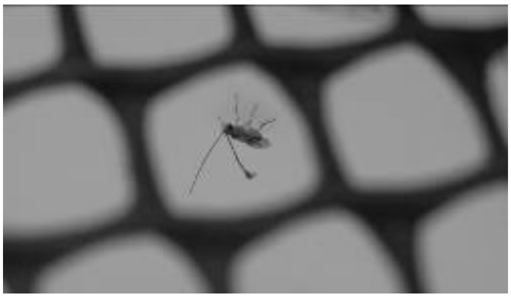

Figure 3. Adult of *Psyttalia fletcheri* at the bottom of the box seen through the 6 mm x 6 mm mesh

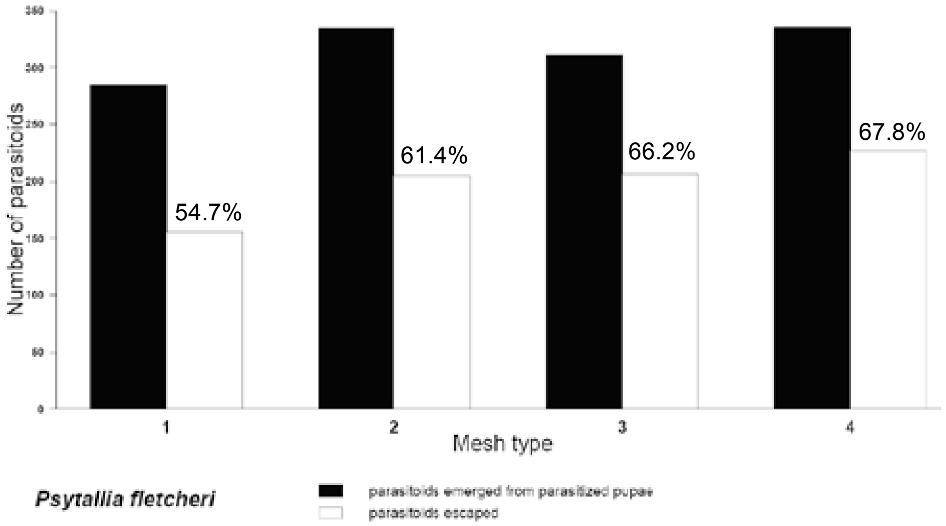

Figure 4. Total results (3 replications) of the effect of the mesh size on *P. fletcheri* escape: (i) number of parasitoids emerged from parasitized pupae of *B. cucurbitae* and (ii) number of escaped parasitoids. The percentage indicates the proportion between these two numbers (ii)/(i)

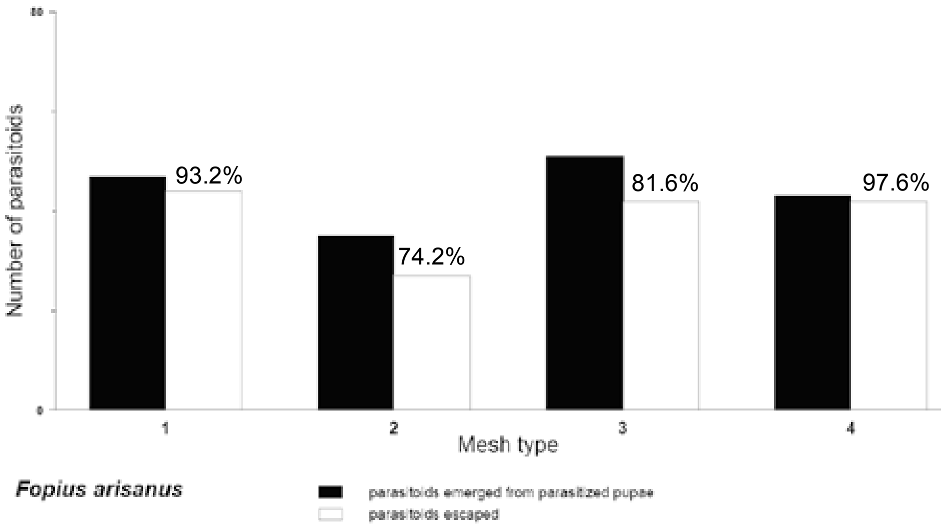

Figure 5. Total results (2 replications) of the effect of the mesh size on *F. arisanus* escape: (i) number of parasitoids emerged from parasitized pupae of *B. zonata* and (ii) number of escaped parasitoids. The percentage indicates the proportion between these two numbers (ii)/(i)

Statistical results are presented in tables 5, 6 and 7. The first replication of the *F. arisanus/B. zonata* pair showed a very poor rate of emergence of *F. arisanus* from the parasitized pupae of *B. zonata* (with a 100% escape) and was thus not taken into account in the statistatical tests. The GLM (table 5) shows a significant effect of the mesh for both the two parasitoid/fly pairs and a significant effect of replication for the *P. fletcheri/B. cucurbitae* pair.

Table 5. Generalized Linear Model results (Probit function: f^{-1} (p) = mesh + replication) of the mesh efficacy on parasitoid escape (3 replications for *P. fletcheri* and 2 replications for *F. arisanus*). df 1 and df 2: degrees of freedom; df 1 = (p-1) for the replication factor and (q-1) for the mesh factor; df 2 = (n-p) for the replication factor and (n-q-[p-1]) for the mesh factor with n = number of observations, p = number of modalities for replication factor, q = number of modalities for the mesh factor; ns: non significant; **: difference at 1% ($p < 0.01$)

factor	*Psyttalia fletcheri*					*Fopius arisanus*				
	number of factors	df 1	df 2	p-value	Signi ficance	number of factors	df 1	df 2	p-value	Signi ficance
replication	3	2	9	0.006	**	2	1	6	0.314	ns
mesh	4	3	6	0.003	**	4	3	3	0.008	**

The Tukey's test indicated the p-value and the significance for the mesh comparison, for the two pairs (table 6). Only three comparisons show significant differences (mesh #1 and mesh #3, mesh #1 and mesh #4 for the *P. fletcheri/B. cucurbitae* pair; mesh #2 and mesh #4 for the *F. arisanus/B. zonata* pair). In these 3 cases, mesh #4 gives better results.

Table 6. Mesh comparison by a Tukey's test for the efficacy on parasitoid escape. *: $p < 0.05$; **: $p < 0.01$

Comparison mesh to mesh	*Psyttalia fletcheri*		*Fopius arisanus*	
	p-value	significance	p-value	significance
2 – 1	0.275		0.135	
3 – 1	0.029	*	0.337	
4 – 1	0.003	**	0.785	
3 – 2	0.712		0.898	
4 – 2	0.282		0.037	*
4 – 3	0.905		0.098	

Finally the overall mesh efficacy differences are given in table 7 and the mesh types are classed by rank of efficacy.

Table 7. Mean results of the mesh efficacy on parasitoid escape, standard deviation and rank of the mesh types (3 replications for *P. fletcheri* and 2 replications for *F. arisanus*). "a" means that the corresponding mesh is significatively more effective than the mesh classed "b"

Mesh type	*Psytallia fletcheri*			*Fopius arisanus*		
	mean escape %	sd	rank	mean escape %	sd	rank
1	40.0	29.5	b	91.2	7.7	ab
2	63.2	15.3	ab	72.1	31.2	b
3	66.6	11.5	a	84.0	15.1	ab
4	68.0	3.0	a	98.1	2.7	a

To sum up, the results of all the tests (technical, sequestration of flies, escape of parasitoids) in these experiments led to the retention of mesh #4, which systematically showed the best performance. This mesh has a hole size closest to that used in Hawaii.

DISCUSSION

Designing an augmentorium prototype including the retaining net

The study suggested that net with mesh #4 be included as a component in a prototype of augmentorium. It is only one component of the augmentorium, but it is a key one. Indeed the characteristics of the mesh determine the efficacy of the technique.

However the other components of the augmentorium are not less important than the net. They mostly have to be adapted to the needs of the farmers in terms of cost and sustainability and to provide an environment adapted to the emergence of the parasitoids. Allowing us to retain a net compatible for sequestration of flies and release of parasitoids present in the island, this study contributed to design a prototype (figure 5), which is currently being tested by several organic farmers in Reunion Island.

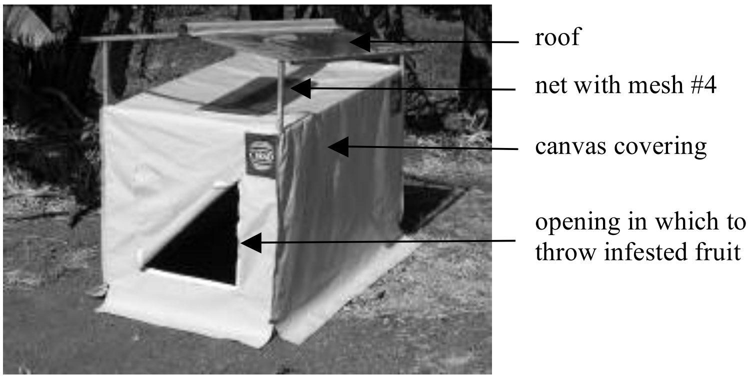

Figure 5. Augmentorium prototype designed in Reunion Island (see the net with mesh #4 on the top of the structure under the roof)

Towards the use of augmentoria in Reunion Island by organic farmers

In Reunion Island, recent collections of infested zucchini fruits in three locations between February and April 2009 indicated that several hundred adult flies could emerge per kilogram of infested fruit (Jacquard, 2009, personal communication). In these conditions, sanitation is important and this method of utilising damaged fruit appears to be relevant.

There are some other fruit fly sanitation methods available, such as tilling crop, burying fruit, bagging fruit, steeping fruit in water or feeding culled fruit to animals [14]. In practice, for vegetable and fruit growers, the use of a specific tool such as the augmentorium, placed in the field, is an important psychological argument to encourage them to really pick up the infested fruit which has dropped to the ground. A prophylactic measure using augmentorium may thus become the technique of choice for implementing the management of fly populations.

With experience, farmers may be able to integrate other techniques of crop protection, for example fly trap plants, sprays of adulticid protein baits (using biological insecticides) on the trap plants, male annihilation technique using mass trapping with sexual parapheromones, biological control and cultural practices, which are also relevant and effective when they are used together.

Augmentoria may also contribute to the management of other categories of pests in a global approach. To be effective, the augmentorium technique has to be used at a large scale both in terms of time (several months or years) and space (farm, landscape) with concerted practices by the farmers, who should use this sanitation technique integrated with other measures and especially with a reduction of chemical pesticide use.

Relevance of augmentorium for sustainable management of agroecosystems

We showed that the augmentorium can selectively release parasitoids. This technique may thus play a role to control populations of flies using natural enemies. In this respect, the mesh of the net is a determining factor permitting escape of the parasitoids.

Furthermore, augmentoria can perhaps be considered for use in augmentative biological control, by regularly placing parasitized pupae of flies in the augmentorium. Other techniques such as mass-hatching devices have been studied against other pests, in order to produce beneficials, and these have proved to be interesting [18].

Finally, another possible use of the augmentorium would be to produce compost, mixing infested fruit and other components such as vegetal residues, sugar cane stems, manure or litter of small animals. Currently studies are being carried out in this respect.

CONCLUSION

In conclusion, the study showed the efficacy of the retained mesh (hole area 1.96 mm^2), both for the sequestration of fruit flies and for the release of parasitoids. A prototype of an augmentorium has been designed using this net. Augmentoria can be considered as a recommended tool for sustainable protection against fruit flies, the major pests in Reunion Island. Finally, sanitation using augmentorium may become a vital component of agroecological protection against fruit flies, and it may play a central role in conservative biological control in Organic Agriculture for these fruit and vegetable species. It could be considered as a potential and significant tool of biological control by releasing parasitoids and could also be used to produce compost. These three potential roles of the augmentorium (sanitation, biological control, production of compost) gives to this technique a real relevance in agroecosystems where optimal ecological functioning of the agroecosystem is favoured and it is particularly adapted to most organic farming systems.

For these reasons this technique has already been adopted by some organic farmers. The practice fits well with their mentality (preventive crop protection without chemicals) and is compatible with the possibility of making compost using organic matter mixed with infested fruit. It could be envisaged that this "organic farming technique" could be adapted not only to the framework of the conventional agriculture, contributing to the replacement of pesticides, but also in fruit and vegetable gardens for citizens in towns and villages.

Further research is needed to demonstrate that the additive release of parasitoids from augmentoria into the farm can have measurable effects in the percentage of fruit fly infested fruit and to explore in detail these three ways in which potential benefits can be obtained and finally to propose to farmers an improved prototype of the augmentorium

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TECHNOLOGY FOR ORGANIC PRODUCTION OF SOYBEAN IN MACEDONIA

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ABSTRACT

Organic production within the EU is defined the Regulation, which recently replaced the old 2092/91.Although Macedonia is not yet a member of the European Union, тechnology for organic production of soybeans is harmonized according to the requirements of the EEC. This paper detailed how the techniques and principles of organic production of soybeans, as it can be implemented in production conditions in different agroecosystems conditions in Macedonia. The yields from the soybean grain which can be obtained in Macedonia through organic production, depending on conditions and methods of production from 1000 to 2500 kg/ha. This technology of agricultural production is based on the results of scientific research, knowledge and practical realization within the scientific and practical experiences. The data referred to in this paper, except from existing research and experience in the field of soybean breeding conducted with us, and are supported by data from foreign literature and results from this area.

Keywords: organic, soybean, production, yields, principles, technology

INTRODUCTION

According to the old Chinese literature, the first written information about soybean can be found in the book Materia medica from the tsar Sheng Nung from 2838 B.C. [11]. According to the written data of [1], soybean as agricultural crops is growing in China since 6-7 thousands years ago [3] [10]. The soybean together with the rice, wheat, barley and millet, was one of the five most important crops for the Chinese civilization. Development of the marine traffic in the 18th century, soybean has been spread to Europe and America. In Europe, for the first time, a German botanic Engelbert Kaempfer has spoken about it. After his trip to Japan, he wrote the book „*Amoenitatum exoticarum*". The book is published in 1712 and contains detailed description of the plants and recipes for preparation of different drinks and food [3] [5]. Charles Linne in 1737, in the book „*Hortus Califfortianus*" is mentioning soybean as *Phaseolus max*, and in 1753 in his famoust masterpiece „*Species Plantarum*" is describing soybean under the name Dolichos soja. Konrad Moench is naming it as, while Maksimovič in 1873 is giving the name *Glycine hispida*. Today worldwide the name *Glycine max* (L.) Merrill is accepted, recognized by Ricker and Morse in 1948 [citation in 6].

According to USDA [15], the world production of soybean is continuously increasing. Today the biggest soybean producer is USA with 38% and 86.8 millions tones from the total world production (228.4 millions tones) in 2006. The soybean as crop for oil production is leading as compared to the other oilseed crops with participation of 57% from the total plant oil production. Also, the soybean is culture with number 1 world consumption of protein food with participation of 68%.

The soybean is extremely important in human nutrition because of the special chemical composition of the grain as it contains approximately 30-50% proteins and 18-24% oil, depending of the variety and cultivation conditions. The commercial varieties averagely contain up to 40% proteins and 20-22% oils, 34% carbohydrates and about 5% mineral elements: potassium (K), phosphorus (P), sulfur (S), calcium (Ca), iron (F), magnesium (Mg) и sodium (Na). Also, the grain is rich with vitamins: A, B-complex, D, E and K. The proteins are rich in essential aminoacids, especially with lysine and methionine. These aminoacids are the most similar with the animal proteins, thus they have high biological value [8].

The soybean is commonly used as fodder, but in the last two decades more and more different products for human nutrition are spreading, as: cheese tofu, soybean milk, burgers, sausages, bread, different types of sweets and other products [16].

The possibility for acquiring medical and diet products from soybean for human consumption made soybean to be very attractive for organic production. Soybean is very important in the crop rotation because the plants are naturally enriching the soil with nitrogen that is stays available for the next crop. The particularity of soybean regarding nitrogen as compared to other cultures is in the ability through symbiosis with noodle bacteria to secure major part of this element. Because of this characteristic, the soybean is very favourable culture for organic production, where the application of chemical fertilizers is unacceptable. The soybean is utilizing soil nitrogen only in the period of phase VE (emerging) to the period of noodle formation at the root hairs, which is according to many authors the period of the first two to three weeks after the emerging. After it the greatest part of the needs is utilised from the atmospheric nitrogen. In conclusion the needs of nitrogen fertilization are very small and necessary only in the first month of vegetation when the plants are small and the utilization is low, if symbiotic nitrogen fixation is provided. The soybean with symbiotic nitrogen fixation can fixate important quantity of nitrogen as up to 40-50 kg/ha [12]. Increasing the number of organic farms and debating for increase of energy prices, these "free of charge" natural ways of fertilization are coming back to the research centre of many scientists and organic farmers.

The aim of soybean yield utilization (green grain, mature grain, raw material for human nutrition, raw material for fodder, green manure etc) is of main importance for making the decision for soybean organic production. The previous conditionally depends on agriecological characteristics of the area where soybean cultivation is planned, irrigation possibilities, location and size of agricultural plots, agricultural mechanization etc [9].

MATERIAL AND METHODS

Climatic conditions

The mean monthly temperatures for the location Ovche Pole differ for 2006 and 2007 (Figure 1 and 2). For all months in 2007 the temperature was higher or equal with those in 2006. Mean annual temperature was also differing, for 2007 is 13.02°C, while for 2006 is 11.54°C. During the vegetation period (May – September) the values of mean monthly temperatures were higher in 2007 as compared to 2006. The analyses of precipitations show that great differences exist in the two research years for the location Ovche Pole (Figure 1 and 2). In the second year, 2007, the precipitations were two times higher (457 mm) as compared to 2006 (185.9 mm). However, in the critical vegetation period for soybean (flowering, pod formation) in July 2007 there is no rainfall. From the clime diagram (Figure 1) it is clear that the period from July to November is arid for the location Ovche Pole.

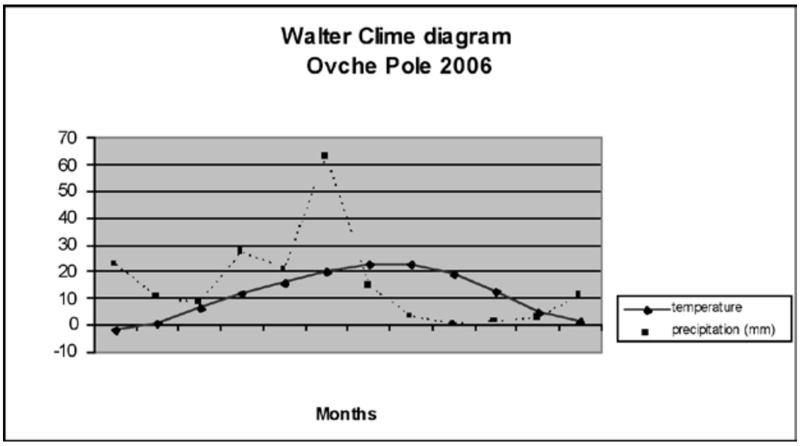

Figure 1. Walter clime diagram for Ovche Pole, 2006.

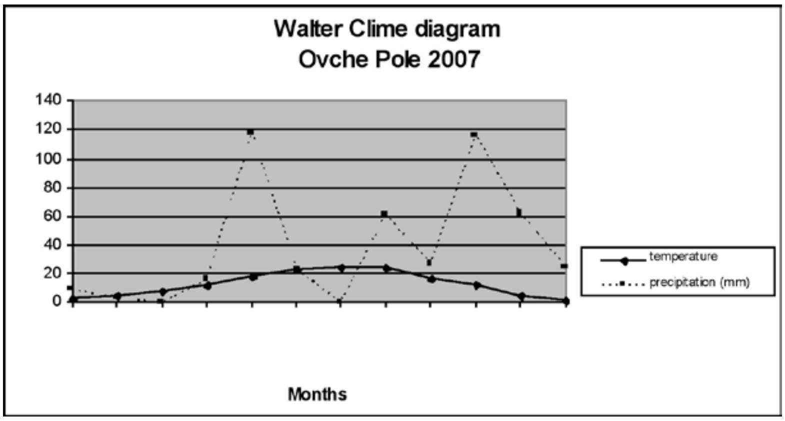

Figure 2. Walter clime diagram for Ovche Pole, 2007.

The mean monthly temperatures for the location Strumica differ in 2006 and 2007 similar as at the first location (Figure 3 and Figure 4). The values of mean monthly temperatures in 2007 are higher almost for all months, as in the vegetation periods. Mean annual temperature values are also different. In 2007 it is 12.8°C, while in 2006 was 14.1°C. In July 2007, maximum mean monthly temperature of 28°C is noted. At the location Strumica, the analysis of monthly precipitation shows higher values (623.9 mm) as compared to 2007 (537.4 mm). Nevertheless, these differences are not as extreme as it is for location Ovche Pole. As at the first location, the most critical month regarding the rainfall in 2007 is July (0.3 mm).

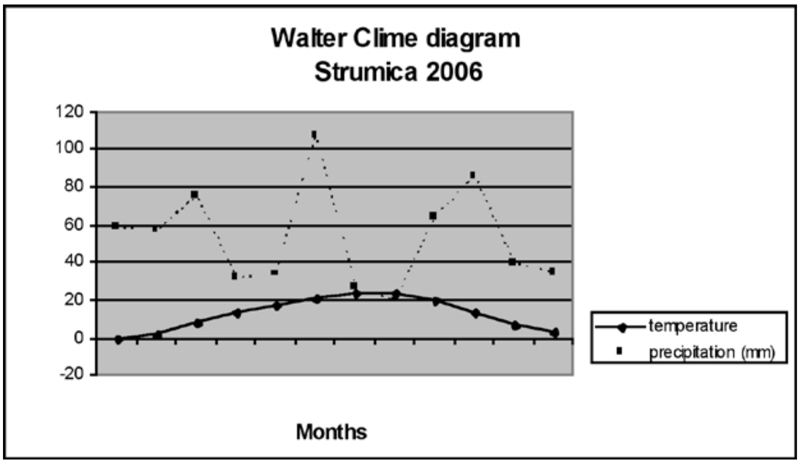

Figure 3. Walter clime diagram for Strumica, 2006.

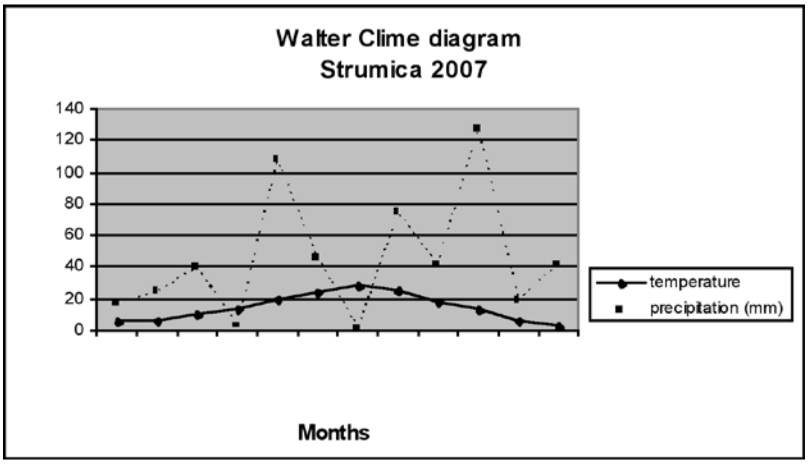

Figure 4. Walter clime diagram for Strumica, 2007.

If an experiment is conducted for one year and at one location the results will not be reliable and significant. Conducting experiments for more years and location is of highly importance for evaluation and breeding of varieties with wide adaptability [7]. Grain yield is the most important quantitative characteristic in soybean production (*Glycine max* (L.) Merrill) which depends of the genetic potential and the environmental conditions of growing [14]. Each environment is specific because there is specific action of predictable and unpredictable factors [citation in 13]. The field experiments are conducted on the trial fields that have been passed the organic conversion period at Faculty of Agriculture in Strumica and Poledelstvo, Erdzelija (Ovche Pole). The trial fields at both of the locations were under irrigation system. The sowing was performed in the beginning of May 2006 and 2007, at the both locations. The experiment design is randomized block system with basic trial field of 12.5 m^2. The 6 tested varieties are in 00/0, I and II maturation group in two agriecological different regions in Republic of Macedonia (Ovche Pole and Strumica). In Ovche Pole the trial field was at 230 m altitude, soil type smolnica and two years wheat as pre-cropping culture. In Strumica the soil is mild carbonate with low acid pH reaction.

Two basic factors are analysed, the first one is different soybean varieties and the second is different agriecological regions for growing (Ovche Pole and Strumica). The basic and before sowing plowing were standard, on time and in the same manner during the two experimental years, at the both regions.

The sowing was performed manually, where the distance between rows was 50 cm and 5 cm within the row, i.e. 400.000 plants per hectare. Before sowing, the seeds of all used varieties were inoculated with biological concoction prepared from nitrogen fixation bacteria (*Bradyrhizobium japonicum* spp.). The following soybean varieties were examined:

(1) Ilindenka – is the first Macedonian soybean variety, recognized by the State Committee for varieties in 2004, II maturation group, 135 to 140 days vegetation length

(2) Pela – is the second Macedonian soybean variety, recognized by the State Committee for varieties in 2004, 00/0 maturation group, 90 to 100 days vegetation length

(3) Daniela 97 – Bulgarian variety, I maturation group, 125 to 135 days vegetation length

(4) Pavlicheni 121 – Bulgarian variety, 125 to 135 days vegetation length

(5) ZPS015 – Serbian variety, 0/I maturation group, 115 to 125 days vegetation length

(6) Delta – Canadian variety, maturation group 0/I, 120 to 125 days vegetation length

During the vegetation, 2 manual cultivations between rows were performed, the first one in phase (V_1- V_2), developed simple leaves, and one to two pairs triple leaves, and the second one in the phase (R_1) beginning of flowering. The first furrow irrigation (50 l/m^2) was conducted in the phase (R_3), beginning of pod formation, (different calendar schedule for varieties from different maturation group), and the second irrigation with the same irrigation norm at the phase (R_5- R_6), beginning of seed formation and their development. In the period between two irrigations the plants are foliar fertilized with biological liquid fertilizer based on dissolved humus from Californian Red Worms (*Lumbricus rubellus*), – Bioflor [18]. There were no any pathogens and pests during the vegetation period of soybean crop during the two years of cultivation. The harvest was conducted manually in the phase (R_8), full maturation which is different for different varieties that belong in different maturation groups. After the harvest, the yield (kg/ha) and grain quality characteristics were analysed. Grain quality was determined on average grain sample in laboratory. Protein content in the grains was determined according to Kjeldhal method, while the oil content according to method of extracted oils with Sokslet apparatus. All data were statistically analysed according to the method of variance analysis (ANOVA) and LSD test for evaluation of significant differences. As indicators of variability of tested characteristics for repetitions, locations and years, the following parameters were calculated: average value ($\overline{x}$), average value error (S $\overline{x}$), standard deviation (s).

RESULTS AND DISCUSSION

Grain yield is the most important characteristic in soybean breeding (*Glycine max* (L.) Merrill), which depends on the genetic potential and the environmental conditions of soybean growing [14]. The organic cultivation is often followed with stresses; the difference in yield from different genotypes is depending not only on genetic components but also on different abilities for their replenishment [2].

Table 1. Soybean grain yield in kg/ha from 6 tasted varieties at two locations for two years according to organic production criteria.

Region		Variety						Average
		Ilindenka	Pela	Daniela 97	Pavlicheni 121	ZPS 015	Delta	
Ovche pole	2006	2840	1260	2500	1690	1540	1710	1890
	2007	1752	580	1510	610	935	1070	1076
Strumica	2006	3100	1490	2830	2570	2430	2760	2530
	2007	2270	670	1690	1980	1650	1540	1633
Average		2490	1000	2132	1712	1639	1770	1782

The results presented in Table 1 show that average yield for all the varieties grown in conditions of organic cultivation for two years is 1782 kg/ha. The yield for all genotypes is showing higher values for 2006, location Strumica as compared to 2007 for the location Ovche Pole. The highest yield is obtained from the variety Ilindenka (3100 kg/ha) in the first year in Strumica, and the lowest yield is for the variety Pela (580 kg/ha) in the second year in Ovche Pole.

Genotype	Year	Location	$\overline{x}$	Sx	S	CV(%)
Ilindenka	2006	Ovche Pole	138.35	1.56	15.80	11.42
		Strumica	164.65	1.96	19.75	11.99
	2007	Ovche Pole	133.59	1.70	17.21	12.88
		Strumica	143.91	1.67	16.84	11.70
Pela	2006	Ovche Pole	149.35	2.04	20.63	13.81
		Strumica	151.99	1.95	19.72	12.98
	2007	Ovche Pole	115.70	1.63	16.43	14.20
		Strumica	158.17	2.45	24.72	15.63
Daniela 97	2006	Ovche Pole	170.35	2.01	20.28	11.91
		Strumica	166.55	2.04	20.62	12.38
	2007	Ovche Pole	126.87	1.59	16.02	12.62
		Strumica	180.58	1.63	16.47	9.12
Pavlicheni 121	2006	Ovche Pole	110.68	1.48	14.92	13.48
		Strumica	114.04	1.10	11.07	9.71
	2007	Ovche Pole	82.32	0.84	8.53	10.36
		Strumica	114.17	1.62	16.32	14.29
ZPS015	2006	Ovche Pole	148.71	1.78	17.98	12.09
		Strumica	172.34	2.63	26.55	15.40
	2007	Ovche Pole	113.29	2.48	25.03	22.09
Delta	2006	Ovche Pole	168.40	2.57	25.96	15.42
		Strumica	166.46	1.86	18.78	11.28
	2007	Ovche Pole	131.20	1.93	19.47	14.84
		Strumica	148.21	1.89	19.11	12.89

Table 2. Average values and indicators for genotypes variability for 1000 grains weight for two years and two locations.

Although 1000 grains weight is depending mostly on genetic characteristics of the variety, it is also dependent on environmental conditions, mostly climatic. Absolute grains weight is determined by the speed and the duration of irrigation. The smaller grains are placed at the terminal pat of the plant because the period for irrigation is relatively short [2]. The highest value for 1000 grains weight is for the variety Daniela 97 (180.58 g) in 2007, location Strumica, and the lowest value is for variety Pavlicheni 121 (82.32 g) in 2007, location Ovche Pole (Table 2). The variability coefficient is in the range of 9.12% for variety Daniela 97 which in the same time showed the highest 1000 grains weight in 2007 in Strumica, to 5.63% for variety Pela in Strumica in 2007. It is well known that the strong interaction genotype – environment has strong influence on expression on qualitative characteristics. The temperature during soybean growing is strong factor influencing the protein and oil content in soybean grains [citation in 18]. Usually, protein and oil content are inverse variation to temperature changes, e.g. temperature raise increase oil content in grains and decrease protein content [17]. The protein content is very variable characteristic (Table 3).

Genotype	Year	Location	Protein	Oil
Ilindenka	2006	Ovche Pole	29.71	22.86
		Strumica	34.51	21.79
	2007	Ovche Pole	27.04	23.16
		Strumica	28.6	20.49
	Average		29.97	22.07
Pela	2006	Ovche Pole	35.67	22.27
		Strumica	32.1	24.15
	2007	Ovche Pole	36.31	25.74
		Strumica	36.5	20.62
	Average		35.15	23.19
Daniela 97	2006	Ovche Pole	31.09	22.67
		Strumica	32.05	22.05
	2007	Ovche Pole	21.97	26.84
		Strumica	29.01	23.00
	Average		28.53	23.64
Pavlicheni 121	2006	Ovche Pole	33.63	20.97
		Strumica	32.46	22.68
	2007	Ovche Pole	25.3	24.95
		Strumica	32.46	22.05
	Average		30.96	22.66
ZPS015	2006	Ovche Pole	32.9	21.80
		Strumica	34.99	21.56
	2007	Ovche Pole	24.99	25.24
		Strumica	31.91	21.80
	Average		31.20	22.60
Delta	2006	Ovche Pole	35.88	20.33
		Strumica	33.19	22.50
	2007	Ovche Pole	28.69	23.86
		Strumica	35.67	19.47
	Average		32.46	21.54

$LSD_{0,05}$	2.25	1.10
$LSD_{0,01}$	3.05	1.49

Table 3. Average values of protein and oil content in grains of different genotypes at two locations and two years.

The lowest and minimal protein content showed variety Pela (36.5%) in the first year 2006 in Strumica, and the lowest percent of proteins showed variety Daniela 97 (21.97%) in the second year 2007 in Ovche Pole. The highest average value of protein content, on average basis for all variants has variety Pela (35.15%), followed by the varieties Delta (32,46%), ZPS015 (31.20%), Pavlicheni 121 (30.96%), Ilindenka (29.97%) and Daniela 97 (28.53%).

CONCLUSIONS

From the conducted experiment on organic production of soybean in two different agriecological locations and during two experimental years, the following conclusions can be drawn:

- The average yield of soybean from the cultivated varieties during two years and at two locations is 1782 kg/h. Taking in account that the price of soybean grain as row material for organic products is higher, the gained yield indicates economic justification of organic production of soybean.
- The highest average yield is gained from the variety with the longest vegetation period (Ilindenka, 140 days), while the lowest yield is gained from the variety with the shortest vegetation period (Pela, 90 days).
- The highest average protein and oils content is observed in the variety with the shortest vegetation period (Pela). The low grain yield of this variety is compensated with very high quality of grains from nutrition aspect.
- Because of extreme low precipitations in July 2007 at the both locations, the grain yield is 40% lower as compared to 2006 for all the varieties under the experiment.
- According to the results of the experiment, the location Strumica showed higher average yield from all the varieties than the location Ovche Pole and it is more suitable for organic production of soybeans.

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ECOLOGICAL FOOTPRINT OF OIL PUMPKIN AND FALSE FLAX PRODUCTION – THE CASE FOR ORGANIC AND BIODYNAMIC FARMING

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ABSTRACT

Rising energy prices and climate change intensified the search for alternative farming systems where the environmental impact and energy consumption per unit will be lowered. A long-term field trial, started in 2007 at the University of Maribor, focuses on food quality and the ecological footprint of conventional (CON), integrated (INT), organic (ORG) and biodynamic (BD) farming systems. Gained data has been evaluated and interpreted using the SPIonExcel tool. Results from the first year show a significantly lower ecological footprint of both, ORG and BD, systems in production of oil pumpkins (*Cucurbita pepo* var. *Styriaca* L.) and false flax (*Camelina sativa* L.), mainly due to non-use of external production factors, like mineral fertilizers and pesticides. When yields are added to the equation, the ORG and BD systems emerge as more environmentally friendly per unit of produced crop as well. Thus, ORG and BD farming systems present viable alternatives for reducing the impact of agriculture on climate change, while ensuring a more sustainable food security. However, an obvious room for improvement exists in the area of the ecological footprint of machinery use in all systems studied.

Keywords: organic agriculture, biodynamic agriculture, ecological footprint, farming system comparison

INTRODUCTION

Indicators and/or tools for evaluating sustainable development have to be chosen very carefully; regarding the method, which best suits the needs, set goals and expected results[1]. Ecological footprint (EF)[2] tries to summarize the biologically productive area, which is needed to produce yearly flows of materials spent by the population of a certain region (city, state, world) with all accompanying waste in the form of emissions (especially CO_2) and the area needed for building infrastructure. This is compared to the area available to a certain population or individual, called the biocapacity [3]. Data for the EF is usually excerpted from statistical databases; in the case of agriculture from yearly statistics of individual countries. The drawback of such data lies in the inaccuracy of the attained footprint for smaller units e.g. farm level.

LCA (life cycle assessment) is a tool based on actual/real data, it assesses the environmental burden caused by a product, the production process or activity[4]. It takes into account the technological processes of all activities, basic materials and transportation into and from the production unit. In the second step sources used for each single input are evaluated by adding the environmental impact, including the resulting emissions and waste. The result can be interpreted on a per unit of product basis (kg) or equivalent area (ha), where areas used outside of the production unit are included [1]. The only drawback of this tool is the limited comparability of the gained data on a world or state level. Consequently LCA needs to be joined with other indicators or tools.

Research in the area of the EF or the LCA in agriculture is still developing. Furthermore, to our knowledge up-to-date there has been no scientific research published on comparing production of oil crops in different production systems using a joint framework of the EF and LCA – called the Sustainable process index ® - SPI [5-7]. With a long-term field trial we tried to fill this void and bring some more clarity to the discussion of sustainability of various production systems. In this sense experimental data from a long-term field trial is used in this paper, therefore results reflect conditions in real-life situations and farming systems.

MATERIALS AND METHODS

Long-term field trial

The long-term field trial is located at the experimental site of the University Agricultural Centre, University of Maribor. The mean air temperature of the area in the growing period (May-September) was 18,6°C, total rainfall in the same period amounted to 436 mm. Sixty 7m×10m experimental field plots were established in autumn 2007 on a dystric cambisol (deep) (average pH value 5.5 (0.1 KCl solution), soil soluble P at 0.278 g/kg^{-1} and soil soluble K at 0.255 g/kg^{-1} in ploughing soil layer), within two different five-course crop rotation designs. In one rotation there are typical crops for this region (two years of red-clover grass, wheat, white cabbage, oil pumpkins), the other one is an alternative crop rotation (two years of red-clover grass mixture, spelt, red beet, false flax/ garden poppy). Four production systems + control plots were arranged in a randomised complete block split-plot design with four replicates. The farming systems differed mostly in plant protection and fertilization strategies [8]. The experimental area was managed organically since 2002, where grass-clover was produced since 2005. Also 4 m wide grass-clover protection belts are separating the farming systems under study.

The farming systems used are defined by the valid legislation and standards – conventional (CON) [9], integrated (INT) [9-11], organic (ORG) [12], biodynamic (BD) [12,13] and the control [9] farming system, where no fertilization/plant protection was used.

SPIonExcel tool

LCA with the Sustainable Process Index (SPI), a member of the EF family, was used in this paper, as it is well suited for this task[5]. We will not go into details of this method, as they are described in several research papers [5]. In short, SPIonExcel calculates the EF of a process and SPI of a product or service through the input that characterizes the process given by an eco-inventory. The eco-inventories used for the calculation of the overall footprint contain engineering mass and energy flows of processes in terms of input and output flows [5].

From the attained footprint an additional ecological efficiency of production systems was calculated using the following equation:

$$\text{Ecological efficiency of production} = \frac{\text{ecological footprint}}{\text{yield}} \quad (1)$$

The result of Eq. (1) gives an indication of the "cost" in terms of ecological sustainability of a given product or service [5]. The number indicates what fraction of the overall "ecological budget" of a production system is used to provide this good or service - in our case 1 kg of oil pumpkin seed or false flax seed. Lower values indicate better environmental performance of production systems.

Data used

All work done on the trial in 2008 was carefully monitored and recorded. Data collected from the field trial were transformed into tasks done in a system in one year and the time needed for those tasks (e.g. ploughing, seeding, harrowing, spraying, etc.). Because of the nature of the trial, where not all operations could be done by machines (e.g. spraying), real-life operational times were taken from the University Agricultural Centre Farm, where the experiment took place. Tasks related only to the nature of the trial (e.g. mowing of protection belts) were not included in the calculations. The footprint was determined for 1 ha of area.

Statistical analysis

Data for the ecological efficiency of production were analysed by one-way ANOVA with production system as a factor using Statgraphics Centurion (Version XV, StatPoint Technologies, Inc., Warrenton, VA) and were followed by means comparisons after Duncan, 95% probability [14]. Values given within the paper are means ± standard error (SE).

RESULTS AND DISCUSSION

When looking at the results of the EF of production systems for oil pumpkin and false flax, a high proportion of the final footprint with CON and INT systems derives from the use of mineral fertilizers and pesticides (Table 1). However, ORG and BD systems have higher footprints in the field of machinery use impacts, mainly because of manure spreading, harrowing and the use of BD preparations with the BD system. The surprising fact is, that also control plots for oil pumpkin and false flax production leave an EF of 113334.7 m^2 and 100841.6 m^2, respectively. This means that only by using current standard machinery to till the soil and produce crops, we already leave a great environmental impact and „consume" 10-11 times more land than is needed to plant the crops on. In this sense there is great need for improvement in the current agricultural practice and the way we understand, till and work the soil. However, when the total EF area of CON oil pumpkin and false flax production is visualized, it takes some effort to perceive and realize the vast impact this industrial way of farming really has on the environment and ecosystems. The INT system performs slightly better than the CON system, although it is publicised and advertised as nature friendlier and as one of the sustainable agricultural systems [10].

Production system	**control**	**CON**	**INT**	**ORG**	**BD**
Oil pumpkin:					
Production area (m^2)	10000	10000	10000	10000	10000
Machinery (m^2)	102398	103361	103361	146949	161325
Fertilizers and pesticides (m^2)	0	305836	204461	37840	37840
Seed (m^2)	937	937	937	937	937
Total footprint (m^2)	113335	420134	318759	195726	210102
Index (%)	100	371	281	173	185
False flax:					
Production area (m^2)	10000	10000	10000	10000	10000
Machinery (m^2)	90458	96027	96027	135009	144592
Fertilizers and pesticides (m^2)	0	250163	148788	37840	37840
Seed (m^2)	383	383	383	383	383
Total footprint (m^2)	100841	356573	255198	183232	192815
Index (%)	100	354	253	182	192

Table. 1 The EF for 1 ha of oil pumpkin and false flax production in 2008.

Production system	control	CON	INT	ORG	BD
Oil pumpkins, *:					
EE ($m^2\ kg^{-1}$)	240.7 ± 54.9^{c}	962.5 ± 205.5^{a}	714.1 ± 144.4^{ab}	438.5 ± 88.7^{bc}	379.7 ± 64.6^{bc}
False flax, *:					
EE ($m^2\ kg^{-1}$)	38.0 ± 16.0^{b}	171.7 ± 19.9^{a}	101.7 ± 48.7^{ab}	87.5 ± 34.3^{ab}	66.2 ± 17.2^{b}

Table. 2 Ecological efficiency (EE) of oil pumpkin and false flax production for 2008 expressed in m^2 of impact for 1 kg of produced DM yield. Means ± SE, n=3. Different letters indicate statistically significant differences at P≤0.05 (Duncan test).

Results of the ecological efficiency of production give an even more insightful picture, as yields are taken into the equation (Table 2). The value for the ecological efficiency in the CON system amounts to 4.0, 2.2 and 2.5 times as much as in the control, ORG and BD farming systems for oil pumpkin production, respectively. Similar values can be observed for false flax production, where the CON plots reached 4.5, 1.96 and 2.6 higher values (and thus lower efficiency) when compared to control, ORG and BD plots, respectively. One has to keep in mind, however, that these are the results for the first year of crop production after grass-clover, thus values and ratios will probably change in the next 2-3 years of the trial, where control plots are expected to produce significantly lower yields than in the year 2008. Despite this fact, the ORG and BD systems still would have significantly higher ecological efficiencies of production.

And taking a step further than only production levels, what will happen when we run out of oil? It is important to keep in mind is that the relation between population and oil production is one of cause and effect. The sky-rocketing of population is not merely coincident with the sky-rocketing of oil production. It is the latter that actually causes the former. With abundant oil, a large population is possible — ignoring, of course, the fact that environmental degradation may eventually wipe out those human numbers anyway. Without abundant oil, on the other hand, a large population is not possible[15].

CONSLUSIONS

But where can we improve in the future? As previously mentioned, efficient use of machinery and inventing new forms of working the soil will be of crucial importance. To discontinue the use of mineral fertilizers and pesticides would obviously improve the ecological footprint and environmental efficiency of the prevalent CON and INT farming systems.

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SENSORY PROPERTIES OF RED BEET FROM DIFFERENT FARMING SYSTEMS

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ABSTRACT

In recent years the importance of food quality has increased, but there is still lack of research in this field. Sensory properties are also one of the characteristics that determine the quality of food. Organic food is considered to be tastier, but results of surveys are sometimes contradictory. We examined the sensory properties of red beet, which was, in addition to the control sample, produced in conventional(CON), integrated(INT), organic(ORG) and bio-dynamic(BD) farming systems. Randomly selected evaluators scored their preference for four characteristics (colour, odour, taste and overall acceptability) using a nine-point hedonic scale. Results show statistically significant differences for all characteristics ranging from highest to lowest in the order control>BD>ORG=INT>CON, except for odour, where no significant differences were found. Furthermore, it has been found out that males scored more uniformly, whereas females expressed a sharper perception and ability to differentiate between different samples.

Key words: organic agriculture, biodynamic agriculture, sensory evaluation, farming system comparison, red beet

INTRODUCTION

Consumer demand for organically grown products is steadily growing and has exceeded supply in many countries. Consumers are becoming increasingly concerned about food quality, especially regarding how, when and where food is produced [1]. Also consumer and research interest in the biodynamic farming system is posing questions regarding food quality[2], which have yet to be answered.

Moreover, amongst consumers sensory quality is one of the more important parameters to determine the quality of food. In general, organic food is considered to be tastier, but results of surveys are sometimes contradictory [3]. Often differences appear because of discrepancies at the evaluation design and process (unevenly ripe vegetables, different varieties, wrong storage of vegetables, etc.), sometimes there are just no differences detectable to the human sense[4]. Even though some authors advocate the use of trained panellists in order to attain more consistent results[5], hedonic sensory evaluation aims at determining the acceptability of a product and/or preference of a given product compared to another one from the point of view of the consumer [6].

Thus, the main question we asked ourselves was what the consumer preferences are when tasting/choosing fresh vegetables from various farming systems? Therefore the sensory properties of red beet were examined, which was, in addition to the control plots, produced in conventional(CON), integrated(INT), organic(ORG) and bio-dynamic(BD) farming systems in a long-term controlled field trial. To our knowledge up-to-date no similar studies have been done comparing hedonic sensory quality of red beet in all of these various production systems. Therefore, the production systems and sensory evaluation methods are explored in the first part of the paper, followed by an examination of the evaluation results with a special focus on production system and sex of evaluators as factors. We round up the paper with an affirmation, that production systems do have a significant influence on the hedonic sensory profile and acceptance of red beet.

MATERIALS AND METHODS

Long-term field trial

The experimental site for the production of the experimental material is located at the University Agricultural Centre of the University of Maribor in Pivola near Hoče (46°28N, 15°38E, 282 m a.s.l). The yearly mean air temperature of the area is 10.7°C; where the mean monthly minimum is in January with 0.4°C and the average monthly maximum is in July with 20.8°C. Average annual rainfall in the area is around 1000 mm. Thirty 7m×10m experimental field plots were established in 2007 on a dystric cambisol (deep) (average pH value 5.5 (0.1 KCl solution), soil soluble P at 0.278 g/kg^{-1} and soil soluble K at 0.255 g/kg^{-1} in ploughing soil layer), and are maintained within two different five-course crop rotation designs, where various sequences of crops in the crop rotations are used. In one rotation there are typical crops for this region (two years of red-clover grass, wheat, white cabbage, oil pumpkins), the other one is an alternative crop rotation (two years of red-clover grass mixture, spelt, red beet, false flax). Four production systems + control plots were arranged in a randomized complete block split-plot design with four replicates. The farming systems differed mostly in plant protection and fertilization strategies (Table 1). Soil cultivation, sowing and harvesting were identical among experimental plots and were performed on similar dates and in a similar manner to adjacent fields. The experimental area was managed organically since 2002, where grass-clover was produced since 2005. Also 4 m wide grass-clover protection belts are separating the farming systems under study.

Table. 1 Production systems used and their differences

Production system	Soil cultivation and basic operations	Weed management	Pest management	Manure application
Conventional farming according to the Slovene agriculture act and good agricultural practice (GAP)	Ploughing, seedbed preparation, sowing, harvesting	Preventive use of herbicides according to GAP, harrowing when needed	Preventive use of pesticides according to GAP	NPK and N mineral fertilizers used according to GAP and nutrient removal estimates
Integrated farming according to the standards for Integrated farming	Ploughing, seedbed preparation, sowing, harvesting	Use of herbicides according to the rules of INT management, harrowing at least once	Curative use of pesticides according to the rules of INT management	NPK and N mineral fertilizers used based on soil analysis and nutrient removal estimates
Organic farming according to the EC regulation on Organic Farming	Ploughing, seedbed preparation, sowing, harvesting	Harrowing 2-5 times/season, cover crops after cereals, weed burning in vegetables	Use of some natural pesticides (Neem-oil, BT extract) on vegetable crops when needed	1,4 livestock units (LU) of cattle manure /ha
Biodynamic farming according to Demeter International production standards	Ploughing, seedbed preparation, sowing, harvesting	Harrowing 2-5 times/season, cover crops after cereals, weed burning in vegetables	Use of BD preparations, some natural pesticides (Neem-oil, BT extract) on vegetable crops when needed	1,4 livestock units (LU) of composted cattle manure / ha with added BD compost preparations
Control plots	Ploughing, seedbed preparation, sowing, harvesting	Harrowing 1-3 times/season	none	none

Farming system definition sources: [7-11]

Same varieties of crops were used in all farming systems, where the origin of the seed differed – organically grown for the ORG, BD and control plots vs. conventionally grown for CON and INT plots. The red beet variety Rote Kugel was chosen, as it was the only one available in both, CON and ORG, qualities.

Samples of red beet in all farming systems were picked on 19th August 2008 from the centre of the experimental plots, afterwards cleaned and stored at optimal conditions [12] in a cooling room at 6°C and 95% relative humidity until the sensory evaluation took place.

Sample preparation

We randomly picked 40 roots (10 from each repetition) from the stored samples of red beet for each farming system, which were washed, peeled, grated and stored in a plastic container with a closed lid just before the sensory evaluation took place. These five (5) pooled samples were served on open white plastic trays, marked with 3-digit random numbers. Additionally a plastic fork was offered. Each serving weighed around 17g. Serving orders were randomised.

Sensory evaluation

The sensory evaluation took place during the 12th Alpe Adria Biosymposium, which was held between 20th and 21st November 2008. The hedonic sensory evaluation was offered as an accompanying event and took place in a classroom (each day from 9am to 6 pm), where separate tables with ample room between them were provided for the volunteers. Each evaluator was accompanied to the table, handed out the evaluation sheet and explained the purpose and procedure of the hedonic evaluation. A 9-point hedonic scale was prepared, where 1 was marked as extremely dislike, 9 as extremely like and 5 as neither like/neither dislike. Attributes evaluated included colour, odour, taste and overall acceptability. White plain bread and water were at disposal to neutralize taste. The evaluation took place at 20°C under normal white light.

Statistical analysis

An analysis of variance (ANOVA) was performed on the attained sensory data [13]. Production system was a factor in the model and was followed by least squares means comparisons after Duncan (95% probability, levels of significance used: n.s. - non significant ($p>0,05$); *$\leq 0,05$; **$\leq 0,01$; ***$\leq 0,001$) [14]. Additionally, a separate analysis was done for both sexes separately. To examine the association between the sensory attributes a correlation analysis was included.

RESULTS AND DISCUSSION

A total of 91 evaluators took part in the sensory evaluation, out of which 59% (n=54) were women and 41% (n=37) men. Age of the evaluators was evenly distributed as follows: 34% between 18 and 27 years of age, 22% between 28 and 37 years of age, 22% between 38 and 47 years of age, 15% between 48 and 57 years of age and 7% between 58 and 67 years of age. This was interpreted as being a typical consumer group for Slovenia.

In a previous study that we found [15], no significant differences were detected between samples of CON and BD produced red beet. In our study, however, BD and CON systems differed significantly in all measured attributes, except odour (Table 2). Beet from control plots attained highest scores, although also lower yields than other plots (data not shown), both of which could be correlated with the amount of N fertilizer used. However, the amount of N fertilizer applied can not be the only source of variation, for similar amounts of N were applied in remaining four production systems, whereas they were of different origin (mineral vs. organic). Another factor contributing to differences could be pesticide use in the CON and INT systems, whereas no pesticides were used in the other systems under study.

Table. 2 Least square means of sensory evaluation scores for Colour, Odour, Taste and Overall Acceptability (n=455) depending on production system in the year 2008.

Production System	Colour	Odour	Taste	Overall Acceptability
	**	n.s.	**	*
Control	6,50±0,18[a]	6,01±0,19	6,50±0,19[a]	6,34±0,18[a]
Conventional	5,40±0,24[c]	5,50±0,19	5,34±0,21[c]	5,44±0,20[b]
Integrated	5,87±0,19[bc]	5,75±0,19	5,89±0,19[bc]	5,88±0,18[ab]
Organic	6,03±0,19[ab]	5,52±0,18	5,83±0,20[bc]	5,85±0,19[ab]
Biodynamic	6,21±0,19[ab]	5,48±0,21	6,08±0,19[ab]	6,06±0,19[a]

Different letters indicate statistical significant differences at 95% probability (Duncan test).

Levels of significance: n.s. - non significant (p>0,05); *≤0,05; **≤0,01.

Also the difference between the ORG and BD system was „only" in the BD preparations being used, as no BD compost was yet available in the year 2008. The reason for differences in taste and overall acceptability may lay in sugar contents or phenolic compounds, which were shown to be higher in BD produced grapes[16]. In spite of this fact, analysis on the contents of bio-active compounds in red beet and the differences of those between production systems is yet to be done in future research studies. No significant differences were found between ORG and INT red beet.

According to the correlation analysis there was a significant positive correlation between colour vs. odour, taste and overall acceptability (r=0.629, r=0.579 and r=0.734, respectively; 455 df, p<0,001), odour vs. taste and overall acceptability(r=0.705 and r=0.797, respectively; 455 df, p<0,001) and taste vs. overall acceptability (r=0.686; 455 df, p<0,001). Odour had the greatest influence on overall acceptability, whereas taste had little influence on the colour scores of the samples.

The interaction between production system and sex showed no significant differences for all attributes scored (p>0,05). However, when we analysed each of the sexes separately, significant differences appeared with all scored attributes, but only with female evaluators (Table 3). Although males scored the samples differently, they were not able to significantly differentiate between various production systems.

Table. 3 Least square means of sensory evaluation scores for Colour, Odour, Taste and Overall Acceptability (n=455) split between sexes with production system as a factor in the year 2008.

Sex	System	Colour	Odour	Taste	Overall Acceptability
Female (n=270)		***	*	***	**
	Control	6,76±0,21[a]	6,18±0,25[a]	6,81±0,22[a]	6,63±0,21[a]
	Conventional	5,13±0,33[c]	5,24±0,26[b]	5,18±0,28[c]	5,22±0,27[c]
	Integrated	5,61±0,29[bc]	5,65±0,28[ab]	5,78±0,28[bc]	5,83±0,26[bc]
	Organic	6,05±0,26[ab]	5,37±0,26[b]	5,67±0,29[bc]	5,76±0,27[bc]
	Biodynamic	6,31±0,24[ab]	5,35±0,28[b]	6,02±0,25[b]	6,07±0,26[ab]
Male (n=185)		n.s.	n.s.	n.s.	n.s.
	Control	6,13±0,32	5,76±0,29	6,05±0,33	5,92±0,32
	Conventional	5,78±0,33	5,89±0,25	5,57±0,31	5,76±0,30
	Integrated	6,24±0,19	5,89±0,23	6,05±0,24	5,94±0,23
	Organic	6,0±0,28	5,73±0,23	6,08±0,24	5,97±0,25
	Biodynamic	6,05±0,31	5,67±0,31	6,16±0,31	6,05±0,28

Different letters indicate statistical significant differences at 95% probability (Duncan test).

Levels of significance: n.s. - non significant (p>0,05); *≤0,05; **≤0,01;***≤0,001.

Having in mind that the majority of organic food consumers in the EU [17] or other countries [18] are represented by women in the ages from 25 to 40 (which was also the biggest age group in our study), our results indicate one of the possible reasons consumers opt to buy organic food. Women are better tasters [5] and as such are usually in charge of buying food for the whole family. Also women with children more often tend to choose organically produced food [17]. In this sense the taste of it plays, along with other factors, an important role in the decision making process – especially if you are a better taster and the food you choose tends to be tastier [3].

CONCLUSIONS

It was observed in the present study that production system and sex of evaluators had an impact on sensory quality of red beet. Control and BD produced red beet scored higher in most attributes than CON produced red beet, with the ORG and INT systems in-between. The acceptance of red beet for female evaluators points towards one of the reasons why the average organic consumer prefers ORG and BD foods over CON and INT foods.

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SORGHUM EXTRACTS ALLELOPATHIC EFFECTS ON *AMARANTHUS RETROFLEXUS* SEED GERMINATION AND GROWTH

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ABSTRACT

One aspect of organic farming is using crop allelopathic potential for against of weed germination and growth. With regards to importance and abundance of Amaranthus retroflexus weed in fields an experiment was conducted using CRD based factorial design with three replications to study the allelopathic effects of extracts at different growth stages and different concentration on germination and growth of Amaranthus retroflexus in 2008-2009. Treatment was: different harvesting stages (vegetative, flowering and seed filling stages), extract of different organs (leaf, stem, root and total plant), different concentrations (5, 10, 15 and 20%). Analysis of variance at germination stage showed that main and an interaction effects were significant on all attributes. Using extracts decreased germination percentage and its aspects. Leaf extract of all vegetative stages had more decreasing effect. 20% concentration of all parts and stages prevented germination. Minimum growth, seedling dry weight, germination percent and germination rate, was 49.06, 68.92, 59.44 and 67.31%, respectively. The main and interaction effects were significant in greenhouse experiment. All attributes decreased by increasing concentration from 5% to 20% in all stages. Leaf extract and stem extract had the most and least impact on Amaranthus retroflexus seed germination. Sorghum extract decreased height, leaf area and number, leaf, shoot and root dry weight and biomass as 50.40, 54.20, 57.71, 77.48, 73, 64.51 and 72.35% , respectively. Sorghum allelopathic ability can use for decreasing plant population of pigweed and prevents more using of herbicides.

Key words: allelopathy, *Amaranthus retroflexus*, sorghum, germination, growth,

INTRODUCTION

Allelopathic effects can affect on all ecological factors, in stance growth, plant canopy succession, survival, extension and crop production [11]. Under present condition, weed invasion is the most important reason of crops yield reduction. More use of herbicides caused increasing tolerance weeds for some of herbicides, plant population changing towards species that have near relationship with crops and increased environment pollution. Studying on allelopathy can solve these problems [18] and Allelopathic compounds can use as model for herbicide production [23]. Leaves and leaf residuals, roots, pollens and flowers, epidermis, stem, seeds and fruits have active allelopathic property or in degradation process [24].

Cessation by allelopathic compounds covered all life stages from seed until mature plant and seed germination, seedling growth, leaf area, dry matter and production [8]. *Amaranthus retroflexus* is one of important and major weeds in world and its physiological characteristic made it well known competitive weed for crops [10].Nonchemical and biological control methods for preventing of tolerance induction to herbicides was important purpose of this weed control [3].

Changing enzymes activity effects storage compounds transmission may cause germination cessation [8]. Delaying or cessation of storage compounds can reduce respiration substrates and metabolic energy in allelochemicals exposed seeds decreased germination and seedling growth. Osmotic effects by affecting water absorbing rate led to delaying seed germination, and cell elongation [9]. In upper concentration of these materials, seed germination and mitosis stopped [21].

Allelopathic interaction in development and growth is complex process that affects all development and growth aspects [8]. De Neegard and Porter [7] reported decreasing protein synthesis, hormones, chlorophyll, cell division, changing cell wall structure, membrane permeability and function, changing active transmission, especial enzymes cessation, anther germination and spores, organelle synthesis, photosynthesis, respiration, leg-hemoglobin biosynthesis, nitrogen fixation bacteria activity nitrogen fixation mycorhizal fungi, changing crop water rate and DNA, RNA by allelochemical disturbances.

Decreasing in carbohydrate achievement rate by allelochemical inhibitors led to decrees in plant total growth and crop dry weight [8]. Roots are more sensitive to allelopathic compounds than shoots [17].Corn root exudates inhibited *Amaranthus retroflexus* and *chenopodium album*. Sunflower extract decreased weed canopy to 33%, sorghum residuals decreased *Portuleca oleracea* L, *Digitaria ischaemum* L population as 70% and 98%, respectively [25].

Rye, triticale, sorghum and barley extract decreased germination and growth of barnyard grass and bristly foxtail [6].100 sorghum species root extract inhibition ability on *Amaranthus retroflexus* germination and growth. Some species extract caused inhibition of seedling growth of *Amaranthus retroflexus*. Growth inhibition rate was 12-96% for root, 8-82 for seed germination and 13-75% for shoot growth[2]. Sorghum residuals decreased *Chenopudum album*, bristly foxtail and *Amaranthus retroflexus* germination up to 43- 80 and 95%, respectively [20]. Alam *et al* [1] reported that sorghum root extract prevented *Amaranthus retroflexus* seedling growth up to 21-65%. Inderjit *et al* [14] reported that sorghum extract with 3 and 4% concentration decreased *Amaranthus retroflexus* seed germination, root, seedling and plant growth. Sorghum extracts with 2-20% concentration *decreased* seed germination, complete plant and root growth of *Amaranthus spinosus*, *Yamopsis tetragonoloba* and *Vigra unguiculata* [16]. Eirshad and Chima [15] showed that sorghum extract decreased barnyard grass dry weight from 31 to 48%. Sorghum residuals extract were main inhibition factor for *Amaranthus spinosus* and bean germinaton, root and shoot growth [13]. Glycoside and sorgholeon are sorghum active compounds. They are stron inhibitors of *Amaranthus spinosus* root growth that decreased from 13 to 27% [19].The aim of this investigation was determination of extracts of Sorghum damaging effects on germination and growth of *Amaranthus retroflexus*.

MATERIALS AND METHODS

This research was done at laboratory and greenhouses of agricultural campus of Islamic Azad University, Tabriz Branch, located at 38°3' N, 46°27'E, 1360 m altitude in 2008-2009. Experiment included three separate stages: I- Sorghum planting and prepare extract from different growth stages. II- Germination test in laboratory. III- Growth test in greenhouse. Experiments arranged in CRD based factorial design with three replicates. Experimental factors were, 1. different stage harvesting (harvesting before flowering, in flowering stage and grain filling). 2. different extracts of sorghum (leaf, shoot, root and total plant), 3. different concentration of sorghum organs extract in 4 levels (5, 10, 15 and 20 percent).

Sorghum seeds (Speedfeed) were sown into moist soil to a depth of 3 cm as 60×20cm. Harvesting was done according growth stages. Collected weed species were separated into roots, leaves and shoots, dried in an electrical oven at 60°C for 48 hours and then milled. In order to produce extract, 20 g of powdered material was plunged in 100 ml of water for 24 hours and then filtered and centrifuged [4]. Laboratory experiment was done in Petri dishes in lab germinator based on ISTA rules for ten days. Fifty healthy Amaranthus retroflexus seeds were put in Petri dishes and the extracts of different parts of Sorghum were applied. Number of germinated seeds, shoot, root and seedling length and seedling dry weight, were measured on third, seventh and tenth day. Coefficient of Germination Rate, germination time and dry weight changes were calculated.

Greenhouse experimental: Greenhouse temperature and humidity were changeable from19 to 35°C and 40 to 70% in average, during test period. After seedlings growth in nine liter pots, the irrigation continued until plant establishment. There after, five plants were kept in a pot and irrigated with extract in the first every 5 days and 7 days in the end (150 to 200 cc). Plant height, shoot, leaf and root dry weight, leaf number and leaf area and biomass were measured. MSTATC and Harvard Graph 98 were used to analysis data and draw graphs, respectively.

RESULT AND DISSCUSIONS

Laboratory investigation: Treatment *Amaranthus retroflexus* seed with distilled water produced the highest seedling and root length, dry weight, and germination percentage in comparison with sorghum extracts with significant difference. *Amaranthus retroflexus* seed germination decreased by sorghum different organs extract and sorghum extract (concentration 20%) inhibited seed germination.

Sorghum leaf extract and shoot extract decreased germination of *Amaranthus retroflexus* seeds 96.62% and 59.44% by 15 and 5 % concentration (Table2) than control treatment, respectively. Highest significant difference inhibition effects on germination were obtained by vegetative stage sorghum extract than other stages (Figure1).

Treatment by sorghum extract not only decreased germination but also decreased growth and dry matter accumulation in *Amaranthus retroflexus* seedling. Treatment by 5, 10, 15 and 20% concentration extract decreased dry weight of *Amaranthus retroflexus*, as 68.92, 85.87, 86.30 and 88.91 %, respectively (Figure2). Decreasing seedling dry weight resulted by decreasing seedling growth. Treatment by different sorghum extract decreased severely *Amaranthus retroflexus* seedling growth. Treatment with leaf extracts in vegetative stage decreased seedling growth as 73.11% and in shoot extract at filling stage decreased as 49.06% in compairsion with control, respectively (Table3).

Increasing leaf extract concentration from 5% to 20% increased inhibitor effect from 7o.76 to 92.77.Germination rate decreasing in *Amaranthus retroflexus* seed was from 67.31 to 94.92% by shoot 5% and leaf extracts 15% in comparision with control (Table 2) which caused increasing germination time in control as 9.6 to 29 and 155 days, respectively.

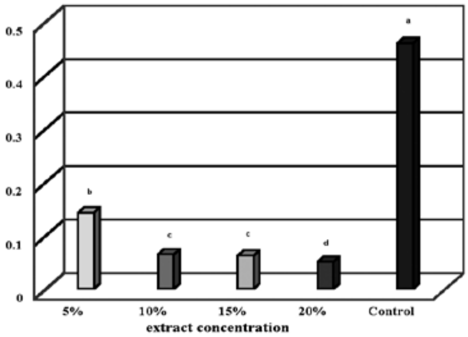

Figure 2: Sorghum different extracts concentration effect on *Amaranthus retroflexus* seeding dry weight

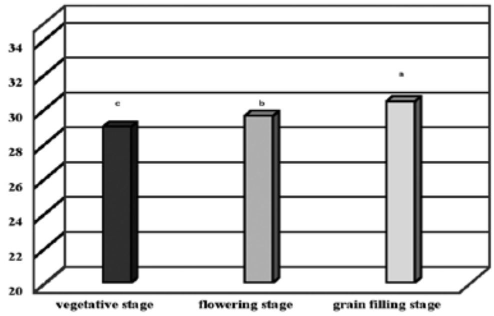

Figure 1: Sorghum different stage extracts effect on *Amaranthus retroflexus* seed germination percentage

The negative impact of sorghum extracts on growth and germination of *Portuleca oleracea* L. and *Digitaria ischamum* L [25], barnyard grass, and bristly foxtail [6], *Chenopodium album* [20] and *Amaranthus retroflexus* [2,20] seed and seedling has been proven. Changes in germination activate enzymes and osmotic affects caused cessation in germination. Main effects of allelopathic compounds are delaying of radicle and shoot growth. This leads to some physiological effects that reduce growth and dry matter accumulation in plantlets [8].

Greenhouse investigation: Analysis of variance showed that sorghum different stages extract and concentration had significant effect on all morphologic traits (Table1).

Treatment *Amaranthus retroflexus* seeds with different concentration of sorghum organs extract caused significance decreasing in all traits. Sorghum different organs extract in 5% to 20% decreased *Amaranthus retroflexus* height, leaf number and leaf area in compare with control treatment as 50.40, 54.20 and 57.71% with shoot extract in 5% concentration and leaf extract as 92.65, 95.72 and 96.88% by with 20% concentration decreased, respectively (Table2). Highest and lowest *Amaranthus retroflexus* height obtained by grain filling and vegetative stages of leaf sorghum extracts (Table3).

Sorghum flowering and grain filling stage extracts increased leaf number 14.39 and 4.80%, respectively in comparison with vegetative stage extract (Figure3) and these were 17.90, 10.85% for *Amaranthus retroflexus* leaf area *(*Figure4). In other hand grain filling and vegetative extracts of sorghum had minimum and maximum decreasing effect on *Amaranthus retroflexus* leaf area and number.

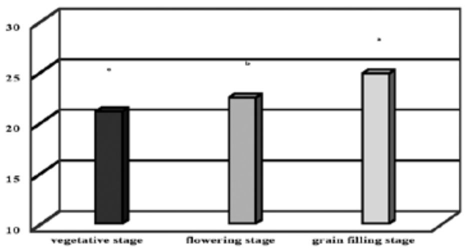

Figure 4: Sorghum different stage extracts effect on *Amaranthus retroflexus* leaf area

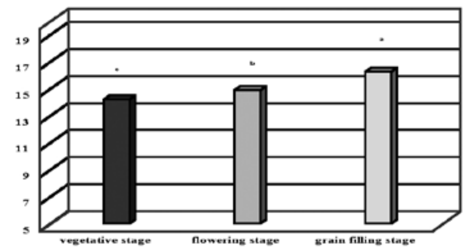

Figure 3: Sorghum different stage extracts effect on *Amaranthus retroflexus* leaf number

Table 1. Analysis of variance of surveyed germination attributes of *Amaranthus retroflexus*

Source of variation	Degree of freedom	Plant Height	Leaf number	Leaf area	Leaf dry weight	Shoot dry weight	Root dry weight	Leaf and shoot dry weight	biomass
Organs	3	60.74**	73.29**	136.38**	0.76**	0.62**	0.65**	2.20**	7.34**
Residual amount	4	14111.3**	6628.87**	15765.8**	452.76**	532.72**	192.55**	1967.66**	3385.40**
Organs*residual	12	7.87**	8.06**	11.15**	0.36**	0.49**	0.17**	1.33**	2.91**
Stages	2	100.78**	64.66**	219.13**	9.55**	12.42**	7.42**	43.74**	82.40**
Organs*stages	6	2.60**	0.61	1.37	0.06**	0.15**	0.05**	0.35**	0.46**
Stages*concentration	8	1.08	11.77**	56.60**	4.32**	4.81**	1.52**	18.15**	30.65**
Stages*concentration*organs	24	0.60	0.25	0.43	0.02*	0.08**	0.03	0.13**	0.19**
Experimental error	120	0.65	0.36	0.72	0.01	0.007	2.19	0.02	0.05
CV%		3.07	3.96	3.72	4.22	2.97	7.22	2.58	3.2

* and ** significant at 5% and 1% respectively

Dry matter accumulation rate in different organs of *Amaranthus retroflexus* decreased by sorghum extracts. This decreasing depends on concentration, organ and growth stage. Leaf, shoot and root dry weight decreased by leaf extract with 20% concentration in comparison with control as 97.92, 98.32 and 98.46%, respectively. *Amaranthus retroflexus* dry matter accumulation in root, shoot and leaf was decreased 77.48, 73 and 64.51 % by sorghum 5% concentration shoot extracts, respectively (Table2). Sorghum leaf extract in vegetative stage and shoot extract at grain filling stage had maximum and minimum effects on *Amaranthus retroflexus* dry matter accumulation in shoot and root respectively (Table3).

Sorghum extracts allelopathic effects decreased *Amaranthus retroflexus* biomass, the reduction by 20% concentration of root, leaf, shoot and mixture organs extracts in comparison with control was 97.65, 98.45, 96.64 and 98.07%, respectively. The reduction in 5% concentration was 78.64, 84.98, 72.35 and 79.65%, respectively (Table2). Sorghum different parts extract at vegetative stage affected *Amaranthus retroflexus* biomass more than flowering and grain filling stage (Table3).

Seedling stage was the most sensitive stage to allelopathic compounds and sorghum allelopathic compounds affect rate on *Amaranthus retroflexus* in germination and seedling stage will have important role in canopy establishment. Allelopathic compounds caused morphologic injured on *Amaranthus retroflexus* seedling and weed seedling growth was less than crop in field. Changes in enzyme activities, respiration production deficit, reduction in production and metabolic energy transmission caused *Amaranthus retroflexus* seed sessation [8].This process decreased *Amaranthus retroflexus* seed germination 59 to100% and seedling growth 49 to73%. More sensitivity to allelopathic compounds may depend on small seed size of *Amaranthus retroflexus*. Small seeds are more sensitive to allelopathy because they have less carbohydrate storage and germination occurred in soil surface or near soil surface that there are more allelochimical and increase allelochimicals absorption amount [13]. Delaying of germination and increasing germination time by sorghum extracts from 9 days to more than 30 days had more effect on crop competition and larger crop seedlings had better competition with this weed.

Allelopathic compounds may decrease cell turgor [9], photosynthesis rate, transpiration, enzyme activity, metabolic energy for respiration and development activity [5] mitosis division, DNA replication [22] protein and hormone synthesis [7], mineral absorption and transmission from roots to other parts of plant [8], photosynthetic pigments synthesis [12], chloroplast and, mitochondrion membrane permeability changing and increasing abscisic acid rate [25] per oxidation induction [26] and finally decreasing cells growth, shoot and root by sorghum allelopathic compounds may lead to decreasing in shoot and root growth of *Amaranthus retroflexus* as 50-90% and 64-98%, respectively.

GENERAL CONSEQUENCES

Sorghum root and shoots extracts effect *Amaranthus retroflexus* seed germination and growth that showed different allelochemicals presence in sorghum which effect different *Amaranthus retroflexus* attributes. Leaf extracts in all concentration in vegetative stage had more effect on growth and germination factors of *Amaranthus retroflexus* that showed secondary metabolite higher concentrations in vegetative stage in sorghum leaves. Sorghum stem extract in grain filling stage have lowest effect because of assimilates transportation from lower leaves and stem to grains decreased concentration of these materials. Extract highest inhibition effect on *Amaranthus retroflexus* germination and growth was as below order:

vegetative extract< flowering extract<grain filling and leaf< total organs< root<shoot.

All of sorghum organs have allelopathic effects and decreased *Amaranthus retroflexus* germination and growth as 60 and 50%, respectively, may be important in decreasing *Amaranthus retroflexus* density in fields and establishment sustainable agriculture.

Table 2- Sorghum different parts extracts effects on Amaranth attributes

B (g)	RDW (g)	SDW (g)	LDW (g)	LA (cm^2)	LN	H (cm)	CRG	SL (cm)	GP %		Extract concentration
5.09c	1.91c	1.95c	1.63d	20.15d	15.78c	26.59c	2.06d	2.71e	32.33d	Root	5%
3.58e	1.4e	1.62e	0.87f	18.55e	13.46de	24.58d	1.40e	1.86g	31.13e	Leaf	
6.59b	2.08b	2.57b	1.95b	24.77b	17.32b	29.23b	3.41b	3.56c	38.13b	Stem	
4.85d	1.78d	1.73d	1.83c	22.34c	15.71c	25.18d	2.43c	3.13d	37.23c	Total	
3.23f	1.19f	1.29f	0.98e	16.42f	11.09f	22.94e	1.12f	1.84gh	13.08g	Root	10%
2.24g	0.74h	0.94g	0.83f	14.73g	9.50g	20.15f	0.83gh	0.97 i	10.28h	Leaf	
3.59e	1.24f	1.28f	1.01e	19.22e	14.02d	23.01e	1.43e	2.45f	17.41f	Stem	
2.24g	1.04g	0.94g	0.92ef	16.72f	12.94e	22.67e	0.98fg	1.74h	8.28 i	Total	
1.67h	0.64hi	0.68 i	0.54gh	11.33i	5.68 i	16.79h	0.92g	0.74 j	6.55 j	Root	15%
1.17j	0.48jk	0.66 i	0.45h	9.76j	5.25 i	15.2 i	0.53 ij	0.23 l	3.17k	Leaf	
1.73h	0.54ij	0.81h	0.59g	14.0gh	9.36g	18.06g	0.93g	0.96 i	8.72 i	Stem	
1.38 i	0.41k	0.77h	0.57g	13.58h	8.52h	16.49h	0.69hi	0.57k	8.17 i	Total	
0.56 l	0.13 l	0.52j	0.23 i	4.47m	3.15k	6.13 l	0.0j	0.0k	0.0 l	Root	20%
0.37 l	0.09 l	0.16 l	0.18 i	1.83n	1.62 l	4.33m	0.0j	0.0k	0.0 l	Leaf	
0.80k	0.19 l	0.29k	0.27 i	7.28k	4.07	8.13 j	0.0j	0.0k	0.0 l	Stem	
0.46 l	0.16 l	0.20 l	0.19 i	5.92 l	3.02k	7.29k	0.0j	0.0k	0.0 l	Total	
23.83a	5.86a	9.52a	8.66a	58.57a	37.82a	58.93a	10.43a	6.36a	94 a		Control

Table 3- Sorghum different parts extracts in different growth stage effects on Amaranth attribures

B (g)	RDW (g)	SDW (g)	LDW (g)	H (cm)	SL (cm)		Extract concentration
5.74h	1.65fg	2.32f	2.02f	25.09de	1.98f	Root	vegetative stage
5.24 i	1.34 i	2.25g	1.82g	23.73f	1.71g	Leaf	
5.87h	1.58gh	2.31f	1.98f	25.64d	2.25e	Stem	
5.26 i	1.49h	2.11h	2.04f	24.68e	1.95f	Total	
6.90e	1.98d	2.74d	2.43d	26.44c	2.45d	Root	flowering stage
6.45g	1.72f	2.74d	2.24e	24.70e	1.97f	Leaf	
7.28d	1.96de	2.92c	2.56c	27.48b	2.64c	Stem	
6.70f	1.87e	2.67e	2.48cd	26.23c	2.83d	Total	
7.87b	2.21b	3.10b	2.77b	27.29b	2.85b	Root	grain filling stage
7.27d	2.08c	2.97c	2.53c	25.47d	2.26e	Leaf	
8.63a	2.41a	3.41a	2.95a	29.29a	3.24a	Stem	
7.70c	2.19b	3.12b	2.79b	27.43b	2.88b	Total	

GP: Germination percent, SL: Seedling length, coefficient of Germination Rate, H: plant Height, LN: Leaf Number, LA*: Leaf Area, LDW*: Leaf Dry Weight, SDW*: Stem Dry Weight, RDW*: Root Dry Weight, B*: Biomass, *: (in plant)

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CHANGES IN YIELD AND ITS COMPONENTS OF ONION IN ROTATION WITH SUGAR BEET

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ABSTRACT

Correct rotation performances in crops led to decreasing in disease, insect and weed population and increase soil organic carbon percentage. As yield increases chemical materials application which is one of organic agriculture aspects is done. For studying onion possible rotation with sugar beet, an experiment in three replications was conducted in two years. Rotation with sugar beet increased 35-55 mm bulbs number from 170 to 220, and bulb weight from 9 to 13.4 kg, 55-75 mm bulb numbers from 18 to 33, and bulb weight from 2.2 to 5.5 kg in plot in comparison with non-rotation onion. Rotation increased also oval shape bulbs number from 140 to 184 and its weight from 5.8 to 10.5 kg, and total weight from 13.7 to 20.63 kg per plot. Rotation increased significantly 75-95 mm sugar beet roots number from 11 to 15 per plot. Differences between other attributes were not significant. It can be say that onion is susceptible to weeds so it is better to put it in rotation with competitive plant as sugar beet to improve its yield

Keywords: bulb size, onion, rotation, sugar beet

INTRODUCTION

Rotation is a ancient crop management that improved yield of crop systems. Rotation increases yield by soil vegetation cover duration [9][10], higher water use efficiency [8], and soil nutrients conservation [1][2]. Onion is a native plant in Azarbaijan [3]. Onion is a shallow root plant and a suitable rotation increased its yield. Onion rotation must be containing with legumes as alfalfa and cuter plants as sugar beet, potato and colza, which their presence in onion rotation shows high useful effects [4]. Although these plants do not add much residuals to soil, but they have deep roots and can decrease nutrients leakage [5] and prevent some common diseases as onion rust, Downy mildew (Peronospora destructor), Pink root disease (Pyrenochaeta terrestris), Fusarium Basal Rot (F. osysporum f. sp. cepae), and onion fly (Delia antiqua) [7]. Sugar beet needs soil organic carbon and must be grown after multiyear alfalfa, it voids soil profile nutrients but they clean the field from weeds and improve soil structure. Sugar beet diseases is common with Brassicaceae and Chenopodiaceae and must not put colza in sugar beet rotation.

MATERIALS AND METHODS

This experiment was conducted in East Azarbaijan agricultural and natural resource research center in three replications. There was arranged onion and sugar beet in a rotation in which onion-onion, onion-sugar beet, and sugar beet-onion and these plants cultivation after fallow planted after 2-year rotation. There was no fertilizer used. Attributes like as number, shape and weight of different size onion bulbs, was measured.

RESULTS

35-55 mm diameter onions increased significantly by onion after sugar beet. 55-75 mm diameter onions increased significantly by onion after sugar beet, it increased from 18 to 39. Some attributes like as decreasing diseases, remaining residuals on soil surface to erosion prevention and winter water reservation may be the cause of yield increasing (fig 1). There was significant difference between two systems (onion after sugar beet and onion after sugar beet) in oval shaped bulbs number. Rotation increased also oval shape bulbs number from 140 to 184 and its weight from 5.8 to 10.5 kg. The same trend was shown in oval shaped bulbs weight from 13.7 to 20.63 kg per plot (fig 2).

Rotation with sugar beet increased 35-55 mm bulbs number from 170 to 220, Weight of 35-55 mm onions increased significantly in onion planted after sugar beet from 9 to 13.4 kg. Weight of 55-75 mm onions increased significantly in onion planted after sugar beet from 2.3 to 5.5 kg. Because of sugar beet deep root, it used deep soil nutrition and remained surface nutrients for onion root. Bulbs total weight increased from 13.7 in onion after fallow to 20.6 kg in onion after sugar beet. Sugar beet as a clean crop increased onion yield significantly in compare to fallow (fig 3). Pependick [11] proposed that slow growth plants, which are susceptible to pests and weeds, must cultivated after competitive or weed retardant plants, so this rotation increased their yield.

Only roots with diameter 75-95mm number increased significantly in sugar beet after onion in compare sugar beet after fallow. Rotation increased significantly 75-95 mm sugar beet roots number from 11 to 15 per plot (fig 4).

DISCUSSION

It can be said that selected proper crop for rotation has important role. Different plants showed different behavior in related with first crop [6][12]. Monoculture of sorghum was less than its rotation with oat. However, sugar beet monoculture produced higher yield than rotation. Onion yield and yield components were higher in its rotation with sugar beet, because leaf number, bulb weight and … was higher in rotation with sugar bet. In addition, there was no special disease and low extended weed observed.

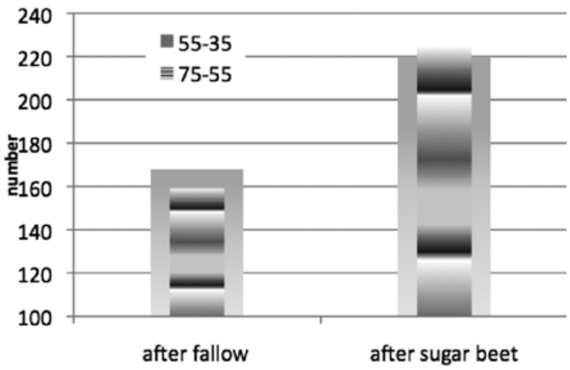

figure 1:effect of rotation on onion different size number

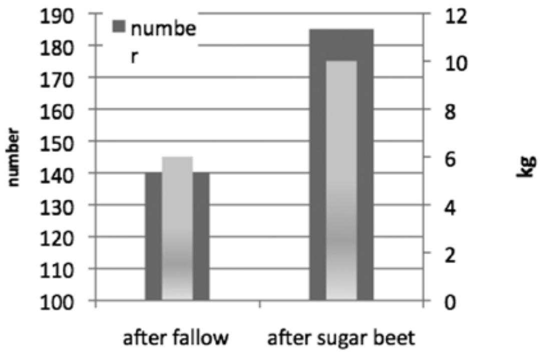

figure 2:effect of rotation on onion oval shape number and weight

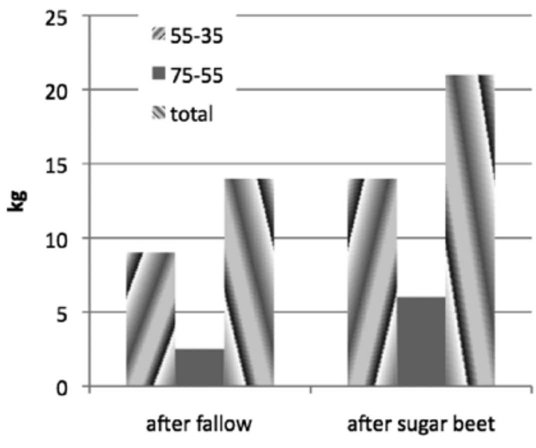

figure 3:effect of rotation on onion different size weight

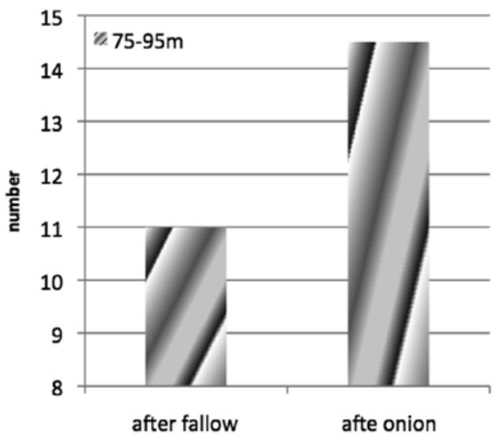

figure 4:effect of rotation on sugar beet 75-95 mm size number

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USE OF GENETIC MATERIAL SUITABLE FOR ORGANIC CHICKEN MEAT PRODUCTION

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ABSTRACT

The demand on organic production had increased in recent years and this increase showed its effect on poultry sector. Consumers prefer totally natural chicken meat despite its higher price. Organic production is consumer-driven, and consumers prefer slow growing, yellow skinned and color feathered chickens. Slow growing chickens reach slaughter weight between 80-120 days. Causes such as; abdominal fatness and some health problems which occur in fast growing chickens are eliminated by using slow growing chickens in organic production. Using fast growing genotypes in organic production can be described as a genetic dissipate. Consequently, it is necessary to crossbreed genotypes suitable for organic production. And, it is possible to use Turkish local genotypes for the breeding of slow growing genotypes.

Keywords: Chicken meat, Organic production, Slow growing genotype, Welfare

INTRODUCTION

Poultry production in the industrialized countries has changed significantly during the past 75 years, and poultry meat is leading The World's total meat consumption after pork. Chicken meat represents 29 percent of meat production from farmed animals and this proportion is rising each year. Advances in genetic, biotechnology, nutrition, hatching, animal health, feed additives, but above all, increase in population and demand on cheap animal meat have effect on the rising of chicken meat [1]. All these advances shortened the production period of conventional broilers, and they reached 2-2,5 kg weight in about 42 days. Muscle system of the chicken grows rapidly, but the organs and the skeletal system can not grow in the same level. As a result of the difference in the growth of body systems, a variety of health and reproductive problems occur in broilers [2] and some of the most common health problems observed are skeletal disorders [3]. Also, heart failure is associated with rapid growth potential and growth rate, the incidence of both hypoxemia and heart failure is higher in fast growing broilers, it can be controlled by feed restriction [4]. However, feed restriction is not applied in commercial production systems. Skeletal problems compromise the birds' welfare, increase mortality and increase carcass downgrading due to lesions [5].

Slow growing chickens reach to market weight of 2-2.5 kg between 80-120 days. Whole of the body parts grow in a harmony and the incidence of health problems decreases. In certain regions of the world, such as East Asia and Europe, consumers are willing to pay a higher retail price for more tasty chicken meat produced in less confined conditions [6]. Also, European Union executed to use slow growing genotypes in organic chicken meat production. In organic production systems, birds have access to outdoors. Outdoor access allows the birds to express natural behaviours such as foraging and dust bathing. In extensive organic production system birds have access to ample space, sunlight and fresh air. Also, indoor housing is used to maximize the welfare [7]. Fast growing chickens are developed for production in indoor, climate-controlled conditions. These birds grow quickly with high yield but they may not be appropriate for alternative systems where conditions are not well controlled [8]. The color-feathered and slow-growing chickens are developed for organic and free- range production systems as alternatives to fast growing broilers [9]. Slow growing chickens are more adapted to outdoor accessed production systems because they are more active and have better viability than fast growing chickens with fewer metabolic problems, less leg disorders and less mortality [7]. In order to diversify chicken products to take account of consumers' changing demands, producers adapt breeding and management strategies accordingly. Most of the countries developed or developing their own slow growing chickens.

Meat quality of slow growing chickens

Appearance is a quality trait. Most of the slow growing chickens' feathers are colored. The skin colors of the colored chickens are more yellow than the white ones [8]. This yellow skin is preferred by consumers. In a study on the effect of age on some physico-chemical and sensory characteristics of the meat, flavour enhancement was found maximal during the sexual maturation of chickens [10]. Slaughter age of slow growing chickens is closer to sexual maturity age than fast growing chickens. Sensory qualities of meat such as tenderness, juiciness and flavor are likely to be impacted when birds are slaughtered at a younger age [11]. Hence, it is normal to find slow growing birds' meat more flavorful [12]. Tenderness reflects the meat texture, affecting the firmness and chewy characteristics of meat. Meat from slow growing chickens that are marketed older is firmer and chewier than broiler meat [9]. Also, slow growing chickens have small amount of fat in abdominal part of the body [13]

Breeding strategies for slow growing chickens

Organic chicken meat consumption reached satisfying levels in most developed countries. Label Rouge in France, Label de Qualite Wallon in Belgium are examples of slow growing chickens which are used in organic production. The breeding companies completed the strategies in these countries. Their new focus is to develop the meat quality traits. In many developing counties, poultry production in rural areas is based on traditional systems [14]. The native chicken population of these countries can be used as a material for developing slow growing chickens. East Asia countries China, Taiwan are develoing their own slow growing chickens. There are more than 100 native chickens in China, most of the companies use these genotypes in their breeding programmes.

The current breeding strategy for slow growing chickens is characterized with crossbreeding between native breeds and highly-selected lines with rapid growth rate or relatively high egg production. In most cases, native chickens have small numbers of egg production. Total egg production of these lines is not useful for commercial breeding. The breeding objectives focus on improving growth rate and reproductive efficiency while maintaining original appearance characters of native chicken such as plumage colour, body shape, comb shape, skin and shank color. The performances of native chickens have been greatly improved by crossbreeding. Most used programme is a system of two-way or three-way crossing to produce commercial chickens. In most cases, excellent native breeds may be used as the male line in order to maintain fine meat quality and the appearance characteristics. Foreign broiler lines, recessive white for instance, serve as female line to improve reproduction performance of breeders as well as growth rate of commercial chicken [9]. Selection of the native chickens for increasing the live weight also can be used for breeding commercial lines.

We are executing a project about the development of slow growing chickens in our department in Ondokuz Mayis University. The purpose of the study is to bring out slow growing chickens by the crossing of heavy parents of commercial egg layers and the parents of fast growing broilers. The results of the study will be shared at the end of the study.

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BIOTERRA UNIVERSITY RESEARCH FOR THE OBTAINING OF ECOLOGICAL FOOD PRODUCTS WITH NUTRITIONAL AND THERAPEUTIC VIRTUES FOR HUMAN'S CONSUMPTION

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ABSTRACT

This paper presents briefly an important achievement of Bioterra University research focused on the obtaining of an ecological food range with nutritional and therapeutic virtues for human's consumption. These food products were targeted in order to put in practice the new scientific concept about safe, healthy, and natural nourishment and they happily join together the natural genuine qualities of the traditional, ecological way of manufacturing updated to the high production request, and they proved also real therapeutic values, thus we used ecological domestic raw materials. The technologies used have low production costs due to the processing and ecological preserving manners, to the raw ecological indigenous materials and also, they are not polluting and use low energy. For instance, our paper describes a pattern of better capitalizing ecological blueberries, considering them a precious indigenous raw material featured by a lot of phyto-therapeutic, bio-stimulating and nutritive qualities, indispensable for the human body.

Keywords: ecological foods range, nutraceutical products, natural processing and preserving, life quality

INTRODUCTION

Nowadays, the consumer became more mature; he is not anymore interested in shape, colour and aspect of the foods, but of its essence and of consequences on long-term of such alimentation on the human health and life quality. We might say that we assist to consumer higher interest for more natural, not very processed, without additives food products, healthier for consumption. These food products are targeted in order to put in practice the new scientific concept about safe, healthy, and natural nourishment and they happily join together the natural genuine qualities of the traditional, ecological way of manufacturing updated to the high production request, and they proved also real therapeutic values, thus we used ecological domestic raw materials. Considering this important aspect, Bioterra University research team focused on the obtaining of an ecological f oods range with nutritional and therapeutic virtues for human's consumption, so called, nutraceutical products.:

- blueberries' integral processing for getting bio-stimulating juice and sub-products (described in this paper);
- "Carotina" natural preserved, antioxidant, full of vitamins and minerals juice obtained from a mixture of Hyppophae rhamnoides, carrot and several indigenous aromatic and medicine plants which happily combines the taste pleasure with plants active principles; it is a health and youth elixir for all ages. It has law production price due to the processing and preserving technology and raw indigenous materials used;
- soy-beans seeds with different flavours for humans' consumption that are adequate processed under the shape of berries, respecting the natural way, the result being a natural delicious, nutritive (40% proteins) product with different tastes and flavours of pizza, sausages, vanilla, etc.;
- natural concentrate for soft drinks based on soluble roasted chicory and several aromatic plants**;** it is a liver protector, carminative and antioxidant product thanks to its polyphenolic compounds.

MATERIAL AND METHODS

The paper presents briefly an example of one of our ecological foods range with nutritional and research, respectively a pattern of better capitalizing ecological blueberries, considering them a precious indigenous raw material featured by a lot of phyto-therapeutic virtues. –as fruits or as natural juices – are due to the richness of their "vital principles" induced by photosynthesis as: glucides, lipids, proteins, enzymes, vitamins (A, B1, B2, C, E, P, PP), minerals (K, Ca, Cl, Fe, P, Mg, S),and phyto – chemicals.

The blueberries' quality is due to their well-balanced complex composition on one hand, and to its small, very juicy fruits on the other hand; we all know that in the cells' membranes there are lots of vitamins, minerals, pigments and flavours, so that there is a very high contents of "noble" elements per surface-unit, higher than larger fruits. Blueberries are also rich in anti-oxidants, such as vitamins and anthocyanins, the latest are also very useful pigment with a synergic part. The blueberries' bio-chemical composition is described in the following table:

RESULTS AND DISCUSSIONS

Blueberries Bio-Chemical Composition

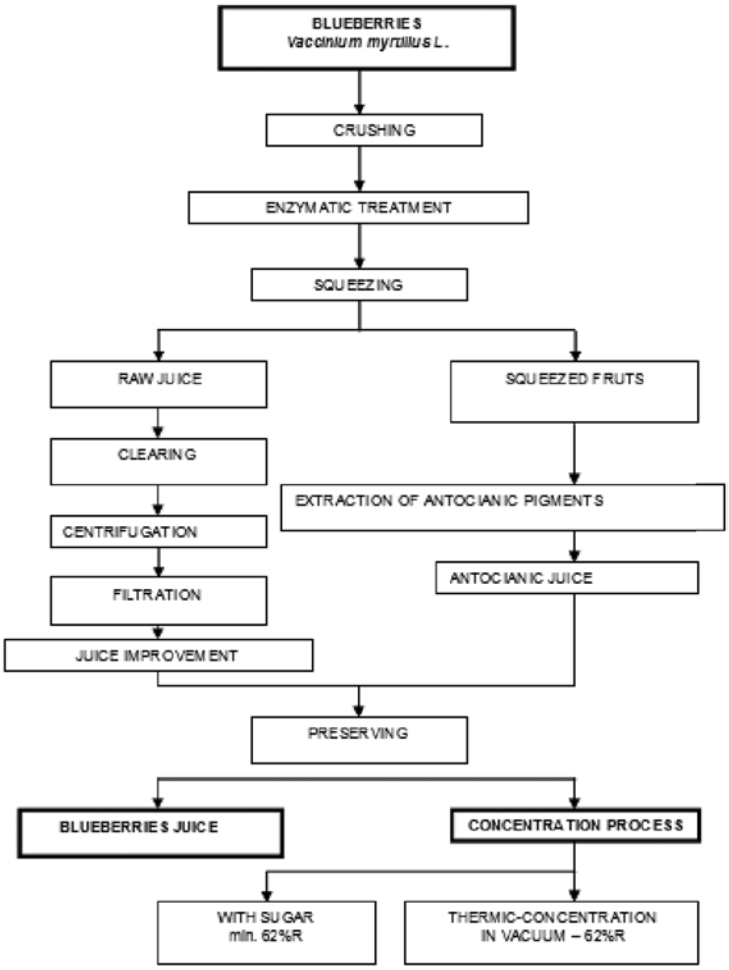
Item No.	Composition	Content
1.	Dry matter %	13 – 15
2.	Total sugars %	5,5 – 7,0
3.	Total acidity (malic acid)	1,28 – 1,68
4.	Harmonic Ratio % Total sugars % Total acidity	5,5 7,0 1,28 1,68
5.	Pectins %	1,98 – 2,76
6	Proteins %	1,94 – 2,70
7.	Tannins %	0,93 – 1,42
8.	Minerals %	2,92 – 3,56
9.	Potassium mg/100 g	187
10.	Calcium mg/100 g	20
11.	Magnesium mg/100 g	5
12.	Phosphorus mg/100 g	16
13.	Iron mg/100 g	1,38
14.	Copper mg/100 g	1,73
15.	Manganese mg/100 g	1,28
16.	Ascorbic acid mg/100 g	110 – 169
17	B Carotene mg/100 g	1,2
18	Anthocyanins %	0,736

The goals of our work were the obtaining of an important range of natural food products and sub-products, such as: natural, bio-stimulating blueberries' juice, concentrates from natural juices, ingredients for food industry like natural red colorants from anthocyanins pigments, purrified pectin, blueberries' wines, blueberries' vinegar, nutritional improved fodder for animals breeding. This was done by using an integral technology scheme with the advantage of being low costing, low energy consumer and no polluting.

Briefly, in the first stage, we obtained the bio-stimulating, natural juice from indigenous blueberries in which the quite high acidity of the vacuolar juice (in the blueberry pulp) is a strong lasting pigment for purple red stabilizer for coloring juice and hydro-alcoholic extracts.

In the second stage, wastes deriving from processing are used fresh, dry or powder, because of their nutritional and bio-stimulating functions due to vitamins and minerals content. After squeezing the blueberries' sub-products rich of anthocyanins, i.e. the "blueberry cake" which is an ideal raw material with high uses and outputs, we obtained natural red pigments for food products, that represents a major purpose as we must substitute the chemical dyeing products harmful for health.

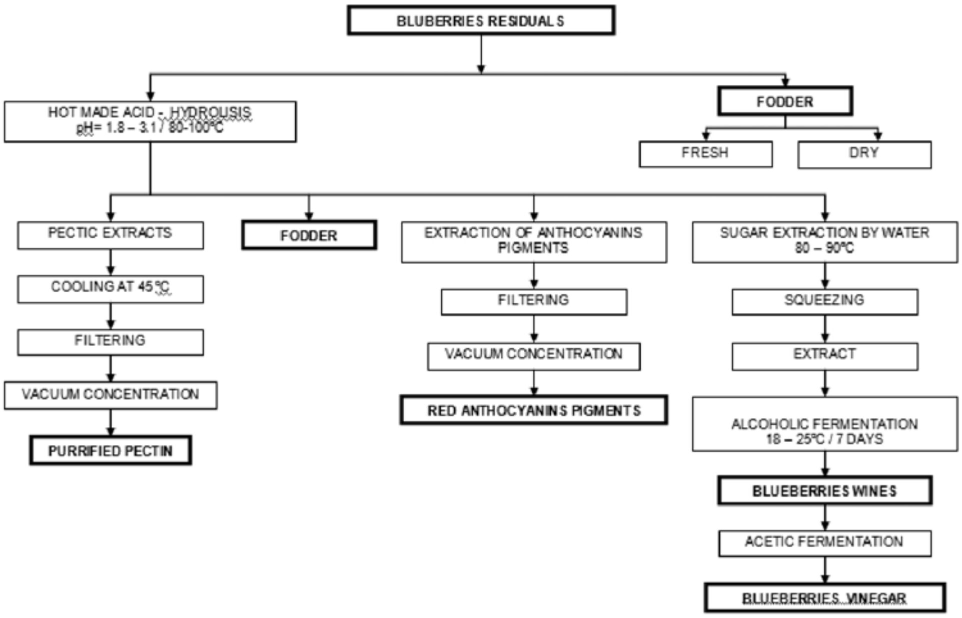
The main blueberries' processing technological scheme with the specific procedures is the following:



The following products and sub-products are gained thanks to the overall processing of blueberries:

Item no.	Products and sub-products	%
1.	Fresh blueberry fruits	100,00
2.	Selected fruits	93,07
3.	Raw blueberry juice	67,63
4.	Fruits pure'	22,82
5.	"Blueberry cake" = blueberries leftovers	25,19
6.	Structural wastes (seeds, peels)	10,25

In the second stage, we provided various ways of capitalizing blueberries after its first processing, as it is presented in the following scheme:



OUTLOOK

- The objectives of our work were accomplished by the better capitalizing of indigenous ecological blueberries, a precious raw material, with the obtaining of an important range of natural food products and sub-products, by using a ow energy consumer and no polluting technology.

- We obtained natural blueberries' bio-stimulating juice in which the quite high acidity of the vacuolar juice (in the blueberry pulp) is a strong lasting pigment for purple red stabilizer for coloring juice and hydro-alcoholic extracts.

- The blueberry leftover cake, rich of anthocyanins, is an ideal raw material with high uses and outputs.

- The achievement of natural red pigments for food products obtained from natural sources is a major purpose as we must substitute the chemical dyeing products harmful for health.

- Wastes deriving from processing are used fresh or dry or powder because of their nutritional and bio-stimulating functions due to vitamins and minerals.

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RESPONSE OF COTTON (GOSSYPIUM HIRSUTUM L.) TO USING SAHARAN DESERT SOIL AND NATURAL FERTILIZATION

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ABSTRACT

It has been shown that Saharan soil solution when illuminated with visible light have the potential of enhancing bioavailable (Fe^{+2}/ Fe^{+3}) iron and some other essential macro and micro nutrient elements as well as some basic amino acids. In this study, these properties of the desert soil have been tested on the certified cotton cultivar (*Gossypium hirsutum* L.) by using illuminated and non-illuminated Saharan desert soil solutions. It has been shown that measurable growth parameters obtained by using illuminated Saharan dust. Thus, it can be suggested that desert origin dust under specific conditions may act as a source of natural fertilizers.

Keywords: Saharan dust, cotton (*Gossypium hirsutum* L.), mineral elements, natural fertilizers.

INTRODUCTION

It's known that the sources and transport pathways of dust play an important role in global climate and biogeochemical cycling, because dust transcends topographic and oceanic barriers. Dust from distant sources is a major component of soils in arid and humid areas. This dust provides nutrients needed for plant growth and influences hydrology by altering soil texture. Saharan dust has an important impact on climatic processes, nutrient cycles, soil formation and sediment cycles [11]. This cycle atmospheric deposition involves complex biological and chemical interactions of iron and nitrogen are amongst essential inputs for agriculture that are not yet fully understood.

Airborne microorganisms are found to be ubiquitous in the atmosphere. Cultivable bacteria and fungi have been sampled high up in the stratosphere. Microorganisms attached to Saharan dust can be transported across the Atlantic Ocean [4]. Bacteria and fungi have also been found in cloud water, and precipitation [10]. In desert regions, dust is dispersed from different sources. These include alluvial deposits on dry flood plains wadis, playas, etc. In addition to wind stress, dust production is influenced by vegetation, soil structure, and moisture content of the soil, texture, mineral content and surface roughness [3]. One of the most problematic results of the topsoil erosion is the repeated blowing away of the fine particle fraction, as this upper layer believed to contains most of the nutrients [9]. This is mainly because of the accumulation of water and nutrients, which support higher levels of plant growth and biomass, and enhance species diversity [1]. The yield of agricultural products mainly depends on the availability of nutrients and if deficient, plant nutrients are added to the soil, in different manner as to increase the yield. Sulzberger and Laubscher has shown the light-induced dissolution and the photochemical production of Fe(II) by using Lepidocrosite and oxalate as a reductant based on the assumption that oxalate present in atmospheric waters due to anthropogenic sources. Recently, Saydam and Senyuva (2002) suggested that desert soil can be a potential source of bioavailable iron through in cloud photochemical reduction of iron minerals assisted by the oxalate released by the fungi's present within the desert soil. Hence, in nature, the temporal and spatial variability of the bioavailable iron delivered to the crust via rain may be controlled by in cloud photochemical reduction of desert origin dust assisted by the impact of oxalate released by fungus present within the desert soil. Saydam and Senyuva (2002) has further shown that, the basic process in the photochemical production of bioavailable iron through decarboxylation reaction involves simultaneous action of oxalate released by the fungus within the cloud droplet above some threshold solar radiation. It has been further shown that besides the photochemical production of Fe(II) upon collapse of iron hydroxyl oxide containing clay mineral the release of other micro nutrient elements like Zn and Mn also been demonstrated following the release of iron along with phosphate. Therefore, desert origin dust may support the view that it may have the potential of supplying some essential micronutrient elements to the nature [11]. One essential point is the solar light intensity dependency of reduced iron production and its stoichiometry following its production since reduced iron is rather unstable and in the absence of sufficient solar light it is oxidized back to stable iron. Recently, Mace et al 2003, has reported that the organic N within rain and aerosols exhibited statistically significant linear relationships to Ca^{2+}, K^+, Mg^{2+}, NO^{3-}, and SO_4^{2-} during periods when kinematics trajectory analysis indicated the origin of winds from arid regions, mainly in Northern Africa, and when the aerosol optical index was high, in other words during dust pulses originating from Saharan. Detailed analyses of amino N have further shown that amino N were indicative of biological organisms and individual dissolved free amino acids contributing the largest percentages to amino N totals in aerosols were glycine, arginine, proline, and valine. The authors have further indicated that increased concentrations of glycine, proline, and valine can often be associated with a bacterial or a biological influence since primitive organisms, such as bacteria, contain these amino acids in high concentrations. Having understood the mechanism which can lead us to enhance solutions with reduced iron and some other essential elements and amino acids it was decided to imitate this process artificially and to test its possible impact by using various seeds. The first test have been performed by Yücekutlu (2004) on the certified wheat cultivars monocotyledons (*Triticum aestivum* L. and *Triticum durum* L.) by using Hewitt nutrient solution [6] and deionized water used as two extreme control solutions and illuminated and non illuminated Saharan desert solutions as. This study has shown that measurable growth and photosynthetic parameters can be obtained by using illuminated desert dust solutions under controlled environment. The growth media were; Hewitt Nutrient Solution, Illuminated Saharan Desert Soil Solutions, Non-illuminated Saharan Desert Soil Solutions, Deionize Water [14]. At this stage we have tested the impact of Saharan soil solutions by using dicotyledons cotton (*Gossypium hirsutum* L.) under natural solar cycle.

MATERIAL AND METHODS

1. Saharan desert soil solution

In this research, Saharan desert raw soil samples taken from southern Tunisia, near Tozeur has been used. In laboratory the raw soil samples dried, sieved (200 mesh) and homogenized. As a tree different growth media, illuminated and non- illuminated Saharan desert soil solutions and distilled water have been utilized. During the course of the experiments no, in situ, Fe(II) measurements have been made but the system illuminated with natural solar light for more than twelve hours during the months of July to September 2004 at Ankara (34N, 4E) when the light intensity is well above the threshold level and it was assumed that Fe(II)/Fe(III) ratio has reached to a steady sate level after two hours of irradiation as suggested by Saydam and Senyuva (2002).

Basing on this hypothesis we have decided to test the impact of desert originated soil following its in cloud transformations. As to imitate the cloud, 2 kg of homogenized less than 200 mesh Saharan soil is dumped into 2 L volumetric flask and kept under solar light during the daylight and abbreviated as Saharan Irradiated (SI). The basic idea behind the use of 2 L volumetric flask was to increase the optical path as this is often reaches a few kilometers within the cloud itself. Basic aquarium pump was used to aerate the system so that complete mixing has been maintained during the irradiation that is lasted more than two hours as to reach a steady state of reduced iron formation as mentioned by Saydam and Senyuva, 2002. Similar Saharan dust containing mixture was kept in dark and abbreviated as Saharan Dark (SD) as first control and distilled water containing solution (DW) as second control solutions.

Irrigations were performed every other day by spraying the respective solutions through the leaves as to imitate the rain. To avoid cross contamination during spraying the other two pots were removed. Saharan desert soil samples were analyzed by X-Ray Diffraction *(Philips W1140 model)* using CuKα radiation and a goniometry speed of 2/min at Hacettepe University Department of Geological Engineering. Mineral analyses of the used Saharan desert soil sample are composed of 55% quartz, 17% calcite, 4% clay, 23% gypsum and 1 % feldspar [14]. These results were agreed with literature [2].

2. Cotton seeds

In this research, cotton (*Gossypium hirsutum* L.) cultivars were used. Elite seeds of the cultivars were obtained from Central, South Agricultural Research Institute in Turkey. Plants were grown during the period of 12 July/8 September 2005 at ambient temperatures.

2.1. Harvest dates

Cotton seeds were planted on 12 July 2005 and lasted till 8 September 2005 when the last sampling was performed. Each pot contains equal amounts of homogenized commercial soil (pH=5.5). Pots were placed at well solar illuminated location with equal spacing. Each set contained 12 plants (3plants/pot) and harvested four times; (H_3) 4th leaf stage, (H_4) 5th leaf stage, (H_5) 6th leaf stage and (H_6) 7th leaf stage. Shoot length, leaf area and chlorophyll contents of the seedlings were measured at harvest dates H_3, H_4, H_5 and H_6.

Shoot length of seedling was measured (cm.seedling^{-1}) at harvest dates. Leaf area (cm^2 seedling^{-1}) expansion is one of the fundamentals processes of plant growth [13].

Photosynthetic pigments were extracted from eight separate seedling samples in pure acetone. The absorbance of the extracts was measured at 644.8 and 661.6 nm using a Dr Lange CADAS 200. Spectrophotometer. The concentration of chlorophyll (Chl_{a+b}) was determined and calculated using adjusted extinction coefficients [7].

3. Experimental design and statistical analyses

The experiments were performed in randomized design. Statistical variance analysis of the independent data with eight replicates (n=8) was performed by using the SPSS packet program and the differences between the means were compared with least significant differences (LSD) at the 5% level.

RESULTS

1. Seedling length (cm/plant) and area (cm^2)

The seedling length and area of cultivates at H_3, H_4, H_5 and H_6 stages were shown in **Figure 1 and 2**. Growth parameters observed at each stage for cultivates sprayed by Illuminated Saharan Solution (SI) was statistically greater than dark (Non-Illuminated) Saharan Solution (SD) and Distilled Water (DW).

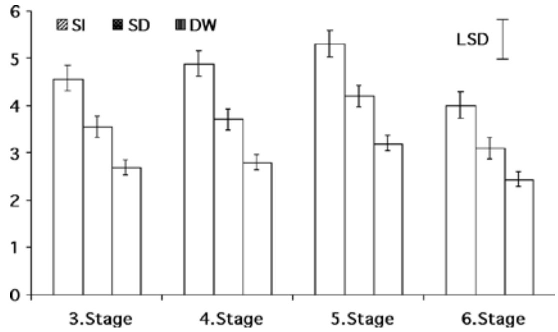

Fig.1. Effect of different growth media on the length of seedling at the third, fourth, fifth and sixth leaf stage (H_3, H_4, H_5 and H_6) for cotton cultivar. Illuminated Saharan Desert Soil Solution (SI), Dark Saharan Desert Soil Solution (SD) and Distilled Water (DW).

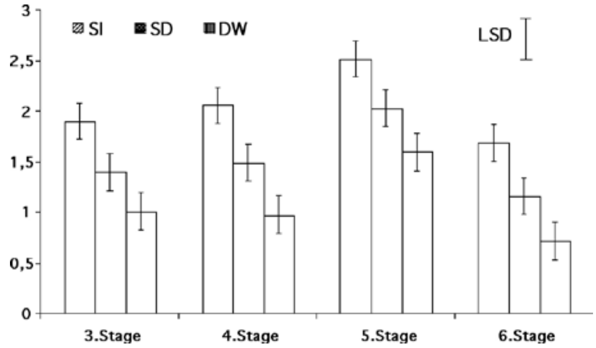

Fig.2. Effect of different growth media on leaf area of H_3, H_4, H_5 and H_6 leaf stage of seedling for cotton cultivar ($cm^2 area^{-1}$). Symbols and abbreviations correspond to those in **Fig.1.**

3. *Chlorophyll*$_{a+b}$ content ($mg.g^{-1}.fw$)

Statistically, the observed photosynthetic growth parameter at (H_3, H_4, H_5 and H_6) stages is however much more stressed in favor of cultivates irrigated by illuminated Saharan desert solution as shown in **Figure 3**.

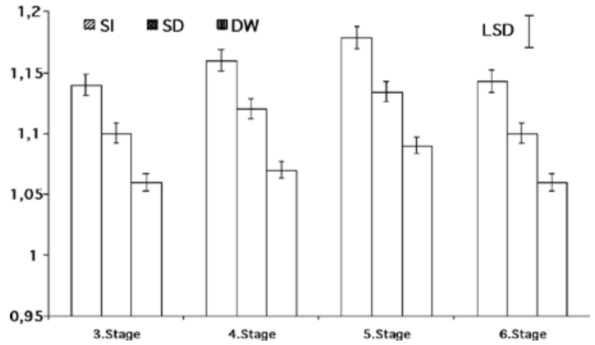

Fig.3. Effect of different growth media on *Chl* $_{a+b}$ content of H_3, H_4, H_5 and H_6 of seedling for cotton cultivar ($mg.g^{-1}$ fresh leaf weight). Symbols and abbreviations correspond to those in **Fig.1.**

DISCUSSIONS

As shown by Yücekutlu (2004) by using wheat varieties, maximum measurable growth and photosynthetic parameters were also obtained by using illuminated Saharan soil solution for cotton cultivates. The observed photosynthetic activity was significantly greater for the illuminated Saharan desert solution and during the course of growth period steady increase is also observed in the chlorophyll content of illuminated cultivates. Therefore the ratios of micronutrient elements at illuminated desert soil solution may pave its way to a new fertilizer solution that is much more acceptable by nature. Saydam and Senyuva (2002) have also shown that the production of bioavailable iron is induced by solar illumination and the availability of this iron is further distributed by the sporadic nature of rain events along the path of atmospheric depression. Therefore the natural enhancement of the crops by desert induced soil can be detected by modern meteorological radars provided that the distinction between the day light and night wet deposition events is made.

CONCLUSION

The results of this work may lead us to change our understanding of the global dust transport and associated rain events along the track of atmospheric depressions at appropriate seasons where the solar radiation is above some threshold level as to sustain the formation of bioavailable iron. This work also carries even more importance for those developing nations that happen to own such resources, often accepted as land without any use, offering them the prospect of prosperity since now we have the technology to imitate the natural process and to utilize the end product in true "organic farming".

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SITUATION OF ORGANIC FARMING IN ANIMALS AND DAIRY CATTLE

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ABSTRACT

In recent decades, increasing numbers of animals are raised in intensive production systems. As the numbers of farm animals rise, so do their greenhouse emissions. Organic milk production increases methane emission and, therefore, can reduce global warming potential only by reducing emission of carbon dioxide and nitrous oxide considerably.

In Turkey, demands to organic animal products out of country are significant scale, although organic animal production is a little from country. Market price of organic milk products are higher than conventional ones.

Priority have to be given to following subjects in organik dairy farming in Turkey; Politics related to education, research and support should be developed for short, middle and long times; Demands should be determined not only from, but also out of the country; producers must be organise; organic products have to be presented; regulation conditions have to be provided.

Key Words: Organik Agriculture, Animal Husbandry, Oganic dairy farming,

ORGANİK HAYVANCILIK VE SÜT SIĞIRCILIĞI

Entansif üretim sistemlerinde yetiştirilen hayvan sayısı son yıllarda artmıştır. Sera gazı yayılımı, populasyon büyüklüğüne bağlıdır. Dolayısıyla hayvan sayısı arttıkça sera gazı yayılımı da artmaktadır. Organik süt üretimi, metan gazı yayılımını artırıp CO_2 ve N_2O yayılımını azalttığından global ısınmayı düşürme potansiyeline sahiptir.

Türkiyede organik hayvansal ürünlere dış talep önemli ölçüde olmakla birlikte, organik hayvansal üretim çok azdır. Organik süt ürünlerinin market fiyatı, geleneksel üretim ile üretilenlerden daha yüksektir.

Türkiyede organik tarımın geliştirilmesi için; eğitim, araştırma ve destekleme ile ilgili kısa, orta ve uzun süreli politikalar geliştirilmeli; ülke içi ve ülke dışı ihtiyaçlar belirlenmeli; üreticiler organize olmalı; organik ürünler tanıtılmalı; yönetmelik şartları sağlanmalıdır.

Anahtar Kelimeler: Organik Tarım, Hayvancılık, Süt Sığırcılığı

INTRODUCTION

Ecological agriculture is a kind of agricultural system that its every step (from production to consumption) is controlled and certificated and natural methods are used, and using of chemicals (such as fertilizer, medicine, hormone) is forbided.

Farm animals are an important an integrated part of most organic farms. They make valuable contributions to the productivity and sustainability of organic agricultural systems. The development of organic animal husbandry has been slower than the organic plant production. There are several reasons for this, historical and philosophical as well as the fact that research on animal production often is more expensive and difficult to carry out compared to crop research. However, organic animal research has increased considerably in several European countries lately and resulting from this, improved efficiency and productivity can be expected in organic animal production, as well as beter animal welfare. There is a big interest in organic farming in Europe, both among politicians, consumers and farmers. Organic agriculture is subsidized by the EU, and the Commission is currently working on Action Plan for organic food and agriculture. Animals are an important part of most organic farms and research to develop beter organic systems is now performed in many European countries. Thus we can expect organic animal production to increase during the years to come. Livestock production which is one of the main branches of agricultural process should be conducted with objectives of saving ecological balance and obtaining biological improvement in a sustainable manner with respect to human health. International Federation of Organic Agriculture Movement (IFOAM) express that "all livestock should be treated under the suitable conditions to show their innate behaviour" in the definition of organic farming. According to this definition, human have to apply some limitations for restrictive and forced methods, which are used in the intensive livestock production systems [10].

Today, intensive livestock production, which is conducted to meet demand for excessive animal protein, causes some problems. These are:

1. Decreasing reproductive rates livestock which are forced for higher production.

2. Increasing mastitis rates and foot diseases in dairy herds.

3. Decreasing resistance to many diseases in all livestock.

4. Developing some dengerous diseases (i.e. BSE) due to feeding intensive animal diets which contain rendering products.

5. Developing some metabolic disorders (i.e. fatty liver syndrome) and cage layer fatigue and breast blisters in the caged poultry systems.

6. Increasing of global warming.

In recent decades, increasing numbers of animals are raised in intensive production systems in which chickens, pigs, turkeys, and other animals are confined in cages, crates, pens, stalls, and warehause-like grow out facilities. These production systems are devoid of environmental stimuli, adequate space, or means by which to experience most natural behaviors. Furthermore, because these industrialized, "landless"facilities tend to produce more manure than can be used as fertilizer on nearby cropland [5]. In recent years, industrial livestock production has grown at twice the rate of more traditional mixed farming systems and at more than six times the rate of production based on grazing.

Confining greater numbers of animals indoors and further separating production operations from agricultural land will only exacerbate the environmental problems already posed by this sector, which FAO has deemed "one of the top two or three most significant contributors to the most serious environmental problems, at every scale from local to global" [22].

Livestock inventories are expected to double by 2050, with most increases occuring in the developing world [22]. As the numbers of farm animals reared for meat, egg, and dairy production rise, so do their greenhause gases (GHG) emissions. GHG emmissions from livestock are inherently tied to livestock population sizes because the livestock are either directly or indirectly the source for the emissions [24]. Since the 1940s, for example, escalating animal populations have significantly increased emissions from both animals and their manure [17].

Regarded as the most important GHG, CO_2 has the most significant direct-warming impact on global temperature because of the sheer volume of its emissions. Of all the natural and human-induced influences on climate over the past 250 years, the largest is due to increased CO_2 concentrations attributed to burning fosil fuels and deforestation [3]. The animal agriculture sector accounts for approximately 9% of total CO_2 emissions, which are primarily the result of fertilizer production for feed crops, on-farm energy expenditures, feed transport, animal product processing and transport, and land use changes [22]. As a result of as the numbers of farm animals reared for meat, egg, and dairy production increase, so do emissions from their production. By 2050, global farm animal production is expected to double from present levels. The environmental impacts of animal agriculture require that governments, international organisations, producers, and consumers focus more attention on the role played by meat, egg, and dairy production. Mitigating and preventing the environmental harms caused by this sector require immediate and substantial changes in regulation, production practices, and consumption paterns. Although demands to organic animal products from out of Turkey are significant scale, organic animal production is a little. Market price of organic animal products are high. In addition present structural problems of animal husbandry in Turkey also obstruct development of organic animal farming [26].

The reasons of organic animal farming is not develop today in Turkey, except apiculture, are as follows;

- In Turkey still such as alum, plague of bovine, tuberculosis, brucellosis epidemic diseases are exist Food hygiene criteria that are applied In the World trade can not be obtained yet in Turkey. So, animal and animal products imports have been forbided by a lot of countries [26].

- Demand of organic animal products is a few in Turkey. Because income levels are very low of most of consumers in Turkey. Today they can not consume animal products that are produced by conventional farming in adeğuate amounts

- Standart rules of EU on animal health and wellfare in organic farming.

Price of certificate is generally very high for small family units in Turkey. Some inputs of organic farming can be provided by out of Turkey. In addition some of necessary chemical and microbiologic analysis have to made out of Turkey [26].

Basic objective of Turkey in scope of membership to EU were determined as developing of distibuting of income, fight with poverty, to set into action of dynamics of regional developing [1]. Because of this, some activities such as supporting of organic inputs, increasing of investment potential, constituting of conditions in order to provide knowledge flow to producers and processors are some opportunities that have to be evaluated in the period adaptation to EU. According to mentioned things above, organic animal farming have potential in point of view export for today in Turkey. Because of increasing of population speedly more production is necessary for consumption of Turkey. So obligatorily modern Technologies have to be used for today. For his reason ecological production systems are not attractive in adequate level for today. In addition because of production is low and prices also are high in this system are attractiveness of organic production decreased for country markets.

ORGANIC DAIRY FARMING

Milk is very important food. But, as a result of conventional farming contains some remainder substances. That is why milk create some health problems. So it is important to produse of milk as organic. For this reason organic farming have to be developed in plants and animals. Organic agriculture systems are developing speedly in Europe and USA. Animal feeding strategies have positive effects on environment in organic milk production . Global warming potential of milk production is for 48-65% due to emission of methane. Organic milk production increases methane emission and, therefore, can reduce global warming potential only by reducing emission of carbon dioxide and nitrous oxide considerably. Organic milk production reduces pesticide use, whereas it increases land use per tone of milk .In recent years organic dairy farming had acquired a big significance as alternative method of dairy farming in other dairy farming systems in America and Europe. because of some for reasons developing of standards of sustainable animal husbandry and wellfare, decreasing of negative effects to environment during producing, increasing of income of producers, protection of herd health [1] [18] [23] [25] [20]. USA, Canada an EU Countries are ahead in producing of organic animal products. But in even these countries the objectivece in related to animal health and wellfare make difficult transition from conventional to organic farming. In spite of this increase of milk and milk products are 37%/year in 1998-2003 period [24]. Production cost and profitability are different among farms in the countries which organic animal farming are made as widespread in those parts. In these countries demand to high quality organic milk and milk products produced as controlled and certificated are getting increase. Because of ocganic food usage, suitable barn conditions, suitable animal breed, animal health and some other rules in organic farming producing cost is higher than conventional farming. That is why, market price of organic products have to be convenient in point of view creating demand and unit profitability Market price of organic products are higher than conventional ones at 25-50% level. In addition, low product amount per head and rearing lower number animals per unit area also effect producing profitabity [26]. Rate of organic dairy cattle and milk production in some EU countries are given in Table 1 [2].

Table 1. Rate of organic dairy cattle and milk production in some EU countries

Country	Organic dairy cattle (%)	Organic milk production (1000 tone /year)
Austria	15	300
Denmark	7	300
Germany	1.2	28.5
Holland	0.5	60
France	-	80
Great Britain	-	20
Sweden	4.3	-
Switzerland	10	-

Organic dairy farming are made the most intensively in Austria. In this country the share of market of organic milk and milk products is 3.5-5.1% in total milk and milk products [4]. In Denmark the sahre of ornanic milk is 20% in total cow's milk production [15].

Advantages of organic dairy farming as follows;

- Frequencies of health problems, that cause economic lost, is lower than conventional farming; Frequencies of some metabolic disorders such as mastitis, ketosis, milk fever, foot diseases are lower than in conventional herds [19] [8] [7].
- Convert efficiencies of forages to milk is higher [19].
-Lactating cow's number in the herd is higher (Reksen et al 1999).
-Conception rate is higher, service index and culling rates are lower, service period and calving interval are shorter [19].
-Resistance to many diseases is higher
-Negative effect to global warming is lower,
- Some dangerous animal diseases (such as BSE) are not seen, because of feeding are mainly based to forages and pastures.

Veterinary- health costs are lower at 15.29% - 44.44% levels (Rates are differs from country to country). Because, frequencies of the diseases that cause economic lost is lower azalmaktadır [9] [13] [14]. Average milk yields of cows that are raised in organic herds are lower 4.06% (Germany) – 28.35% (USA) than ones reared conventionaly [9] [13] 21]. Because, feeding are mainly based to forages and pastures [15]. Average labour costs are higher 6.63% - 94.80% in organik dairy dairy farming. İncrease rates are differs from country to country [6] [12] [16]. Organic milk is the first time produced at 2005 in Turkey, in Kelkit Organik Farming Unit (1350 tone/year). Kelkit Organic farming had established at 2002 and it has the most big capacity in Europe. Organic farming had been started with 600 imported heifers at 2003. Organic milk produced in the unit is purchased by one Firm from İzmir and marketed in İzmir (2.10 TL/kg =~ 1 Euro). In Europe 10-15 years ago organic milk was only processed in factory of the every unit. Today it is purchased and sold as commercial in some countries. In Turkey yet transition had not been realized to certification system and suitable standarts have not been constituted. As soon as possible standarts have to be constituted, or ınternational standarts constituted have to be assimilated and producers have to be informed on the subject.

Turkey only have 0.2% of organic agriculture areas of the World today (57 000 ha).

Organic milk which produces in with high costs can found market higher price in point of producers and consumers respectively 10-40% and 20-150%. In this situation it is difficult to develop of organik milk production in Turkey. But, when conventional structure of dairy cattle farming in Turkey is thought, future of organic dairy farming may be bright; For example East Anatolian Region have significant potantial for organic milk production. Because East of Anatolian Region's structure of agricultural area of is not dirty and it has suitable climatic condition for dairy cattle farming.

As a result of, priority have to be given to following subjects in order to provide transition to organic dairy farming towards demand out of country;

a) Politics related to education, research and support should be developed for short, middle and long times,

b) Determining of demands from and out of country

c) Producers have to be organised

d) Organic products have to be presented

e) Regulation conditions have to be provided

f) Supervision

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CAN WE CREATE NETWORKS FOR SUSTAINABLE LIVING IN OUR CITIES AND VILLAGES?

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ABSTRACT

This study aims to create holistic management of sustainability in cities and rural areas. The objectives are to prevent immigration from rural areas to cities, to improve quality of life in the cities and the villages, to reduce of carbon dioxide emissions and to live in harmony with the nature. This study explores the organic production potential of rural settlements around Ankara to aid in discovering and establishing sustainable agriculture practices, and helps conservation of natural balance by clean agricultural production. Organic agriculture production in Ankara and Turkey, statistics for conventional food reaching Ankara Wholesale Market, vegetable and fruit transport distances to Ankara were elaborated. A project which was held using a novel methodology, Dragon Dreaming, was used to increase awareness for organic farming among the people living in rural and urban settlements in Ankara. Various economical models integrating organic production with municipality supported organic markets, Community Supported Agriculture and the synergy created between rural and urban people in Ankara were discussed.

***Keywords*:** sustainable living, organic agriculture, community supported agriculture, Dragon Dreaming, Güneşköy, Ayrancı Organic Products Market, Ankara

INTRODUCTION

United Nations established Millennium Development Goals, MDG, in 2000 and expected to improve the poor living conditions in the poor parts of the world until 2015 with the help of rich countries [1]. One important goal of MDG is to eradicate the poverty and hunger. One of the targets of this goal is to achieve full and productive employment and decent work for all, including women and young people. Another goal of MDG encourages the states to incorporate sustainable development policies and programs to prevent the loss of environmental resources. A rapid rise of greenhouse gases is a reminder of climate change problem. The last but not the least goal of MDG is about development of global partnership for development.

Global economical crisis which was started in 2008 resulted in reduction in the growth of economies and many nations, including Turkey, suffer from increased unemployment. Turkish gross national product had a growth rate of 9.4 % in 2004, but declined to 1.1 % in 2008 and still lowered to a negative growth rate of -13.8 % in the first quadrant of 2009 [2]. The unemployment statistics for 2009 has been announced as 13.4 % [3], but rising to more than 20 % in some southern and southeastern cities of Turkey.

There is a high rate of migration from rural to urban and from northern, eastern and south eastern regions of Turkey to western regions [4]. According to 2008 census, total population of Turkey is 71.5 million and 25 % lives in the rural areas. The rate of migration from rural to urban increased to 29 % in the last decade.

The global economic crisis affects all nations in the world by rising unemployment, falling income and migration of people. The increasing population and increasing rate of consumption of natural resources resulted in climate change and peak oil. United Nations (UN) is working on reduction of the impact of humans on our planet earth. The UN organized international meetings for taking actions to mitigate the effect of climate change (Rio de Janeiro 1992, Kyoto 1997 and Johannesburg 2002), annual climate change conferences (COP) and established MDG to reduce the poverty in the poor regions of the world.

Various forms of alternative ways of living have been experienced all over the world for creating sustainable living. The Transition Town movement has started in UK to organize the towns resilient to climate change and peak oil [5]. In Italy, Slow City movement [6] has been started and both movements are spreading in the world.

The purpose of this study is in accordance with MDG mentioned above, e.g. eradication of the poverty and hunger, incorporation of sustainable development policies and programs to prevent the loss of environmental resources, development of partnership between people living in rural and urban areas. For this purpose various activities such as organic food production, raising awareness between people in these areas to support each other for a sustainable living were organized.

The production of organic food by environmentally friendly cultivation techniques (e.g. drip irrigation, natural farming, companion planting, crop rotation, composting) were considered here. The multinational seed companies push hard the governments all around world to use their infertile and genetically modified seeds (GMO) by free trade agreements. That is a great threat to the food security of the world. The use of local seeds is forbidden by governments under the pressure of big international companies and western countries. The biodiversity of eco systems are under pressure due to GMO's, pesticides and chemicals used in agriculture. As all the food is grown locally, the reduction of food transportation radically reduces the environmental impact of food chain. People living in a town can access high-quality organic food directly from producers. Organic markets promote an urban healthy lifestyle by enabling city inhabitants to be better informed and buy organic and safe food directly from farmers [7]. *It also contributes to the survival of local producers, promotes a conviviality not found in the city supermarkets and reconnects city and countryside*.

The organic markets, which get only minimum support from municipalities and NGOs, provide new and alternative retail channels for small organic producers. Farmers can earn more and consumers can find organic food

Alternatively, in community supported agriculture (CSA) fresh, organically grown, reasonably priced box of vegetables are delivered to the doors of the supporters. This service fosters awareness of tradition, taste and the natural seasonal availability and healthy food. *Being in touch with the surrounding region, getting the best from it and the luxury of receiving organic food to home brings the feeling of confidence about its provenance.*

Creating multi channel communication platforms between producers and consumers is seen as one of the main challenges. A workshop named "Planning for Sustainability" was organized by John Croft [8] in Middle East Technical University (METU), Ankara in February 2009. After this workshop, a group of people including the authors of this paper came together and made a voluntary project. *Their overall aim is to create a direct communication platform, producer/consumer link and raise awareness on organic agriculture by increasing cooperation between each other.*

In this paper, organic agriculture in Turkey and Ankara will be analyzed in section 2, focusing briefly upon local production yield and environmental effects with maps and some statistics. Case study areas of the project will be explained in section 3. The use of Dragon Dreaming methodology, overview of the project and some examples from activities held in this project will be presented. The added value**,** some benefits and lesson learnt from this project will be discussed in the last section.

ORGANIC AGRICULTURE IN TURKEY AND ANKARA

Organic agriculture started in Turkey in 1985 for export of 8 kinds of products, and then it is increased to 201 types today with rising demand. Organic agriculture has been held in 49 provinces in 2004, today this number is 65 [9]. Small and fragmented farms do organic farming all over the country. In 2007, 5723 farmers were in the process of transition to organic farming on 38924 hectares of fields. *Today organic farming was done by 10553 farmers on 135360 hectares and had a yield of 431203 tones*. The Ninth Development Plan of the country covering the years of 2007-2013, aims to increase organic agriculture areas to 3% of total agriculture area. The total production area increased to 45000 hectares between 2002 and 2007 and yield was 43000 tones. Production area is not really developed but the yield is really incremental. As seen in Figure 1, *Aegean coastal provinces and southeastern Anatolia plains produce highest organic yield in the country.*

Major organic crops in Turkey are: cotton, wheat, apple, grape, corn, tomato and olive. *Apple was at top of the list in 2004 and cotton was in 2008* [9].

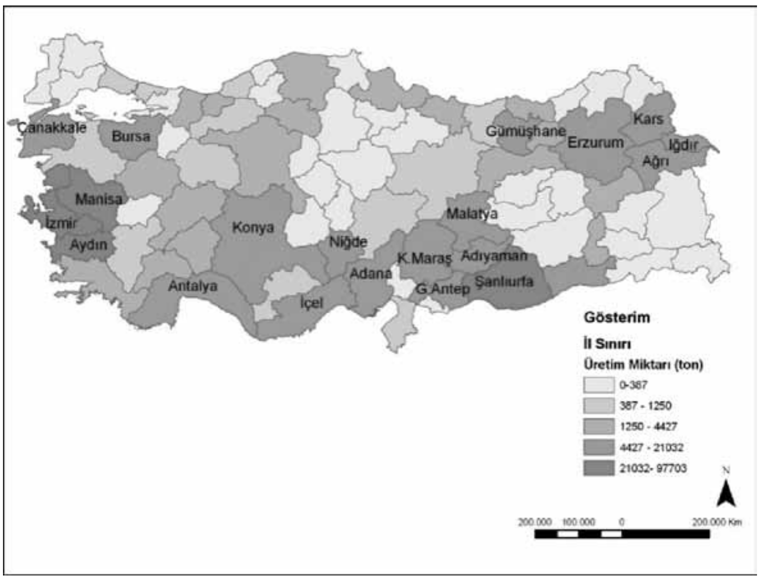

Figure 1. Distribution of organic production in the provinces of Turkey

Ankara is the capital of Turkey and case study area in this project. So, some wholesale market statistics are compiled for conventional produce. An amount of 313832 kg of vegetables and 371166 kg of fruit, with a total of 684998 kg were entered to the wholesale market in 2008 [10]. All these produce transported by 51770 trucks in that year. *The wholesale market is located in the city center, the heavy traffic load and environmental pollutant effects of these vehicles are serious* problem (Table 1).

The number of trucks	51770
Average amount of travel(km)	1000
Average amount of fuel (L/1000 km)	250
Total amount of fuel (L)	13000000
Total CO_2 (kg)	39000000

Table 1. Ankara wholesale market statistics, 2008 [10]

The main provinces which feed Ankara are İzmir, Adana, Bursa, Antalya, Mersin and Eskişehir (Figure 2).

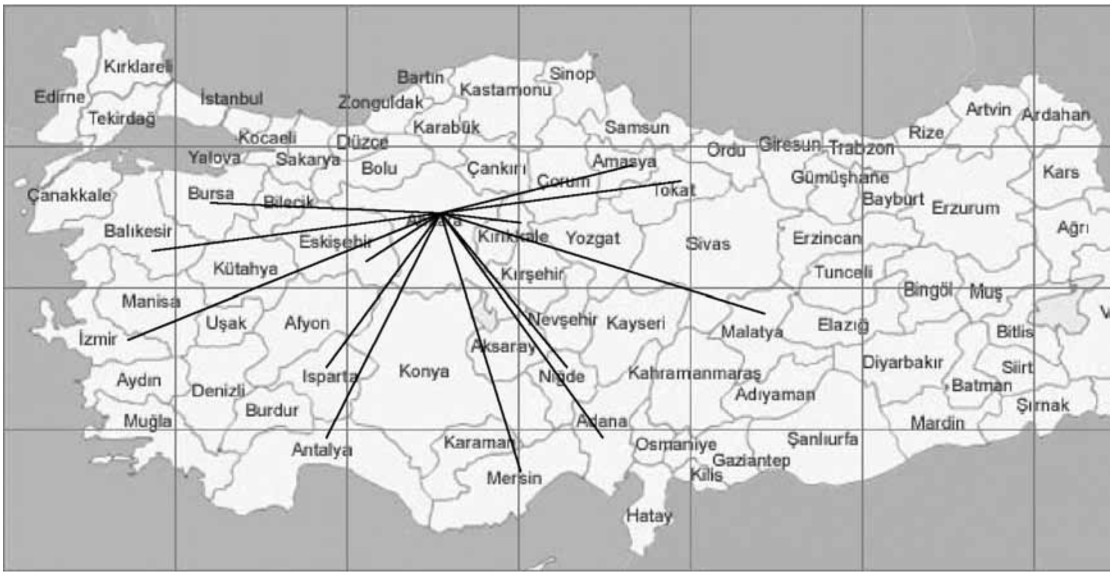

Figure 2. Provinces sending vegetables and fruits to Ankara

Onion, tomato, wheat and pepper are the major organic produce in Ankara [11]. Limited number of farmers (17) in Ankara produced 3536 tons of vegetables in 308 hectares in 2008. There are 7 private firms in Ankara for organic certification.

Organic agriculture is held in *Beypazarı and Nallıhan* districts in Ankara. Furthermore, 79 farmers in *Kızılcahamam and Çamlıdere* produce *organic honey* in 360 hectares in 512 beehives [12].

RAISING AWARENESS BETWEEN PRODUCERS AND USERS

This part defines the case study areas, project methodology and project details about raising awareness on organic agriculture. Some activities will be presented as examples in this issue.

Güneşköy, Hisarköy and Ayrancı Organic Market in Ankara

In Turkey there are 81 provinces and 38000 villages. The population living in the villages is about 25% of population of Turkey. There are 944 villages in Ankara (Figure 3).

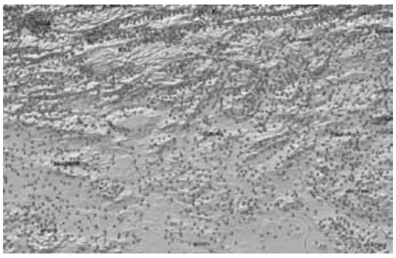

Figure 3. Villages in Ankara

Güneşköy, is the first and nearest eco-village initiative near Ankara (Figure 4). In 2002, 7.5 ha of land in the Balaban Valley were purchased from the state. Balaban Valley extends 50 km in north-south direction on the border of Ankara and Kırıkkale provinces. The Balaban stream flows at the basin of the valley and joins to Turkey's largest river, Kızılırmak. Güneşköy is situated 3 km away from a local village, Hisarköy [13]. Hisarköy is 27 km away from Kırıkkale and has a population of about 300 people.

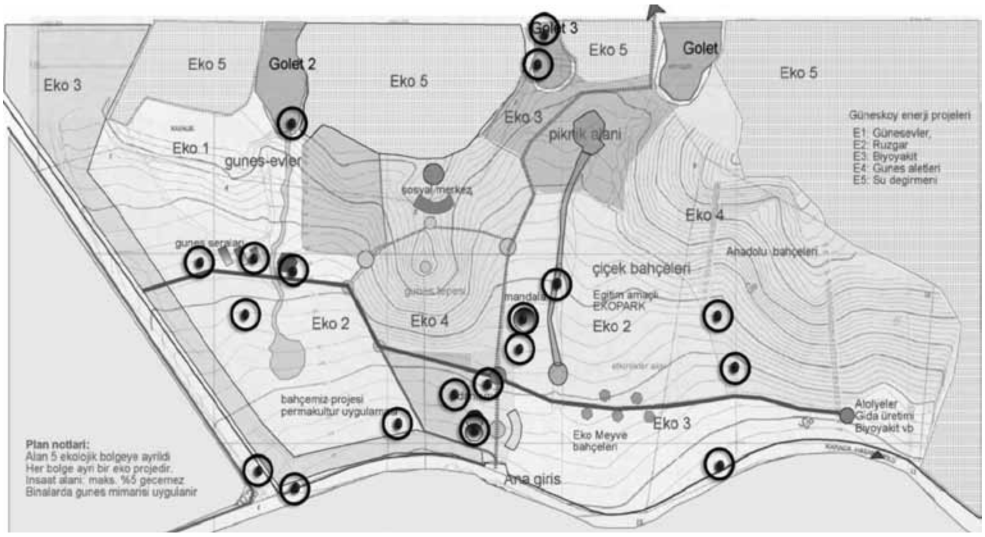

Figure 4. Plan of Güneşköy [13]

Eight members founded Güneşköy cooperative in 2000 and first organic agriculture was started in 2005. The local farmers from Hisarköy worked in the field and paid for the period of about 8 months. Two women from Hisarköy worked as paid farmers for the first time in Güneşköy in 2009. A box of organic vegetables is delivered weekly to 100 families in Ankara. This is the 4th year in 2009 that this community supported agriculture (CSA) project continues between June and November. A variable amount of 8-*10 kg of vegetables is put in a box and 28 different kinds of vegetables are served to the door of the supporters of project in Ankara throughout the season. In 2008, total production is about 15 tons in 0.7 ha*. The resources used in this cultivation are listed in Table 2.

Water	4800 tons
Electricity	21000 kWh
Transport	2 tons of fuel
CO_2 production	6 tons (transport)
CO_2 captured	5.8 tons (30 tons organic matter, 4 tons dry organic matter)

Table 2. Resources used in Güneşköy for CSA

The organic production in this small land (0.7 ha) is compared with the conventional production in Ankara (Table 3).

Conventional vegetable production in Ankara		**Organic vegetable production in Güneşköy**	
Area	39.000 ha	Area	0.7 ha
Production	720.000 tonnes/year	Production	15 tonnes/year
Yield	18 tonnes/ha	Yield	21 tonnes/year

Table 3. Comparison of conventional versus organic vegetable production in Ankara and in Güneşköy [13, 14]

The second case study area is *Ayrancı Organic Market in Ankara which is the unique one established 1.5 years ago and coordinated by Çankaya Municipality. Nearly 30 producers with 107 stands participate in this market.* Market is in the city center and very near to the parliament and residential areas. According to the questionnaire that was given to customers at the market, consumers are from the close neighborhoods such as Ayrancı, Dikmen, Öveçler and Kavaklıdere. However, there are consumers from all over Ankara who has concerns on their and their families' health after the GMO debates recently raised in the country. Beyond vegetables and fruits, legumes, olive oil, bread, cosmetics and detergent are also sold in the organic market. Income of the producers varies between 200 and

2000 TL in this weekly organized organic market. Hisarköy villagers also sell some of their products in this market (Figure 5).

Figure 5. Hisarkoy villagers in Ayrancı Organic Product Market

Ankara is a metropolitan city with 4 million inhabitants, but the organic food consumption is relatively low. There is a need for activities to raise awareness. So for this purpose a project is started in March 2009 and still continues by applying a novel methodology which is described in the next section.

Dragon Dreaming Project Methodology

A workshop named as "Planning for Sustainability" was held in February 2009, in METU, Ankara. This 3-day activity was coordinated by *John Croft,* founder of GAIA Foundation of Western Australia. He created a new project management methodology named as "Dragon Dreaming" about sustainable community projects. After giving theoretical background, he interactively guided some groups according their dreams and activated them through their goals.

In many community projects, 90% of projects failed to get beyond the first stage- dreaming. Of the 10% that succeeded, another 90% failed to get beyond the second stage- planning. This means 1% of projects actually get off the ground and do what they set out to. To increase this low success rate, he developed his Dragon Dreaming *approach.* It is a tool to help a project through four stages; dreaming, planning, doing and evaluation/celebration (Figure 6). Leaving out any one step, the project will invariably fail [15]. Everyone involved in the project has to decide whether they are prepared to carry an equal share of the project. No one is the head or master; they are at the equal level.

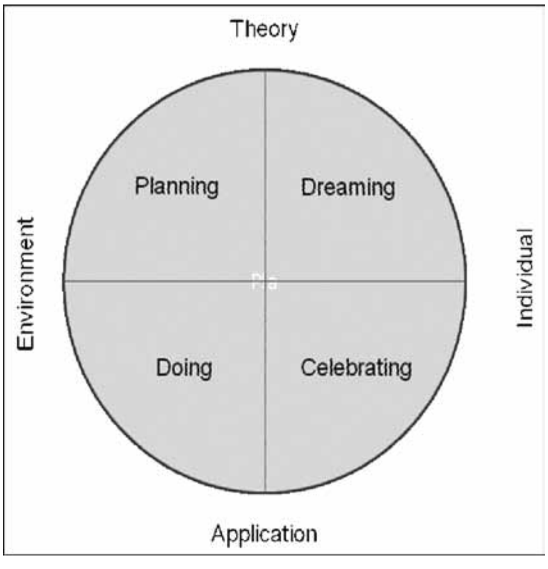

Figure 6. Dragon Dreaming stages

In Dragon Dreaming, *there are 4 main steps*, each having three subdivisions and altogether there are 12 steps [15]. Each step is a fractal, the structure of the whole is reflected in each of the steps [16]. In dreaming stage, the group comes together and everyone asks this question to themselves in turn: "What would this project need to achieve to make your participation 100% worthwhile?". There is no evaluation, competition or criticism at this stage – just go on including all the objectives. When the dreaming circle is finished, we define the objectives for the project. Planning is the second stage where an idea is worked up, where research and investigation take place. In planning stage, the Board Game is played.

On a large piece of paper we draw a circle at the top labeled "Start" and one at the bottom labeled "Finish". Then the group comes together to think of any task that will be needed to complete the projects' objectives. After identifying and positioning the tasks we come up with into the 4 stages of dreaming, planning, doing and evaluating /celebrating. When we have our list of tasks, we can get a sense of the strengths and weaknesses of the group – if we have mainly planners, dreamers, doers, celebrators. Then we add circles with labels for every task to our start / finish board game piece of paper, dividing the board into 4 stages. In the next step, we add lines to show any connections we can see between the tasks. Every task should have at least one input and one output – if we cannot find one there are probably tasks missing [16]. When everything is connected up we the plan for the project is finished. *This web is named as karabirrdt.*

We ask each person in the group to identify; *which tasks they feel passionately about, which tasks make them would fear taking on and which tasks they feel competent to do.* These are the people who should do the tasks. People taking on fearful tasks will need a mentor. Tasks with lots of inputs and outputs are key tasks and we need to make sure they are resourced properly. The group empowers fundraising through their sociogram [17]. Doing stage is where the idea is implemented.

Celebration is the last stage where the success of the project is evaluated and this stage looks at the failures and difficulties before starting the cycle again [8]. John Croft kept emphasizing the need for celebration – so that those who are putting energy into the project keep getting something back. This should include fun, nourishing activities but also acknowledgement for what people have done [8]. *Nonviolent communication principles* [18] and *Gaia Foundation of Western Australia's main principles* such as personal growth (commitment to your own healing and empowerment), community building (strengthening the communities of which you are a part) and service to the Earth (enhancing the wellbeing and flourishing of all life) are all included in these projects [19].

Overview of the Project

After the workshop, a group of people came together under the same dream for creating sustainable living in our traditional villages and connecting rural and city people for organic agriculture. Seven people from different professions such as chemists, industrial engineer, chemical engineer, agricultural engineer, city planner and an architect went to Hisarköy to start a Dragon Dreaming project. In a cold day in March 2009, they met with Hisarköy villagers and everyone shared many dreams, they were all written in large sheets. Then another meeting was held in METU including these people and some other stakeholders such a person having an organic certification firm, a farmer having large lands making organic agriculture and Ayrancı Organic Market coordinator.

They all shared their dreams again. Then in April 2009, these dreams were categorized in 4 phases, then strengths and weaknesses of the project were written down in another meeting and the main aim was created. The aim is to raise awareness about organic agriculture in Ankara inhabitants and connecting them to Güneşköy-Hisarköy and other organic producers. *A karabirrdt was built in 4 stages and many tasks were created and connected to each other* (Figure 7). People in the group had many tasks and these were connected to each other. Then a Gannt chart showing timetable of the project was prepared. After all these preparations, there was core team coordinating these tasks.

This team made some regular meetings every month. They gathered some statistical data about Turkey, Ankara, Güneşköy and Ayrancı Organic Market which are presented above. Also they determined all stakeholders in this project. *These stakeholders are farmers and women working in the fields of Güneşköy, deliverer of boxes of vegetables, organic market customers, CSA supporters, and participants of the organized activities. Academicians from METU and Gazi University in Ankara are interested in this project. Çankaya Municipality, Yenimahalle Municipality, Union of Municipalities of Central Anatolia and province/district directorates of agriculture* might be the future stakeholders of organic projects. Ministry of Environment, Agriculture, Public Works Ministry Rural Areas Department and Parliament constitute secondary category of possible stake holders. National and international funding agencies such as TÜBİTAK, EU, UNEP, SGP and World Bank are taken into consideration. People are informed with radio programs and e-mail groups.

Four main activities were organized for raising awareness which will be explained in the next section. Questionnaires were given to the producers in Ayrancı Organic Market and to the city people participated to various activities.

The mayor of Çankaya was contacted for creating a city farm. A lunch was organized for the celebration phase with a famous singer, Yıldız İbrahimova for her support to one of the activities. Some reports were written for Çankaya Municipality organic agriculture advisory committee.

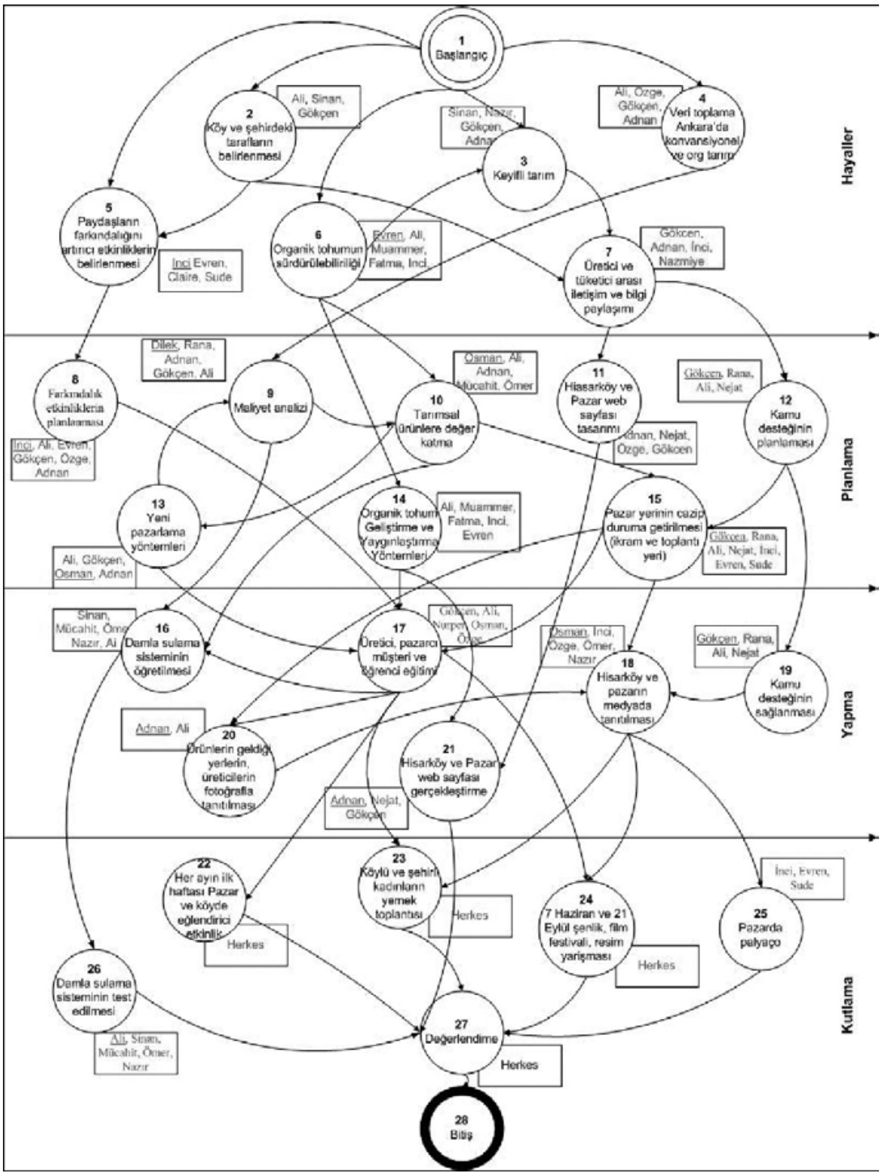

Figure 7 Karabirrdt of the project

Activities in the project

The first activity in this project was made in *June 7th, 2009* and named as *Organic Garden Trip to Güneşköy*. This activity was announced by the posters and leaflets which were distributed to the market customers in Ankara. Totally 65 people participated to this trip who were willing to see an eco-village near Ankara (Figure 8). They heard about this trip from environmental e-mail groups and leaflets in the market. The entire group met at the organic market. Most of them have seen the marketplace for the first time. According to the questionnaire given during the trip, they were wondering to see fields of organic agriculture and they were willing to meet with the other committed people and to have information on CSA of Güneşköy. They were not familiar with the terms of companion planting, nonviolent communication, local exchange trade system (LETS) and drip irrigation. They were unaware of the amount of pesticides and artificial fertilizers used in the country or fruit and vegetable mileage in Ankara.

When they arrived at Güneşköy, one of the cooperative members informed the group about the site, fields, pond, strawbale building used for meeting and biodiesel fuel production operations [20]. Then some of the people cleaned the weeds, planted some vegetables and installed pipes for drip irrigation. Organizers distributed cloth bags to the participants to be used in organic market. Children competed in kite running and villagers served delicious local food to the guests coming from Ankara. According to the questionnaire, the visitors were satisfied about seeing an eco-village initiative, learnt the details of some techniques and some decided to participate CSA.

Figure 8. Trip to Güneşköy

The second activity was *another trip to Cappadocia, Avanos for grape harvest in October 3-4, 2009*. A producer who sells his organic products in Ayrancı Organic Market invited customers to his farm in Avanos. It was a 2-day-grape harvesting festival. 40 people participated to this trip, they harvested organic grapes, strawberries and other vegetables and they prepared molasses and wine from grapes by pressing and boiling (Figure 9). They tasted local food and learnt to make earthenware in a local shop. Famous Turkish singer Edip Akbayram and central administrator of that district, Avanos Kaymakamı also attended this festival. All the participants enjoyed the festival.

Figure 9. Pressing grapes in Avanos

The third activity was made for the *children in November 8th, 2009*. The aim was to educate young generation about organic agriculture and while they are having fun. Project members organized a small amphitheater made up of straw bales. Famous singer Yıldız İbrahimova, as an honorary guest gave a concert to the children in Ayrancı Organic Market. Children's Theater Team of Çankaya Municipality performed some plays with the children and gave messages about healthy organic food. Then children learnt to make compost, to plant acorn seeds and they painted wooden toys (Figure 10).

Figure 10. Children's festival in Ayrancı Organic Market

The last activity in Ayrancı organic market was *New Year Celebration in December 20th, 2009*. All of the producers in the market and some of the participants of the market prepared local food, pastry, hot wine and fresh juice; there were an open buffet for everyone who came to the marketplace (Figure 11). Photo exhibitions from Avanos grape festival and from other activities explained above were seated in the center of marketplace. Violin and saz (local instrument) concerts were given by the producers and their children. Then Dr. John Fagan and Dr. Ayla Cevik from Maharishi International University gave a briefing on Vedic Organic Agriculture (gaining nourishment from soothing melodies) and danger of genetically modified seeds [21]. Fagan's motto was "Protect your ancestral and traditional seeds".

Figure 11. The New Year celebration in Ayrancı Organic Market

CONCLUSIONS

Similar to many developing societies, the agrarian relations in Turkey face important problems in terms of their conditions of survival within the developing tendencies of capitalistic changes that are undergoing. The commercialization of the inputs that are needed for production and consumption and the integration of the villagers/producers to the extending markets through producing agricultural products and consuming industrial products force villagers to sustain their life more and more through the means of *commercial relations, big seed firms and extending cash economy*. *The conventional agriculture made by globalized firms, wholesale market legislations, seed act impedes organic food producers in the country.* So, organic markets, CSA or any kind of other alternative techniques of distributing and selling healthy food gain more importance. But this project's priority is to raise awareness of adults and children for consuming organic food in the city, learning the process of organic cultivation and to create direct communication link between producers and consumers. *If people take part in the production, the added value for them is that they know what they get, where it comes from etc. and this induces the social cohesion and the sense of responsibility towards the environment, too.*

After making Dragon Dreaming Project on organic agriculture and synergy between city and rural people, some *lessons learnt and important tips from this project management are listed below:*

- Contribute to personal growth, community building and service to the Earth,
- Find a group of committed people who will leave behind their egos, (there should be minimal conflicts of interest in the core team),
- Involve everybody, both villagers and city inhabitants in the transition,
- Create together, clear written aims- karabirrdt and refer to them frequently,
- Some people will leave and others will join- whoever turn up are the right people,
- Trust the process, celebrate the successes,
- Build a bridge to local government,
- Disseminate ideas, build social networks between old and young, rural and city people,
- Everyone is equal (horizontal and heterarchical approach, no hierarchical and no top to bottom).

Today's global economic model succeeds in creating competition by dividing people from one another. To build cooperative, harmonious societies we need an approach that creates more opportunities for people from different places and ages to interact- work together, have fun together. *A healthy society is one that encourages close ties and mutual interdependence, granting each individual a net of unconditional emotional support.*

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THE DOUBLE-BIND RELATIONSHIP BETWEEN ENVIRONMENT AND ORGANIC AGRICULTURE. ORGANIC FARMING AS A SOLUTION FOR ENVIRONMENTAL PROBLEMS AND ENVIRONMENT AS AN ASSET FOR THE DEVELOPMENT OF ORGANIC FARMING?

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ABSTRACT

This paper deals with two interconnected questions: How can organic farming (OF) cope with the increasing environmental issues? How can environmental issues be a cornerstone for the future development of organic agriculture? In this paper we propose to re-assess the double-bind relationship between organic agriculture and environmental issues. Our approach combines three elements: overview of related scientific literature, valuation of the concept of ecosystem services within a network of stakeholders, identification of some promising initiatives. Firstly we present a comprehensive view on the interrelationships between environment and organic farming: the concept of ecosystem services to agriculture is used to characterise both the services to agriculture (supporting and regulating services) and the services from agriculture (non marketed services). In a holistic approach we handle a wide range of environmental components: biodiversity, water supply and quality, soil fertility, climate change. Secondly we focus on innovations and case studies involving organic agriculture for improved environmental performances. This is based on empirical surveys of a range of actions concerning biodiversity conservation, water quality improvement, landscape management and preservation of soil fertility. Finally we conclude on related outlooks for the development of organic farming. This work was realised in the frame of the technological combined network called "Development of Organic Farming". This network includes in France, a wide range of partners involved in research, training and extension activities.

Key-words: environment, Organic farming, ecosystem services, innovative actions,

INTRODUCTION

Standard approaches of the relationships between organic farming (OF) and environment are mainly dedicated to assess the impacts of OF on the environment (Stolze *et al*., 2000; Alföldi *et al.,* 2002; Bengtsson *et al*., 2005; Pimentel *et al*., 2005). Such studies are addressing questions of the following type: does OF result in less leaching of nutrients, in higher carbon storage, in higher level of biodiversity …? They are generally based on comparative studies with conventional agriculture, evaluating the effects of agricultural regimes on various environmental compartments with balances, indicators or model-based scenarios. But OF is not only a set of environmentally friendly practices. It is also a development model of agriculture including social and cultural components (El-Hage Scialabba, 2007). Specific management practices, knowledge and know-how are core issues in organic agriculture. In other words the relationships between organic agriculture and the environment cannot be restricted to a single linear relation of impact omitting the reverse relationship from the environment towards farming. This entails considering environment and its management as resources for OF through the enhancement of biodiversity, water, landscape, soil, energy and nutrients cycling, … Subsequently we propose to characterize the interactions between the environment and OF as a double-bind relationship: 1) as usual the impact of OF; 2) the practices implemented by organic farmers to manage the environment and natural resources as production factors and assets.

To characterise this double-bind relationship we used the concept of ecosystem services. After a short presentation of the diversity of ecosystem services and related management practices implemented by organic farmers we firstly focus our analysis on biodiversity and landscape, two key issues for environment preservation. A similar work has been carried out for other components of the environment: soil, water, energy consumption, contribution to climate change (results not shown). Secondly, again on biodiversity and landscape, we present some case studies and innovations involving organic agriculture for improved environmental performances. Finally we conclude on related outlooks for the development of OF: adaptation to environmental stakes with specific practices, territorial approach, multi-stakeholders project approach and cooperation with conventional farmers,.

MATERIAL AND METHODS

This work has been realised in the frame of the technological combined network called "Development of Organic Farming". This network includes a wide range of partners involved in research, training and extension activities in France. In order to design an extensive view of the interrelationships between OF and environment we combined three methods:

- Debates between stakeholders of the network (researchers, technical advisors, teachers …) to discuss the shared issues between development of OF and resolution of environmental problems. In a second step this group designed a common and shared framework to handle the interrelationships between OF and the environment.
- Review of scientific literature. We investigated the literature published after 1999 through computer queries. Associated with the term OF (agriculture) we used a large set of key-words: biodiversity, water, landscape, energy use, soil, life cycle assessment, energy and nutrient inputs, nitrogen and nutrients leaching, carbon storage,
- Survey about different innovative projects involving organic agriculture and farmers for improved environmental performances. We interviewed organic farmers, environmental managers, technical advisors and local facilitators.

This approach refers to Participatory Action Research (PAR) (Monceau, 2005; Charles and Ward, 2007) by defining collectively a "problem" and then attempting to solve it by bringing together various players and resources. It allows to gather very different forms of knowledge: scientific, technical, empiric, local know-how, … Interconnecting different knowledge and experiences led to the following practical issue for our work: the current societal need for improved environment could be an asset to develop OF. Addressing such a challenge requires specific knowledge on both the environmental impacts of OF on the way farmers manage agro-ecosystems and how collective dynamics towards development of OF and practices could be engaged. The concept of ecosystem services (ES) seems to be a relevant framework for reaching such an objective.

ECOSYSTEM SERVICES: A FRAMEWORK TO HANDLE THE INTERRELATIONSHIPS BETWEEN OF (ORGANIC FARMING) AND THE ENVIRONMENT

The concept of ecosystem services: Ecosystems services (ES) are defined as "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life" (Daily, 1997). ES are defined by the demand of the society, they are directly or indirectly useful to man and society. In recent years, the concept of ES has gained wide acceptance within international scientific community and was popularized by the United Nation's sponsored Millennium Ecosystem Assessment (MEA) program (Reid *et al*., 2005). ES were classified into four main categories: *provisioning*, such as the production of food and water; *regulating*, such as the control of climate and disease; *supporting*, such as nutrient cycles and crop pollination, and *cultural*, such as recreational benefits. Agroecosystems both provide and rely upon important ES. Agriculture receives and produces ES, but also receives and produces disservices that reduce productivity, increase production costs (e.g. pest damage) or jeopardise natural resources (pesticide-poisoning of non targeted species) (Zhang *et al*., 2007). As compared with the classification of the MEA we used a classification more suited to agricultural issues, with the three following categories (modified after Zhang *et al*., 2007 and Le Roux *et al*., 2008) (Figure 1):

- "Input" services, which contribute to the provision of resources, the maintenance of the physical and-chemical processes supporting agriculture, and which guarantee the regulation of biotic interactions, positive or negative: i.e. the maintenance of the structure or the fertility of soils, pollination, control of biological invasions;

- “Production” services contributing to agricultural productivity. These ES concern plant and animal production (levels and stability of production over time, quality of products themselves);
- “Output” services not directly contributing to agricultural income, which include, in particular, the control of water quality, carbon sequestration or the aesthetic value of landscapes.

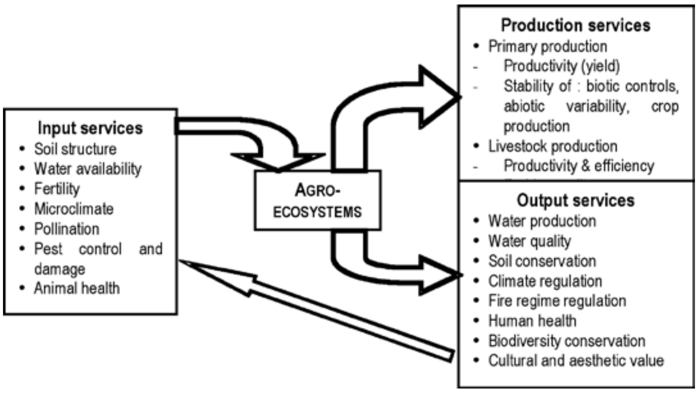

Figure 1: classification of Ecosystems services and dis-services adopted for this study (modified from Zhang et al., 2007 and Le Roux et al., 2008)

Ecosystem services and OF: The concept of ecosystem services appears as a relevant framework for OF. Indeed OF is more based on an efficient use and combination of various natural resources: water, soils, biodiversity, … and rely heavily on natural processes and ecosystem services, permitted by a large set of environmental friendly practices: habitat management to enhance pestspredators interactions, biological control of pests, rotational grazing, crop rotations, specific soil tillage, … OF also encompasses a wide range of performances, beyond physical yield as a major production output, other performance criteria have also to be considered in terms of market and additional productions. Thus, organic agriculture contributes to the conservation of key ecosystem services such as increased water retention, reduced soil erosion and increased agro-biodiversity and natural biodiversity.

	Services	**Management levers**
« Input » services	Soil structural stability (erosion control, compaction resistance)	Mixed farming systems and recycling of manure, organic manure, vegetation cover (intercrop, rotation), conservation tillage, non-crop vegetation and setting-up of hedges and maintenance of more permanent grasslands
	Water availability for primary production	Vegetation cover (intercrop, rotation), organic manure, conservation tillage, non-crop vegetation and setting-up of hedgerows and field margins
	Soil fertility	Mixed farming systems and recycling of manure, organic manure, crop rotation (including nitrogen-fixing plants), vegetation cover, recycling of crop residues, mixed cultivar, conservation tillage, non-crop plants, maintenance of more permanent grasslands
	Micro-climatic regulation	Setting up and management of trees and hedges
	Pollination	Prohibition of chemical insecticides and adapted pesticide application times and products, construction of nest boxes, management of nearby habitats, increased landscape complexity
	Pest control (plant and animal)	Agro-biodiversity (mixed cultivars), construction of nest boxes, setting up and management of hedgerows, weed strips and field margins with sequential flowering, maintenance of natural habitats, increased landscape complexity, Prohibition of chemical pesticides and resistant varieties and breeds
	Control of biological invasions	Preservation of predators and parasitoids, non exotic crops or biological control agents
	Animal health	Breeds diversity, reduced animal stocking density per ha, Prohibition of chemical pesticide, quality of the animal feeding, alternative veterinary medicine (homeopathy, essential oils)
Prod. ser. contributing to agr. productivity	Plant production (food, fibres, energy, etc) Animal production	Quality of forage (higher use of roughage and nitrogen), genetic diversity of crops and domestic animals breeds, mixed cultivars, resilient varieties Prohibition of chemical pesticides Increasing the share of grazed vegetation into animal feeding. Synchronisation between grazed resources availability and animal requirements in the season.
« output » services not directly contributing to agricultural income	Water availability (potable, irrigation, hydro-electricity, industry …)	Vegetation cover, conservation tillage, organic manure, maintenance of natural habitats (woods and forests), mechanical soil interventions Prohibition of synthetic pesticides, antibiotics and hormones, and lower fertilizer application Conservation of adapted local varieties and breeds
	Water purification	Vegetation cover, organic manure, agro-biodiversity, maintenance of wetlands, reduced stocking density per ha, mixed cultivars, phytoremediation
	Soil conservation	Fileds margins, cover crops, mixed cultivars, conservation tillage
	Global and regional climate regulation	Mixed farms with recycling of manure, higher use of roughage feed and reduced concentrate use for feeding, overall wastes recycling, biogas digestion Vegetation cover, rotation, agroforestery Prohibition of chemical fertilizers and pesticides, reduced mechanical weeding with conservation tillage
	Diversity conservation overall and of key species	Genetic diversity of crops and breeds, conservation of heirloom varieties prohibition of GMO Management of diversified hedgerows, increased landscape complexity
	Animal welfare	Loosed-house and access to and outside runs for poultry flocks with a minimum area per hen, reduced animal stocking density per ha
	Aesthetic value for tourism and spiritual	Smaller fields, increased landscape complexity Promotion of traditional and rural varieties

Table 1: Agro-ecosystem services whose provision is altered by organic practices and management levers (modified from Le Roux et al., 2008)

Table 1 presents a set of services provided by agroecosystems in the particular context of OF. One specific contribution in the technological combined network concerns the identification of levers for improved services. In order to do so we used the following approach:

1. Identification of the relevant services of agroecosystems in the context of OF;

2. Analysis of the ecosystems functions which underlie these services;

3. Assessment of OF practices' effects on these services and identification of management levers.

This approach has not been limited to a review of the scientific literature. We brought also together agronomists, ecologists and technical advisors to exchange on management levers for improved services. Combining scientific and practical knowledge, we focussed on the levers whereas most scientific papers focus on services and ecosystem functions without addressing potential drivers. Nevertheless this remains a first attempt that would deserve to be expanded and detailed. To go deeper on the impact of OF and on the management of ES by OF practices we then focused our analysis on biodiversity and landscape.

BIODIVERSITY, LANDSCAPE: CONSERVATION AND MAINTENANCE OF SERVICES BY OF

Impacts of OF on biodiversity

OF appears to be associated with higher levels of biodiversity, supporting higher species richness and overall abundance, in particular for plants, predatory invertebrates and birds. In comparison with conventional farming, Bengtsson (2005) concluded, from a meta-analysis of 66 published studies that, on average, OF promotes species richness with 30% more species and has a positive effect on abundance with 50% more individual per species. This overall positive effect of OF can be linked to favourable farming practices, which have direct or indirect impact:
- Stimulation of the soil biological activity and the management of the fertility with organic manure, complex and varied rotation including ley as part of cereal/vegetable rotation;
- Maintenance and management of non-crop habitats, cover crops and field margins;
- Prohibition of most agrochemicals, alternative crop protection methods with partial effects, higher tolerance level for pests;
- Mixed farming and the promotion of the agro-biodiversity, intra and inter–fields that stimulate for instance crop beneficials with a combination of cultivated species and weeds and with a diversity of crops in the rotations.

Meta-analysis of published studies suggests that biodiversity responses to OF vary across studies (The Soil Association, 2000; Bengtsson *et al.*, 2005; Hole *et al.*, 2005). For instance, 16% of the studies analysed by Bengtsson *et al.* indicated a negative effect of OF on species richness. Table 2 summarizes the variable results of these papers comparing organic to conventional farming. Furthermore, the magnitude of the response varies and some taxa show larger and more consistent response than other since they show variable sensitivity to disturbance (Fuller *et al.*, 2005; Ondine *et al.*, 2009). Aavik and Lira (2010) just revealed that OF significantly supported the species richness of high nature-value species, i.e. species intolerant to contemporary agricultural practices, while agro-tolerant species did not depend on the farming system. Ondine *et al.* (2009) proved that OF enhanced species abundance of two farmland and one non-farmland species, while four other non-farmland ones were less abundant in OF compared with conventional. Cover crops can contribute by hosting populations of beneficial as well as phytophagous arthropods that can provide significant stability to the agro-ecosystem. Fernandez (2008) showed that the number and the diversity of biological controllers increased with the presence of cover crops and decreased with the utilization of agrochemicals. Consequently OF is thus globally favourable to biodiversity despite some species are not or not much sensitive to intensive practices.

Taxon	Hole et *al.*, 2005	Bengtsson et *al.*, 2005	Fuller et *al.*, 2005	The Soil Association, 2000	FIBL, 2006
Vascular plants	+	+	+	+	+
Earthworms	+ Contradictory results		+		+
Pest butterflies	0	0		0	
Aphid		0		-	
Non-pest insects		0			
Non-pest butterflies	+			+	
Spiders	+	+	+ variable results	+	+
Carabidae	+	+	+ variable results	+	+
Staphylinidae	-			+	+
Mammals	Activity +		+ variable results		
Birds	+	+	+ variable results	+	+
Soil microbes	+	+			+
Collembola	Little difference				
Diptera	Contradictory results				
Hymenoptera pollinators	Contradictory results				+

Table 2: Effects of organic farming on biodiversity, compilation of the outcomes of five major reviews (Modified from Bessonnier, 2008)

Meta-analyses from The Soil association, 2000 ; Bengtsson et *al.*, 2005 ; Hole et *al.*, 2005 investigated respectively outcomes from 23, 66 et 76 publications. Green boxes: positive impact of OF; Yellow boxes: cases where results are inconsistent or there is no difference between OF and conventional farming; Red boxes: negative impact of OF.

Effects of landscape structure and farming on biodiversity

Biodiversity in agricultural landscapes is also affected by many factors other than the farming system, as the landscape structure and its heterogeneity. Many studies show that the differences between the management systems, OF or Conventional farming are not always sharp and landscape variables explain more of the variation in species richness in particular for mobile species as Lepidoptera or Carabidea (Weibull *et al.*, 2003; Roschewitz *et al.*, 2005; Debras *et al.*, 2006; Rundlof and Smith, 2006; Piha *et al.*, 2007; Ekroos *et al.*, 2008; Rundlof *et al.*, 2008). In fact in mosaic landscape, OF would have no or little effect on diversity or species richness since the high proportion of non-cropped areas already provide shelter and alternative food for the biodiversity. Thus positive effects of OF on species richness and diversity will be larger in homogenous and intensively managed agricultural landscape. For instance in Sweden, Rundlöf and Smith (2006) proved that the number of species and the abundance of butterflies vary more between organic and conventional farming in an homogenous landscapes (70% of arable land with in average open fields of 6ha and less than 3% of greenland) than in an heterogeneous landscape (15% of arable land with fields of 3,2ha and 19% of greenland) (Figure 2).

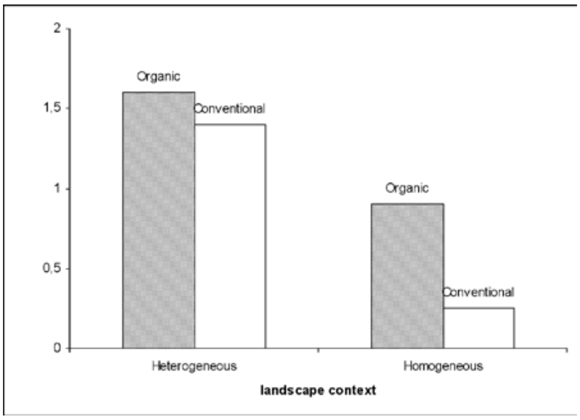

Figure 2: Number of butterflies species according to farming systems and landscape structure (from Rundlof and Smith, 2006) (mean number of butterflies species per 50m transect, visit and year).

The interrelationship between landscape and farming method depend on the species or groups of species. Species that are little mobile, such as the soil fauna, are mainly determined by the environmental conditions and farming practices at plot scale and would then directly be endangered by intensive farming. For mobile species, landscape structure plays an important role which can at least partially compensate the negative impacts of intensive practices. Figure 3 summarise these interactions between landscape structure and agriculture on biodiversity.

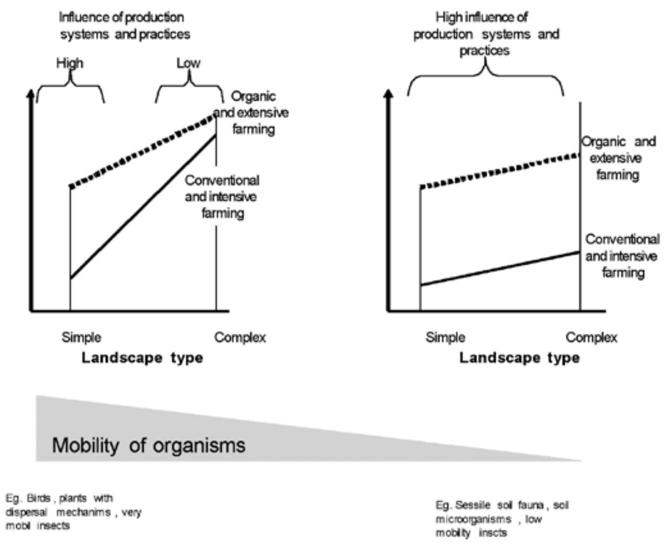

Figure 3: effects of landscape complexity and farming method on landscape scale species richness (modified from Roschewitz *et al.,* 2005 ; Rundlöf et Smith, 2006 et Le Roux *et al*., 2008)

OF and landscape structure

In reference to the importance of landscape structure for the preservation of biodiversity it is to understand how OF interacts with landscape heterogeneity. OF is often associated with a better landscape quality. Frequently, organic farms show higher landscape diversity than conventional farms (Van Mansvelt *et al.*, 1998; Hendriks *et al.*, 2000; Stolze *et al.*, 2000). These investigations were characterised by very small samples (2–8 farms per region), but confirmed by Norton *et al.* (2009) and Levin (2007) with relevant statistical samples and methods. Despite the issue of landscape is mentioned in European standards as an outcome of organic production, there are no clear requirements concerning landscape in organic regulations. Nevertheless, some requirements explain indirectly the relative landscape quality derived from OF management. Baning chemical fertilisers forces organic farmers to maintain nutrient balances through diversified and long crop rotations and to have smaller fields with longer field margins, which are potential habitats and corridors for wild flora and fauna (Van Elsen, 2000). Moreover, organic practices and their effects on landscape should be seen within a broader framework, embracing socio-economic and cultural parameters. Consequently, farm-specific parameters such as farm size, physical and geographical conditions, way of envisaging farming (part-time or full time farming) have major effects on landscape structure. There is a wide diversity of organic farmers, they have different values, objectives and practices and this explains the diversity of landscape in organic farms (Levin, 2007).

Managing services from biodiversity to OF

In agroecosystem, biodiversity performs a variety of ecological services directly useful to agriculture (Le Roux et al., 2008; Altieri, 1999). Beyond the production of food, the recycling of nutrients and other dimensions (Table 2), we focus on two major services provided by arthropod diversity: the control of the abundance of undesirable organisms and pollination.

Insect Pest management.. Increasingly research suggests that the level of internal regulation of function in agroecosystems is largely dependent on plant and animal biodiversity. Biodiversity plays an important role in plant protection by maintaining self-regulation characteristics of natural communities limiting the arrival of invasive pests and heavy pest damage. This regulation is often partial, but it proved to be efficient when pest populations are low. In case of outbreak, we talk about "stabilising" factor rather than control agents. Examples illustrating their potential in OF are numerous (Bengtsson *et al.*, 2005; Hole *et al.*, 2005; Simon *et al.*, 2007; Zehnder *et al.*, 2007; Simon *et al.*, 2009). Whereas when this natural service is lost, as in intensive artificial agroecosystems, farmers must cope with costly external inputs, fertilizers or pesticides for instance, growing their dependency on non-renewable resources.

Knowledge on the mechanisms and drivers to enhance beneficial biodiversity are still poor and scattered. Few studies have concentrated on elucidating the nature and dynamics of the trophic relationships between plants and herbivores, in between herbivores and between herbivores and their natural enemies. Still, two major practices appear as unanimous (Altieri, 1999; Tscharntke *et al.*, 2007; Simon *et al.*, 2009):

- Reduction use of pesticides, both chemical and natural, that have undesirable effects on non-target species. This concerns both synthetic and natural products, as for instance the use of natural insecticides proved to be as much toxic for beneficials (Simon and al., 2009).
- Maintenance of crop diversity in time and space: at the farm level through mixing crops, rotations, and small fields creating structural mosaic of adjoining crops or uncultivated land, and at the landscape level making sure to maintain connexions between natural and cultivated plots by establishing vegetationally diverse field margins and/or hedgerows which may serve as biological corridors.

However, even if the effect of plant management on pest control is mostly positive, contradictory results exist revealing the difficulties of identifying the optimal composition of plants. Especially as these techniques must be site and species specific. What matter is "functional" biodiversity and not diversity per se and herbivores should not be favoured. Simon et al. (2009) reported that 16 studies show a positive effect of selected plant or plant assemblages for the control of key pests, whereas 9 studies revealed no effect and 5 a negative one. Systematic studies on the 'quality' of plant diversification with respect to the abundance and efficiency of natural enemies are needed. *Crop pollination*. The production of 75% of the world's most important crops that feed humanity and 35% of the food produced is dependent upon animal pollination (Klein et al., 2007).The contribution of insect pollination to the world output economic value was recently estimated at 153 billion US$ revealing the vulnerability of agriculture to pollinators decline (Gallai *et al.*, 2009). Morandin and Winston (2005) assessed pollination deficit and bee abundance in organic, conventional and herbicide-resistant genetically modified (GM) rape. OF proved to better sustain wild bee abundance in opposition with GM fields.

CONTRIBUTION OF ORGANIC FARMERS TO INNOVATIVE PROJECTS TOWARDS BIODIVERSITY AND LANDSCAPE CONSERVATION

This part is based on the narratives of projects dealing with biodiversity and landscape management. Following the projects through the stakeholders' narrative we understand the specific involvement and skills of organic farmers. Two situations are presented:

- The negotiation and the design of contracts between farmers and an institution in charge of nature conservation at regional level: Conservatoire des Espaces Naturels de Rhône-Alpes (France).
- The implementation of agroforestry projects combining trees and crops at farm level in the department of Gers (France)

Negotiation and design of contracts between farmers and the Conservatory of Natural Areas in Rhône-Alpes

The manager of the Conservatory summarises as follows his experience with organic farmers and agriculture: " *As manager of areas with high biological value (dry grasslands, wetlands, rangelands, rocky environments ...), we develop partnerships and signed agreements with farmers. These agreements specify the specific practices that farmers have to implement to ensure the preservation of biodiversity. These practices are very different according to the natural habitats and species to preserve.*

Currently, we have contracts with around 60 to 80 farmers. We are not looking specifically to involve organic farmers. The practices required for biodiversity are specific and often different from those included in organic rules: i.e. very low stocking rate in pastures, late date of harvest in hay meadows … But, without any special action, we observe that nearly 30% of contracting farmers are organic. This is much more than the regional average which is around 3%. In my opinion this is due to the technical challenges which are facing farmers involved towards biodiversity management. The solutions are often complex, you have to imagine, to test, to combine. It is not so easy to introduce dry pastures in your grazing system without reducing too much your livestock production. Our partners farmers are part of those who innovate on the limitation of inputs, water consumption, balance of their farming system. Innovative farmers among whom there is a high percentage of organic farmers.

In mountains, rangelands, dry or wet areas, the compliance with organic regulations is not sufficient to be an organic farmer. You have to observe, to be innovative and to adapt your practices to specific contexts and constraints. These are skills and know-how common for organic farmers, but they are not the only ones. Such skills are also frequent for conventional farmers. So we are glad to develop partnerships with organic farmers but there is no reason to handle this as a priority. In some areas it will be impossible to find an organic farmer to sign an agreement with us. For the future, to manage larger areas, collective actions and agreements involving organic and conventional farmers seem to me an emerging issue".

Implementation of agroforestry projects combining trees and crops at farm level in the department of Gers

In organic agricultural systems, the role of trees can be fostered. Agroforestry combines trees and shrubs with crops and/or livestock. It can be advantageous systems by increasing economic benefits, social outcomes and ecological services. This narrative presents innovative projects targeting implementation of trees in farms. The presentation is focussed on motivations of farmers.

We interviewed the manager of the NGO "Trees and landscape 32" and two farmers involved in a project targeting the development of agroforestry in the department of Gers (abbreviated as number "32" at French level) (http://www.arbre-et-paysage32.com/pdf/page03/Bilan_Agrof_Gers.pdf). This project started in 2006. Three years after, in 2009, more than 100 hectares of agroforestry have been implemented. For the manager of the NGO, there is no standard profile of farmers involved in agroforestry. There are both conventional and organic farmers. There is no specific sensitivity of organic farmers concerning landscape issues. The original commitment of each farmer is due to personal reasons, cultural or aesthetic: "*If I replant trees, it's for the pleasure, it's more enjoyable. I do not imagine myself working for a week in the same field, without seeing its end*" (a farmer). During the progress of the project other motivations economic, patrimonial and finally agri-environmental are emerging. Gradually farmers realize that agroforestry techniques can improve the autonomy of their farm by limiting inputs of fertilisers. Agroforestry can also become a way to diversify their income or to build capital over the long term with valuable species of trees. Finally, combining trees and crops may also lead to a collective reflection on agroforestry as a method for improved environmental performances. In the action groups, organic farmers often have an influence because they make progress more quickly towards this way of handling agroforestry. Organic farmers are often at origin of such a debate on environment and agroforestry. The manager considers this debate of great importance. Firstly, OF is not perfect, there are risks of nitrate leaching, carbon storage is limited and agroforestry is a way for improved performances. Secondly, such debates contribute to the collective dynamics between organic and conventional farmers and finally could lead to more consistent projects at territorial level. Indeed to have an impact on landscape there is a need to involve a large set of stakeholders: organic and conventional farmers, environmental and agricultural organisations, local electives and communities

DISCUSSION, CONCLUSION

Relationships between organic agriculture and environment strongly evolve. Three levels can be distinguished from this dynamic viewpoint. At a first level, one can consider that environmental quality is guaranteed by (i) the definition and practices of organic production which "combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes" (Council Regulation (EC) No 834/2007), (ii) controls operated with producers, processors and retailers on production methods. Soil fertility management, choice of species and varieties, multiannual crop rotation, recycling organic materials, cultivation and protection techniques would entail environmental benefits. However, improvements are possible, namely with a better integration of trees, legumes and animals in specialized systems, or with protection methods combining efficiency and ecology.

At a second level, OF is enjoined to fulfil measurable objectives in terms of environmental performances, usually evaluated on individual compartments with various methods. Assessments mostly rely on comparisons with conventional agriculture (Lamine and Bellon, 2009), leading to scientific controversies (Kirchman & Bergström, 2008), whereas environmental performances are increasingly expected at levels of organisation consistent with ecological entities (watershed, habitats, landscape…). In this respect, we noticed that few studies deal with transition pathways after conversion, with the integration of environment as a production asset for organic production, or with a comprehensive approach of the environment (as opposed to separate compartments). However, OF is acknowledged as favourable for a set of environmental compartments, even if ecology can be fostered in production processes to master environmental performances (Niggli *et al*., 2009).

At a third level, one can also consider that the development of environmental awareness in agriculture and society can be a strategic guide for the development for OF and that it implies all stakeholders in the organic sector. This avenue is supported both by regional bodies (water agencies, regional parks, conservatories..) and by Council Regulation ((EC) No 834/2007) stating that the second societal role of organic production method is to "deliver public goods contributing to the protection of the environment and animal welfare, as well as to rural development". This can lead to contracts between organic producers and other stakeholders involved in environmental management. Increasingly, environment is considered both in public and private initiatives; organic farming receives substantial support from policy for its contribution to environmental protection as well as the provision of ecosystem services, although issues differ according to the topic addressed (e.g. preservation of water resources vs biodiversity), And the organic sector is also facing private sector and associations interested in environmental-friendly agriculture.

OF both uses and maintains ES. The economic valuation of ES has been attempted in OF, and preliminary results show significant differences in favour of organic agriculture (Sandhu *et al.*, in press). Future developments of OF will have to take into account such challenges. However, some trends can compromise this possibility to provide ES. For instance, the size of organic farms is increasing, e.g. in Denmark (Langer and Frederiksen, 2005) and in Germany (Best, 2008). Best (2008) also noticed that later entrants seem to be somewhat less concerned about the environment, and also reported fewer mixed farms and a drop in direct marketing. This is related with the conventionalisation thesis, addressed by several authors (Darnhofer *et al.*, 2009; Lamine and Bellon, 2009). OF will also have to demonstrate its added value as compared with other forms of ecologized agricultural regimes, whose qualification is progressively strengthened.

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GROWTH PROMOTION AND YIELD ENHANCEMENT OF SUGAR BEET AND WHEAT BY APPLICATION OF PLANT GROWTH-PROMOTING RHIZOBACTERIA

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ABSTRACT

Biological N_2-fixations provide a major source of nitrogen for plants as part of environmental friendly agricultural practices. Plant growth promoting rhizobacteria (PGPR) are able to exert a beneficial effect upon plant growth. These screening approaches and practical applications of PGPR in organic agriculture are the major focus of this research. We selected ten different isolates of PGPR from a pool of 496 rhizobacterial isolates obtained from the wild wheat (*Triticum* spp. and *Aegilops* spp.), barley (*Hordeum* spp.), rye (*Secale* spp.), oats (*Avena* spp.), beta (*Beta* spp. and *Corollinae* spp.), stonecrops (*Sedum* spp.) and raspberry (*Rubus* spp.) plant rhizosphere in Van region on the basis of N_2-fixing and P-solubilizing activities. The isolates were identified based on FAMEs analysis using the MIDI system and BIOLOG assays. *C. cellulans* TV6I, *B. megaterium* TV11C, *P. polymyxa* TV12E, *S. typhimurium* TV24A and TV122D, *P. lentimorbus* TV30C, *H. alvei* TV33A and TV34A, *A. pasteurianus* TV69E and *B. cereus* TV83F were the best N_2-fixing and P-solubilizing attributes. PGPR caused high root weight, total root numbers and encouraged adventitious root formation but it's were strongly dependent on species. PGPR inoculation influenced the weight of roots, shoots, and leaves in wheat and sugar beet during the early stages of growth. Plant-growth response was variable and dependent on the inoculant strain, plant species, and growth parameter evaluated. These studies showed that effective PGPR species may be used in organic and sustainable agriculture.

Keywords: Plant growth-promoting rhizobacteria (PGPR); isolation, wheat, sugar beet, N_2-fixation, P- solubilization.

INTRODUCTION

Nitrogen and phosphorus are essential nutrients for plant growth and development. Intensive agriculture entails the risk of excessive fertilization. Large quantities of chemical fertilizes are used to replenish soil N and P, resulting in high costs and severe environmental contamination. Conventional crop production methods have been linked to the negative effects on the environment, human health and safety, and long-term soil fertility. Nitrate leaching and groundwater pollution are significant public concerns in many parts of the world. Organic farming has potential for reducing some of the negative impacts of conventional agriculture on the environment.

There are many explanations and definitions for organic agriculture. Organic agriculture is a production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. It is a system that begins to consider potential environmental and social impacts by eliminating the use of synthetic inputs, such as synthetic fertilizers and pesticides, growth hormones, antibiotics, veterinary drugs, genetically modified seeds and breeds, preservatives, additives and irradiation [5]. Organic farming is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives [1]. Application of soluble manufactured fertilizers is generally prohibited in organic farming systems. Instead, it is advocated that soil fertility be maintained through a variety of other means. These have been summarized as follows: use of natural minerals; enhancement of N_2 fixation through appropriate types of green manure; best recycling practice and efficient use of manures; enhancement of soil biological activity so as to increase weathering of minerals in soil and non-symbiotic N_2 fixation; and creating a balance between the number of animals and the cultivated area [6] [2] [22].

Biological N_2-fixations provide a major source of nitrogen for plants as part of environmental friendly agricultural practices. Biological N fixation (BNF) provides a major source of nitrogen for plants as part of environmental friendly agricultural practices [3]. Microorganisms are important in agriculture in order to promote the circulation of plant nutrients and reduce the need for chemical fertilizers as much as possible Plant growth promoting rhizobacteria (PGPR) are able to exert a beneficial effect upon plant growth. Plant-associated N_2-fixing and P-solubilizing bacteria are regarded as a possible alternative for inorganic nitrogen fertilizers, and PGPR strains have previously been attracted the attention of agriculturists as soil inoculums to improve the plant growth and yield [2] [3] [4] [6] [13] [19]. Apart from fixing N_2, diazotrophs can affect plant growth directly by the synthesis of phytohormones and vitamins, inhibition of plant ethylene synthesis, improved nutrient uptake, stimulated plant growth and key enzyme activities and enhanced stress resistance, solubilization of inorganic phosphate and mineralization of organic phosphate [8] [9] [20]. Therefore, use as biofertilizers for agriculture important. Increasing and extending the role of biofertilizers would reduce the need for chemical fertilizers and decrease adverse environmental effects. PGPR in turn having a great impact on root biology, influence plant growth, nutrition and development are important for long-term sustainability. Therefore, the objective of this present study was to isolate and identify plant growth promoting rhizobacteria from the rhizosphere of wild crops and characterize them for nitrogen fixation, phosphate solubilization and plant growth promotion.

MATERIALS AND METHODS

Bacterial strains were initially isolated from the rhizosphere soil of wild beta and cereals based on whole-cell fatty acid methyl ester (FAMEs) analysis using the MIDI system (Sherlock Microbial Identification System version 4.5, MIDI, Inc., Newark, DE). The identified bacterial strains were maintained in nutrient broth (NB) with 30% glycerol at -86°C for further tests. These bacteria were also tested for N_2-fixing ability, as described by Döbereiner (1988), and phosphate solubilisation capacity on National Botanical Research Institute's phosphate growth medium (NBRIP-BPB). Ability of rhizobacterial isolates to grow on Döbereiner nitrogen-free culture medium indicated their non-symbiotic N_2-fixation ability [12] [17].

Phosphate solubilization activity of the bacterial isolates was detected on NBRIP-BPB. It contained (per liter): glucose, 20 g; $Ca_3(PO_4)_2$, 10 g; $MgCl_2$ $6H_2O$, 5 g; $MgSO_4$ 7H2O, 0.25 g; KCl, 0.2 g; $(NH_4)_2SO_4$, 0.1 g, and BPB, 0.025 g. To compare the reproducibility of the halo formation, pH indicator bromophenol blue was supplemented phosphate growth medium. The pH of the media was adjusted to 7.0 before autoclaving, as described earlier [16]. The pH of the media was adjusted to 7.0 before autoclaving. 5 ml of NBRI-BPB medium was transferred a sterile test tube and autoclaved. Autoclaved, uninoculated broth medium served as controls. The sterile liquid medium was inoculated with 500 µl suspension of the tested bacterial strains. The test tubes were incubated for 14 days at room temperature. At the end of the incubation period, change in pH of the culture broth was recorded. After incubation for 6 days, water soluble P was determined colorimetrically by the vanadomolybdophosphoric acid colorimetric method.

We selected ten different potential PGPR from a pool of 496 rhizobacterial isolates obtained from the wild wheat (*Triticum* spp. and *Aegilops* spp.), barley (*Hordeum* spp.), rye (*Secale* spp.), oats (*Avena* spp.), beta (*Beta* spp. and *Corollinae* spp.), stonecrops (*Sedum* spp.) and raspberry (*Rubus* spp.) plant rhizosphere in Van region on the basis of their SIM value, N_2-fixing and P-solubilizing activities. The selected ten strains were tested for their growth and yield increasing potential under greenhouse conditions by conducting pot experiments. Selected strains showed good N_2-fixing and phosphate solubilizing ability. A pot experiment in a greenhouse was conducted in order to investigate the effect of different N_2-fixing and P-solubilizing bacterial species on wheat and sugar beet growth. The experiment also included applications of mineral nitrogen (N), phosphorous (P), and NP-fertilizer as well as a control treatment without inoculation and fertilizer application. The experimental design consisted of six completely randomized blocks in a factorial arrangement having16 treatments as 10 N_2-fixing and P-solubilizing bacteria (*Cellulosimicrobium cellulans* TV6I, *Bacillus megaterium* TV11C, *Paenibacillus polymyxa* TV12E, *Salmonella typhimurium* TV24A, *Paenibacillus lentimorbus* TV30C , *Hafnia alvei* TV33A, *Hafnia alvei* TV34A, *Acetobacter pasteurianus* TV69E, *Bacillus cereus* TV83F and *Salmonella typhimurium* TV122D), two levels of N fertilizer applications (N1: 40 and N2: 20 mg N kg^{-1} soil in the form of urea), two levels of P fertilizer applications (P1: 35 and P2:

18 mg P kg^{-1} soil in the form of TSP), and NP fertilization (40 mg N and 35 mg P kg^{-1} soil) as well as a control treatment without inoculation and any fertilizer application. For sugar beet, greenhouse trials were conducted with the same treatments (only with different fertilization rate) as used in wheat experiment. Sugar beet received 60 and 30 mg N kg^{-1} soil in N1 and N2 pots, 45 and 23 mg P kg^{-1} soil in P1 and P2 pots and 60 mg N + 45 mg P kg^{-1} soil in NP pots in the form of urea and triple superphosphate. For sugar beet and wheat, 12 and 24 seeds were sown per pot, respectively. On 10th day after sowing, the seedlings were thinned up to six sugar beet and twelve wheat seedlings per pot.

The sugar beet and spring wheat seedlings were grown in a greenhouse under a day-night cycle of 14-10 h natural light, 18-14°C, and 60% relative humidity. The pots were watered to 60% water holding capacity and were maintained at this moisture content by watering to weight every 2-3 days. For each species and treatments, the plants were harvested 35 days after emergence, with minimal damage to the root system, and then washed gently under running tap water to remove the adhering soil particles, and morphological characteristics of each plant were recorded: plant height, root length and root weight. Total root length was measured according to Farrell et al. (1993). The lateral root number per plant was counted after washing away the soil from the roots. At harvest the wheat root system was separated from the shoots.

RESULTS AND DISCUSSION

Among the 496 rhizobacterial strains, 248 strains exhibited N_2-fixing activity and 114 were efficient in phosphate solubilization; 110 strains were efficient in nitrogen fixation and P-solubilisation. Inoculation with selected plant growth-promoting rhizobacteria enhanced sugar beet and wheat seedling growth (Table 1 and 2). All the bacterial strains, except for *Cellulosimicrobium cellulans* TV6I and *Salmonella typhimurium* TV24A, enhanced plant height as compared to the control.

Table.1. The effect of PGPR and fertilizer application on the leaf, root-shoot weight in the individual plant of sugar beet in the greenhouse

Treatments	Bacterial strain No	Bacterial traits**		Leaf weight (g plant^{-1}) ***	Root-shoot weight (g plant^{-1})
		NF	PS		
Control *				1.45± 0.17 bc	0.129 ± 0.014 c
N1 (120 kg ha^{-1})				2.04± 0.35 a	0.151 ±0.020 ac
N2 (60 kg ha^{-1})				1.80 ± 0.60 ac	0.149 ±0.023 ac
P1 (90 kg ha^{-1})				1.53 ±0.38 ac	0.135± 0.021 bc
P2 (45 kg ha^{-1})				1.52 ± 0.17 ac	0.133± 0.01 bc
NP (120+ 90 kg ha^{-1})				1.83 ± 0.37 ab	0.166 ±0.033 ac
C. cellulans	TV6I	S$^+$	+++++	1.36± 0.51 bc	0.128±0.031 c
B. megaterium	TV11C	S$^+$	+++	1.32± 0.46 bc	0.129 ±0.034 c
P. polymyxa	TV12E	S$^+$	+++	1.84 ±0.15 ab	0.186± 0.020 a
S. typhimurium	TV24A	+	+++++	1.40±0.29 bc	0.128 ± 0.024 c
P. lentimorbus	TV30C	S$^+$	+++	1.35±0.48 bc	0.138 ±0.038 bc
H. alvei	TV33A	S$^+$	+++++	1.65 ±0.40 ac	0.156± 0.038 ac
H. alvei	TV34A	S$^+$	+++++	1.86 ±0.59 ab	0.168 ±0.018 ab
A. pasteurianus	TV69E	S$^+$	+++++	1.32 ±0.42 bc	0.134 ± 0.019 bc
B. cereus	TV83F	S$^+$	+++++	1.28± 0.19 c	0.135±0.018 bc
S. typhimurium	TV122D	S$^+$	+++++	1.36 ±0.39 bc	0.171± 0.055 ab

* Control: without bacteria and fertilization, N1: 60 mg N kg^{-1} soil, N2: 30 mg N kg^{-1} soil, P1: 45 mg P kg^{-1} soil, P2: 23 mg P kg^{-1} soil, NP: 60 mg N + 45 mg P kg^{-1} soil.

**NF:N_2- fixation, PS: Phosphate solubilization , "S$^+$" strong positive reaction "+" positive reaction, Diameter of clear zone formed around the bacterial colony as a result of solubilization of tri-calcium phosphate on NBRIY agar medium: + = f 3 mm clear zone, + + = 3-5 mm clear zone, + + + = 5-8 mm clear zone, + + + + = 8-10 mm clear zone (S$^+$), + + + + + = > 10 mm clear zone (S$^+$).

*** Mean ± standard error, number with the same letters is not statistically different according to Duncan's Multiple Range Test ($p < 0.05$).

Three bacteria increased root-shoot weight of sugar beet significantly compared to control; especially *P. polymyxa* TV12E and followed by *H. alvei* TV34A, and *S. typhimurium* TV122D. Data suggest that mineral fertilization and seed inoculation with *Paenibacillus polymyxa* TV12E, *Hafnia alvei* TV33A and TV34A increased leaf weight in sugar beet as compared to the control, although differences between various treatments were insignificant, except for nitrogen fertilization (N1). The increases with inoculation as compared to control plants changed between -11.7% and 28.3% for leaf weight per plant, and -0.8% and 44.2% for root-shoot weight per sugar beet plant. N1, P1 and NP applications as compared to control plants, however, were increased the leaf yield of sugar beet up to 40.7, 5.5, and 26.2% and root-shoot weight by 17.1, 4.7, and 28.7%, respectively (Table 1).

Eight bacteria increased root fresh weight of wheat plants significantly compared to control; especially *Paenibacillus polymyxa* TV12E and followed by *Hafnia alvei* TV33A and TV34A, and *Bacillus megaterium* TV11C. *Hafnia alvei* TV33A and TV34A produced the highest root fresh weight, while they were not significanty affected shoot fresh weight (Table 2). Inoculation with *S. typhimurium* TV122D followed by *Bacillus cereus* TV83F and *P. polymyxa* TV12E gave the highest values in terms of shoot fresh weight in wheat. Bacterial strains increased root length of wheat seedlings significantly, especially *C. cellulans* TV6I, *Paenibacillus polymyxa* TV12E and *B. megaterium* TV11C. In wheat, lateral root number were increased by using the effective strains, such as *H. alvei* TV33A, *P. polymyxa* TV12E, *C. cellulans* TV6I, *B. megaterium* TV11C, *B. cereus* TV83F, and *S. typhimurium* TV122D compared with the control. In contrast, there were no significant changes among *S. typhimurium* TV24A, *P. lentimorbus* TV30C, *H. alvei* TV34A, and *A. pasteurianus* TV69E in terms of lateral root number.

Table 2. Effect of fertilizer applications and seed inoculations of spring wheat with plant growth-promoting rhizobacteria (PGPR) on plant height, shoot and root weight, root length and lateral root number.

Treatments	Plant height (cm) **	Shoot fresh weight (g plant^{-1})	Root Fresh weight (g plant^{-1})	Root Length (cm)	Lateral root number
Control*	34.5 ±1.2 e	0.46±0.6 e	0.08±0.02 cd	5.5 ±1.1 cd	4.4 ±0.8 d
N1 (80 kg ha^{-1})	39.5 ±4.4 bc	0.63± 0.08be	0.08± 0.04 cd	5.9 ±1.4 ad	4.6 ± 0.7 d
N2 (40 kg ha^{-1})	42.9± 3.6 a	0.67±0.13 ad	0.09±0.03 bd	6.4 ±0.3 ad	4.7 ±0.7 d
P1 (60 kg ha^{-1})	35.9±1.8 de	0.49±0.12 e	0,10± 0.02 ac	7.1 ±0.6 ab	6.9 ±0.7 a
P2 (30 kg ha^{-1})	34.6 ±2.6 e	0.47±0.12 e	0.08 ± 0.03 cd	5.7±0.3 bd	5.8 ± 0.6bc
NP (80+ 60 kg ha^{-1})	39.0± 4.0 bd	0.70±0.15 bc	0.09±0.02 bd	6.1± 0.5 ad	4.8 ± 0.7 d
***C. cellulans* TV6I**	36.7 ±1.0 ce	0.55± 0.10 ce	0.12± 0.04 ac	7.3±1.2 a	6.3 ±0.5ab
***B. megaterium* TV11C**	38.9 ±1.9 bd	0.58±0.05 ce	0.13±0.03 ab	7.0 ±1.1 ab	6.6 ±0.1ab
***P. polymyxa* TV12E**	42.0 ±1.8 ab	0.67±0.15 ad	0.15±0.02 a	7.1±0.9 ab	7.1 ±0.8 a
***S. typhimurium* TV24A**	35.1±1.5 e	0.48±0.08 e	0.10±0.04 ad	6.4± 1.2 ad	5.0 ± 0.6cd
***P. lentimorbus* TV30C**	41.6± 1.1 ab	0.63±0.08 be	0.07± 0.03 d	5.0 ±1.0 d	5.0 ±0.5cd
***H. alvei* TV33A**	40.8± 3.3 ab	0.62±0.11 be	0.15±0.09 a	6.7± 1.9 ac	7.2 ±0.7 a
***H. alvei* TV34A**	39.0±1.7 bd	0.51±0.10 de	0.14± 0.03 a	5.0 ±1.6 d	5.0 ±1.0cd
***A. pasteurianus* TV69E**	40.4 ±1.9 ab	0.59±0.07 ce	0.09±0.01 bd	5.9 ±0.6 ad	4.8 ±0.5 d
***B. cereus* TV83F**	43.1±2.0 a	0.77±0.20 ab	0.09±0.02 bd	6.2 ±0.7 ad	6.1 ±0.5 b
***S.typhimurium* TV122D**	43.2±1.9 a	0.81± 0.23 a	0.09±0.02 bd	6.6 ±1.1 ac	5.9 ±0.5 b

* Control: without bacteria and fertilization N1: 40 mg N kg^{-1} soil, N2: 20 mg N kg^{-1} soil, P1: 35 mg P kg^{-1} soil, P2: 18 mg P kg^{-1} soil, NP: 40 mg N + 35 mg P kg^{-1} soil, Bacterial traits as explained in Tab. 1.

** Mean ± standard error, number with the same letters is not statistically different according to Duncan's Multiple Range Test ($p < 0.05$).

The increases with inoculation as compared to control plants changed between 1.7% and 25.2% for plant height, 4.3% and 76.1% for shoot fresh weight, -12.5% and 87.5% for root fresh weight, -9.1% and 32.7% for root length and 9.1% and 63.6% for lateral root number in wheat. Mineral fertilizer application as compared to control plants increased plant height by 0.29-24.3 %, shoot and root fresh weight per plant by 2.2-52.2 and 0-25.0%, and root length and lateral root number by 3.6-29.1 and 4.5-56.8% in wheat. Of the bacterial inoculations, N_2-fixing and P-solubilizing *Paenibacillus polymyxa* TV12E and *Hafnia alvei* TV33A inoculation produced the highest root fresh weight and lateral root number while *C. cellulans* TV6I, *B. megaterium* TV11C, *P. polymyxa* TV12E gave the highes root length. The inoculation with PGPR increased wheat root length and root number by 9.1-32.7% and 9.1-63.6% depending on species (Table 2). It is particularly interesting that growth of wheat (root weight, lateral root number) and sugar beet was significantly enhanced by *Paenibacillus polymyxa* TV12E than other strains (Table 1 and 2). The result showed that the stimulation of lateral root and root hair number of the seedling in wheat could be promoted by PGPR due to increasing total root number and weight of young plant. In generally, PGPR effect on the initation and development of modified root outgrowths and lateral roots similar to values reported by others [18]. Plant growth-promoting rhizobacteria change root growth, increase root weight and can have influence on nutrient uptake potentials [2]. Root surface area is usually expressed per unit of root weigh. Beside the possible direct effect of PGPR on nutrient uptake and the indirect effect via the increased root surface area due to the stimulation of lateral root development, the effect on root hair development has to be considered. Uptake of nutrients from soil by plants root depends on crop demand, uptake ability of unit root length, root distribution and structure of root system [21]. The positive effects of PGPR on plant growth are correlated with changes in root morphology, namely increasing the lateral root length and root hair number and length [14] [15]. Inoculations with the plant growth promoting rhizobacteria produced the highest shoot and root weights and total root numbers and encouraged adventitious-root formation. The rapid establishment of roots, whether by elongation of primary roots or by proliferation of lateral and adventitious roots, is advantageous for young sugar beet and wheat seedlings. The effect of PGPR, as a complex process, depends on bacterial strains and population, plant-bacterial strain combination, plant genotype, growth parameters evaluated, and environmental conditions [6] [7] [19]. We evaluated the rhizosphere isolates in relation to their potential use in plant growth promotion by screening for nitrogen fixation and phosphate solubilisation. Microorganisms are important in agriculture in order to promote the circulation of plant nutrients and reduce the need for chemical fertilizers as much as possible. The identification and the isolation of PGPR bacteria from Van region soils, which combine the ability to solubilize phosphate with the fixation nitrogen capable of promoting plant growth, could also significantly increase the productivity of crops. For spring wheat, the optimum plant growth and maximum bacterial efficiency are obtained from plants inoculated with TV122D, TV33A, TV34A, RC05, TV12E and TV11C, while TV12E, TV34A and TV122D were the most effective PGPR for sugar beet. These strains may be used in organic and sustainable agriculture.

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RESPONSE TO SALINITY OF WARM SEASON TURFGRASSES ORGANICALLY GROWN IN PEAT OR COCOPEAT

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ABSTRACT

Plants of seashore paspalum cv “Sea Isle 2000” and bermudagrass cv “Patriot” were subjected to three levels of salinity by means of irrigation with water + NaCl while they were organically grown in the nursery using peat or cocopeat as substrates. The aim was to verify if cocopeat may be a valid alternative to peat in high salinity conditions to grow plants of these species in order to produce stolons for environmentally friendly turfs. At any saline level, seashore paspalum was more productive than bermudagrass, but the response to salinity was similar in both the species. A decrease in stolon production occurred while salinity increased but no differences were observed between the substrates when plants were subjected to saline stress. Therefore, the cocopeat used in this experiment was suitable for the intended purpose.

Keywords. Environmentally friendly turfs, stolons, mother plants, nursery activity, peat, cocopeat, saline water.

INTRODUCTION

The demand of environmentally friendly solutions is increasing also in the field of turf production [4] [6]. When the turf is obtained by the transplant of pre-rooted plantlets, which is a technique recently developed for warm season turfgrass species [14] [15], the achievement of an organic turf requires the application of an organic method in the nursery. In case of selected clones of stoloned species, the nursery activity is based on the pot cultivation of mother plants which stolons are collected from. Peat is the substrate usually used for both the plantlets and the mother plants of stolons, whose employment is also allowed according to Europe Union law regulating the organic production (Council Regulation EC 834/2007) provided that no chemically synthesised fertilizers are added. Indeed, peat is one of the most important constituents of growing media in pot plant industry both in Europe [10] and USA [3]. Nevertheless, the increasing cost of high quality peat for horticultural use, together with the emergent interest on peat-lands for their natural and/or archaeological value that has produced an 'anti-peat' campaign in many European Countries, are expected to lead, in the near future, to a drastic reduction in the use of peat in favour of alternative materials [8] [10]. Cocopeat, called also coir pith or coir dust, is a waste product of the coconut industry that is proposed as a possible alternative to peat for container media purposes due to its suitable physical and chemical properties [5] [13]. Being an organic renewable matter, cocopeat can be connoted as an ecologically friendly peat substitute, and so particularly suitable for sustainable agriculture and organic agriculture [11] [7].

In the present work plants of selected clones of seashore paspalum (*Paspalum vaginatum* Swartz) and bermudagrass [*Cynodon dactylon* x *C. transvaalensis* (L.) Burtt-Davy] were subjected to three levels of salinity by means of irrigation with water + NaCl while they were organically grown in the nursery using peat or cocopeat as substrates. Seashore paspalum and bermudagrass are warm season turfgrasses often used in arid areas where saline soils and/or saline irrigation water are frequent [9] [2]. The aim of the work was to verify if cocopeat may be a valid alternative to peat in high salinity conditions to grow plants of these species in order to produce stolons for the achievement of environmentally friendly turfs.

MATERIALS AND METHODS

The experiment was carried out from 25th May to 10th September 2009 at the Department of Plant, Soil and Environmental Science, in Florence (Italy). Plants were grown in the open air on a bench equipped with a PE cover. During the experiment, average air temperature and average relative humidity were 25.9 °C and 46.6%, respectively.

Stolons of seashore paspalum (*Paspalum vaginatum* Swartz) cv "Sea Isle 2000" and bermudagrass [*Cynodon dactylon* x *C. transvaalensis* (L.) Burtt-Davy] cv "Patriot" were used as starting material. Stolons were rooted in peat (STENDEL, Italy) in polystyrene alveolate 160-holed trays and then transplanted in pots 18 cm in diameter and 2 L in volume (3 plantlets per pot) on 17th June. Peat or cocopeat (LaMundialdeCoco, Dominican Republic), both added with 5 g L^{-1} of the organic fertilizer PHENIX (6% N + 8% P_2O_5 + 15% K_2O + 3% MgO), were used as substrate. Physical and chemical properties of peat and cocopeat are shown in Table 1.

	Peat	Cocopeat	Unit of measurement	Method
Bulk density	150	85	kg m^{-3}	UNI EN 13041 2007
Real density	1625	1603	kg m^{-3}	UNI EN 13041 2007
Total pore space	90.8	94.7	% v/v	UNI EN 13041 2007
Volume % air at pF 1	10.9	12.1	% v/v	UNI EN 13041 2007
Volume % water at pF 1	79.9	82.6	% v/v	UNI EN 13041 2007
Easily available water	37.9	45.4	% v/v	UNI EN 13041 2007
Buffering capacity	2.0	2.2	% v/v	UNI EN 13041 2007
Available water	39.9	47.8	% v/v	UNI EN 13041 2007
pH	5.5	6.0		1:1.5 volume extract
Electrical conductivity (EC)	0.5	0.4	dS m^{-1}	1:1.5 volume extract

Table 1. Physical and chemical properties of peat and cocopeat used in the experiment.

During the first 2 weeks after transplant all the plants were irrigated as needed with tap water (0 g L^{-1} NaCl; pH 7.2; EC 0.5 dS m^{-1}). From 1st July they were divided into 3 groups, each subjected to irrigation with tap water + 0 (= control), 5 or 10 g L^{-1} NaCl, respectively. Irrigation water pH and EC were 7.6 and 11 dS m^{-1} with 5 g L^{-1} NaCl and 7.7 and 20 dS m^{-1} with 10 g L^{-1} NaCl. Each pot received totally 5.3 L of water + NaCl. Pots were equipped with underpots in order to collect drainage water.

Organic fertilization was provided periodically by adding 2 g L^{-1} of LYSODIN ALGA-FERT (7% organic-N) and 0.5 g L^{-1} of AUXIM (0.6% EDTA-Fe + 0.6% Mn + 0.4% Cu + 0.4% B) to saline water (totally 2.6 g and 0.65 g per pot of LYSODIN and AUXIM, respectively).

Plant production of stolons [number, fresh matter (FM), dry matter (DM)] and shoots [fresh matter (FM) and dry matter (DM)] was detected as the sum of 3 subsequent harvestings (17th July, 3rd August and 10th September). To obtain dry matter, fresh matter was oven dried (80 °C) until constant weight.

Average EC of peat and cocopeat at the end of the experiment are shown in Table 2.

For each species, 4 replications (1 replication = 1 pot) were arranged in a split-plot design with substrate as main factor and NaCl dose as sub-plot factor. Data were subjected to ANOVA and the means were separated by Duncan's Test (P≤0.05).

	0 g L^{-1} NaCl	5 g L^{-1} NaCl	10 g L^{-1} NaCl
Peat	1.1±0.35	8.3±0.70	16.9±1.80
Cocopeat	0.5±0.05	7.8±0.40	13.3±0.75

Table 2. Average EC (± SE) of peat and cocopeat at the end of the experiment (1:1.5 extract method).

RESULTS

Salinity affected production in both the turfgrass species. The effect of salinity concerned both the assimilatory capacity of the plants (decrease in DM production) and their water uptake (decrease in FM), with a strong negative impact on stolons and a moderate influence on shoots.

The three NaCl doses resulted in statistically significant differences in stolon FM and DM, with similar decreases in the two species. The number of stolons decreased statistically compared to control (0 g L^{-1} NaCl) at 5 g L^{-1} NaCl in seashore paspalum and at 10 g L^{-1} NaCl in bermudagrass (Tabs. 3 and 4). However, seashore paspalum was more productive than bermudagrass at any salinity level. Besides, at the third harvesting, bermudagrass produced stolons only in cocopeat irrigated with tap water + 0 and 5 g L^{-1} NaCl (data not shown).

		Stolons			Shoots	
		Number pot^{-1}	FM g pot^{-1}	DM g pot^{-1}	FM g pot^{-1}	DM g pot^{-1}
Substrate	**peat**	78 a	51.7 a	7.4 a	32.5 a	5.7 a
	cocopeat	85 a	45.1 a	7.7 a	21.7 b	4.6 a
Salinity (g L^{-1} NaCl)	**0**	103 a	65.8 a	9.6 a	30.0 a	5.2 a
	5	78 b	46.2 b	7.3 b	31.1 a	6.0 a
	10	64 c	33.2 c	5.8 c	20.1 b	4.3 a
Interaction "substrate x salinity"		n.s.	*	n.s.	*	*

Table 3. Effect of substrate and salinity (g L^{-1} NaCl) of irrigation water on the production of stolons and shoots in *Paspalum vaginatum* Swartz cv "Sea Isle 2000".

Values in the same column followed by different letters are statistically different at P≤0.05 (Duncan's Test).

		Stolons			Shoots	
		Number pot^{-1}	FM g pot^{-1}	DM g pot^{-1}	FM g pot^{-1}	DM g pot^{-1}
Substrate	**peat**	26 a	19.5 a	4.1 a	5.1 a	1.4 b
	cocopeat	39 a	26.8 a	5.7 a	8.3 a	2.5 a
Salinity (g L^{-1} NaCl)	**0**	39 a	33.2 a	6.3 a	7.8 a	2.1 a
	5	31 ab	21.5 b	4.8 b	7.4 a	2.2 a
	10	27 b	14.8 c	3.6 c	4.9 b	1.5 a
Interaction "substrate x salinity"		n.s.	n.s.	n.s.	n.s.	n.s.

Table 4. Effect of substrate and salinity (g L^{-1} NaCl) of irrigation water on the production of stolons and shoots in *Cynodon dactylon* x *C. transvaalensis* (L.) Burtt-Davy cv "Patriot".

Values in the same column followed by different letters are statistically different at P≤0.05 (Duncan's Test).

No statistically significant difference due to the substrate was detected on stolon production (Tabs. 3 and 4). A statistically significant interaction "substrate x salinity" was noticed for stolon FM in seashore paspalum: a higher value was obtained in peat than in cocopeat at 0 g L^{-1} NaCl, but the former substrate seemed to suffer the effect of salinity to a greater extent (more marked FM decrease), so that no differences between the two substrates were observed at 5 and 10 g L^{-1} NaCl (Fig. 1). Both the species, but especially bermudagrass, produced more stolons than shoots at any salinity level. Shoots represent, on average, 36% and 23% of total FM in seashore paspalum and bermudagrass, respectively, and 41% and 29% of total DM respectively in the two species. Only shoot FM was affected by salinity, showing a statistically significant decrease at 10 g L^{-1} NaCl (Tabs. 3 and 4). In seashore paspalum shoot FM was higher in peat than in cocopeat and a significant interaction "substrate x salinity" was noticed for both FM and DM. In peat, shoot FM and DM decreased significantly at 10 g L^{-1} NaCl compared to control and 5 g L^{-1}, while no decrease due to salinity occurred in cocopeat; nevertheless, higher values were observed in peat than in cocopeat at 0 and 5 g L^{-1} NaCl (Figs. 2 and 3). In bermudagrass the substrate showed an effect on shoot DM, with a higher value in cocopeat than in peat (Tab. 4).

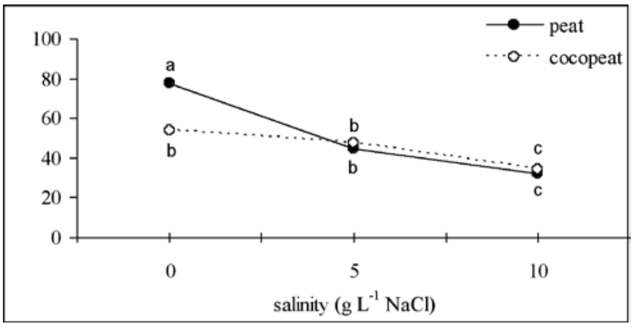

Figure 1. Effect of salinity (g L^{-1} NaCl) of irrigation water on the production of stolon FM in *Paspalum vaginatum* Swartz cv "Sea Isle 2000" grown in peat and cocopeat. Different letters indicate statistically different values at P≤0.05 (Duncan's Test).

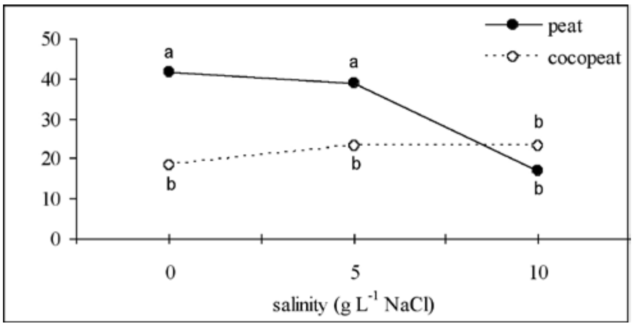

Figure 2. Effect of salinity (g L^{-1} NaCl) of irrigation water on the production of shoot FM in *Paspalum vaginatum* Swartz cv "Sea Isle 2000" grown in peat and cocopeat. Different letters indicate statistically different values at P≤0.05 (Duncan's Test).

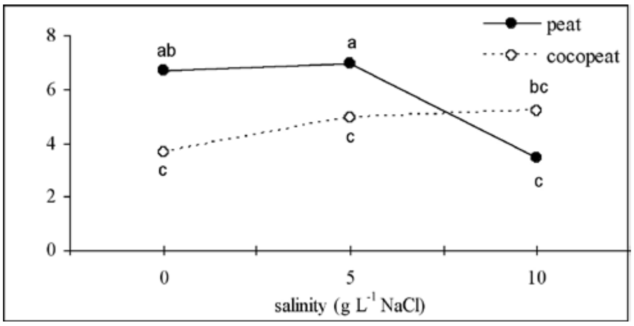

Figure 3. Effect of salinity (g L^{-1} NaCl) of irrigation water on the production of shoot DM in *Paspalum vaginatum* Swartz cv "Sea Isle 2000" grown in peat and cocopeat. Different letters indicate statistically different values at P≤0.05 (Duncan's Test).

DISCUSSION AND CONCLUSIONS

Cocopeat is considered a possible renewable peat substitute for use in organic horticulture. The properties of cocopeat from different sources may vary probably due to differences in row coconut fruits, processing methods and storage conditions. Some cocopeats show a high level of salinity, often with a significant contribution of sodium and chloride, that may cause problems for certain salt-sensitive plants or in presence of saline irrigation water [8] [1]. But, this was not our case. Indeed, peat and cocopeat used in our experiment showed very similar starting EC values (Tab. 1). As expected, at the end of the experiment EC resulted the more increased the higher was the dose of NaCl added to irrigation water, but values were higher in peat than in cocopeat (Tab. 2). That is probably ascribable to the fact that cocopeat shows a lower cation exchange capacity than peat [1]. However, seashore paspalum cv "Sea Isle 2000" and bermudagrass cv "Patriot" showed a similar response to salinity in the two substrates, especially with respect to stolons that represent the material that plants are asked for to produce in the nursery. A decrease in stolon production occurred while salinity increased and no differences were detected between the substrates when plants were subjected to saline stress. In seashore paspalum stolon FM was higher in peat than in cocopeat, but only at 0 g L^{-1} NaCl. Both in peat and in cocopeat plants "invested" their assimilatory activity in producing stolons more than shoots, especially bermudagrass. However, at any saline level, seashore paspalum was more productive than bermudagrass. A similar behaviour was shown by the two species also when they were grown hydroponically under various levels of NaCl in the cultural medium [12], although in that case the tested bermudagrass cv ("Tifway 419") was more severely affected by salinity than seashore paspalum cv "Sea Isle 2000".

On the basis of our results, the cocopeat used in the experiment appeared to be, probably thanks to its low EC value, a valid alternative to peat in high salinity conditions for plants of seashore paspalum and bermudagrass grown in pot in the nursery for the organic production of stolons.

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STRUCTURE OF COLLEMBOLA COMMUNITY AND ITS NUTRIENT MINERALIZATION AS AFFECTED BY APPLICATION OF DIFFERENT ORGANIC MANURES AND EFFECTIVE MICROORGANISMS®

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ABSTRACT

Despite the importance of using organic farming, basic information about the important role of microorganisms and its correlation with soil fauna in stimulating and enhancing supply and release of nutrients from these nutrient sources is lacking. To address such gaps in information, this research was conducted to determine the effect of microbial inoculants called Effective Microorganisms® (EM) and its interaction with farmyard and green manure on the structure of Collembola community on the nutrient mineralization by Collembola, and yield of carrot (*Daucus carota* L.). The study was conducted in the Organic Nature Farming Training Center in Central Java, Indonesia from December 2007 to March 2008. The treatments were farmyard manure (FYM), FYM+EM, green manure (GM), GM+EM, EM alone and the unmanured control. Abundance of Collembola was significantly increased by application of farmyard manure under field condition and by green manure under greenhouse condition. Microarthropods were extracted from 10 cm deep soil samples and were taken during growth season and prior to land preparation. Addition of EM on green manure in the greenhouse condition resulted in the greatest increase in abundance and richness of Collembola. *Isotoma* sp (Isotomidae) was the most abundant Collembola in each treatment; 68.13% in the field and 62.93% in the greenhouse. The combination of GM and

EM had a significant effect in increasing rate of mineralization as indicated by the reduction in soil C/N ratio, increasing soil P concentration, and increasing yield of carrot. Natural stable isotope analysis using $\delta^{15}N$ and $\delta^{13}C$ show that Collembola may have a role in enhancing N mineralization as affected by EM.

Keywords: farmyard manure, green manure, Nitrogen, natural stable isotope

INTRODUCTION

The dynamics in the soil ecosystem is substantially regulated by the trophic interactions of soil invertebrates, fungi, and microbes [4][13]. They are considered to play an important role in the nutrient turnover of soils by catalyzing organic matter decomposition and, subsequently, nutrient cycling. It has been reported that under microcosm experiments, soil fauna have a significant impact on microbial mineralization processes [4][35] but in the field, the connections between soil fauna and microorganisms may be overshadowed by temperature, humidity, population density, and predation [13].

The role of soil organisms in soil processes is more significant in organic farming than in chemical-based agriculture. Stolze *et al.* [46] concluded that crop under organic farming perform better than in conventional farming with regard to soil organic matter. Unfortunately, the effect of organic nutrients on crop yield is long term and not immediate, thus, farmers are reluctant to use organic fertilizers in their cropping system.

The use of a mixed culture of microorganisms as an additive to manures is an effective technique for stimulating supply and release of nutrients from these nutrient sources. Many commercially available manure additives are used in agricultural production systems in many countries. One of the popular additives in many countries is Effective-Microorganisms® (EM).

Effective Microorganisms® (EM) is a mixed culture of 80 species of beneficial microorganisms including a predominant population of lactic acid bacteria (*Lactobacillus* sp.) and yeast (*Sacharomyces* sp.), and a small proportion of photosynthetic bacteria (*Rhodopseudomonas* sp.), actinomycetes and fermenting fungi [19]. The concept of "effective microorganisms" was developed by Japanese agronomist Teruo Higa, from the University of Ryukyus in Okinawa who reported in the 1970s that a combination of approximately 80 different microorganisms is capable of positively influencing the decomposition of organic matter such that it reverts into a "life promoting" process [19].

One of the theories proposed by Higa and Wididana [20] on how EM may be affecting the soil and plant environment is that when EM is applied to soil or plant leaf surfaces, the populations of photosynthetic bacteria and nitrogen fixing bacteria increase dramatically. It was thought that the high number of photosynthetic bacteria and nitrogen fixing bacteria in the soil and at the leaf surfaces might have enhanced the plant's photosynthetic rate and efficiency, and its nitrogen fixing capacity. However, this has not been established experimentally.

Previous studies have shown that the inoculation of agroecosytems with EM cultures can improve soil and crop quality [19]. Similarly, Daly and Stewart [9] reported that applications of EM to onion, pea, and sweet corn increased yields by 29%, 31% and 23%, respectively. Khaliq *et al.* [28] reported that the application of EM on organic and inorganic fertilizers significantly improved soil conditions, which in turn directly increased crop yield.

The supply and availability of plant nutrients in the soil is mainly regulated by rate of release of plant nutrients from soil organic matter. The soil fauna is likely to play an important role in this process. The effect of the use of EM on decomposition and mineralization of organic matter by soil fauna is a question of interest. Hence, a better understanding of these processes is needed to find out whether the decomposition and mineralization of nutrients from organic matter could be enhanced by improving soil conditions for soil fauna. This will have significant implications for sustainable agroecosystem management in the future.

This study focused on the influence of EM on the ability of Collembola in transformation of organic matter into available nutrients for the uptake of plants. Collembola were chosen in this study because this group, together with mites, are among the most abundant soil microarthropods that play an important role in decomposing soil food webs [38]. Mites are dominant in forest soils and undisturbed habitats, whereas Collembola are increasingly important in managed grasslands and especially in arable land. Because of their large population sizes (10^4 to 10^5 m^{-2}), rapid reproduction rates, role in fragmenting detritus, and grazing upon microbes, Collembola have a significant impact on microbial dynamics [21]. Although, Collembola and other mesofauna have a function similar to macrofauna in attacking and fragmenting plant residues, they are considered to be more important in regulating microbial populations rather than macrofauna, e.g., amphipods, isopods, centipedes and millipedes, earthworms and mollusks like snails and slugs [47]. Collembola closely interact with all elements of the decomposer food web [32] and are active under most environmental conditions – unlike nematodes, bacteria or earthworms.

The study on the impact of EM application on epigeic Collembola was conducted to provide an answer to the following single research question: Is Effective-Microorganism® (EM) effective in hastening the rate of decomposition of organic matter and its rate of mineralization by Collembola?

The general objective of this study was to determine the effect of EM on structure of Collembola community and their rate of mineralization and its interaction with organic amendments, i.e. farmyard and green manure. More specifically, the study aimed to:

1. Investigate the influence of EM and its combination with farmyard and green manure on biodiversity and abundance of

Collembola;

2. Evaluate how Collembola applied with EM and organic amendments affect nutrient mineralization; and,

3. Evaluate how interaction of EM, organic amendments, and Collembola affect plant growth/yield.

MATERIALS AND METHODS

The experiment was conducted from December 2007 to March 2008 which was an extremely rainy season at *Pusat Pelatihan Pertanian Akrab Lingkungan* (Organic Nature Farming Training Center) in Garung District (7° 16‘ 60S, 109° 55‘ 0E, 1070 m a.s.l.), Wonosobo Regency, Central Java, Indonesia. Temperature and humidity in this study area were 18-23^{0}C and 70-80%, respectively. Since its establishment in 1996, this organic farm consistently follow organic farming practices i.e. using organic manures and biopesticides as fertilizer and pesticide inputs. The soil texture at the site is a gravelly sand, with a pH of 7.4-7.6 and a mean of organic matter content of 26.2 %.

Greenhouse Experiment. Plastic bags filled with 5 kg soil were prepared for each treatment. Each treatment was replicated three times with each replication consisting of 6 pots. The Randomized Complete Block Design (RCBD) was used with five treatments and one control.

The treatments in this study were formulated as follows:

T_0: control	without manure nor Effective-Microorganism* (EM). Nutrient availability was expected to come only from previous crop session.
T_1: FYM	fertilized with 10.000 kg/ha farmyard manure (one year incubated goat manure).
T_2: FYM + EM	same as T_1 (FYM) with EM applied at a rate of 2 liters/ha.
T_3: GM	fertilized with 10.000 kg/ha green manure comprised of Azolla (*Azolla pinnata*) and water hyacinth (*Eichhornia crassipes*) after incubation for 7 days.
T_4: GM + EM	as T_3 (GM) plus 2 liters EM/ha.
T_5: EM	using 2 liters EM/ha without additional farmyard manure nor green manure. (modified from Khaliq *et al.,* [28])

All EM applications were prepared using a mixture of basic EM, sugar and water in the ratio of 1:1:10 (modified from Khaliq *et al.,* [28]).

Field Experiment. The experiment with carrot was carried out using Randomized Complete Block Design with five treatments and one control, with three replications. Each treatment comprised of a raised-bed plot measuring 1 m x 7 m with a distance of 30 cm between them. The field experiment had the same treatments as the greenhouse experiment.

Composite soil samples for chemical analysis were taken from each plot (three field replicates) four times (prior to land preparation and three times during the growth season). Due to technical problem, soil samples for T3 and T4 were only taken two times (before land preparation and before harvest time). Samples were collected at 3 sampling points per plot using a drill corer (0-10 cm depth) and were pooled, air-dried and finally analyzed for soil carbon content. These samples were mixed to make a composite sample, which were subjected to various analyses (organic matter content, N, P, K, and pH).

Soil samples for the study of Collembola were taken three times during the growth season (three replicate plots per treatment). Samples were collected at three sampling points per plot using steel cylinders (0-10 cm depth, 100 cm^2). Soil microarthropods were extracted from the soil samples using an extractor based on the method by Tullgren [51]. The extraction used standard 25 W electric light bulbs.

Microarthropods were collected in small plastic bottles filled with 70% isopropanol. The extraction was terminated after 5 days. Collembola were identified at the Research Center for Biology, Indonesian Institute of Science, Cibinong, West Java. Collembola was identified up to genus level according to Greenslade *et al.* [16].

Carrot (*Daucus carota*, L.) was chosen as experimental crop since it is widely grown by farmers in the area. In addition, carrot is relatively free from pest infestation compared to other crops grown in the area like cabbage and broccoli.

Yield data from the field trial was obtained from sample one square meter area per plot. On the other hand, yield of carrot grown in the greenhouse trial was determined by weighing all the tubers from all pots. Tuber dry weight was recorded after exposure in an oven set at 105^{0}C for three days.

Measurements of $\delta^{13}C$ and $\delta^{15}N$

The Collembola specimens and soil samples (24 samples from all treatments using the same methods with the previous Collembola and soil sampling) were transferred into tin capsules, dried at 60^{0}C for 48 h, and then were weighed. Individuals of Collembola were pooled as one sample to obtain sufficient material for measurements of mean body weight and to obtain $\delta^{13}C$ and $\delta^{15}N$ values for analysis. Since it was impossible to separate the Collembola into genus prior to analysis, they were analyzed as composite samples. Only the Collembola's composite sample from greenhouse experiment was used in this measurement because there were insufficient samples from field experiment for proper analysis.

The $^{13}C/^{12}C$ and $^{15}N/^{14}N$ ratios of soil and Collembola samples were determined using a coupled elemental analyzer (Flash EA 1112, Thermo Electron) and mass spectrometer (DELTA^{plus} XP, Thermo Electron) system. Natural stable isotope abundance was expressed using the $\delta^{13}C$ and $\delta^{15}N$ permil (‰) deviation from standards, as follows:

$$\delta^{13}C, \delta^{15}N = \frac{R_{\text{sample}} - R_{\text{standard}}}{R_{\text{standard}}} \times 1000,$$

where *Rsample* and *Rstandard* represent the $^{13}C/^{12}C$ or $^{15}N/^{14}N$ ratios of the sample and standard, respectively. Pee Dee Belemnite (PDB) and atmospheric nitrogen were used as the standards for C and N, respectively.

Statistical Analysis

Collembola abundance, number of taxa, and different indices of diversity were examined. Shannon-Wiener diversity, Pielou's evenness, Margaleff species richness and Simpson's measure of dominance were calculated. The dominant structure of the genus assemblage was assessed following the classification system of Engelmann [12].

Analysis of variance (ANOVA) was done to determine significant differences among treatments. Some data sets were log-transformed or square-root arc-transformed in order to achieve homogeneity of variance. Mean comparison was done using Least Significant Difference (LSD) procedure at 0.05 and 0.01 levels.

For soil chemical parameters, significant differences between treatments were tested by ANOVA followed by LSD procedure. This statistical analysis was performed using JMP for Windows (SAS Institute, Carry, USA). Correlations between Collembola abundances, crop yield, community parameters and chemical parameters were analyzed by means of the Spearman Rank Order Correlation Coefficient (r_s) using VassarStats [33].

RESULTS AND DISCUSSION

Relative Abundance of Each Genus of Collembola

A higher number of genera of Collembola were observed in the greenhouse than the field experiment. A total of 13 and 23 genera of Collembola representing five and seven families were identified in the field and greenhouse experiments, respectively (Tables 2 and 3). Two genera of Collembola in the field experiment, i.e. *Isotoma* and *Sinella*, and five genera in the greenhouse trial, i.e. *Isotoma, Hypogastrura, Archerontiella, Sinella*, and *Sminthurides*, were the most dominant. In both the field and greenhouse trials, *Isotoma* was the most dominant genus with up to 68.13% and 62.93% abundance, respectively (Tables 2 and 3). The findings confirm other experiments, which found that genus *Isotoma* especially species *I. notabilis* was the dominant taxa compared to other Collembola living in the upper soil layers [29][45]. It is notable that some species from the genus *Isotoma* e.g. *I. viridis* and *I. notabilis* were most abundant under organic crop management [1].

Table 2. Densities of total Collembola and each genus of Collembola as affected by application of EM and different organic manures in the field experiment[1].

	MEAN DENSITY (NUMBER m^{-2})							
TAXA	T_0	T_1	T_2	T_3	T_4	T_5	TOTAL	%
All Collembola	666 ab	1567 a	1533 ab	1000 ab	867 ab	533 b	6166	100.00
Isotomidae								
Isotoma	467 ab	1200 a	1067 ab	633 ab	467 ab	367 b	4201	68.13
Isotomurus	0	133	133	0	67	0	333	5.40
Folsomia	0	67	0	33	0	0	100	1.62
Subisotoma	0	0	0	33	0	0	33	0.54
Entomobryidae								
Sinella	167	33	67	67	200	67	601	9.75
Rambutsinella	33	0	0	200	33	33	299	4.85
Lepidocyrtus	0	0	0	0	33	0	33	0.54
Hypogastruridae								
Hypogastrura	0	0	233	0	0	0	233	3.78
Archerontiella	0	133	0	0	33	0	166	2.69
Paronelidae								
Salina	0	0	0	0	0	67	67	1.09
Callyntrura	0	0	0	0	33	0	33	0.54
Sminthurididae								
Sminthurides	0	0	33	0	0	0	33	0.54
Sphaeridia	0	0	0	33	0	0	33	0.54

[1]Numbers followed by common letters in the same row are not significantly different at LSD 0.05.T_0=control, T_1=FYM, T_2=FYM+EM, T_3=GM, T_4=GM+EM, T_5=EM.

Table 3. Densities of total Collembola and each genus of Collembola as affected by application of EM and different organic manures in the greenhouse experiment.

	MEAN DENSITY (NUMBER m^{-2})							
TAXA	T_0	T_1	T_2	T_3	T_4	T_5	TOTAL	%
All Collembola	3567 b	3300 b	4300 b	9000 ab	13533 a	5267 ab	38967	100.00
Isotomidae								
Isotoma	2567 b	2500 b	3167 b	3567 b	8167 a	4533 ab	24501	62.93
Desoria	0	0	167	67	0	0	234	0.60
Cryptopygus	0	0	0	0	367	0	367	0.94
Folsomia	33	167	0	133	0	0	333	0.86
Subisotoma	0	0	0	67	0	0	67	0.17
Isotomiella	0	0	0	67	0	0	67	0.17
Isotomurus	0	133	167	0	67	0	367	0.94
Hypogastruridae								
Hypogastrura	0	133	300	4433	3467	33	8366	21.49
Archerontiella	0	200	0	200	33	67	500	1.28
Entomobryidae								
Sinella	367	100	133	67	433	100	1200	3.08
Rambutsinella	67	33	0	267	33	67	467	1.20
Coecobryas	0	0	0	0	33	0	33	0.08
Lepidocyrtus	0	0	0	0	67	0	67	0.17
Lepidosinella	0	0	0	0	33	0	33	0.08
Entomobrya	0	0	0	0	0	67	67	0.17
Lepidosira	0	0	0	0	33	0	33	0.08
Willowsia	0	0	0	0	0	33	33	0.08
Sminthurididae								
Sminthurides	533	0	300	33	700	267	1833	4.71
Sphaeridia	0	33	0	67	0	0	100	0.26
Neanuridae								
Lobella	0	0	0	33	33	0	66	0.17
Paronelidae								
Salina	0	0	33	0	0	100	133	0.34
Callyntrura	0	0	0	0	33	0	33	0.08
Cyphoderidae								
Cyphoderus	0	0	33	0	0	0	33	0.08

[1]Numbers followed by common letters in the same row are not significantly different at LSD 0.05.T_0=control, T_1=FYM, T_2=FYM+EM, T_3=GM, T_4=GM+EM, T_5=EM.

Several species of epigeic Collembola in organic fields, including *I. viridis*, have been found to be vulnerable to fungicide applications, which might have negatively affected Collembola by reducing their fungal food supply [15].

Hypogastrura was the second commonly encountered species in the greenhouse trial with up to 21.49% abundance (Table 3). Unlike *Isotoma*, which is dominant in all treatments,

high densities of *Hypogastrura* was mostly obtained from the treatment with GM alone and the treatment of GM+EM.

In general, most individuals and genera found belong to the family Isotomidae. Individuals of this family accounted for more than 65% of total Collembola densities under each treatment (Tables 2 and 3). This result supported the findings of Reeleder *et al.* [40] who confirmed that Collembola populations in a cultivated soil were dominated by the families Isotomidae and was not affected by any tillage treatment. The lowest individual densities were found for the family Sminthuridae in the field site and family Cyphoderidae in the greenhouse experiment.

Diversity Parameters of Collembola Community

The application of organic matter significantly resulted to higher diversity of Collembola. In general, the diversity and richness of Collembola as determined by the Shannon-Wiener and Margalef index were higher in the treatment with organic manuring regimes, i.e. FYM and GM, in both the field and greenhouse experiments (Table 4). Compared to FYM application, GM resulted in relatively more diverse and richer Collembola with a 100% increase of the number of genera, indicating that green manure could improve soil physical properties and better food quality for Collembola. It is well known that green manuring have positive effect on soil texture. Martin and Fernandez [34] found more micropores in a soil manured with straw than in unmanured soil. Green manure crops influenced soil biota both immediately, through increased food supply, and indirectly, by changes in soil chemical and physical variables [26].

Organic matter together with EM resulted to the highest biodiversity of Collembola. When EM was combined with GM under field and greenhouse conditions, it consistently resulted in highest richness of Collembola with 7 and 14 genera of Collembola, respectively (Table 5). Furthermore, EM also tends to increase Collembola diversity when it is combined with FYM in the field. Apparently, the treatment using EM alone (T_5) also increased Collembola diversity in the field and increased richness both under field and greenhouse conditions. It is likely because EM probably increase the microbial diversity of soils and plants. Collembola are well known to ingest a broad range of microorganisms such as fungi and bacteria, hence the increase in microbial biomass and diversity due to EM application may also increase the diversity and richness of Collembola as well.

The evenness of Collembola generally did not differ among treatments in both the field and the greenhouse experiments, which range between 0.50 – 0.70 and 0.30-0.55, respectively. It shows that the frequency of each Collembola genus was not well-balanced with an evenness of below 0.7. This indicates that each treatment in the field and greenhouse trials can be classified as not diverse habitats for Collembola which means the treatments in this study have affected Collembola to disperse aggregated spatially.

Table 4. Number of Collembola genera, evenness, diversity and dominance as influenced by application of EM and different organic manure regimes.

TRIAL SITE	TREATMENT	NUMBER OF GENERA	NUMBER OF DOMINANT GENUS	DIVERSITY (H’)	RICHNESS (I’)	EVENNESS (J’)
Field	T_0 - Control	3	2	0.75	0.67	0.68
	T_1 - FYM	5	1	0.84	1.04	0.52
	T_2 – FYM+EM	5	2	0.97	1.05	0.60
	T_3 - GM	6	2	1.13	1.47	0.63
	T_4 – GM+EM	7	2	1.37	1.84	0.70
	T_5 - EM	4	3	0.95	1.08	0.69
Greenhouse	T_0 - Control	5	3	0.87	0.86	0.54
	T_1 - FYM	8	1	0.99	1.52	0.48
	T_2 – FYM+EM	8	1	1.03	1.44	0.50
	T_3 - GM	12	2	1.19	1.97	0.48
	T_4 – GM+EM	14	2	1.19	2.33	0.44
	T_5 - EM	9	1	0.66	1.58	0.30

Table 5. Density of Collembola (number m^{-2}) obtained at different times of sampling (months after planting, MAP) and subjected to various treatments in the field and greenhouse trials during crop season.[1]

		BEFORE	AFTER TREATMENT		
TRIAL SITE	TREATMENT	TREATMENT	1 MAP	2 MAP	3 MAP
Field	T_0: Control	133 ns	100 cd	267 ns	200 ns
	T_1: FYM	233 ns	800 aa	367 ns	400 ns
	T_2: FYM+EM	133 ns	633 ab	167 ns	733 ns
	T_3: GM	167 ns	100 cd	267 ns	633 ns
	T_4: GM+EM	400 ns	433 bc	300 ns	533 ns
	T_5: EM	300 ns	100 cd	267 ns	200 ns
Greenhouse	T_0: Control	233 ns	67 cc	367 bb	400 ns
	T_1: FYM	167 ns	167 bc	967 bb	567 ns
	T_2: FYM+EM	167 ns	967 bc	733 bb	833 ns
	T_3: GM	300 ns	6033 ab	1167 ab	333 ns
	T_4: GM+EM	100 ns	8201 aa	3033 aa	633 ns
	T_5: EM	400 ns	967 bc	2167 ab	766 ns

[1]Numbers followed by common letters in the same column are not significantly different at LSD 0.05 (ns: not significant).

Temporal Abundance of Total Collembola

The abundance of Collembola was generally influenced by organic manure and EM applications during the first sampling time (1MAP) in the field experiment and during the first and second sampling time (1MAP and 2MAP) in the greenhouse experiment (Table 5). This indicates that Collembola was probably attracted more to organic manuring regimes and EM application in the first month after treatment due to better quality of dietary resources. It is well known that the quality of dietary resources is a key aspect of the function and performance of animals living in the detrital food web [31]. Higher densities of Collembola were found in the greenhouse than in the field trial (Table 5). The densities of Collembola at each sampling time in the field site were relatively constant and did not show any significant difference except in the first sampling time; whereas in the greenhouse trial, they tend to decrease significantly subsequent to the first sampling time. This condition might relate to abiotic conditions especially effect of precipitation during crop season which was an extremely rainy season with minimum 12.5 mm/day to maximum average 20.4 mm/day (Table 1), but perhaps also to changes in the availability of food sources.

The organic manuring regime had a different effect on the abundance of Collembola in the field and greenhouse experiments (Table 5). In the field condition, Collembola were significantly influenced by farmyard manure (FYM) treatment. Other studies with farmyard manure in the field condition confirm that decomposer populations often benefit from organic amendments including animal manures (Curry, 1994). Nakamura [37] found that the microarthropod decomposer community temporarily increased after cow dung application. Furthermore, Bolger and Curry [7] reported that moderate applications of cattle and pig slurry resulted in moderate increases of hemidaphic Collembola. On the other hand, under greenhouse conditions higher density of Collembola was observed in treatments with green manure (GM). Moreover, the application of GM had a greater effect on the abundance of Collembola when combined with EM. Obviously, under greenhouse condition, Collembola and EM preferred green manure compared to farmyard manure as their diet or substrate. It is well known that Collembola food preference depends on the substrate on which the fungus is grown [25]. Greenhouse condition is likely to provide better condition for microorganisms, including EM which contains bacteria, actinomycetes and fungi, to grow on green manure. While in the field condition, this association between microorganisms, Collembola and green manure were greatly influenced by heavy rain. Both FYM and GM contributed significantly in Collembola abundance only during the first sampling time (1MAP), indicating the role of Collembola in decaying and grazing these substrates was effective in this period (Table 5). However, application of EM could prolong this process until two months after crop planting when combined with GM under greenhouse condition, assuming that higher diversity and abundance of microorganisms in that treatment could probably persist longer due to EM application.

Soil Chemical Parameters

Under field and greenhouse experiments, the application of FYM and GM tend to increase the total organic carbon (OC) contents in soil during cropping season (Figures 8 and 9, Table 6). In contrast, soil organic carbon in the treatments with GM and combination of GM+EM in the greenhouse experiment were reduced by 48% and 23% respectively, indicating that green manure and EM could increase decomposition of soil organic material. Larsen [31] reported that during incubation, the pool of green manure derived carbon available for root uptake decreased due to decomposition. It is well known that plant residue contains an appreciable amount of water-soluble organic compounds, such as free amino acids, organic acids, and sugars that are readily available for microbial decomposition by the vast majority of soil microbes. These materials are rapidly taken up by the microbes for catabolic and anabolic activities. These water-soluble compounds are generally utilized by bacteria and "sugar fungi" (Zygomycetes such as *Mucor* spp, and *Rhizopus* spp.), all of which exhibit rapid growth rates [48].

Table 6. Percentage change of soil chemical properties after three months application of EM and different organic manures as compared with concentrations before treatment.

TRIAL SITE	TREATMENT	CHANGE (%)				
		C & Total Organic	Total N	K	P	C/N
Field	T_0 : Control	+57.2	-32.1	-204.8	+102	+52
	T_1 : FYM	+39.3	+24.2	-252.4	+201	+5
	T_2 : FYM+EM	+86.9	+6.6	-331.7	+166	+43
	T_3 : GM	+11.6	-9.7	-449.7	+321	+9
	T_4 : GM+EM	+17.7	-18.3	-383.1	+32	+28
	T_5 : EM	+67.0	-33.3	-126.6	+240	+55
Greenhouse	T_0 : Control	+28.7	-19.7	-158.5	+1085	+35
	T_1 : FYM	+54.8	+6.1	-64.5	+4402	+31
	T_2 : FYM+EM	+39.6	+25.1	-174.8	+2681	+10
	T_3 : GM	-48.2	+12.4	-101.3	+2687	-67
	T_4 : GM+EM	-23.2	+32.2	-89.4	+2381	-63
	T_5 : EM	+27.1	-33.3	-46.7	+1178	+41

(+) increase; (-) decline

Application of FYM when combined with EM show inconsistent results in the field and greenhouse trials. In the field investigation, FYM+EM show higher increase in total organic carbon up to 86.9% compared to only 39.3% in FYM alone; whereas in the greenhouse the increase in FYM+EM were 39.6% compared to 54.8% in FYM (Table 6).

It is difficult to explain the different effects of EM on FYM to total organic carbon in both experiments because there are almost no clear trends. In an earlier study, Kautz *et al.,* [26] reported that total carbon in soil was most clearly influenced by farmyard manure, especially when combined with mineral nitrogen fertilization.

Soil nitrogen in the field and greenhouse experiments generally had the same trend which tends to fluctuate in each sampling time. Most applications of organic manure tend to increase N content during cropping season except in treatment with GM or GM+EM in the field experiment (Table 6). This indicates that GM application was likely ineffective as soil amendment under field conditions. In the greenhouse experiment, N content generally was positively influenced by FYM and GM; whereas in the field site it was only positively influenced by FYM. The increase of N in the treatment with FYM was likely correlated with the presence of adequate available nitrogen or residue as a result of mineralization process which occurred during one year incubation period prior to the treatment application. This idea is strongly supported by Sorensen [44] who reported that the animal manure N was gross mineralized after 7 days of decomposition.

Evidently, application of EM when combined with FYM or GM in the greenhouse trial increased N concentration up to 25% and 32% compared to 6% and 12%, respectively, in the same treatment without EM. In contrast, nitrogen was decreased in the control and in the treatment with EM alone at 3 months after planting in both the field and greenhouse trials.

The C/N ratio of soil showed that field and greenhouse experiments had a different pattern (Figure 10). Under field conditions, the treatment with FYM (T_1) resulted in the lowest C/N ratio, whereas the rest of the treatments had relatively similar values with the control. However, a more explainable result was shown under greenhouse condition in which the C/N ratio of soil generally declined after the application of organic manure and EM, except in the treatment with FYM. Under greenhouse conditions, when EM was applied with GM, there was a consistent decline in C/N ratio in the soil. The lowest C/N ratio was found when EM was combined with GM. This low carbon-to-nitrogen ratio indicated a favorable condition for decomposition of plant residues and multiplication of microorganisms [48].

Concentrations of P and K in soil showed opposite trend in all treatments. Phosphorous tend to increase markedly especially at 1MAP, whereas K content tend to decrease abruptly at 1MAP and 2MAP in the field trial and at all sampling time in the greenhouse experiments. According to Sylvia *et al.* [48], the C/P ratio can determine the extent to which inorganic phosphorus can be mineralized or immobilized. Field experiments showed that there was a decline in C/P ratio of soil as a result of FYM application (Figure 11). This suggests that mineralization had occurred because more phosphorus was present in the soil than the actual amount needed for carbon assimilation. Conversely, the highest soil C/P ratio value was found in the control. This indicates that an insufficient amount of available phosphorus in the residue for assimilation of the added carbon, then inorganic phosphorus from the soil was used and immobilization occurred.

Under greenhouse conditions, the C/P ratio generally declined as influenced by organic manuring regime. The effect of EM application on the C/P ratio was not detected when it was applied neither with FYM nor with GM in both the field and greenhouse experiments. Bardgett *et al.* [3][5] reported that the soil fauna had no effect on P mineralization due primarily to the reutilization of nutrients by the microbial biomass of soils and litters with high C/N ratio.

Table 7. Dry matter yield of carrot in the field and greenhouse experiments as affected by application of EM and different organic manure regimes.

	DRY WEIGHT (g)	
TREATMENT	Field (m^{-2})	Greenhouse (Per Tuber)
T_0 : Control	201 bcc	2.43 bb
T_1 : FYM	301 aaa	2.57 bb
T_2 : FYM+EM	282 abb	2.93 bb
T_3 : GM	215 abc	3.30 ab
T_4 : GM+EM	203 bcc	4.41 aa
T_5 : EM	187 ccc	3.23 ab

[1]Numbers followed by common letters in the same column are not significantly different at LSD 0.05.

Carrot Yield

In the field experiment, application of FYM alone gave significantly the highest yield among the treatments (Table 7). On the other hand, in the greenhouse experiment, application of GM resulted in a 36% increase in yield over the control. Furthermore, when EM was combined with GM, yield increased significantly by 81.5% over the control.

Although the application of EM alone resulted in a 33% increase in yield over the control, statistically the difference is not significant.

Under greenhouse conditions, the increase in yield resulting from EM application gave higher yield in plots applied with GM compared to FYM treatment, showing that EM had more visible effects when applied with green manure. The low response of FYM to EM in the greenhouse trial was likely due to relatively high C/N ratio of FYM (Table 6). It is well known that a higher C/N ratio could promote immobilization of available nitrogen resulting in a slowing of the decomposition processes due to limited nitrogen availability. When this occurs, the kinetics of the decomposition process depends greatly on the rate of microbial biomass turnover, which releases more nitrogen [48]. However, under field conditions, the role of EM as an additive microbial decomposer to enhance the rate of microbial turnover might be overshadowed by abiotic factors i.e. high rainfall, while the role of EM in the greenhouse experiment was clearly shown.

Correlation of Collembola Abundance, Soil Chemical Parameters and Carrot Yield

Field Experiment. In the field experiments, highly significant positive correlations with soil N and P contents were found in the total Collembola and *Isotoma* abundance (Table 8). Of the two Collembola genera, only the abundance of *Isotoma* was highly correlated positively with carrot yield (Table 9). This may indicate that *Isotoma*, which is the most dominant genus in this study, tend to have a key role in mineralization of N and P. This is in accordance with a previous study [4] which found that in the presence of Collembola, N and net P mineralization was significantly increased relative to a defaunated control. Moreover, Sticht *et al.* [45] reported the significant correlation between N supply and CO_2 enrichment with higher densities of Collembola especially the family Isotomidae. In addition, Axelsen and Kristensen [2] reported a positive influence of N fertilization with respect to organic or inorganic N fertilizer supply on Collembola abundance.

Table 8. Correlation (r_s) of Collembola abundance and carrot yield with soil chemical parameters.

	ALL COLLEMBOLA		ISOTOMA		CARROT YIELD	
PARAMETERS	Field	Greenhouse	Field	Greenhouse	Field	Greenhouse
Organic	-0.26*	-1.00**	-0.26*	-0.94**	-0.26*	-0.94**
C	-0.26*	-1.00**	-0.26*	-0.94**	-0.26*	-0.94**
N	0.89*	0.60**	0.89*	0.37**	0.89*	0.66**
P	0.83*	0.03**	0.83*	-0.14**	0.83*	0.31**
K	-0.54*	0.66**	-0.54*	0.77**	-0.54*	0.77**
C/N	-0.77*	-0.83**	-0.77*	-0.66**	-0.77*	-0.71**
C/P	-0.60*	-0.54**	-0.60*	-0.31**	-0.60*	-0.71**

*Correlation is significant at 5% level.

**Correlation is significant at 1% level.

The finding that Collembola had a significant effect on N mineralization is likely to be related to the make-up of the soil microbial community and the feeding strategies of Collembola. Most Collembola are known specialist fungal-feeders, including some species in the genus *Isotoma*. Since the microbial community of organic soils is largely dominated by fungi [3], and NH_4^+-N – the main mineral N form in these soils – is preferentially used by fungi, it is likely that the feeding activities of Collembola have a greater effect on N mineralization. Sjursen and Holmstrup [43] reported that collembola primarily excrete nitrogen in NH_4^+-N form.

There was a highly significant correlation on the total Collembola and *Isotoma* abundance with carrot yield (Table 9). This correlation is supported by the positive effect of Collembola on N and P mineralization, which in turn provides adequate elements for plant growth in improving yield. For plants, nitrogen is used largely in the synthesis of proteins, but structurally it is also a part of the chlorophyll molecule. Many proteins are enzymes, and the role of nitrogen can be considered as both structural and metabolic. Phosphorus is necessary to many plant functions, including carbohydrate metabolism, enzyme activation, osmotic regulation, efficient use of water, nitrogen uptake and protein synthesis, and translocation of assimilates. It also has a role in reducing certain plant diseases and in improving quality of harvest [50].

Greenhouse Experiment. Under greenhouse conditions, there was highly significant negative correlation with the abundance of total Collembola and *Isotoma* density with soil organic carbon (Table 8). Consequently, the carbon-to-nitrogen ratio of soil substrates was highly significant negatively correlated with the total Collembola and *Isotoma* abundance. This means that nitrogen availability was increased despite the decline in the amount of carbon in soil substrates due to decomposition. This idea is supported by Larsen [31] who reported that the large loss of carbon indicates that green manure - derived carbon was very important for fuelling the microbial mediated release of mineral nitrogen and subsequent plant growth. It is well known that the presence of adequate available nitrogen will increase the rate of decomposition and the conversion of organic-nitrogen compounds to ammonium is mediated by enzymes produced by microbes and soil animals including Collembola. According to Sylvia *et al.* [48], net production of ammonium is influenced not only by environmental factors and the C/N ratio of substrates and microbes but also by other biotic factors. Most important of these is the role that soil animals play as predators of the primary decomposers, bacteria and fungi. This could explain why Collembola especially *Isotoma* increased the decomposition of organic manure. Of the five Collembola genera in the greenhouse experiment, *Isotoma* was the only genus which was highly correlated with carrot yield (Table 9). However, richness of Collembola had a significant correlation with the yield.

Effect of Application of EM and Different Organic Manures on the Rate of Nutrient Mineralization by Collembola

Figure 12 shows that the $\delta^{15}N$ and $\delta^{13}C$ of Collembola form cluster patterns which could be categorized into two groups i.e. T_1, T_2, T_3 and T_4 as the first group, while T_0 and T_5 belong to the second group. Otherwise, the $\delta^{15}N$ and $\delta^{13}C$ of soil substrates were plotted closely to each other as one group for all treatments. Apparently, the $\delta^{15}N$ values of the first group of Collembola (+7.1 to +10.8‰) and all soil substrates (+7.16 to 11.19‰) were relatively in the range of $\delta^{15}N$ standard value (Table 10).

The $\delta^{15}N$ value of soil applied with FYM was 11.19‰ which is in the range of the standard value of farmyard manure (+10 to +25‰) [27]. Unfortunately, the $\delta^{15}N$ value of soil applied with FYM+EM was surprisingly relatively low (+7.7‰). There is no definite trend in the results and difficult to explain when compared to the data of percentage change of total soil nitrogen (Table 6) which shows that the increase of soil N in the treatment with FYM+EM (+25%) was higher than with FYM alone (+6%).

Meanwhile, the $\delta^{15}N$ value of soil substrate which was applied with GM and GM+EM; 7.16‰ and 9.75‰ (Table 10), respectively, generally were still in the range of the standard value of green manure or litter (-10 to +10‰) (27). However, an enrichment of $\delta^{15}N$ of soil substrate occurred when GM was applied with EM (+9.75‰). This is ±2‰ higher compared to the application of GM alone (+7.16‰) or EM alone (+7.5‰). This indicates that the combination of GM and EM likely could enhance biologically-mediated reactions (e.g. assimilation, nitrification, and denitrification) which strongly control nitrogen dynamics in the soil. It is well known that these reactions almost always result in ^{15}N enrichment of the substrate and depletion of the resource product [27]. This is supported by the data on the increase of total soil nitrogen in T_4 (GM+EM) after three months of planting which showed the highest increase (32%) (Table 6).

Except in T_0 and T_5, the $\delta^{15}N$ values of Collembola among treatments (+7.1 to 10.8‰) generally were in the close range of the $\delta^{15}N$ values of soil substrates (+7.16‰ to +11.19‰). In contrast, the $\delta^{15}N$ values of Collembola in the control (T_0) and the treatment with EM alone (T_5) were extremely higher (almost doubled) compared with the rest. Both T_0 and T_5 showed significant enrichment in Collembola's ^{15}N during decomposition i.e., 20.7‰ and 21.7‰ (Table 10), respectively, which is out of range of normal ^{15}N values (-9 to 16‰) in individual amino acids [48]. This indicates that Collembola in the treatment without organic amendment may undergo nitrogen stress as reported by Larsen [31] that nitrogen stress is likely to lead to an increased recycling of nitrogen and consequently retention of ^{15}N in the Collembola tissue. This is supported by the data on soil nitrogen in T_0 and T_5 which markedly dropped by 19.7% and 33.3%, respectively after three months of planting (3MAP) (Table

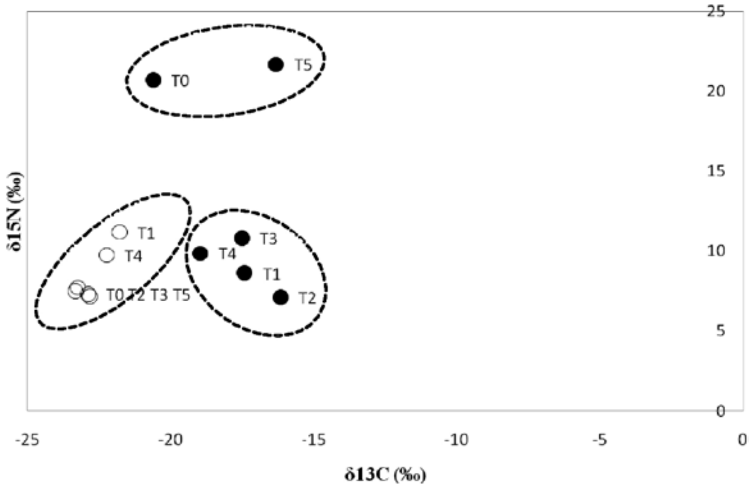

Figure 12. Plotted of $\delta^{15}N$ and $\delta^{13}C$ showing the correlation between Collembola and soil substrates in the greenhouse experiment as affected by application of EM and different organic manure regimes. Closed circles (●) indicate Collembola. Open circles (○) indicate soil substrates. T_0=control, T_1=FYM, T_2=FYM+EM, T_3=GM, T_4=GM+EM, T_5=EM.

10). Several authors have hypothesized that animal in negative nitrogen balance become progressively enriched in ^{15}N [6].

The finding that there was enrichment in ^{15}N observed in Collembola in the treatment with GM and the combination of GM+EM (+9.88‰ and +10.8‰, respectively) compared to ^{15}N observed in the soil substrates (+7.16‰ and +9.75‰, respectively) suggests that EM may enrich the microorganism community of soil substrates in the green manure treatments as well as enhance the chemical degradation of complex molecules, including the fractionation of ^{15}N. Richer microorganisms may attract more Collembola to inhabit these treatments and boost nitrogen mineralization as reported by Swift *et al.,* [47] that soil mesofaunal activities enhance mineralization through the 'external rumen mutualism' (faecal pellets) with microbes. Sampedro *et al.* [41] who studied the soil feeding and litter-feeding soil fauna also reported Collembola tissues being enriched with ^{15}N by 9‰.

In contrast, the $\delta^{15}N$ value of Collembola in the treatments with FYM and FYM+EM (+8.6‰ and +7.1‰, respectively) declined as compared to the same treatments in the soil substrates (+11.19‰ and +7.73‰, respectively). The high $\delta^{15}N$ value of farmyard manure in soil substrates was not consistent with the $\delta^{15}N$ value in Collembola's tissue. This contrasting result showed that Collembola may not be involved in N mineralization of farmyard manure. This indicates that Collembola do not prefer farmyard manure compared to green manure as their diet. Application of EM on farmyard manure also could not enrich the ^{15}N of both Collembola and soil substrates. A possible explanation for the lack of contribution of EM on farmyard manure in enrichment of ^{15}N could be due to the goat manure, used in this study, which is already incubated for one year. This one year incubation might have resulted to nutrient leaching losses and decomposition processes of the goat manure; thus, EM which mostly contains fungi and bacteria did not find any optimum media in which to grow. In agreement with this finding, Thomsen [49] reported that the synchronization between crop N demand and mineralization of N from farmyard manure was highly related to the time of farmyard manure application.

Table 10. The value of $\delta^{15}N$ and $\delta^{13}C$ of Collembola and soil substrates in the greenhouse experiment as affected by application of EM and different organic manure regimes.

	COLLEMBOLA		SOIL SUBSTRATES	
TREATMENT	$\delta^{15}N$ (‰)	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	$\delta^{13}C$ (‰)
T0: Control	20.70	-20.60	7.31	-22.88
T1: FYM	8.60	-17.41	11.19	-21.79
T2: FYM+EM	7.10	-16.15	7.73	-23.25
T3: GM	9.88	-17.50	7.16	-22.83
T4: GM+EM	10.80	-18.95	9.75	-22.24
T5: EM	21.70	-16.31	7.50	-23.33

CONCLUSIONS

The effect of EM on abundance of Collembola was detected only in the greenhouse experiment; while the effect of organic amandments was confirmed in both field and greenhouse experiments. Under greenhouse condition, the application of EM in combination with GM could prolong high abundance of total Collembola in two months instead of one month like in other treatments.

The diversity and richness of Collembola were positively influenced by EM and organic amendments. Application of EM in combination with GM consistently resulted in the highest richness of Collembola. In accordance with previous studies, genus *Isotoma* (Family: Isotomidae) was consistently the most abundant Collembola in both field and greenhouse trials.

Both soil chemical analysis (Organic carbon, N, and P) and natural stable isotope analysis confirm that EM applied with GM was the most effective in increasing nutrient mineralization. However, the role of Collembola to enhance ^{15}N fractionation as affected by EM and organic amendments is promising although it needs further studies to validate.

The greenhouse study indicates that EM was only effective in increasing yield when it was combined with organic amendment particularly green manure; whereas EM was not effective in increasing carrot yield in the field condition due to high precipitation.

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ECOLOGICAL DESIGN CONCEPT AND BASIC PRINCIPLES AT STRUCTURAL AND SOCIETAL SCALE

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INTRODUCTION

Industrial production methods, that has only a 250-year history, has led to a rapid growth in economy along with opening many new products and working areas, captured the control of resource utilization, encouraged consumer economy that considered nature as an unlimited source, and resulted in the formation of mass society, encouraged consumerism at a top level, and incrementally increased production in parallel with consumption. Beginning from this period, fossil fuel consumption has gradually increased and as a result of this uncontrolled industrialization, a huge increase occurred in wastes, pollution and greenhouse effect existing in the earth and the atmosphere. In spite of the regeneration capability of nature, such unprecedented severe pressures has brought bio-climatic cycles and ecological system of the earth to the point of deterioration (1).

Climate Change is defined as "a change in climate happening as a result of human activities directly or indirectly disturbing the composition of global atmosphere, in addition to natural climate change observed in a comparable time period" under the United Nations Framework Convention on Climate Change (UNCCFC) (2). Greenhouse gases in the atmosphere increase depending on the energy consumed in the world. Carbon dioxide, methane molecules and particularly water vapors prevent the reflection of rays coming to the world to the space back, and thus, surface of the world and troposphere becomes hotter than required. This incident resembles greenhouses that get hot by sunlight, but don't release the heat outwards, and therefore, it is known as natural greenhouse effect. With a wide understanding in the last decade that; such increases in climate and earth (1,5 – 5,8°C) (3) shall be detrimental to whole life of living beings, it is recognized that; the repair and replacement of this condition is subjected to a long process, and problems of today will also be important for next generations (4).

Here, a necessity to seek solutions immediately and put these solutions into effect as soon as possible has come to light. However, this change can only be achieved by a multidimensional structure encompassing deep changes in economic and social structuring, advances in ecological design, academic studies and accumulations and a determined policy and its practitioners. The concept "sustainability" is evaluated in terms of structure and society in this paper, and basic principles to be followed are reviewed.

Ecological Design Concept:

It is emphasized by scientists that; global warming and environmental pollution arose out of the actions of mankind and a precaution should be taken as soon as possible. Some of the environmental effects of global warming and pollution are depletion of natural resources, climate changes, desertification and deforestation, ozone decrease in stratosphere, acidification, air-water-earth pollution, human and animal poisoning, and the loss of wildlife and bio-diversity. Human activities that lead to ecological change are primarily defined as energy consumption (49%), industrialization (24%) and deforestation (14%)(5). According to the data, 'Energy' is revealed as the factor primarily affecting ecosystem. Then, the role of the selected fuel type and consuming in a way that yields the most efficiency with the least energy, and reduction of greenhouse gases are huge in order to maintain the ecosystems providing gas absorption.

Ecological Architecture can be defined as a building method that; provides economic, social and environmental benefits depending on positioning, water and energy activity, material and resource use and operation during building utilization, takes physical environment into account with its biological, cultural and psychological aspects, does not dispose of hazardous waste to environment, and where all entries and outputs of the structure, beginning from the design of building to its demolishment, can adapt to the ecological system (6).

A structure designed in line with eco-centric (ecological-centered approach to planning and design) and holistic principles will have the least impact on ecosystem, exist like the established order of nature, and will help the preservation of ecological diversity and human health, air, water and soil quality. Considering that; exhaustion of resources making a part of ecosystem due to excessive use will lead to the loss of self-regeneration ability of the system, every intervention to the nature should be performed within a plan, and the elements composing the whole need to be designed in a sustainable way for the sustainability of the whole.

From a **Structural** aspect, issues like 'Ecological Material Utilization', 'Indoor Air Quality', 'Lighting', 'Renewable Energy Use', 'Suitability to Climate, Wind, Direction Factors', 'Energy Efficiency', 'Thermal Comfort', 'Recycling', 'Utilization of Rainwater and Wastewater' are of importance.

In terms of **Society**, topics like 'Changing Consumption Habits', 'Cooperation Among State- Local Governments-Industry-

Nongovernmental Organizations- Occupational Organizations-Society" have great importance.

Sustainability on the Scale of Structure:

When the effects of buildings to environmental problem are analyzed, they are found to use 50% of the used energy, 40% of raw materials, 50% of chemicals harmful to ozone, 80% of cultivated land and 50% of potable water (7).

Ken Yeang (2006) stated that; 'Ecomimesis' concept and ecological design approach should include biological environmental integration. 'Ecosystem does not leave waste in itself, everything is reused, and provides benefit to another organism.' Yeang argues that; this system could applied in a building form, carrier and/or infrastructure, and all wastes and products of the structure could be reused and the system could make use of this (8).

Image 1, Hamzah & Yeang Architects

Ecological Material Utilization: Lumber, reusable brick, cut stones, volcanic tuffs, linoleum, fleece, paper panels, compacted earth, adobe, terra cotta, clay, linen, hemp, seaweed, cork, wood, fiber, sandstone, rubbles, bamboo can be listed as eco-friendly materials and hay bales and polyurethane blocks can be used for insulation. However, a point to be considered in this matter is whether the material exists in the vicinity. To save energy to be used between manufacturing-construction areas, local materials needs to be selected (9). For example, bamboo is a rapidly growing eco-friendly material. But this plant does not grow in Turkey, and is only ecological in terms of the environment it grows within. Shigeru Ban, a Tokyoite architect, is famous for using ecocredential recyclable materials in a way to produce minimum waste. He has built buildings with different functions like mass housing, churches, theatre buildings, bridges and libraries with paper materials (10).

Considering these principles, ecological meanings of structures differ depending on their geographical position, and ecological material utilization suitable for every environment differs likewise (11). Traditional construction practices are natural and self-generated sustainable behaviors since they make use of the characteristic building materials of the environment they are situated in. Utilization of 'ecological but imported' products by ignoring local materials, decoration of indoors and outdoors with "green" elements suggest that; the concept is misinterpreted by some circles or regarded as a means of advertisement.

VOC, i.e. volatile and harmful substance emission should be controlled in all indoor materials like carpets, paints and adhesives for achieving indoor air health. Low water consuming fittings and toilets should be used for effective water use, dimmer elements and low energy consuming LED bulbs saving energy with motion sensors are to be preferred in lighting. Material supply, manufacturing and transport, use and wastes used for the furnishing indoors pose a serious threat to environment. Today, waste amount is increasing day by day, and it is estimated that;

3-5% of the existing wastes are generated by furnishings. Taking into account that; total annual solid waste amount in Turkey is 12 million tons and 12% of them are recyclable wastes, we can understand the importance of the situation. In Germany, one of the countries against dump sites, it is prohibited by law to dispose of materials composed of organic components at the rate of 5% to dump sites since 2005. Waste furniture burned in dump sites causes carbon dioxide and other harmful emissions, and therefore, it is not accepted as an environmental approach. Unwanted domestic utensils should be encouraged to be handed over, reused and recycled, and they should be not considered as wastes since going out of date because of rapidly changing trends, and they are to be utilized. With implementation of furniture recycling in interior architecture, some indoor elements like kitchen, bathroom and office can be produced with less energy and labor (12).

Life Cycle Evaluation (LCE) is one of the methods used for evaluating the environmental effects of a product or service. This evaluation is performed on the basis of raw material extraction, processing, packaging, transport, construction, use, maintenance and repair when necessary, disposal when its life ends, recycling and getting it ready for reuse; and, environmental performance and potential effects of materials are attempted to be determined. LCE determines environmental effects depending on energy consumption and emission values in all stages like manufacturing, use, transportation etc., and aims to establish databases for local and international ecosystem. Building materials reviewed within the scope of this system are bricks, wood, ceramics, marble tile floor coatings, thermal insulation materials, PVC woodworks, windows, metal products, wall papers, aluminum, glass and concrete. There is not satisfying work and database on natural stone (trass) (13).

Renewable Energy Consumption: According to 2004 World Energy Report 2004, energy consumption will increase by 60% by 2030, and 2/3 of this need will be demanded by developing countries. Most of the energy used today is generated from fossil fuels like coal, petrol and natural gas. These fuels are non-renewable energy resources formed by decomposition of plants and animals for millions of years. With the present speed of fossil fuel consumption, they are estimated to be exhausted approximately in 50-70 years, and it is revealed that; the world will warm with a 1,5-4 degree increase in about 40 years due to nitrogen oxide in the atmosphere by use of such fuels and greenhouse effect forming as a result of combination with other harmful gases.

Half of the energy consumption takes place in buildings (14). Within this context, while renewable energy resources like water, solar, wind, geothermal, tidal, bio-fuel that are not harmful to environment and also could be generated locally take about 1.5-2% of the total primary energy supply, the potential of these resources is gradually better understood.

Image 2, Wind Turbines

Microgeneration is defined as utilization of fuels and energies with low-carbon emission (15); photovoltaic solar panels, ground source heat pumps, micro-combined thermal-power systems, small-size hydroelectric power plants and wind turbines are examples of this practice. Companies producing microgeneration applications for houses and businesses have become widespread lately in Britain and USA (16). Electricity accumulators, collectors, photovoltaic (PV) solar panel cells convert the solar energy into electrical energy. Such systems can be used for illumination of office, industrial buildings, streets, tunnels and similar areas in various forms like being a part of walls and roofs or over ventilation and shadowing elements.

Solar chimneys work as a simple hydroelectric power plant and generate power, and since passive solar buildings are structured according to various criteria, they can facilitate about 85% reduction in the amount of energy used in a house.

Ground source heat pumps, use of water pressure for generating electricity, bio-fuels obtained from organisms and their metabolic outputs, biomass energy technology based on the utilization of tree wastes, oil seed plants, vegetable wastes, animal wastes, urban and industrial wastes and generating energy from these sources, biogas energy taken from organic wastes, bio-diesel coming as a result of the reaction of oils taken from oil seed plants like canola, sunflower seed, soybean and safflower, and animal oils with alcohol, geothermal energy generated by making use of hot water, steam, gases containing chemicals, formed by the heat accumulated in the depths of the earth's crust, and the energy formed by these have great importance in terms of sustainability. It is anticipated that; hydrogen energy with increasing popularity among renewable energy resources and the related fuel cell technology will be used more in houses directly in the following years. Turkey has a great privilege in this sense with its rich boron deposits (17).

Suitability to Climate, Wind and Direction Factors: Climate and orientation should be performed in the right way for material efficiency. A good example of this is the fairly good relative humidity and temperature values depending on natural ventilation in the house achieved as a result of local materials and orientation in design in traditional Turkish houses. Choosing the right form and direction for ventilation and sunlight in buildings, adaptability to solar energy, wind and topographical features provide energy savings up to 30-40% with materials that could be supplied from the immediate surroundings; and establishes an efficient structure together with natural ventilation, active passive solar energy methods, correct positioning and external environmental planning.

In 'Eastgate Centre' in Zimbabwe, designed by Mick Pearce by taking inspiration from termite mounds, heat-air level is notably successful despite absence of a heating-ventilation system. The building is designed according to the position of sun and taking thermal control as basis just like ant nests. Heat balance between the building mass and air can be adjusted and the air reaches the floors and offices before leaving from the chimney.

Energy Efficiency: Buildings generate energy with different purposes in different stages. At least 5 times the energy used in the material production, transport and construction of a building with at least 50-year lifetime is required in the utilization and operation stage of the building. 1/3 of the energy consumed in our country is used in buildings. 15% of this energy is utilized by lighting, hot water, cooking and electrical household appliances. The remaining 85% is used for heating and cooling purposes (18). This situation presents the significance of increasing energy efficiency in buildings. Energy efficiency principle is protected by calculating wind effect and direction, the effect of near buildings to free sunshine areas, number and attributes of residents, daily temperature differences and the operation mode of building (19). Another point to take into consideration in energy use in buildings is thermal insulation. A successful thermal insulation could be attained by using materials with correct intensity in insulation materials and building-specific details as well as taking climatic conditions into account.

Form, position (location in the land), transparency of building shell and thermophysical properties of the material from building-related design parameters are important in heating-cooling oriented energy use reduction. Thermal mass, a function of material density and specific heat, is a measure of heat storage capacity. Thermal mass elements can be basically listed as building shell establishment, interior walls and furnishings. According to the studies, cooling load could be reduced between 18% and 50% with the efficient use of thermal mass (20). Planting deciduous trees to the south side of buildings can block 60-90% of solar radiation in summers and 20-50% in winters. Leaf cover of such plants serve as a windbreak to hot winds in summer, and cold winds in winter and thereby aids the insulation of walls.

Passive cooling and ventilation is ventilation method that naturally happens due to wind-chimney effect. High amounts of active ventilation need in buildings particularly in summer can lead to muscle pains, asthma, influenza, throat dryness and fatigue in users. These indications that imply 'sick building syndrome' are to a great extent seen in long-term residents of mechanically ventilated buildings. Avoiding such problems is possible by using passive ventilation systems. Exterior surface colors and coating properties in the buildings determine solar radiation intensity absorbed and reflected from building shell. Light colors decrease radiation intensity, and dark colors increase absorbed solar radiation amount, and this directly affects surface temperature. For example, while solar reflectivity rate of a roof surface is 26%, this rate increases up to 72% by white coating application, and yearly 125 kWh energy saving can be achieved from active cooling system operation (21).

Enhancing energy efficiency in intelligent building systems is made possible by some additional reinforcements and systems. Especially high energy consuming buildings are designed as energy-efficient intelligent buildings to make savings, and technologies like automation, integration with passive system, solar chimneys, double façade systems, intelligent shell take place in these systems. The ultimate point in today's energy-efficient intelligent building concept can be shown as "ANN" (Artificial Neural Networks). This system is described as a learning, experiencing, responding and deciding building automation. Managed by central control and operation, this system provides energy saving and security control together, data about weather conditions are evaluated, all sustainable objectives like solar heating, daylight-sensitive artificial lighting systems, on-site energy generation, sound control, insulation, protection from sun, pressure adjustment, and ventilation are accomplished by loading them all to automation systems (22).

Recycling: For a habitable environment, rather than environment-damaging structures, the ones contributing to it should be erected. Waste amounts of the buildings throughout their production, use and demolition periods and the damages upon the environment show that; the required level of awareness is yet to be reached in terms of materials. Lack of information about the properties and dimensions of materials in projects, design changes and revisions, mistakes in quantities, damages occurring as a result of unsuitable storage of materials, worker mistakes and absence of waste management plans cause an unnecessary increase in the amount of wastes.

Approaches like eco-friendly local material utilization, recycled or recyclable materials, reuse, reduction of material use should become widespread. There are references about reducing material use by reduction strategy, protecting and prolonging the existing products and decreasing wastes of product manufacturing industries. Reuse strategy is the reuse of the product within the same cycle. Recycling strategy anticipates re-production of products from waste materials (23). It is possible to recycle many materials used in buildings like plaster and steel materials (24).

It is important that wastes of users can be a food substance for living systems in the environment, and they could be recycled biologically and/or technologically by purifying them of hazardous substances. Renewable energy resources connections of all buildings, establishing the mechanisms necessary for transforming wastewater and solid wastes, development of recycling projects and reuse of materials like glass, metal and plastic in themselves by separating their organic wastes are some of the methods that will minimize the damage done by wastes on the environment. Wastewater collected from dishwashers, washing machines and wash basins can be used in activities like car wash; and rainwater can be used in garden irrigation works.

Energy can be generated in cement quarries by burning a small amount of thermoplastic fuel rather than anthracite. Moreover, greenhouse gas emission from thermoplastic will be less. By using plastic bottle wastes, a concrete that doesn't have carrying capabilities, but having superior properties of insulation can be created; woodwork profiles, insulation materials, fences, handrails, greenhouse coverings, sewer pipes, roof covers, floor coverings, various furnishings and accessories could be produced by recycling PVC joineries and adding them to original plastics. Plastic wastes could be used in building by converting them into thermal and electrical energy; garbage chutes that could gather plastic package wastes in a certain place could be put in semi-public areas like schools, restaurants and buffets. With the recycling of plastic, both the use of natural resources will decrease, and the raw materials of plastic, crude oil, gas and coal could be saved up. In parallel with these listed properties, increasing plastic materials recycling and using them in buildings will make a great contribution to environment (25).

Sustainability on the Scale of Society:

Changing Consumption Habits: Sustainability can be summarized as developing natural resources like soil, water and vegetation while making use of them and achieving maximum profit with minimum harm. Here, the point to be emphasized in the first place regarding the protection of ecological balance is the necessity to make all-round studies to raise environmental awareness. Sticking to "energy architecture" principles, reuse of existing idle settlements by transforming them, preferring efficient appliances for consumption, using low energy-consuming tools, preventing unnecessary expenditures (electricity, water, etc.), popularizing ecological tourism that supports locals instead of artificially created locations, maintaining and keeping cultural values alive are some of things to be done. "Eco-village" concept pioneered by the people turning towards nature due to their discontent of urban life, is ecosystem supporting to the extent it can realize a self-sufficient cycle.

Image 3, Ecological Tourism

Cooperation Among State-Local Governments-Industry-Nongovernmental Organization-Occupational Organizations and Society: It should be noted that; industrial processes and production methods play the leading role in positively changing societies and their habits. Considering the fact that; 80% of carbon dioxide emission in the world is caused by 122 multinational companies, and 10% belongs to 4 major oil-producing companies, it is clear that the problems could not be solved by discussing the issue only from a built environment perspective (26). Development policies supporting sustainability in existing and news structures should be endorsed by governments. Various tax reductions and incentives with fiscal and legal methods should be practices in order to enable companies fund and invest in recycling projects. Recently, many systems have been developed to evaluate sustainable buildings and projects. Each system has its own limits and every one of them is designed to assess certain aspects of environmental effects during construction (land, water, energy, material, financial measures, air quality of locations etc.). As an example of environmental assessment systems, LEED in USA (The leader green building design system in energy and environmental design) is a certified classification system with four levels as platinum, gold, silver and certified. BREEAM (Building Research Establishment Environmental Assessment Method) is implemented in UK, and CASBEE (Comprehensive Assessment System for Building Environmental Efficiency) is practiced in Japan. These systems make buildings more attractive since they promise lower cost of operation and healthy interiors.

One of the pilot projects in this sense is Robert Redford building in Santa Monica. The building where "Natural Resources Defense Council" office is also located, holds a "platinum" certificate, the top-level certificate of USGBC (United States Green Building Council). The building, which is ventilated by the ocean winds, consumes 1/3 of the energy used by equivalent buildings in the region, and derives its whole energy from carbon-free renewable energy resources. There are 7.5 KW energy generating solar panels in its roof; accumulated rainwater and water acquired from wash basins are treated, and accordingly annually 151.000 liters of water is saved. In addition, natural materials and maximum utilization of daylight are some of the other distinctive features of the building.

In Turkey, there is not established system other than some ISO standards. Besides, a qualified building stock is not yet reached and socio-economic problems are not solved. Thus, applying assessments systems developed according to the needs of different countries in developing countries may bring with it some disadvantages, and unrealistic results may show up (27). For instance, solar cells and wind turbines used in the implementation of sustainable projects could not be produced in our country, and mainly exported from abroad. And that, of course, increases initial investment costs. Accessibility of required system components is an important issue.

Governments, private sector and universities should support R&D activities to develop these devices. Since state and local governments could be governing actors regarding sustainability by investments, adopted policies, shaping of consumption, incentive regulations and sanctions, society should be guided properly with the support of nongovernmental organizations and occupational organizations.

Along with legal arrangements consisting of national policy, standard, laws and regulations, economic arrangements including taxation and tax reductions, information and awareness campaigns related to eco labeling and certification schemes, voluntary politics media broadcasting national policy elucidating programs, and research and development programs encouraging collaboration with private sector should be established (28).

CONCLUSION

Non-profit organizations, banks, unions, working capital groups, purposeful organizations, worldwide foundations, governments, united nations, investors, real estate agencies, employers and many more communities and organizations have tremendous responsibilities and duties in creating sustainable environments (29).

Today, it is necessary to handle ecological planning with an approach taking environment-nature-man and society as a whole in order to maintain spatial, physical, social and ecological orders. Sustainable societies are the ones where natural and historical resources are protected, business opportunities are available, spatial growth is under control, secure in terms of their surroundings, transportation-health services are easily accessible and that encourage all individuals to cooperate in increasing the quality of their life (28).

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BIOCLIMATIC SKYSCRAPERS

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INTRODUCTION

People are known to have gone through many development processes, developed and changed their environments in line with social structure, economy and technological developments throughout history to first stay alive and then to bring their lives to a higher level. This process, that showed a horizontal direction for a long time, has started to develop also in vertical direction; height and staying at high had different meanings in different periods[1]. The rising tendency, occurring as a result of men's declaration of sovereignty over the nature and environment and the conglomeration of religious, military, commercial, social and cultural factors with technology, have shown a different development in high-rise buildings and structures with special functions[2] like towers and chimneys. In high-rise settlement, which basically aims[3] to make the most of the land it is built over, the importance of the feelings of social statue obtainment and patronizing cannot be underestimated. Developments in structure materials, use of high-strength steel and prestressed concrete in load-bearing system, improvements in ventilation systems, invention of elevator and air pressure tank, innovations in the protection against fire, progress[4] in design methods together with technology and many technical, social, economic factors caused United States of America-based high-rise settlement to influence the world. The development of high-rise buildings gained a huge speed during the global financial comfort times; originality and aesthetic concerns have also begun to be taken into account along with function.

Many cities in the world, that are subject to rapid and uncontrolled urbanization, have looked for a remedy in high-rise settlement as an alternative to uncontrolled expansion; skyscrapers built by utilizing all of the technological opportunities have provided solutions to some of the problems at times; and sometimes they have caused infrastructure and environmental problems as a result of unplanned and measureless construction. It is important to consider the burdens, that might be placed by high-rise structures over their immediate surroundings in terms of infrastructure and transportation problems as an urban planning problem in reality, in order to generate solutions to negative conditions[5].

With the global expansion of technology, high-rise building run leapt from United States of America to Far East at first and then slightly to Europe; and the world has started to head towards an end that overburdens the urban infrastructures, steals the wind and sun of its adjacent structures, causes population and traffic problems[6], consumes much energy and incites consumption.

THREATS OVER THE ECOSYSTEM

While buildings rise with the development of technology, science and technology also developed rapidly; and a new industrial revolution based on atomic energy, automation and computer technologies took place. Every invention and product paved the way for new lines of business; economy gained a great speed. Economy, mass society and market-oriented globalization, based on the consumption of nature like it is an unlimited source, rapidly consumed the sources; highly promoted consumption incrementally increased. As a result of the increase in the use of fossil fuels and uncontrolled industrialization, big increases have been observed in waste, pollution and greenhouse gas values in the atmosphere and the earth; the damage done to ecological system has been so huge that; it overshadowed the regeneration capability of nature[7].

While the world has started to observe the harms of unconscious consumption run, unconscious and unhealthy settlement also leaded to destruction; and, solutions causing dissipation in material and energy consumption, started to give rise to a chain reaction including threat over human health[8].

Facing the fact that; the harms brought to nature take us rapidly to serious irreversible dangers, conduced toward the spread of ecological approach aimed at protecting environment and natural resources; “Environmental Design”, “Green Design”, “Ecological Design” and “Sustainable Design” concepts have become effective respectively. It is obvious now that; regeneration of an ecosystem with corrupted natural balance and its regaining its old functionality takes a long process. And it is also known that; it is obligatory to seek solutions without delay to this process which will absolutely affect next generations and put these solutions into practice rapidly.

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It has become a necessity to move from fossil fuels[9], solutions harming the nature and destructive social relentlessness, that are the easy way in meeting the increasing energy demand and creating environmental pollution as a result of production, to renewable energy and stabile ecosystem solutions. And to realize these, decisive policies, serious changes in economical and social values, progresses in ecological design field, academic knowledge, situation analyses and implementers are necessary[10].

In order to enable man-made artificial environment to not harm the nature and contribute to ecosystem, "Sustainable Design" means the continuation of economic/physical efficiency of 21st century, which is growing and developing day by day; to make the whole sustainable, the parts making up the whole should also be sustainable and the materials used in design, building methods, transportation and urban plannings, change of consumption habits should be actualized with the collaborations of governmental bodies-occupational groups-non-governmental organizations.

Going into action for the future of the earth, the world materialized many organizations with the aim of re-balancing the ecosystem; the search for solutions to this problem has begun with national and international organizations. Kyoto Protocol[11], including provisions regarding the reduction of carbon dioxide and greenhouse gas emission to fight against global warming and climate change, has been signed by many countries and it is determined to set a common attitude. In Johannesburg World Summit on Sustainable Development, decisions similar to Kyoto Protocol were taken. Organizations granting certificates under suitable conditions were established in many countries in order to promote ecosystem-friendly, low energy green buildings; big building companies performed applications deserving these certificates in order to be active in terms of being sensitive to this issue and become famous regarding this subject, and they pioneered the dissemination of ecological design.

ECOSYSTEM-FRIENDLY HIGH-RISE BUILDINGS

High-rise buildings are given prominence in ecological designs since they consume much energy and have many negative & positive environmental influences; and it is found out that; the high-rise buildings designed with this understanding have been fairly successful in producing their own energy, sensitivity towards environmental pollution, supporting the sustainability of environment and achieving economic, durable, flexible and recycled products.

When green design principles, promising sustainable cities for next generations, are applied also in high-rise buildings, it is absolute that; a contribution will be made to the habitability of cities with designs that will create low-energy consuming, comfortable places giving priority to human. Making low-energy consuming and local climate compatible high-rise buildings an integral part of nature and preventing their damaging features to their environment can be realized by equipping them with bioclimatic features and designing them accordingly. Considering the indispensability of high-rise buildings, built with approximately 30% more energy and material consumption compared to other structures, it seems significant to make these buildings ecosystem-friendly entities and to enable them to be a natural and integral part of nature[12].

Bioclimatic design approach is defined as an environmentalist approach based on the synthesis of climate, location, culture, local/traditional material and architecture program, taking the relations among them as basis. Many analytical approaches, reconciling many building traditions, are continually in interaction with nature in bioclimatic model; and the principles of becoming functional not against the natural powers in nature, but together with them, providing energy efficiency in line with climatic factors like temperature, humidity, cloudiness and precipitation, sustainable use of natural resources are pursued in this model. In this model, climate is considered as the primary contextual energy generator and environment is considered as the project input that will provide minimum use of energy[13]. Bioclimatically designed high-rise buildings, on the other hand, are defined as structures offering comfort and quality of life for the occupants with low energy advantage, synchronizing with the climate of their location and utilizing local energy sources[14]. Design parameters developed in a way to ensure high energy gains without reducing comfort level of the occupants, are predominantly based on passive systems. The two most important climatic inputs of these passive systems are wind and sun. Solar data, showing a change depending on seasons, latitudes and orientation in bioclimatic design system, affect building design according to land selection, positioning over the land, orientation, building shell, thermal comfort necessity of the building, visual comfort needs and ventilation needs[15].

In bioclimatic designs, where heat gains and losses are controlled by building shell, building plans and the orientation of locations are shaped according to energy requirement, thermal and visual comfort needs; and, active, passive and hybrid energy systems are utilized to meet these requirements. Passive heating systems are used with different applications as direct gain, indirect gain, atriums and transparent locations; and, heat collecting, storing and radiating functions of building materials are utilized in line with climatic data[16].

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Many electronic devices used indoors form electrical and electromagnetic fields with different qualities; and, adding the utilization of chemically produced materials in building production and radiation of pollutants threatening human health by these materials to the mentioned negative conditions, we confront a series of health risks ranging from headaches to cancer. Taking all these into consideration, naturally obtained building materials, heat insulation and heat storage balance, breathing fronts, odorless neutral environment, control of natural indoors humidity balance, ideal surface and air temperatures, conservation of natural magnetic and electrical fields and non-dissemination of technical electromagnetic fields criteria are also important in the construction of a bioclimatically suitable structure[17].

As high-rise buildings embody many complicated systems, serves many people, consumes much energy and water, paves the environment for a wide variety of material use and requires the orderly organization of all these aspects, they are almost mechanized systems using all sorts of technological development in the first place. Examples in the direction of minimizing energy consumption were given by using automation systems by virtue of information technologies long before ecological solutions were put forward in these complicated building systems; and, buildings equipped with intelligent building features have covered a huge distance in terms of not wasting energy thanks to this "intelligence" of the buildings. The purpose of energy-efficient high-rise buildings is to reduce the amount and cost of energy inputs in a wide area without decreasing the standard of the structure including the production of materials and components constituting the structure, selection, maintenance, operation and management of air conditioning systems[18]. Energy-efficient systems, aiming to bring optimum limitations to the energy consumed in high amounts by high-rise buildings and put a constraint as a result of correct use and make energy savings, are working in an integrated way with intelligent building systems as electronic systems increasing the occupant-oriented performance of buildings, monitoring climatic comfort and controlling energy efficiency; have a significant importance for high-rise buildings turning into eco-friendly structures, producing their own energy with the emergence of ecological design and bioclimatic systems, positioned, designed[19] by taking passive energy systems into consideration and using alternate and sustainable materials. For buildings requiring higher energy than other buildings, particularly high-rise structures, "energy-efficient intelligent building" capability is crucial[20].

At the point achieved through the integration of energy-efficient buildings with intelligent building systems, ANN (Artificial Neural Networks) systems provide advanced automation and therefore serious energy gains. These systems embody many automation systems; and operates as a whole containing building management systems, weather conditions data, daylight-sensitive artificial lighting systems, sun tracking systems, in-situ energy generations, night cooling systems based on the precooling of thermal mass, collectors, sound control via acoustic dampers and covers, insulation from cold at night and sun in daytime, front elements enabling higher utilization of daylight, protection systems from undesired sun and air conditioning systems.

PRINCIPLES

The design of an energy-efficient, bioclimatic-designed high-rise building occurs in the light of many principles; and, energy inputs are minimized in terms of amount and cost for individual and social utility by keeping the building standard high.

Energy Conservation Principle:

Minimizing heating load in winter and cooling load in summer and the principle of increasing natural and artificial lighting activity in design stage is based on the principle of completely setting load amounts and realizing correct projection and design for this objective; and calculation of indoor conditions without deviating from comfort limits. As deviation occurs, energy conservation could not be achieved and extra energy will be consumed to arrive at a standard[21].

Passive System Principle:

It is the principle of principally using natural energy sources suitable to building type and environmental data in heating, cooling, ventilation and natural lighting techniques. It includes the adaptation of energy conservation decisions to design in a correct way and passive climatization techniques aimed at the optimum utilization of self-forming heat sources and absorbers in the natural environment. With the prolongation of the period, in which the required indoor comfort conditions spontaneously originate, as long as possible, minimum need for artificial environment creators is targeted[22]. Location, direction, position, form, shell of the building and solar control and natural ventilation systems are regarded as the fundamental inputs in passive system principle.

Lisans Tezi, İzmir, 2005,s.56

17 TUĞLU, H.U.,(2005) "Ekolojik Açıdan Sürdürülebilir Yapılar ve Malzeme", MSGSÜ FBE Yüksek Lisans Tezi, İstanbul, Ocak 2005, s:56

18 TUĞLU, H.U.,(2005) "Ekolojik Açıdan Sürdürülebilir Yapılar ve Malzeme", MSGSÜ FBE Yüksek Lisans Tezi, İstanbul, Ocak 2005, s:57-58

19 Yılmaz, Z., (2005) "Akıllı Binalar ve Yenilenebilir Enerji", VII.Ulusal Tesisat Mühendisliği Kongresi, 23-26 Kasım 2005, Makine Mühendisleri Odası, İzmir

20 OĞULTEKİN, G., TAPAN, M., ŞENER, S.M., (2008) "Yüksek Teknoloji Yapılarında Biçim/Sentez İlişkisi", itüdergisi_a mimarlık, planlama, tasarım Cilt:7, Sayı:2, 38-51, Eylül 2008

21 Arslan, S., (2007) "Enerji Etkin Tasarımda Akıllı Binalar", MSGSÜ Enformatik Bölümü Seminerleri,31 Mayıs2007, İstanbul

22 Yılmaz, Z., (2005) "Akıllı Binalar ve Yenilenebilir Enerji", VII.Ulusal Tesisat Mühendisliği Kongresi, 23-26 Kasım 2005, Makine Mühendisleri Odası, İzmir

Location of the Building: Location of the building is important as the determinant of solar radiation, air temperature, humidity level, profile of air movements and microclimate conditions forming as a result of these[23].

Position of the Building with Respect to Other Buildings: Positioning of the building is a significant factor directly influencing the utilization of renewable energy sources between other buildings and objects like distance, sun and wind. Optimum benefits from sun and wind to the building changes according to the positioning of the building by taking these factors into consideration and also the position of the obstacles around it[24].

Direction of the Building: Direct utilization of solar radiation by fronts and total gains from solar energy are directly associated with the direction of the building. This direction issue is an important factor influencing natural ventilation conditions and the amount of heat loss via air leak depending on the state of wind reception. It is necessary to benefit from the sun and wind and also avoid them when required according to the climatic features of every region and to provide a spatial array meeting these conditions.

Building Form: Considering the fact that; opening or closing of the building to environmental factors is directly related to its form, building form is considered as an important design parameter in the determination of energy performance. Climatic features of the region where the project will be realized plays an active role in determining the building form in terms of energy performance. Minimizing surface areas that will lose energy in cold climatic zones; turning to compact and courtyard forms in order to minimize heat gains in hot dry climatic zones; preferring long fronted forms in the direction of prevalent wind that will make mutual ventilation in hot humid climatic zones; and turning to more flexible compact forms in moderate climactic zones is of capital performance.

Building Shell: Building shell, which plays an important role in the formation of indoor conditions, is one of the important parameters that changes external environment conditions and transfers them indoors and determines indoor air quality and other features of air features. As the sunlight permeability, absorption and reflectivity coefficients vary in the structure shell, whose performance differs according to opacity and transparency properties and which should be shaped differently in each building and climate condition; it plays an active role as a system influencing the whole ventilation system in the event that it is given proper features.

The systems, which can automatically change according to the thermal and optic properties of climatic conditions of windows and shading elements according to climatic conditions and projected indoor air quality, are known as active front systems; and functions are added with the method of using shading elements, whose positions can change with automatic control; lined glasses, whose optic features can change depending on solar radiation; and electric power generating PV panels as facing elements.

Attributing intelligent features to building shell makes the adjustment to external conditions, like in the example of the self-adjustment of the skin in living organisms, and plays an important role in contributing to indoor light, sound and air quality this way.

Natural ventilation and solar control elements in the intelligent shell system are programmed to minimize the ventilation and lighting energy loads of the building with automatic movements and to keep indoor air quality and comfort at top-level; the double-walled design of the shell as an important solution for reaching this target more easily has become widespread in recent years. Ideal air conditions between two walls are met by virtue of intelligent routers positioned in the direction of sun and wind over outer shell and both comfort and conservation is provided.

Solar Control and Natural Ventilation Systems: Considering that; sun and wind are sources that are sometimes useful and sometimes to be avoided, the structure needs to be a work of design giving place to proper solar control and natural ventilation systems in order to utilize these sources when necessary and avoid them if required[25].

The self-production of the energy that a high-rise building excessively consumes by taking it from the sun is a must of bioclimatic properties. Energy gain from the sun is performed by active and passive systems; gains beginning with design continue as the building lives on.

Passive solar energy systems are completely carried out with arrangements projected in design stage and southern planned directions (from south-east to south-west); and it is based on the principle of accumulating rays coming to large window and glass sections in interior flooring and wall sections designed for this purpose. These systems, that are subject to sun rays throughout the day, diffuse heat throughout the night to other locations and enable heating. Using a passive system suitable for each climatic zone is crucial in terms of efficiency. Considering the building criteria of high-rise buildings, it is obvious to be a body of principles including all processes from the design stage of a high-rise building to its operation. It is known that; many high-rise buildings built in times when consumption is incited are structured towards their own ends and they do not have an energy generation concern, tough they may be open to energy savings with the automation systems of design principles. But, in the 21st century, in which ecological balance should be paid regard, making fine savings calculations and acting in accordance with these calculations is a necessity. From this point forth, it is necessary to design a high-rise structure in a way to provide passive energy gains by taking climate, environment, wind and solar data into account. "High-rise buildings are universal and every project can be applied all over the world" perception should be abandoned and it is now proposed to make different designs bringing special conditions for every climatic zone and settlement. The point in question is unique design of the building depending on solar and wind conditions, compact or lumped mass selection according to the properties of its climatic zone.

Active solar energy systems are based on the principle of supporting the energy system of the building with the help of solar collectors,

23 MOORE, F., Environmental Control Systems, New York, McGraw-Hill Inc., 1993
24 BERKÖZ, E. ve diğerleri, Enerji Etkin Konut ve yerleşme Dizaynı, TÜBİTAK Araştırma Raporu, 1995
25 LEHNER, N., Heating, Cooling, Lighting, New York, John Wiley & Sons, 1991.

solar walls and solar cells. Solar collectors, that easily meet particularly hot water needs by storing solar energy; solar walls, based on the principle that; plates placed on building fronts with special techniques absorb sun rays and transfer the absorbed hot air indoor through fans; and solar cells (photovoltaic batteries) turning solar energy into electrical energy as direct current are active solar energy systems used in bioclimatic high-rise buildings.

CONCLUSION

Bioclimatic high-rise buildings are equipped with ecosystem-friendly features and nature-conscious properties, they have energy conservation systems that do not consume energy recklessly and utilize and transform the wastes as well as offering ideal comfort conditions and they appear as nature-friendly structures producing and using the energy they require from ecological systems and adopting many active and passive design and application principles.

In this system born from the combined design of climatic features and every condition projected for the building; positioning, detailing, utilization of energy producing systems and/or new system development processes take place with one to one association of the building to be constructed and the features of the land it will be positioned.

The destruction of the ecosystem going beyond its regeneration ability requires ecological thinking, designing and practicing in the field of architecture like in many fields. And these necessities will be materialized with laws, sanctions of local authorities and impositions of occupational groups or incentive activities of organizations active in this field or self-control of sectors, companies and persons as a result of the creation of social awareness.

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ORGANIC MANAGEMENT OF ROOT KNOT NEMATODES WITH PHYTOBIOCIDES

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ABSTRACT

In vitro and *in vivo* studies were conducted to observe the efficacy of extracts of turmeric, ginger and caraluma for management of root-knot nematodes. In the *in vitro* studies, *Meloidogyne* eggs were isolated from the galled roots and treated with extracts at 1:1, 1:10, 1:100 and 1:1000 concentrations. The egg hatching was negatively correlated with concentrations of plant extracts, while it was positive correlated with juvenile mortality. Turmeric was shown to be more effective than ginger and caraluma, in reducing egg hatching. It was found that 9, 13 and 20 eggs of *Meloidogyne* were hatched in the extracts obtained from turmeric, ginger and caraluma respectively. However, extracts of caraluma were found to be better than ginger or turmeric in killing 2nd stage juveniles and number of killed nematodes recorded were 6, 4 and 3 respectively. In the pot experiments, turmeric was found more effective than ginger or caraluma in controlling the root-knot nematodes. Significant differences were found among treated and control plants. Turmeric stimulated overall growth of tomato plants and inhibited galling of roots. Ginger and caraluma were also found effective in reducing nematode infection.

INTRODUCTION

Root-knot nematodes (*Meloidogyne* spp.) are sedentary endoparasites which are the most economically serious among the plant-parasitic nematodes (Ghaffar and Hashmi, 1983; Qureshi *et al,* 1984) with a host range of more than 2000 species of plants (Barker, 1985). They cause high economic losses to tomato crops throughout the world especially in developing countries. In Pakistan the climatic conditions for their activity and reproduction are very suitable as the region lies between 24-36^0 North and 61-76^0 East, with a subtropical climate in the warm temperate zone. Similarly, sandy and warm soils, found in arid zones, are favorable for nematode development and infestation. Moreover, in the irrigated areas, monocropping causes considerable increase in the nematode population by constantly providing the host.

Management of root-knot nematodes with chemicals is difficult since these are soil born pathogens. This method requires application of large amounts of chemicals with specialized equipments. However, the method is risky because of potential danger to human health. Secondly, most of the chemicals are not environmentally safe. The most commonly used biological control agents are fungi and bacteria. The most significant problem in developing effective biological control agents is its effective delivery system. Genetic resistance is another tool to manage root-knot nematodes. However resistant genes become ineffective at higher temperatures. Further, development of new races of nematodes makes this method further ineffective.

Root-knot nematodes can be effectively controlled by using the extracts of medicinal plants as reviewed by Sasanelli and Vito (1986), Fathi *et al.,* (2004) and Buena *et al.*, (2007). The method is very effective in controlling root-knot nematodes without harming the environment. Results of pot and *in vitro* experiments are reported in this paper.

MATERIALS AND METHODS

1 Collection and identification of root-knot nematode inocolum

Galled roots from root-knot nematode infected tomato plants were collected from infested fields in Dargai in plastic bags, tagged, labeled and shipped to the laboratory for further processing. Egg masses of root-knot nematodes were isolated from galled roots, preserved in 1% saline solution and stored at 4^{0}C. Mature females were released from galls and sections were cut from the perennial portion of the females according to Eisenback and Triantaphyllou, (1991) to identify nematode species.

2 Separation of eggs from the egg masses

Galled roots of tomato were blended in an electric blender for 2 minutes in NaOCl solution. Nematode eggs were then collected in a beaker after passing the suspension through 500 µ mesh. The eggs were then collected in distilled water and counted in a counting dish as eggs per ml. The procedure was repeated three times and the average number of eggs was recorded.

3 Preparation of levels of treatments

Five concentrations (1:1, 1:10, 1:100, 1:1000 and Control) of turmeric, caralluma and ginger were prepared in water. The nematodes were challenged with various dilutions of extracts from the selected plants. The treatments were replicated six times and data on hatching and mortality of the eggs were recorded.

4 Statistical analysis

Data of laboratory experiments were statistically analyzed by Analysis of Variance test. Significant variations were separated by least significant difference test.

5 Pot experiment

5.1 Preparation of phytobiocides and application into pots

Turmeric (*Curcurma longa* L.), ginger (*Zingiber officinale* Rosc.) and caralluma (*Caralluma edulis* Endgew.Benth.ex Hook.f.) were oven dried and powdered in a grinder separately. One, two and three grams of each plant powder were then applied to the root zone of tomatoes according to the lay out.

5.2 Raising tomato nursery and transplanting

Soil was prepared by mixing sand, silt and clay (2:1:1) and sterilized at 121 ^{0}C for 30 minutes. Tomato nursery was raised in sterilized soil. Apparently healthy seedlings were then transplanted into the pots (one plant per pot).

5.3 Inoculation of plants with root-knot nematodes

Tomato plants in the pots were inoculated with root-knot nematodes except (T_4). Ten egg masses of the root-knot nematodes were applied to each pot.

5.4 Application of plant material to the plants

Different doses of the above mentioned plant material was applied to the plants with root-knot nematodes, except the control. Tomato plants in two of the treatments were kept as control.

(a) Un-inoculated with nematode and untreated with plant extracts (T_4).

(b) Inoculated with root-knot nematodes and untreated with plant extracts (T_5).

The plants were kept in the screenhouse of the Plant Pathology Department under regular observation and normal agronomic practices were applied. Data were recorded on plant height, number of flowers, number of fruits per plant, root weight, number of galls per inch of the root system and number of egg masses per inch of the root system. There were twenty treatments replicated six times.

5.5 Statistical analysis: Data were statistically analyzed by Analysis of Variance test. Significant variations were separated by Duncan's Multiple Range.

RESULTS

1 *IN VITRO* STUDIES

1.1 Effect of phytobiocides on the hatching of root-knot nematode eggs

Results showed that turmeric was more effective in controlling hatching of nematode eggs followed by caralluma and ginger where 9, 13 and 20 nematodes hatched respectively in these treatments (Table 1). Different concentrations of turmeric, ginger and caralluma also significantly reduced egg hatching. In the case of turmeric the minimum number of nematodes hatched was recorded in 1:10 followed by 1:1, 1:100 and 1:1000 respectively. In the control,the maximum number of juveniles were hatched from the eggs. In the case of ginger, 1:10 and 1:1 dilutions were equally effective followed by 1:100 and 1:1000. In the case of caralluma, a concentration of 1:1 was more effective in suppressing the hatching of eggs followed by 1:10, 1:100 and 1:1000 dilutions.

Table 1 - Effect of phytobiocides on the hatching of root-knot nematode eggs

Treatments	Concentrations				Control	Treatment Means
	1:1	1:10	1:100	1:1000		
T1(Turmeric)	5 h	4 h	5 h	7 g	25 b	9 c
T2 (Ginger)	17 d	17 d	18 d	20 c	27 a	20 a
T3 (Caralluma)	9 f	10 ef	11 e	11 e	24 b	13 b
Concentration Means	10 c	11 c	11bc	12 b	25 a	

LSD value for concentrations=1.169
LSD value for treatments=0.9054
LSD value for interaction=1.280
*Means of the same category followed by different letters are significantly different at 5% level of probability using LSD test.

1.2 Effect of phytobiocides on root-knot nematode juvenile mortality

The results showed that caralluma was more effective in killing nematode larvae followed by ginger and turmeric. These biocides killed 6, 4 and 3 juveniles respectively (Table 2). Different concentrations of turmeric, ginger and caralluma also significantly killed the juveniles. In case of turmeric, the maximum number of nematodes killed was recorded in 1:1000 followed by 1:100, 1:10 and 1:1 respectively. In the control, where no treatment was applied, a few juveniles were killed. In the case of ginger, 1:1 and 1:1000 dilutions were equally effective in killing juveniles followed by 1:100 and 1:10 respectively. In the case of caralluma, concentration 1:1000 was the most effective followed by 1:100, 1:1 and 1:10 (Table 2).

Table 2 - Effect of phytobiocides on root-knot nematode larval mortality

Treatments	**Concentrations**				**Control**	**Treatment Means**
T1(Turmeric)	1:1	1:10	1:100	1:1000	0.000 a	3 c
T2 (Ginger)	6.367 cd	4.617 efg	5.300 e	6.283 cd	0.100 i	4 b
T3 (Caralluma)	5.455 de	6.767 c	7.867 b	8.967 a	0.117 i	6 a
Concentration Means	5.102 b	5.078 b	5.833 b	6.722 a	0.072 c	

LSD value for concentrations=0.8648
LSD value for treatments=0.6698
LSD value for interaction=0.9473
*Means of the same category followed by different letters are significantly different at 5% level of probability using LSD test.

2 *IN VIVO* STUDIES

2.1 Effect of phytobiocides on tomato plant height

Significant differences were found among the treatments. Turmeric was found more effective than ginger and caralluma. In the case of turmeric, T_2 (Ginger) was found more effective followed by T_1 (Turmeric) and T_3 (Caralluma). In the case of ginger, T_{10} was found more effective treatment followed by T_9 and T_{11}. In the case of caralluma, T_{15} was found more effective followed by T_{16} and T_{17}. The tallest plant was observed in T_4 where no inoculation and no treatment were applied to the plants, however, the lowest plant was observed in T_5 which was inoculated with root-knot nematodes but no treatment applied. The stimulatory effect of these phytobiocides was also observed. The plants where turmeric was applied and not inoculated with RKN showed the highest plant height which was in T_6 followed by T_7 and T_8. The plants where ginger was applied and not inoculated with RKN, the tallest plant was observed in T_{14} followed by T_{12} and T_{13} respectively. However, the plants where caralluma was applied and not inoculated with RKN the tallest plant was observed in T_{18} followed by T_{19} and T_{20} (Table 3).

2.2 Effect of Phytobiocides on the number of tomato flowers

Significant differences were found among the treatments. Turmeric was again found more effective than ginger and caralluma. In the case of turmeric, T_1 was found more effective while T_2 and T_3 had almost equal effects on the number of flowers. In the case of ginger, T_{10} was found the most effective treatment followed by T_{11} and T_9. In the case of caralluma, T_{16} was found more effective treatment followed by T_{15} and T_{17}. The lowest number of flowers was observed in T_5 which was inoculated with root-knot nematodes and no treatment applied. The plants where turmeric was applied and not inoculated with RKN, the stimulatory effect was observed in T_6 which showed the highest number of flowers followed by T_8 and T_7. The plants where ginger was applied and not inoculated with RKN, the highest number of flowers was observed in T_{13} followed by T_{12} and T_{14} respectively. However, the plants where caralluma was applied and not inoculated with RKN, the highest number of flowers was observed in T_{18} followed by T_{19} and T_{20} (Table 3).

2.3 Effect of Phytobiocides on tomato fresh root weight

Significant differences were found among the treatments. Turmeric was found more effective than ginger and caralluma. In the case of turmeric, T_3 was found more effective followed by T_2 and T_1. In case of caralluma, T_{15} was found more effective followed by T_{16} and T_{17}. In the case of ginger, T_9 was found more effective followed by T_{10} and T_{11} respectively. The maximum weight of fruit per plant was observed in T_5 which was inoculated with RKN and no treatment applied and the minimum root weight was observed in T_4 where plants were neither inoculated with RKN nor treatment applied. The plants where turmeric was applied and not inoculated with RKN, a stimulatory effect was observed in T_6, T_7 and T_8. In plants where ginger was applied and not inoculated with RKN, the best results were observed in T_{13} followed by T_{14} and T_{12} respectively. However, the plants where caralluma was applied and not inoculated with RKN the best results were observed in T_{20} followed by T_{19} and T_{18} (Table 3).

2.4 Effect of Phytobiocides on number of galls/inch of the tomato root system

Significant differences were found among the treatments. Turmeric was found more effective than ginger and caralluma. In the case of turmeric, T_1 was found most effective followed by T_2 and T_3. In the case of ginger, T_9 was found more effective followed by T_{10} and T_{11} respectively. In the case of caralluma, T_{15} was found more effective followed by T_{16} and T_{17}. The maximum number of galls was found in T_5 which was inoculated with RKN and no treatment applied while the minimum number of galls was observed in T_1. However, no galls were observed in uninoculated plants (Table 3).

2.5 Effect of Phytobiocides on the number of egg masses/inch of the tomato root system

Significant differences found among the treatments. Turmeric was found more effective than ginger and caralluma. In the case of turmeric, T_1 was found more effective followed by T_2 and T_3. In the case of ginger, T_9 was found more effective followed by T_{10} and T_{11} respectively. In the case of caralluma, T_{15} was found more effective followed by T_{16} and T_{17}. The maximum number of egg masses was found in T_5 which was inoculated with RKN and no treatment applied while the minimum number of galls was observed in T_1. No egg masses per inch of the root system were observed in uninoculated plants (Table 3).

DISCUSSION

The effect of certain phytobiocides such as turmeric, ginger and caralluma was investigated for the potential management of root-knot nematodes. Significant differences among the treatments were observed using different concentrations of the extracts of powdered plant materials.

Turmeric is an ancient herb which is used for the treatment of cystic fibrosis, hemorrhoids, gastric ulcer, colon cancer, breast cancer, atherosclerosis, liver diseases, arthritis, dementia and traumatic brain injury (Shrikant and Kalpana, 2008). However, its efficacy for the management of plant diseases or nematodes has not been reported. In this study, it was found effective in reducing hatching of nematode eggs. Nematode hatching is an important phenomenon. Exudates from plant roots stimulate egg hatching (Perry, 1989) but repel nematodes in resistant varieties. Suppression of nematode egg hatching could reduce the nematode population and thus help in nematode management. Plant extracts can negatively or positively affect hatching in nematodes. Turmeric also stimulated plant growth as compared to other treatments. The stimulatory and inhibitory effects of turmeric on plant and nematodes respectively have thus been explored in this research.

Ginger is used as a spice in Asian foods. This is an important medicinal plant which has been used in preventing nausea, arthritis, heart diseases, high cholesterol, blood clotting tendency, cough, congestion and muscular cramps during menstruation (Hareyan, 2006). In the present study, application of ginger reduced galling or egg masses in tomato roots. It also improved the growth of tomatoes. Zareen *et al* (2003) have also reported the nematicidal potential of ginger for the management of *M. javanica* by reducing hatching and thereby increasing the mortality. The combined application of ginger and *Pasturia* improved plant growth. Our results further confirmed the effectiveness of ginger as a phytobiocide for the management of root-knot nematodes. Ginger also improved plant growth and number of fruits per plant and minimized the severity of the disease i.e. the number of galls and egg masses on the roots of the tomato plants.

Caralluma is a xerophytic vegetable which is collected from hilly areas. In Pakistan, its cultivation as a vegetable crop has never been reported. Caralluma is reported to have medicinal properties and has been used to suppress appetite, hunger and also used for the enhancement of endurance. Caralluma blocks the activity of several enzymes, which then block the formation of fats, forcing fat reserves to be burnt in humans (Shomon, 2005). However, its effect on the management of nematodes or plant diseases has never been previously investigated . The nematicidal potential of caralluma has been explored for the first time in this research. Caralluma, when applied, was found to be an effective treatment in killing root-knot nematodes followed by ginger and turmeric. Caralluma also effectively reduced egg hatching of root-knot nematodes after turmeric and ginger. Under *in vivo* experiment, caralluma stimulated plant height and fruits per plant a well as inhibited galls on the roots of tomato plants. It is possible that some nematicidal compounds are present in it which are inhibitory to nematodes, and this needs to be explored. The present research has shown, for the first time, the nematicidal and stimulatory potential of turmeric and caralluma on the management of root-knot nematodes and plant growth. Further studies are required to explore the nematicidal compounds in the plants that can be used in the development of biopesticides.

CONCLUSION

Extracts from turmeric, caralluma and ginger were found effective for the management of root-knot nematodes. The application of plant extracts of turmeric were found the most effective in suppressing the hatching of root-knot nematode eggs. However, larval mortality was more in extracts of caralluma. Therefore, the application of plant extracts could be used as an effective tool to manage root-knot nematodes Nematode mortality and plant growth were found to be positively correlated with the doses of the plant extracts of turmeric, caralluma and ginger. Turmeric was found to have stimulated plant growth. Powdered caralluma and turmeric can be applied during transplantation of tomatoes to protect plants from root-knot nematodes.

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Table 3 - Effect of phytobiocides on root knot nematodes and the resultant plant growth of tomato

Treatments	Plant height (m)	No. of Flowers	No. of Fruits Plant $^{-1}$	Root weight (g)	No. of galls/inch root system	No. of egg masses/ inch root system
T1	0.768 ab*	10.000 ab	8.833 abc	23.833 cd	1.833 e	3.833 g
T2	0.782 a	8.833 bc	8.833 bcd	21.167 efg	2.500 de	5.333 f
T3	0.737 bc	8.833 bc	8.833 bcd	20.833 efg	2.667 d	6.833 e
T4	0.793 a	9.167 bc	8.833 abc	14.500 h	0.000 f	0.000 h
T5	0.465 h	3.167 h	2.167 i	31.167 a	7.000 a	23.167 a
T6	0.785 a	10.667 a	9.833 ae	19.333 g	0.000 f	0.000 h
T7	0.765 ab	8.000 cd	7.500 cdf	19.333 g	0.000 f	0.000 h
T8	0.715 c	9.500 ab	9.167 ab	20..500 fg	0.000 f	0.000 h
T9	0.668 d	7.167 def	7.167 def	24.833 bc	2.833 d	10.000 d
T10	0.672 d	7.833 cde	7.833 bcde	26.667 b	2.833 d	14.167 bc
T11	0.665 d	7.167 def	7.167 def	27.000 b	3.000 d	15.333 b
T12	0.788 a	9.833 ab	9.167 ab	22.000 def	0.000 f	0.000 h
T13	0.787 a	10.000 ab	7.333 def	19.000 g	0.000 f	0.000 h
T14	0.790 a	9.000 bc	6.667 efg	20.500 fg	0.000 f	0.000 h
T15	0.627 e	6.167 fg	4.833 h	23.000cde	4.667 c	10.667 d
T16	0.585 f	6.500 efg	4.667 h	24.000 cd	5.833 b	13.667 c
T17	0.543 g	5.333 g	4.167 h	27.000 b	6.000 b	14.667 be
T18	0.792 a	9.000 bc	6.333 fg	24.833 bc	0.000 f	0.000 h
T19	0.782 a	8.000 cd	5.333 gh	23.167cde	0.000 f	0.000 h
T20	0.770ab	6.833 def	4.500 h	22.000 def	0.000 f	0.000 h

* Means of the same category followed by different letters are significantly different at 5% level of probability using DMR test

EFFECTS OF DIFFERENT ORGANIC MANURE APPLICATIONS ON THE NUTRIENT CONTENTS OF SOIL IN THE DIFFERENT GROWING SEASONS: I. MACRO NUTRIENTS

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ABSTRACT

Different kind of organic manure consisting of farmyard manure (FM), chicken manure (CM) and blood meal (BM) was tested in growing cabbage plants (*Brassica oleracea* L.) in 2006-2008 in three different growing seasons; autumn 1 (11/2006-12/2006), spring (03/2007-06/2007) and autumn 2 (09/2007-01/2008), and the effects of the applications on the macro nutrient contents of the soils were evaluated. 17 organic manures treatments and 1 control, collectively 18 treatments, were used in a randomized block design with four replications under the open field conditions. As a result of this study; total nitrogen (N), phosphorus (P), magnesium (Mg) and potassium (K) contents were influenced by the treatments to a different extent in each season regarding the control application, while calcium (Ca) contents were less influenced by the applications. Evaluating the seasonal mean, P and K contents rose significantly from autumn 1 to autumn 2 season, but the increase in total N, Ca and Mg contents were found to be statistically insignificant. That the 10.0 ton ha^{-1} FM+1.2 ton ha^{-1} CM and 1.7 ton ha^{-1} CM+7.5 ton ha^{-1} FM treatments gave the better results than the others were observed within the treatments. Consequently, organic manure treatments were determined to have the macro nutrient contents increased to some extent, FM and CM treatments were better than the BM treatment and it was concluded that the BM be used in small quantities in mixtures.

Keywords: Farmyard manure, chicken manure, blood meal, the macro nutrients

INTRODUCTION

In crop production, it is important for there to be sufficient plant nutrients in soil in order to meet the crop demands. Soil fertility is of importance phenomenon to sustain the crop production and this could be achieved by using some inputs those of which can be provided by chemically or organically. Furthermore, Watson et al. [14] stated that soil fertility is fundamental in determining the productivity of all farming systems and is most commonly defined in terms of the ability of a soil to supply nutrients to crops. Additionally, a fertile soil provides essential nutrients for crop plant growth, supports a diverse and active biotic community, exhibits a typical soil structure, and allows for an undisturbed decomposition [12].

That the chemical fertilizer has led to the environmental pollution is known. Therefore, organic farming movements have gained popularity and have been extended around the world. Not only does organic manure supply essential nutrients to plant, but also does improve soil physical properties such as water retention capacity, soil aeration etc. those of which enhance the plant growth to a great extent. Moreover, as stated Abou El-Magd et. al. [1], organic manure plays a direct role in plant growth as a source of all necessary macro and micronutrients in available forms during mineralization, improving the physical and physiological properties of soils. One potential limitation of manure is the availability of a consistent supply of material that is uniform enough to be confidently incorporated into a production program [5]. Moreover, manures are very variable products difficult to apply accurately and release nutrients in the soil depending on the conditions [3]. Therefore, mineralization rate and also the seasons are of importance to determine the availability of the manures [9; 4]. This experiment aims to elaborate three kind of organic manure and to compare them as an individual or mixture characteristic depending on the different cabbage growing seasons. At the end of this study, plausible applications would be recommended.

MATERIAL AND METHODS

The experiment was carried out under the open – field conditions by growing organic cabbage during 2006 and 2008 in Akdeniz University, Faculty of Agriculture Research Centre. The soil properties of the experimental area are given in Table 1. Initially, cabbage plants were supposed to be grown in the autumn and in the spring season, but the unsuitable conditions had led the first cabbage growing season to be cancelled (11/2006 – 12/2006) and was named as autumn 1 season. Afterwards, the same plots were treated with the same applications and then cabbage plants were transferred to the plots, as spring season, (03/2007 – 06/2007). Third growing season, as autumn 2, the same applications were applied to the same plots and cabbage plant were grown as a second growth season (09/2007 – 01/2008). Summing up, three soil applications but two plant growing cycle were achieved in the end.

Measured parameters	Soil Depth (cm)	
	0-20	20-40
Total N, %	0.11	0.09
P, mg kg^{-1}	3.80	2.50
K, me 100 g^{-1}	0.60	0.4
Ca, me 100 g^{-1}	31.4	26.3
Mg, me 100 g^{-1}	1.28	0.83
Fe, mg kg^{-1}	1.30	0.9
Cu, mg kg^{-1}	0.40	0.38
Mn, mg kg^{-1}	5.10	4.50
Zn, mg kg^{-1}	0.26	0.20
pH (1:2.5 water)	8.16	8.10
EC (1:2.5 water) dS/m	0.09	0.06
$CaCO_3$, %	5.0	3.0
Organic matter, %	1.49	1.20
Texture	Clay (C)	

Table 1. Some physical and chemical properties of the experimental area

17 applications consisting of three different organic manure, farmyard manure (FM), chicken manure (CM), and blood meal (BM) were used as organic manures, CM was supplied from Akdeniz University, Animal Production Department, from an organic production, FM from dairy cattle, and BM from a commercial slaughterhouse**.** Some chemical properties of the manures are given in Table 2.

Measured parameters	Farmyard Manure (FM)	Chicken Manure (CM)	Blood Meal (BM)
Total N, %	0.99	4.28	12.93
P,%	0.47	3.40	0.10
K,%	2.65	2.60	0.28
Ca,%	4.25	2.55	0.17
Mg,%	0.53	0.05	0.03
Fe, mg kg^{-1}	2760	238	3880
Cu, mg kg^{-1}	13.8	36	7.4
Mn, mg kg^{-1}	15.4	25	28.2
Zn, mg kg^{-1}	38	8	29
pH (1:5 water)	7.05	7.80	6.50
EC (1:5 water) dS/m	0.5	3.7	6
Organic matter, %	55	26.6	41

Table 2. Some Physical and Chemical Properties of the Manure Used in This Experiment

The experiment was established as a randomized block design under the open-field conditions with four replications. All applications were adjusted to 150 kg N ha^{-1} regarding to the doses taken up by plants [2], and were applied 15 days before the transplanting in order to assure the incubation period. The doses of each application are given in Table 3.

1) 3.5 ton ha^{-1} chicken manure (CM)
2) 2.5 ton ha^{-1} chicken manure (CM) + 4.0 ton ha^{-1} farmyard manure (FM)
3) 2.5 ton ha^{-1} chicken manure (CM) + 0.3 ton ha^{-1} blood meal(BM)
4) 1.7 ton ha^{-1} chicken manure (CM) + 7.5 ton ha^{-1} farmyard manure (FM)
5) 1.7 ton ha^{-1} chicken manure (CM) + 0.6 ton ha^{-1} blood meal (BM)
6) 1.7 ton ha^{-1} chicken manure (CM) + 4.0 ton ha^{-1} farmyard manure (FM) + 0.3 ton ha^{-1} blood meal (BM)
7) 15.0 ton ha^{-1} farmyard manure (FM)
8) 10.0 ton ha^{-1} farmyard manure (FM) + 1.2 ton ha^{-1} chicken manure (CM)
9) 10.0 ton ha^{-1} farmyard manure (FM) + 0.4 ton ha^{-1} blood meal (BM)
10) 5.0 ton ha^{-1} farmyard manure (FM) + 2.5 ton ha^{-1} chicken manure (CM)
11) 5.0 ton ha^{-1} farmyard manure (FM) + 1.0 ton ha^{-1} blood meal (BM)
12) 5.0 ton ha^{-1} farmyard manure (FM) + 1.2 ton ha^{-1} chicken manure (CM) + 0.4 ton ha^{-1} blood meal (BM)
13) 1.2 ton ha^{-1} blood meal (BM)
14) 0.9 ton ha^{-1} blood meal (BM) + 0.85 ton ha^{-1} chicken manure (CM)
15) 0.9 ton ha^{-1} blood meal (BM) + 4.0 ton ha^{-1} farmyard manure (FM)
16) 0.6 ton ha^{-1} blood meal (BM) + 7.5 ton ha^{-1} farmyard manure (FM)
17) 0.6 ton ha^{-1} blood meal (BM) + 0.85 ton ha^{-1} chicken manure (CM) + 4.0 ton ha^{-1} farmyard manure (FM)
18) control (without any treatments)

Table 3. Treatments and Doses of Different Application

Analytical methods

Soil samples in each plot to be analyzed were taken from 0-20 cm in depth before the harvest and were taken to the laboratory. Afterwards, all samples were air dried, and were passed through 2 mm - sieve. Having sieved the samples, analytical regime was performed as follows; total soil N was determined by Kjeldahl method [8]; plant available P was determined by colorimetry after Olsen method extraction; Exchangeable K, Ca and Mg were extracted with neutral 1N Ammonium Acetate method [7] and were determined via ICP.

Statistical methods

Comparison of the treatment mean was done using the variance analysis by MINITAB 13 and SAS statistical software, and all parameters were compared by Duncan multiple range test ($p \leq 0.05$). Correlation between the seasonal means was performed by Pearson's correlation coefficient at MINITAB 13 statistical software.

Results and discussion

The effects of the applications on the total N, plant available P and exchangeable K are given in Table 4. Total N contents were influenced by the applications to a different extent and the differences between the applications were found to be statistically significant in each season (Table 4). In the autumn 1 season, total N content of soil varied among 0.137 and 0.067 %, taking from 0.6 BM + 0.85 CM + 4.0 FM and 0.9 BM + 0.85 CM application, respectively. In the spring season, the fluctuation in total N contents were fixed 0.155 and 0.116 %, and were taken from 2.5 CM + 4.0 FM and 5.0 FM + 1.2 CM + 0.4 BM application, respectively. Regarding to the autumn 2 season, total N content ranged from 0.178 to 0.098 %, and obtained from 15.0 FM and control application, respectively.

Seasonal mean of total N showed an augmentation in accordance with the successive applications and was recorded 0.10, 0.14 and 0.15 % in autumn 1, spring and autumn 2 seasons, respectively (Table 4). Nimje and Seth [12] stated that farmyard manure has a positive influence in increasing total N contents of soil. Moreover, Lampkin [9] reported that farmyard manure is long-term effective N sources for soils. Regarding to the seasonal mean, there was a clear increase in terms of average soil N contents, but insignificant correlations were fixed between the autumn 1 and the spring; and the autumn 1 and the autumn 2 seasons (Table 4)

Soil P contents were effected by the applications and the statistical significance was observed in the spring and in the autumn 2 seasons ($p<0.001$), whereas no significance was detected in the autumn 1 season (Table 4). In the spring season, P contents varied among the applications, and were recorded between 17.3 and 5.5 mg kg^{-1}, taking from 3.5 CM and 0.9 BM + 0.85 CM, respectively. In the autumn 2 season, the range was found to be between 22.2 and 5.4 mg kg^{-1} regardless of the control (5.3 mg kg^{-1}) and attained from 2.5 CM + 4.0 FM and 1.2 BM application, respectively. A significant correlation between the seasonal mean was fixed as follows; the autumn 1 and the spring season, and autumn 1 and autumn 2 were recorded (Table 4). The results, however, revealed that the applications containing chicken manure brought about an increase in soil P content, proving that chicken manure is a good source of P.

Table 4. Effects of different treatments on the soil total N, plant available P and exchangeable K contents

TREATMENTS ton ha^{-1}	N (%)[a]			P (mg kg^{-1})[a]			K (me $100g^{-1}$)[a]		
	SEASONS[b]								
	1	2	3	1	2	3	1	2	3
1- 3.5 CM	0.085f	0.147ab	0.168abc	6.87	17.3a	18.8bc	0.67	0.77def	0.92cdef
2- 2.5 CM+4.0 FM	0.102cdef	0.155a	0.177a	7.33	12.9bc	22.2a	0.69	0.90cd	0.96cdef
3- 2.5 CM+0.3 BM	0.100cdef	0.139abcd	0.165abc	5.97	14.5ab	18.1bc	0.62	0.79de	1.01bcdef
4- 1.7 CM+7.5 FM	0.047h	0.146ab	0.175ab	7.03	14.7ab	18.3bc	0.70	1.07ab	0.91cdef
5- 1.7 CM+0.6 BM	0.048h	0.135abcde	0.162abc	5.50	10.0cdef	14.6cd	0.68	0.78de	0.96cdef
6- 1.7 CM+4.0 FM+0.3 BM	0.103cde	0.126bcde	0.153cde	6.04	10.9bcde	18.8bc	0.73	0.84cde	0.87cdef
7- 15.0 FM	0.129a	0.142abcd	0.178a	7.16	7.7defg	17.1bc	0.86	1.13a	1.37a
8- 10.0 FM+1.2 CM	0.121ab	0.134abcde	0.177a	7.89	9.5cdefg	20.1ab	0.73	1.05ab	1.28ab
9- 10.0 FM+0.4 BM	0.125ab	0.121de	0.150cdef	5.81	6.7gf	12.1cde	0.73	0.96bc	1.08bcd
10- 5.0 FM+2.5 CM	0.133a	0.138abcd	0.154bcd	5.73	11.1bcd	18.8bc	0.71	0.89cd	0.86cdef
11- 5.0 FM+1.0 BM	0.132a	0.131bcde	0.149cdef	4.42	8.5defg	8.2de	0.74	0.84cde	0.78ef
12- 5.0 FM+1.2 CM+0.4 BM	0.112bc	0.116e	0.164abc	5.11	7.2defg	14.8cd	0.64	0.90cd	1.15abc
13- 1.2 BM	0.133a	0.140abcd	0.136def	4.80	5.9gf	5.4e	0.64	0.79de	0.79def
14- 0.9 BM+0.85 CM	0.067g	0.139abcd	0.132ef	4.64	5.5f	8.2de	0.67	0.75ef	0.74f
15- 0.9 BM+4.0 FM	0.093def	0.131bcde	0.137def	5.03	6.8efg	8.0de	0.67	0.83cde	1.03bcdef
16- 0.6 BM+7.5 FM	0.088ef	0.133bcde	0.135def	4.57	9.3cdefg	8.3de	0.64	0.96bc	1.35a
17- 0.6 BM+0.85 CM+4.0 FM	0.137a	0.143abc	0.129f	5.84	6.2gf	8.7de	0.70	0.82de	1.04bcde
18- Control	0.110bcd	0.122cde	0.098g	3.86	6.6gf	5.3e	0.68	0.64f	0.75f
Significance[c]	$p<0.001$	$p<0.01$	$p<0.001$	N.S	$p<0.001$	$p<0.001$	N.S	$p<0.001$	$p<0.01$
Seasonal Mean	0.11	0.14	0.15	5.98	9.96	14.26	0.71	0.89	1.02
Correlation 1;2	r = – 0.247 (N.S.)[c]			r = 0.562, ($p<0.05$)			r = 0.575, ($p<0.05$)		
Correlation 1;3	r = – 0.151 (N.S.)[c]			r = 0.850, ($p<0.001$)			r = 0.291, (N.S.)[c]		

[a] Average of 4 samples, Values in the same column followed by different letters denote significant differences according to Duncan's multiple range test (p<0,05)

[b] Seasons are numbered as follows;: (1) Autumn 1; (2) Spring; (3) Autumn 2

[c] N.S. (Not Significant)

According to Materechera and Morutse [11], chicken manure presents a viable option for supplying P. Additionally, animal manure represents a valuable source of phosphorus (P) released following breakdown by microorganism in the soil that can sustain crop requirements [3], and further was reported by Nimje and Seth [12]; Iqbal et. al. [6] that farmyard manure increase plant available P contents of soils. Concluding the seasonal mean, P build-up attracted the attention at which should be considered as a problem rather than a source especially in successive application with regard to environmental concern.

Soil K contents were influenced by the applications and found to be statistically significant in the spring ($p<0.001$) and the autumn 2 season ($p<0.01$) with the exception of the autumn 1 season (Table 4). Soil K content showed variations between not only the applications but also the seasons as well. In the spring season, soil K content varied among 1.13 and 0.64 me 100 g^{-1}, taking from 1.5 FM and control application, respectively.

In the autumn 2 season, increases in soil K contents were recognized and the K contents were recorded as 1.37 and 0.74 e 100 g^{-1}, obtaining from 1.5 FM and 0.9 BM + 0.85 CM application, respectively. Taking the highest levels of soil K in FM containing applications could be attributed to the K contents of FM and also the mineralization rate of the material. Regarding the seasonal mean, a positive correlation was observed between the autumn 1 and spring season, while insignificant positive correlation was present between the autumn 1 and the autumn 2 seasons (Table 4). Farmyard manure is known to be a good source of soil K [6; 9; 12].

Table 5 gives the effects of the applications on Ca and Mg contents. The applications had a lesser effect on Ca contents compared to the others, and a statistical significance was not observed in each season. Comparing the seasonal mean, an increase was recorded from 31.92 me 100g^{-1} in autumn 1 season to 36.95 me 100g^{-1} in autumn 2 season. Additionally, insignificant correlation was detected between the autumn 1 and spring, and autumn1 and autumn 2 season (Table 5).

Mg contents were influenced significantly by the applications in the autumn 1 and spring ($p<0.05$), and also in the autumn 2 season ($p<0.01$). In the autumn 1 season, Mg contents were determined in the range of 1.22 and 1.52 me 100 g^{-1} and were taken from 0.6 BM + 0.85 CM + 4.0 FM and 3.5 CM application, respectively. This range was fixed as 1.98 me 100 g^{-1} from 1.7 CM + 4.0 FM + 0.3 BM and 1.46 me 100 g^{-1} from control application in the spring season. Considering the autumn 2 season, Mg contents were recorded as 2.04 and 1.46 me 100 g^{-1}, taking from 0.6 BM + 7.5 FM and 1.7 TG + 0.6 BM application, respectively. Regarding the seasonal mean, insignificant correlation was detected between the autumn 1 and the spring, and autumn1 and autumn 2 season (Table 5).

Table 5. The effects of the applications on exchangeable Ca and Mg

TREATMENTS ton ha^{-1}	Ca (me 100g^{-1})[a]			Mg (me 100g^{-1})[a]		
	SEASONS[b]					
	1	2	3	1	2	3
1- 3.5 CM	33.2	35.6	36.83	1.52a	1.81abc	1.73abcde
2- 2.5 CM+4.0 FM	32.2	35.2	36.24	1.30bcd	1.80abc	1.75abcde
3- 2.5 CM+0.3 BM	30.7	36.0	37.60	1.23d	1.71abcd	1.51e
4- 1.7 CM+7.5 FM	31.6	35.0	35.52	1.38abcd	1.87ab	1.57de
5- 1.7 CM+0.6 BM	33.0	35.9	35.76	1.28bcd	1.83ab	1.46e
6- 1.7 CM+4.0 FM+0.3 BM	32.8	36.1	36.33	1.29bcd	1.98a	1.66cde
7- 15.0 FM	34.4	36.1	37.37	1.43abc	1.94ab	1.74abcde
8- 10.0 FM+1.2 CM	31.6	34.3	35.75	1.31bcd	1.88ab	1.78abcde
9- 10.0 FM+0.4 BM	31.6	35.5	37.27	1.47ab	1.90ab	1.74abcde
10- 5.0 FM+2.5 CM	33.3	35.6	36.87	1.37abcd	1.81abc	1.66bcde
11- 5.0 FM+1.0 BM	32.0	33.6	36.20	1.34abcd	1.71abcd	1.47e
12- 5.0 FM+1.2 CM+0.4 BM	31.8	35.6	38.92	1.34abcd	1.91ab	1.74abcde
13- 1.2 BM	30.2	35.2	36.87	1.37abcd	1.64bcd	1.75abcde
14- 0.9 BM+0.85 CM	30.5	34.7	38.13	1.31bcd	1.50cd	1.85abcd
15- 0.9 BM+4.0 FM	31.9	33.9	38.32	1.25cd	1.64bcd	1.99ab
16- 0.6 BM+7.5 FM	31.7	34.1	36.76	1.23d	1.69abcd	2.04a
17- 0.6 BM+0.85 CM+4.0 FM	31.0	34.5	36.82	1.22d	1.75abcd	1.66cde
18- Control	31.1	32.0	37.82	1.24cd	1.46d	1.87abcde
Significance[c]	N.S.	N.S.	N.S.	$p<0.05$	$p<0.05$	$p<0.01$
Seasonal Mean	31.92	34.94	36.95	1.33	1.77	1.73
Correlation 1;2	r = 0.416 (N.S.)			r = 0.409 (N.S.)		
Correlation 1;3	r = – 0.163 (N.S.)			r = – 0. 137 (N.S.)		

[a] Average of 4 samples, Values in the same column followed by different letters denote significant differences according to Duncan's multiple range test ($p<0,05$)

[b] Seasons are numbered as follows;: (1) Autumn 1; (2) Spring; (3) Autumn 2

Concluding the results, successive applications caused the soil macro nutrient level to have increased. However beneficial the manures, successive application resulting in an accumulation of some nutrients in the soil should be taken into consideration; of these, P build-up was attracted the attention. This is probably the cause of nitrogen-content-based application of the manures, especially chicken manure, so this should be carefully considered in order not to engender environmental pollution. As stated by Pang and Letey [13], high initial application to build up the organic pool followed by reduced inputs in subsequent years would be appropriate.

If the manures are to be classified regarding to the nutrient status of the soil, it could probably be as follows; FM for N and K; CM for P. Moreover, we recommend that chicken manure be applied regarding to the P content much more carefully and chicken manure and farmyard manure be mixed thoroughly. Regarding the blood meal, application difficulties and undesirable features such as bad smell and hygiene, it should be applied in small quantities within a mixture not be alone.

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EFFECTS OF DIFFERENT ORGANIC MANURE APPLICATIONS ON THE NUTRIENT CONTENTS OF SOIL IN THE DIFFERENT GROWING SEASONS: II. MICRO NUTRIENTS

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ABSTRACT

This experiment aims to elaborate the different organic manures on the DTPA extractable iron (Fe), copper (Cu), manganese (Mn) and zinc (Zn) contents in three successive seasons, between 2006 and 2008, including autumn 1 season (11/2006-12/2006), spring season (03/2007-06/2007) and autumn 2 season (09/2007-01/2008). The organic manure used in this experiment was farmyard manure (FM), chicken manure (CM) and blood meal (BM). The experiment was planned as a randomized block design with four replicates and was conducted under the open field conditions with 17 organic applications and 1 control, collectively 18 applications. All micro nutrients tended to increase with regard to the successive applications some of which were found to be statistically significant to a different extent. Considering the seasonal mean, an increase between the seasons in Fe, Cu and Mn contents was found to be statistically insignificant whereas the Zn content was found to be statistically significant. Chicken manure (CM) gave rise to an augmentation in the Cu, the Mn and the Zn contents, blood meal (BM) also showed a tendency to increase in the Fe contents of soils, but blood meal (BM) is recommended to be used in small quantities due to the unfavorable features of the material. Summing up, 2.5 ton ha^{-1} CM + 0.3 ton ha^{-1} BM and 2.5 ton ha^{-1} CM + 4.0 ton ha^{-1} FM applications gave the better results

Keywords: Farmyard manure, chicken manure, blood meal, the micro nutrients

INTRODUCTION

The unabated use of high analysis chemical fertilizers coupled with high yielding varieties and intensive agricultural practices has led to a decline in the micronutrient supplying capacity of many soils, resulting in the sporadic appearance of deficiency of many micronutrients [2].

The soil must provide nutrients for plants in a suitable form and at a rate at which they can be used [8]. Organic fertilizers are rich in water and carbon compounds but generally poor in nutrients [6]. In contrast, organic manure can improve the physical properties of soil to a large extent and enhance the plant growth [4; 8]. Not only does organic manure supply the essential nutrients to plants, but also does supply carbon to soil microorganism for which microbial activity increases, therefore, soil sustainability increases.

Raw manure is an excellent resource for organic crop production. It supplies nutrients and organic matter, stimulating the biological processes in the soil that help to build soil fertility [7]Organic matter acts as a slow-release form of crop nutrients [10]. Moreover, Citak and Sonmez [3]stated that farmyard manure and chicken manure can be used successfully in organic crop production.

This experiment aims to elaborate the effects of three different organic manures on the soil extractable Fe, Mn, Cu and Zn contents and to compare them as an individual or mixture characteristic depending on the different cabbage growing seasons. At the end of the study, reasonable applications would be recommended.

MATERIAL AND METHODS

The experiment was carried out under the open – field conditions by growing organic cabbage in 2006 and 2008 at Akdeniz University, Faculty of Agriculture Research Centre. Table 1 indicates the soil properties of the experimental area. Initially, cabbage plants were planned to be grown in the autumn and in the spring season, but the unsuitable conditions had led to the first cabbage growing season cancelled (11/2006 – 12/2006) and was named as autumn 1 season. Afterwards, the same plots were treated with the same applications and then cabbage plants were transferred to the plots, called spring season, (03/2007 – 06/2007). Third growing season, called autumn 2, the same applications were applied to the same plots and cabbage plant were grown as a second growth season (09/2007 – 01/2008). As a result, three soil applications but two plant growing cycle were achieved in the end.

Measured parameters	Soil Depth (cm)	
	0-20	20-40
Total N, %	0.11	0.09
Plant available P, mg kg^{-1}	3.80	2.50
Extractable K, me 100 g^{-1}	0.60	0.4
Extractable Ca, me 100 g^{-1}	31.4	26.3
Extractable Mg, me 100 g^{-1}	1.28	0.83
DTPA Extractable Fe, mg kg^{-1}	1.30	0.9
DTPA Extractable Cu, mg kg^{-1}	0.40	0.38
DTPA Extractable Mn, mg kg^{-1}	5.10	4.50
DTPA Extractable Zn, mg kg^{-1}	0.26	0.20
pH (1:2.5 water)	8.16	8.10
EC (1:2.5 water) dS/m	0.09	0.06
$CaCO_3$, %	5	3
Organic matter, %	1.49	1.20
Texture	Clay (C)	

Table 1. Some physical and chemical properties of the experimental area

17 applications containing farmyard manure (FM), chicken manure (CM), and blood meal (BM) and one control, totally 18 applications, were used as organic manure. CM was supplied from Akdeniz University, Animal Production Department, from an organic production, FM from dairy cattle, and BM from a commercial slaughterhouse**.** Some chemical properties of the manures are given in Table 2.

Measured parameters	Farmyard Manure (FM)	Chicken Manure (CM)	Blood Meal (BM)
Total N, %	0.99	4.28	12.93
P,%	0.47	3.40	0.10
K,%	2.65	2.60	0.28
Ca,%	4.25	2.55	0.17
Mg,%	0.53	0.05	0.03
Fe, mg kg^{-1}	2760	238	3880
Cu, mg kg^{-1}	13.8	36	7.4
Mn, mg kg^{-1}	15.4	25	28.2
Zn, mg kg^{-1}	38	8	29
pH (1:5 water)	7.05	7.80	6.50
EC (1:5 water) dS/m	0.5	3.7	6
Organic matter, %	55	26.6	41

Table 2. Some Physical and Chemical Properties of the Manures Used in This Experiment

The experiment established as a randomized block design was conducted under the open-field conditions with four replications. All applications were adjusted to 150 kg N ha^{-1} regarding the doses taken up by plants [1] and were applied 15 days before the transplanting in order to assure the incubation period. The doses of each application are given in Table 3.

1) 3.5 ton ha $^{-1}$ chicken manure (CM)
2) 2.5 ton ha $^{-1}$ chicken manure (CM) + 4.0 ton ha $^{-1}$ farmyard manure (FM)
3) 2.5 ton ha $^{-1}$ chicken manure (CM) + 0.3 ton ha $^{-1}$ blood meal(BM)
4) 1.7 ton ha $^{-1}$ chicken manure (CM) + 7.5 ton ha $^{-1}$ farmyard manure (FM)
5) 1.7 ton ha $^{-1}$ chicken manure (CM) + 0.6 ton ha $^{-1}$ blood meal (BM)
6) 1.7 ton ha $^{-1}$ chicken manure (CM) + 4.0 ton ha $^{-1}$ farmyard manure (FM) + 0.3 ton ha $^{-1}$ blood meal (BM)
7) 15.0 ton ha $^{-1}$ farmyard manure (FM)
8) 10.0 ton ha $^{-1}$ farmyard manure (FM) + 1.2 ton ha $^{-1}$ chicken manure (CM)
9) 10.0 ton ha $^{-1}$ farmyard manure (FM) + 0.4 ton ha $^{-1}$ blood meal (BM)
10) 5.0 ton ha $^{-1}$ farmyard manure (FM) + 2.5 ton ha $^{-1}$ chicken manure (CM)
11) 5.0 ton ha $^{-1}$ farmyard manure (FM) + 1.0 ton ha $^{-1}$ blood meal (BM)
12) 5.0 ton ha $^{-1}$ farmyard manure (FM) + 1.2 ton ha $^{-1}$ chicken manure (CM) + 0.4 ton ha $^{-1}$ blood meal (BM)
13) 1.2 ton ha $^{-1}$ blood meal (BM)
14) 0.9 ton ha $^{-1}$ blood meal (BM) + 0.85 ton ha $^{-1}$ chicken manure (CM)
15) 0.9 ton ha $^{-1}$ blood meal (BM) + 4.0 ton ha $^{-1}$ farmyard manure (FM)
16) 0.6 ton ha $^{-1}$ blood meal (BM) + 7.5 ton ha $^{-1}$ farmyard manure (FM)
17) 0.6 ton ha $^{-1}$ blood meal (BM) + 0.85 ton ha $^{-1}$ chicken manure (CM) + 4.0 ton ha $^{-1}$ farmyard manure (FM)
18) control (without any treatments)

Table 3. Treatments and Doses of Different Application

ANALYTICAL METHODS

Soil samples in each plot were taken from 0-20 cm in dept before the harvest and were taken to the laboratory. Afterwards, all samples were air dried, and were passed through 2 mm - sieve. Afterwards, soil samples were analyzed for DTPA extractable Fe, Zn, Mn and Cu according to Lindsay and Norvell [9] and were measured via ICP.

Statistical methods

Comparison of the treatments mean was done using the variance analysis by MINITAB 13 and by SAS statistical software, and all parameters were compared by Duncan multiple range test ($p \leq 0.05$). Correlation between the seasonal mean was performed by Pearson's correlation coefficient at MINITAB 13 statistical software.

RESULTS AND DISCUSSION

Table 4 gives the results of the applications on Fe and Cu contents. Increases were observed in Fe and Cu content as a result of successive applications, and the applications had an insignificant influence on Fe and Cu in the autumn 1 season. However, a statistical significance between the applications was found in the spring and in the autumn 2 seasons. In the spring season ($p<0.01$), Fe contents were measured in the range of 2.06 and 1.46 mg kg^{-1} and were taken from 0.9 BM + 4.0 FM and from 10.0 FM + 1.2 CM application, respectively (Table 4). In the autumn 2 season ($p<0.05$), a noticeable increment was perceived in Fe contents and the highest and the lowest values were determined in range of 5.01 to 2.71 mg kg^{-1} regardless of the control (2.25 mg kg^{-1}), and were taken from 2.5 CM + 0.3 BM and 0.6 BM + 0.85 CM + 4.0 FM application, respectively.

On comparing Cu contents, significant differences were fixed in the spring ($p<0.01$) and in the autumn 2 ($p<0.001$) seasons (Table 4). In the spring season, Cu contents varied among 0.677 to 0.560 mg kg^{-1} from which were taken 2.5 CM + 4.0 FM and 10.0 FM + 1.2 CM, respectively. In the autumn 2 season, the applications had a significant effect on Cu contents ($p<0.001$), and ranged from 1.150 to 0.770 mg kg^{-1}, and these values were determined in 2.5 CM + 0.3 BM and 1.2 BM application, respectively, regardless of the control (0.743 mg kg^{-1}). Concerning the seasonal mean, Fe contents rose from 1.48 mg kg^{-1} in the autumn 1 to 3.30 mg kg^{-1} in the autumn 2, but insignificant correlation was measured between the seasons (Table 4). Cu content also rose from 0.49 mg kg^{-1} in the autumn 1 to 0.94 mg kg^{-1}, but insignificant correlation was observed between the seasons.

Organic manures may contain micro elements required by plants to a certain extent (Table 2). In addition, Gaskell et al. [5] reported that organic fertilizer sources commonly contain one or more minor elements. Chaudhary and Narwal [2] stated that farmyard manure is also a reservoir of nutrients adding to soil fertility build up and showed that increased farmyard manure application increased the Fe and Cu contents of soils. Hlusek et al. [6] also found that farmyard manure had a positive influence in increasing soil Fe contents.

Table 4. DTPA extractable Fe and Cu contents of soil depending on the applications[a]

TREATMENTS ton ha^{-1}	Fe mg kg^{-1}			Cu mg kg^{-1}		
	SEASONS[b]					
	1	2	3	1	2	3
1- 3.5 CM	1.50	1.75^{cd}	3.26^{bcd}	0.535	0.657^{abc}	1.127^{a}
2- 2.5 CM+4.0 FM	1.70	1.79^{bcd}	3.06^{cd}	0.607	0.677^{a}	1.080^{abc}
3- 2.5 CM+0.3 BM	1.64	1.76^{cd}	5.01^{a}	0.457	0.637^{abcd}	1.150^{a}
4- 1.7 CM+7.5 FM	1.40	1.93^{abcd}	3.14^{cd}	0.475	0.630^{abcde}	1.127^{a}
5- 1.7 CM+0.6 BM	1.54	1.96^{abcd}	3.46^{bcd}	0.471	0.640^{abcd}	1.093^{ab}
6- 1.7 CM+4.0 FM+0.3 BM	1.54	1.67^{cd}	3.05^{cd}	0.497	0.597^{bcde}	0.957^{cde}
7- 15.0 FM	1.57	1.47^{d}	3.03^{cd}	0.487	0.573^{de}	0.897^{def}
8- 10.0 FM+1.2 CM	1.36	1.46^{d}	3.08^{cd}	0.456	0.560^{e}	1.020^{abcd}
9- 10.0 FM+0.4 BM	1.66	1.57^{cd}	3.21^{bcd}	0.557	0.590^{cde}	0.977^{bcde}
10- 5.0 FM+2.5 CM	1.68	1.57^{cd}	3.27^{bcd}	0.617	0.607^{abcde}	1.043^{abc}
11- 5.0 FM+1.0 BM	1.26	1.72^{cd}	4.66^{ab}	0.419	0.593^{cde}	0.853^{efg}
12- 5.0 FM+1.2 CM+0.4 BM	1.30	1.64^{cd}	3.84^{abc}	0.416	0.607^{abcde}	0.973^{bcde}
13- 1.2 BM	1.51	2.28^{ab}	3.84^{abc}	0.479	0.643^{abcd}	0.770^{fg}
14- 0.9 BM+0.85 CM	1.27	1.78^{bcd}	2.79^{cd}	0.380	0.667^{abc}	0.797^{fg}
15- 0.9 BM+4.0 FM	1.35	2.06^{abc}	2.83^{cd}	0.452	0.650^{abc}	0.797^{fg}
16- 0.6 BM+7.5 FM	1.66	1.80^{bcd}	2.89^{cd}	0.547	0.660^{abc}	0.780^{fg}
17- 0.6 BM+0.85 CM+4.0 FM	1.42	2.42^{a}	2.71^{cd}	0.420	0.667^{ab}	0.820^{fg}
18- Control	1.36	1.55^{cd}	2.25^{d}	0.467	0.623^{abcde}	0.743^{g}
Significance[c]	N.S.	p<0.01	p<0.05	N.S.	p<0.01	p<0.001
Seasonal Mean	1.48	1.73	3.30	0.49	0.63	0.94
Correlation 1;2[c]	r = – 0.249 (N.S.)[c]			r = 0.036 (N.S.)[c]		
Correlation 1;3[c]	r = 0.049 (N.S.)[c]			r = 0.363 (N.S.)[c]		

[a] Average of 4 specimens, Values in the same column followed by different letters denote significant differences according to Duncan's multiple range test (p<0,05)

[b] Seasons are numbered as follows;: (1) Autumn 1; (2) Spring; (3) Autumn 2

[c] N.S. (Not Significant)

Table 5 gives the results of the applications on Mn and Zn contents. An insignificant influence was observed between the applications on Mn contents in autumn 1 and spring seasons, whereas significant differences were found in the autumn 2 season ($p<0.01$). In the autumn 2 season, Mn contents fluctuated from 13.4 to 7.7 mg kg^{-1}, and were taken from 1.7 CM + 0.6 BM and 0.9 BM + 0.85 CM application, respectively, regardless of the control (5.5 mg kg^{-1} Cu).

Zn contents (Table 5) were found insignificant in the autumn 1 season while a statistical significant was observed in the spring and in the autumn 2 seasons ($p<0.001$). In the spring season, Zn contents varied among 0.75 and 0.32 mg kg^{-1} and from which were taken 3.5 CM and 10.0 FM + 0.4 BM application, respectively.

In the autumn 2 season ($p<0.001$), the highest level of Zn was attained from 3.5 CM application with the highest level of 2.90 mg kg^{-1} Zn and from 1.2 BM application with the lowest level of 0.58 mg kg^{-1} Zn (Table 5). Comparing the seasonal mean of soil Zn contents, a significant positive correlation was observed between the autumn 1 and spring season, and also between the autumn 1 and the autumn 2 season (Table 5). As stated by Chaudhary and Narwal [2], farmyard manure is a good source of micronutrients and can build-up soil nutrient status.

Table 5. Soil DTPA extractable Mn and Zn contents depending on the applications[a]

TREATMENTS ton ha^{-1}	Mn mg kg^{-1}			Zn mg kg^{-1}		
	SEASONS[b]					
	1	2	3	1	2	3
1- 3.5 CM	5.0	11.4	10.2^{abcd}	0.46	0.75^{a}	2.90^{a}
2- 2.5 CM+4.0 FM	8.8	11.7	10.6^{abcd}	0.51	0.53^{bcd}	2.27^{ab}
3- 2.5 CM+0.3 BM	5.0	9.8	12.7^{ab}	0.36	0.65^{ab}	2.33^{ab}
4- 1.7 CM+7.5 FM	5.5	10.3	12.2^{abc}	0.35	0.57^{bc}	1.68^{bcd}
5- 1.7 CM+0.6 BM	6.3	10.3	13.4^{a}	0.42	0.50^{cde}	1.62^{bcde}
6- 1.7 CM+4.0 FM+0.3 BM	6.0	9.4	10.3^{abcd}	0.45	0.42^{defg}	1.37^{cdef}
7- 15.0 FM	6.1	9.0	7.8^{de}	0.34	0.37^{efg}	0.93^{defg}
8- 10.0 FM+1.2 CM	7.2	8.4	11.7^{abcd}	0.36	0.48^{cdef}	1.38^{cdef}
9- 10.0 FM+0.4 BM	7.6	9.4	11.2^{abcd}	0.31	0.32^{g}	0.84^{efg}
10- 5.0 FM+2.5 CM	8.6	8.9	10.8^{abcd}	0.44	0.46^{cdef}	2.03^{bc}
11- 5.0 FM+1.0 BM	5.0	10.5	8.4^{cde}	0.26	0.34^{fg}	0.64^{fg}
12- 5.0 FM+1.2 CM+0.4 BM	5.0	9.4	10.5^{abcd}	0.30	0.42^{defg}	1.70^{bcd}
13- 1.2 BM	6.5	10.6	7.9^{de}	0.26	0.37^{efg}	0.58^{fg}
14- 0.9 BM+0.85 CM	5.1	11.0	7.7^{de}	0.27	0.47^{cdef}	0.78^{fg}
15- 0.9 BM+4.0 FM	6.5	10.9	9.2^{bcde}	0.30	0.37^{efg}	0.66^{fg}
16- 0.6 BM+7.5 FM	6.7	11.1	9.0^{bcde}	0.31	0.40^{defg}	0.68^{fg}
17- 0.6 BM+0.85 CM+4.0 FM	4.8	10.5	8.7^{bcde}	0.37	0.46^{cdef}	0.97^{defg}
18- Control	5.1	8.2	5.5^{e}	0.29	0.34^{fg}	0.49^{g}
Significance[c]	N.S.	N.S.	p<0.01	N.S.	p<0.001	p<0.001
Seasonal Mean	6,16	10,09	9,87	0,36	0,46	1,33
Correlation 1;2[c]	r = – 0.028 (N.S.)[c]			r = 0.582 (p<0.01)		
Correlation 1;3[c]	r = 0.266 (N.S.)[c]			r = 0.772 (p<0.001)		

[a] Average of 4 specimens, Values in the same column followed by different letters denote significant differences according to Duncan's multiple range test (p<0,05)

[b] Seasons are numbered as follows;: (1) Autumn 1; (2) Spring; (3) Autumn 2

[c] N.S. (Not Significant)

At the end of the experiment, soil micronutrient status was influenced by the applications positively, and tended to increase in any applications to a different extent. On the whole, all manures contain micro nutrient to a different extent and this source could be available to plant if the mineralization occurs; therefore, he factors affecting the mineralization rate also have an influence on the nutrient release. As stated by Citak and Sonmez [3], evaluation of the organic manures in different season is not easy since there are differences in mineralization rate driven by the climatic conditions to a great extent.

On the whole, CM gave rise to an augmentation in Cu, the Mn and Zn contents, BM also showed a tendency in increasing the Fe contents, but we do not recommend BM to be used due to the unfavorable features of the material. Though giving a recommendation is not easy due to the great variations between the applications an also the seasons, the optimum doses could be as follows; the 2.5 ton ha^{-1} CM + 0.3 ton ha^{-1} BM and the 2.5 ton ha^{-1} CM + 4.0 ton ha^{-1} FM applications could be suggested. Therefore, a possible micro nutrient shortage problem may be overcome by applying these materials. Thereafter; these material could be easily transferred to an asset.

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EVALUATION OF THE DEVELOPMENTS IN THE CONSTRUCTION MATERIALS IN THE SCOPE OF SUSTAINABILITY

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ABSTRACT

During the history the human beings have tried to make the world more suitable for living. To achieve that purpose he tried to control the nature and to govern it by using the technology. The technological developments started with the industrial revolution enabled the humans to control their environment more easily and to create new life styles. The basic purposes of the all technological improvement struggles are to maximize the life levels of the humans. Nowadays the places which facilitate the life and provide high level of life comfort depending on their life styles which is very intensive and active are required. That created the technology concept which is one of the most important factors of the design process. The buildings in which the humans are living and working should adapt themselves to the technology which progresses in an increasing manner. However all of these technological developments are accompanied with the problems such as environmental contamination and finishing off the resources. The resources has been used as if they are endless and they have been put into a position such that it is not able to renew itself. During the last years the public opinion formed about the problems of the environment created the environmental approaches at different fields. The design approaches are created which are sensitive to the environmental problems in the field of architecture. The maintainability concept of which importance is understood recently has been found its meaning in the design concept which is called as sustainable architecture. The buildings in the sustainable design are environmental friendly and they could produce their own resources needed and having the property of protection of energy. However the affect to the environment from ecological point of view are as much important as providing the required comfort conditions for the users by the materials used. In the sustainable design approach having the materials which are sensitive to the environment the preferred properties. As the importance of that concept is understood, the sustainable design principles considered as more important during the selection of the materials. The materials should create minimum harm for the environment and the natural resources during their whole using life and the quantity of waste should be minimized or the wastes should be evaluated by recycling after being processed. In that manifesto the improvements in the constructions materials and their properness for the sustainable architectural principles will the evaluated.

Keywords: Construction Materials, Sustainable Architecture, Sustainable Materials

INTRODUCTION

Since antiquity, mankind has gained all benefits required for existence from nature and the resources embodies within it. Economic development and rapid growth beginning with industrial revolution have led to environmental problems as well. People started to seek solutions for these problems threatening human health in all fields and ecological awareness is raised. The problems manifested themselves as population growth, rapid urbanization and settlement at first, but recently they are threatening human health with ozone layer depletion, global warming and natural disasters. As these problems could not be resolved throughout many years, the science of ecology gained much more importance, and the necessity to deal with these problems with a broader point of view has become evident. And within this context, "sustainable architecture" concept has been developed. A big part of these ever-increasing environmental problems is caused by building sector. Buildings have more responsibility in generating a great deal of problems like energy source decrease, vanishing of natural resources, and release of greenhouses gases that cause global warming. Hence, designers should take more responsibility than ever before with respect to erection of cities and buildings and material and energy utilization. Their primary objective should be to shape cities and building to enable conserving natural resources and using renewable energy sources in a detailed way. And this is only possible through "sustainable architecture".

"Sustainable Architecture" Consept: The desire of people to live in healthy environments increases with each passing day due to the negative effects of environmental factors on human life. Rapid consumption of energy and natural resources in the world, high carbon dioxide amount caused by fossil fuel consumption and climate changes happening in turn have forced societies to reconsider manufacturing and consumptions modes in all sectors. Major improvements realized in the fields of industry and technology have caused a change in the comfort needs of people, and this, in turn, gave rise to an increase in energy consumption. The built environment satisfying the basic needs of people should be formed in a way not harming the environment. And consequently, environmentally conscious design approaches have been developed in the field of architecture. Concepts like environmentally conscious architecture, eco-architecture, ecological building, ecological architecture and sustainable architecture have come into being in order to create a high quality and healthy living environment and leave it to next generations. While sustainable architecture concept is theoretically frequently mentioned in recent years, in practice this concept is inadequately reflected in applications. However, sustainable architecture notion shows itself since the beginning of human history. The first living unit examples are intuitively constructed according to sustainable architecture understanding. The common features of such buildings are local material utilization and designs harmonious with climate and topography. For instance, the angle of the sun's rays coming to the earth is oblique in winters, and therefore, could be taken into buildings. But, since they are direct in summers, the sun's rays come to the roofs of buildings. Socrates (c. 470-399 BC) made use of all these natural data, and suggested that; in order to let in the sun's rays to houses with a south front in winters and to protect from cold winds, south front should be built high, and north front should be built low and sheltered.[1]

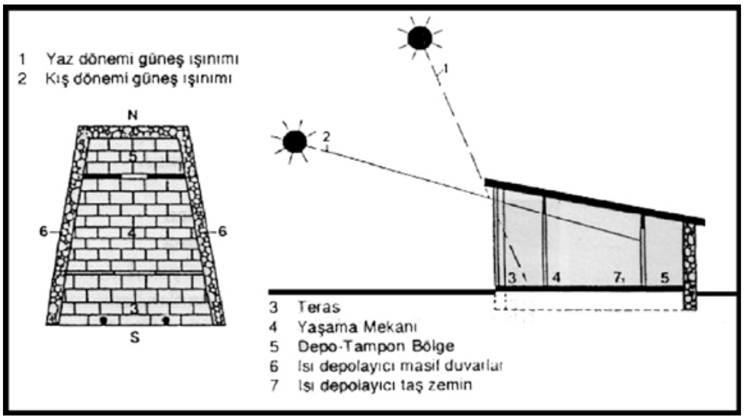


Figure 1. Socrates House(Bozdoğan, B., (2003), "Mimari Tasarım ve Ekoloji" YTÜ FBE, Y.Lisans Tezi)

Roman writer and architecture Vitrivius stated in his 25 BC dated book "De Architectura" that; designs should take climatic conditions of the country in the first place to achieve a proper result. Cities in Ancient Greece and Anatolia were planned in a way to benefit from the sun's rays in winters. For example, all buildings in Priene, an ancient Greek city founded in IV. century BC, are oriented this way.[2]

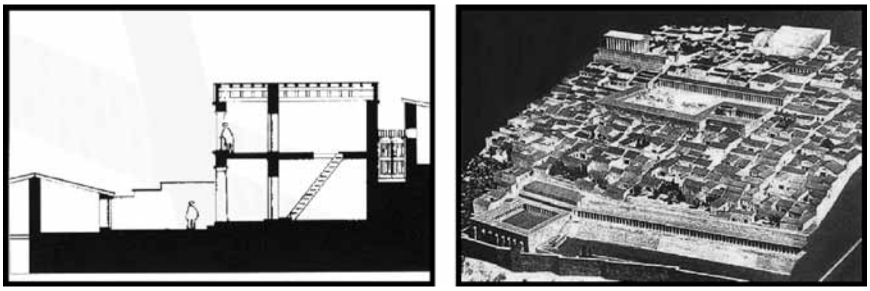


Figure 2. Antique Solar City-Priene(http://www.bodrumpages.com/English/priene.html=)

When we look up the word "sustainability" in a dictionary, we'll come across the definition "processing and/or utilizing a resource without exhausting, depleting and extinguishing it forever".[3] Sustainability is one of the most important concepts of our age that protects natural resources and aims to provide a healthy and comfortable life to next generations; and it is used in conjunction with terms like ecology, environment, energy and material. The term "sustainability" is used for the first time in the "Our Common Future" titled report of United Nations Brundtland Commission in 1987, and defined as "meeting economic, environmental and social needs without damaging living conditions of next generations".[4] A huge part of environmental problems posing a threat upon human health and future are attributable to building sector. Buildings are one of the main energy consumption sources, and innumerable harms are brought upon the environment both during production and also utilization. They form the basis of many problems like vanishing of natural resources, environmental pollution with constantly produced wastes and carbon emission release as a result of using fossil fuels to obtain required energy. It is now necessary to take joint decisions and permanent solutions for the solution of

1 Bozdoğan, B., (2003), "Mimari Tasarım ve Ekoloji" YTÜ FBE, Y.Lisans Tezi

2 Lakot, E., (2007), "Ekolojik Ve Sürdürülebilir Mimarlık Bağlamında Enerji Etkin Çift Kabuklu Bina Cephe Tasarımlarının Günümüz Mimarisindeki Yeri Ve Performansı Üzerine Analiz Çalışması", KTÜ FBE, Y. Lisans Tezi

3 Hoskara, E., (2007), "Ülkesel Koşullara Uygun Sürdürülebilir Yapım İçin Stratejik Yönetim Modeli", İTÜ FBE, Doktora Tezi

4 Karslı T., U., (2008), "Sürdürülebilir Mimarlık Çerçevesinde Ofis Yapılarının Değerlendirilmesi Ve Çevresel Performans Analizi İçin Bir Model Önerisi", MSGSU FBE, Sanatta Yeterlik Tezi

such problems. “Sustainable Architecture” term is asserted with the aim of solving building-based problems.

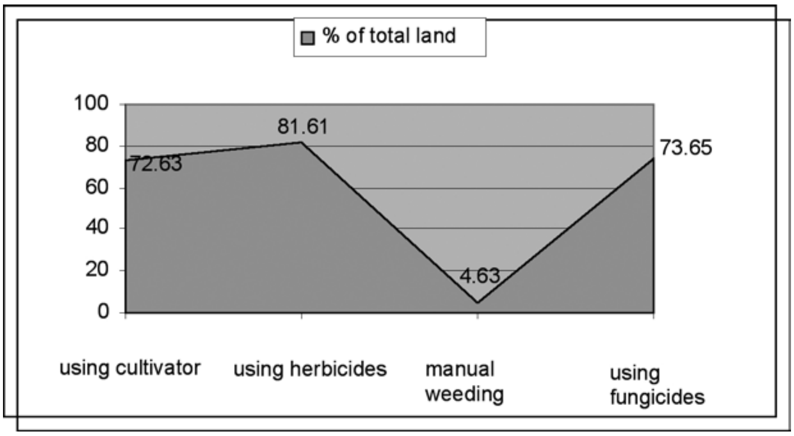


Figure 3. The Effects Of Buildings On Environment (Yeang, K. (1999). *The green skyscraper: The basis for designing sustainable intensive buildings.* Munich: Prestel Verlag.

While secure and comfortable places are designed for residents in sustainable architecture concept, it is also aimed to use natural resources economically and consume energy in a more efficient way. It is an eco-friendly architecture approach aiming to use local and recyclable materials during building constructions. Sustainable building is a building which has minimum effect on natural environment and resources, designed in harmony with nature and utilized energy-efficient and healthy systems.

The reflection of sustainability concept on building design is explained by five objectives in the guide prepared by Minnesota University:[1]

1- Using the Landscape:

- Existing public areas should be preferred instead of green areas during land selection for building construction,
- Natural characteristic and ecology of building land should be protected and improved,
- A settlement reducing the area where the building is constructed should be administered,
- Orientation to sun should be achieved in building design for natural lighting and heating, and climate and environmental effects should be utilized in maximum,
- The existing infrastructure in the building area should be used,
- A landscape design reducing waterproof area formation in the land should be applied,
- Alternative transport options like bicycle path and stand should be supported,

2- Efficiency of Water

- Low water-consuming, water-efficient equipment should be used,
- Wastewater in the building should be treated and reused for irrigation, cooling, toilet cleaning, fire etc. purposes excluding drinking,
- A landscape design providing water conservation and using local plants should be created,
- Rainwater should be collected and reused in appropriate areas,

3- Efficiency of Energy

- Renewable energy sources should be used,
- Use of energy-efficient equipment,
- Reduction of heating and cooling energy consumption generated as a result of heat loss and gains in building shell,
- Efficient use of insulation materials,
- To have the building consume the least possible energy, energy-efficient heating, cooling and ventilations systems should be established,

1 http://www.sustainabledesiguide.umn.edu/, Minnesota Sustainable Design Guide, University of Minnesota

4- Comfort of Space

- Use of low particle producing materials (adhesives, seals, paints, carpets, composite wood products),
- Contaminant sources should be checked, and
- Daylight receiving areas should be increased,
- Increase in ventilation performance,
- Control of harmful gas, toxic substance and CO2 emission, carrying out all measurements, control of humidity and bacterial contamination,
- Providing appropriate thermal conditions,
- Proper ventilation during construction for good interior quality,

5- Materials and Sources

- Regional and local material use,
- Use of renewable resources,
- Use of durable materials and extension of renewal term of materials,
- Use of recyclable and environmentally favorable materials,
- Reduction of building wastes and reutilization in different ways

Providing water, energy and material conservation in buildings are important factors in terms of building sustainability. Constructing buildings that will bring minimum damage to environment need to be one of the most important aims of designers and producers. The scheme created by Kim and Ridgon (1998) to provide a sustainable design oriented guide is considered to be in parallel with the study conducted by Minnesota University.[2]

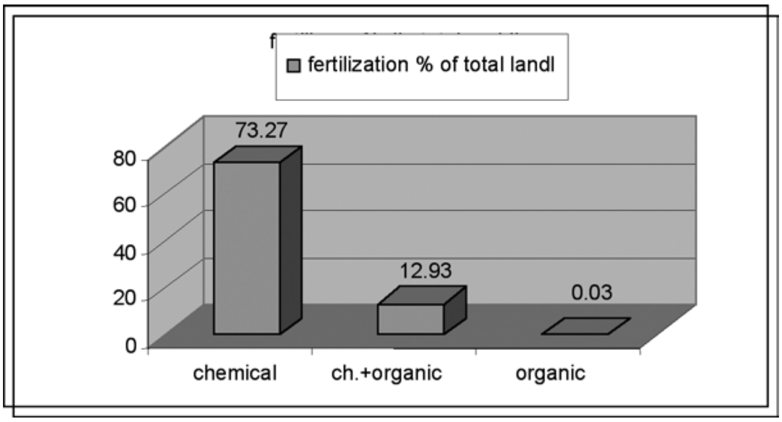


Figure 4. The Conceptual Frame of Sustainable Design In Architecture (Kim, J. ve Ridgon, B., (1998), Introduction to Sustainable Design, National Pollution Prevension Center for Higher Education, Michigan)

When we separately deal with the topics in the scheme, it stands out that; almost all of them are related to the natural resources and materials used. Building materials have huge influence on health, environment and economy. It is of critical importance to select environment-friendly and human health favoring materials. Thus, negative conditions caused by materials used during building constructions are to be known.

The Negative Effects Of Constructional Materials

All building materials used in a building construction go through various stages and undergo many processes before entering the building. Building materials continuously interact with the environment they are located throughout raw material extraction, processing according to the needs, use in the building, demolition after expiry and recycling stages. Energy is consumed in all stages of this lifecycle and during transportation of these materials both production and construction sites, and wastes are generated as a consequence. Therefore, one of the most important factors determining a building's energy-efficiency is material selection. The materials to be used in a building's construction should be the ones selected among the minimum energy-consuming materials in the course of their lifecycle.

2 Kim, J. ve Ridgon, B., (1998), Introduction to Sustainable Design, National Pollution Prevension Center for Higher Education, Michigan.

Figure 5. The Life Cycle Of Constuctional Materials (http://www.athenasmi.org/about/lcaModel.html)

Building materials constantly interact with the user during their use within the lifecycle. Material has a profound effect in creating healthy and comfortable interior conditions for residents. Some building materials release harmful gases during their use. The amount of such gases emitted differs according to the type and application method of the material used. Hence, harmful gas and toxic substance emission rate should be observed carefully in material selection. A component that will harm indoor air quality should not be contained in materials. Wastes formed during demolition of buildings is another important problem, and such wastes are sometimes disposed to unsuitable places without permission and this causes environmental pollution. Therefore, it is critical to select recyclable materials.

Two approaches are prevalent in building material selection issue. According to the first approach, natural materials that do not harm the nature should be selected in sustainable design. However, selecting eco-friendly natural materials will reduce the already scarce resources and cause their total extermination. Raw materials necessary for such materials are mostly extracted from rural areas and damages the habitat. Process of these raw materials generally takes places in locations adjacent to cities and leads to air pollution. Moreover, a high level of energy is used as mentioned before. Thus, at second look, it is recommended to select and use artificial materials that do not bring harm to nature on energy and waste basis.[1]

Materials used in buildings differ depending on the function of building. Besides technical specifications, natural, environmental and human health-related sustainability features should also be taken into consideration during the selection of such materials.

The Evaluation Of Constructional Materials In Scope of Sustainability Consept

Yapı tasarımında kullanılan malzemelerin sürdürülebilirlik özelliklerine göre değerlendirilip seçilmesi sürdürülebilir mimari bir tasarımda önemli bir rol oynamaktadır. Aşağıda geçmişten günümüze kadar kullanılan bazı önemli yapı malzemeleri sürdürülebilir özellikler açısından belirlenen faktörlere göre değerlendirilmiş, malzemelerin olumlu ve olumsuz özellikleri belirlenmiştir.

Evaluating the materials used in a building design in terms of sustainability and selecting them plays an important role in a sustainable architectural design. Some important building materials used from past to present are evaluated below according to the factors determined within the scope of sustainable features, and positive and negative properties of materials are designated.

- The factor of influence upon environment and natural habitat in building material selection

The harm brought by local raw materials with sufficient resources to environment during their extraction, amount of waste produced by materials during their lifecycle and decomposition of these wastes,

- Energy factor in building material selection

Energy amount consumed by raw materials during their extraction, processing, material production, transportation and lifecycle

- Recyclability factor in building material selection

1 Tönük, S., (2001), Bina Tasarımında Ekoloji, Yıldız Teknik Üniversitesi Basım-Yayın Merkezi, İstanbul

Recyclability of building materials

- Human health factor in building material selection

Toxic substance amount generated during material production, application and use

Natural Stone: Natural stone takes an important place among the raw materials extracted from nature and then used. It is used as a building material throughout human history by way of shaping and carving it. It generally serves as the main component in foundations, walls and bridges, and coating material in floors, walls and roofs. Moreover, it is an important materials used in landscape designs like garden wall buildings, pavement and road paving, and also historical building restorations. **Marble** and **granite** are natural stones commonly used as coating materials in buildings.

Figure 6. The Usage Of Natural Stone As Structural And Facing Material (www.necmierol.com/istanbulfotografları)

Turkey is rich in natural stone material reserves and diversity and it is not possible to exhaust them. Marble, travertine, onyx and granite can be listed among them. For instance, there are more than 150 marble reserves with different colors, patterns and qualities in 80 regions in Turkey. In this aspect, natural stones specified as local materials are extracted from quarries and used after processing them. They may harm the environment while being extracted from the quarries (distortion in land structure and natural vegetation, erosion etc.).

There is no need for a complex production plant for processing the stones extracted from quarries and the necessary energy amount is low. Wastes produced as a result of processing could later be used in various fields. Natural stone wastes emerging after demolition of buildings are reusable and recyclable. No harmful substance is released during their production and use and they do not harm human health. However, one of the natural stones, granite is harmful in that; it releases a high amount of radon gas. Natural stone materials have favorable characteristics in terms of sustainability concept.

Adobe: Adobe binding material, which is a traditional material, is a clay soil derived from nature. It is used both as a load-bearing element, and also as a plastering material. It is a cheap building material surviving until today and necessitating no plant building for its production. After adding materials like straw stems to a rich clay soil, the product is mixed with water and cast in molds, sundried and adobe blocks are made. Adobe blocks are bonded with a soil-based mortar. In Anatolian villages, we can still see adobe blocks in most houses.[2]

Mesopotamian architecture completely relied on adobe materials. Yemen, the place where Ād tribe once lived, is known as the country where skyscrapers are built for the first time in the world. The high-rise building in Shibam-Hadramaut region are known as "Manhattan of the Desert". Today, the locals still continue to build adobe houses with the same method. [3]

2 Tümer, G., "Kerpiç ve Tuğla Üzerine", www.yapiteklif.com/makale.aspx

3 http://www.cihanozdemir.com/2008/01/dnyann-ilk-gkdelenleri.html#ixzz0bOsTaaxa


Figure 7. The First Skyscrapers Of The World-Yemen (http://www.cihanozdemir.com/2008/01/dnyann-ilk-gkdelenleri.html#ixzz0bOsTaaxa)

As adobe is produced by naturally gathered clay soil and water, it is completely of local nature and depletion of reserves is not a matter of discussion at all. It poses no danger to the nature during production and does not require any plant for such processes. It is a completely ecological material with high thermal insulation value, low production energy and does not produce any waste and has no harm on human health.

Wood: Wood is an organic material with fibrous tissue derived from trees that are living organisms. It is one of the oldest building materials used by mankind from past to present. Early on, it was used depending on the skills and experiences of people, but in the following years, wood started to be applied in a scientific way in parallel with the advances in technology. It has a significant place among other building materials due to working securely against pushing, pulling, bending and cutting, its elasticity, easy processing and assembling.[1] Wooden materials are used as load-bearing, coating, woodwork, panel insulation and mold elements in buildings. Moreover, it has a wide scope of application as a furniture element.

Looking at the Anatolian traditional buildings from past to present, we see wood in elements like windows, doors and roofs in building using **natural stone** and **adobe** as load-bearing material; and stone materials are used in the foundations of buildings utilizing **wood** as a load-bearing element. Thus, we can say that; different local architectures have come into being with a combination of **wood-stone** or **wood-adobe** materials.[2]


The wooden construction House which has Stone basis-Ordu-Bolama

A House Stone-Wood-MudBrick materials Used together Giresun-Tirebolu

Figure 8. The Examples Of Traditional Architectural İn Which Stone-Wood-Mudbrick Materials Used Together (Yaman, F.Z., (2007), "Geleneksel Ahşap Yapılarda Kullanılan Ahşap Yapı Elemanlarının Uzun-Dönem Performansı – Giresun Zeytinlik Mahallesinde Örnek Yapı İncelemesi", İTÜ FBE, Y.Lisans Tezi, İstanbul)

1 Şen, M.A. ve Yeşilkaya E., "Ahşap Yapı Elemanlarında Farklı Boy Birleştirmelerinin Çekme Mukavemetlerinin Araştırılması", http://www.bayar.edu.tr/~somamyo/files/4sayi6.pdf

2 Kuban, D.,(1995), "Türk Evi Geleneği Üzerine Gözlemler", Türk ve İslam Sanatı Üzerine Denemeler, S: 226-227, İstanbul

Natural wooden materials are cut from trees that are renewable resources in forests and used after processing. A good balance should be provided between production and consumption and a proper forestry policy should be adopted to prevent the exhaustion of wood resources. Otherwise, we may face the risk of losing forests, and this in turn will bring natural environmental problems like erosion, air pollution and global warming.

Since wood undergoes very few processes during its processing, the required energy amount is low. But, the amount of wastes generated during its production is huge. Such wastes are utilized in the production of artificial woods like particle board and plywood, or it is used as a industrial fuel as chips and battens. The energy required by artificial woods produced out of natural wood wastes is high, besides such materials are not recyclable. Because of being produced by use of chemical substances, they contain matters injurious to human health.

Wooden material has no detrimental effect on human health in its natural form. Yet, it is weak against external forces (humidity, impacts, infestation etc.). Some additive materials are used to eliminate this, and in this way wood becomes long-lasting and durable. But these additive materials are harmful to human health.

Brick: Mankind has shaped the soil in nature to use it in buildings and burned this clay soil and made it more durable. The first building material to be produced in this manner is brick. The difference between brick and adobe is that; brick is burned in fire, not sundried. Being an inevitable part of Seljuk and Ottoman architecture in Anatolia, brick is used both as a load-bearing element together with stone, and also as a facing with glazed tile. Sivas Gökmedrese and Konya İnce Minareli Medrese can be listed as the most distinct examples. But today, it is generally as the load-bearing element in buildings and the main component in dividing wall construction, and coating material in floors, walls and roofs.

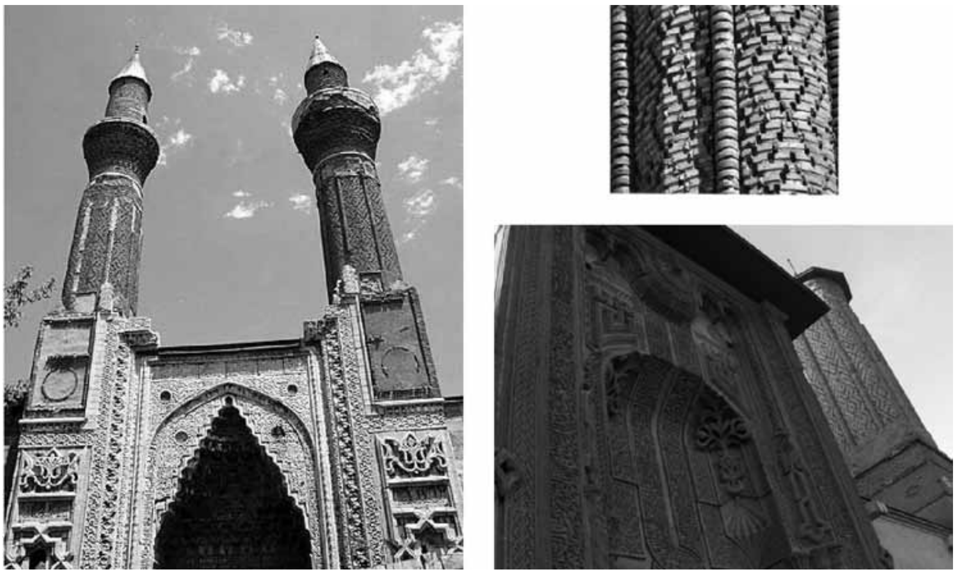


Figure 9. Sivas Gökmedrese and Konya İnce Minareli Medrese (http://www.trekearth.com/gallery/photo782088.htm)

As brick is made out of clay soil, derived from nature and has no chance of depletion, it could be described as a local material. Nevertheless, for it is produced by burning instead of sundrying, the energy amount required during production is higher compared to adobe materials. Because the wastes generated during the production and demolition of buildings can be reused for brick material production, it is recyclable material.

Concrete: Concrete is a hardening composite building material in plastic consistency at first, then becoming solid over time and taking the shape of molds that is obtained by homogeneously mixing cement, aggregate, water and additive materials if necessary at certain amounts. History of concrete goes a long way back like civilization history, and it is known to be used about 5000 years ago during the erection of Egyptian Pyramids in its most primitive and rough form. For Romans, concrete had a vital importance, and colosseums, monuments and road were built by using the primitive form of this material. Concrete in such buildings do not have tensile and impact strength. The building element formed as a result of strengthening concrete with reinforcement materials is known as **reinforced concrete**. Being one of the most important building materials of our century, concrete is one of the leading load-bearing structure materials. It could be shaped relatively easier compared to other building materials. This ability is improved even more with additive material use and unique designs have seen the light of day.

Restaurant Submarino - L' Oceanografic - Opera Hall of Valensia, Spain

Figure 10. The examples of individual designs of concrete buildings http://www.flickr.com/photos/26528022@N07/3043793277/,http://www.mimdap.org/w/?p=1790

One of the biggest problems during obtaining aggregate from the nature is disruption in topography. As a consequence, negative conditions like erosion, air and water pollution are formed. Environmental problems created during concrete production vary depending on the concrete production method. The rapidly increasing ready-mixed concrete production in the world and our country has superiorities in many aspects, but can create negative conditions in terms of environment unless required measures are taken. The most common problem in ready-mixed concrete production is water consumption and water pollution.[1]

One of the most significant factors of global warming that causes climatic changes is greenhouse gases. Harmful emissions generated as a result of fossil energy source consumption in particular are named as greenhouse gases. Since the energy requirements of concrete production are met by these resources, the resulting greenhouse gas emission level is considerably high. Especially during production of cement, one of the main component of cement, atmosphere-pollutant chemical substances are created as well as greenhouse gases. The negative influences of all these harmful substances disturb the natural balance and consequently human health.

High amounts of energy are consumed during concrete material production, raw material extraction, making them components, transporting, mixing and using them building sector. More energy requirement necessitates more fuel consumption and leads to environmental pollution. After the lifecycle of buildings, the resulting wastes are broken and used in various fields as filling materials.[2]

Metal Materials: Metal materials can be divided into two parts as ferrous materials extracted from the nature as ores like steel, cast iron etc., and non-ferrous metals like copper, lead and aluminum. Alloys are produced by mixing two or more metals to attain several features. For example, steel is an alloy material composed of iron and carbon mixture.

Iron and **steel** are known as materials since ancient times. Early on, they were used only in weapon and utensil production since their production was limited. Later, their production broadly increased and they were first used as building material in bridges, and after increases in material quality, they started to be used in buildings. **Steel** is used in two forms as load-bearing system element and cladding element in buildings.[3]

Government House of San Francisco - Hearst Corporation Buildings

Figure 11. The Example Of Buildings Have Steel Structure (http://www.frmtr.com/kultur/750622-dunyada-ki-tasarimlariyla-kendisinden-bahsettiren-yapitlar.html)

1 Coşkun, N., Esin T., "Betonarme Prefabrike Yapım Yöntemlerinin Çevresel Açıdan Analizi", http://www.prefab.org.tr/sempozyum12/metinler/3-1.pdf

2 Tuğlu, U., (2005), "Ekolojik Açıdan Sürdürülebilir Yapılar ve Malzeme", MSGSÜ FBE, Y.Lisans Tezi

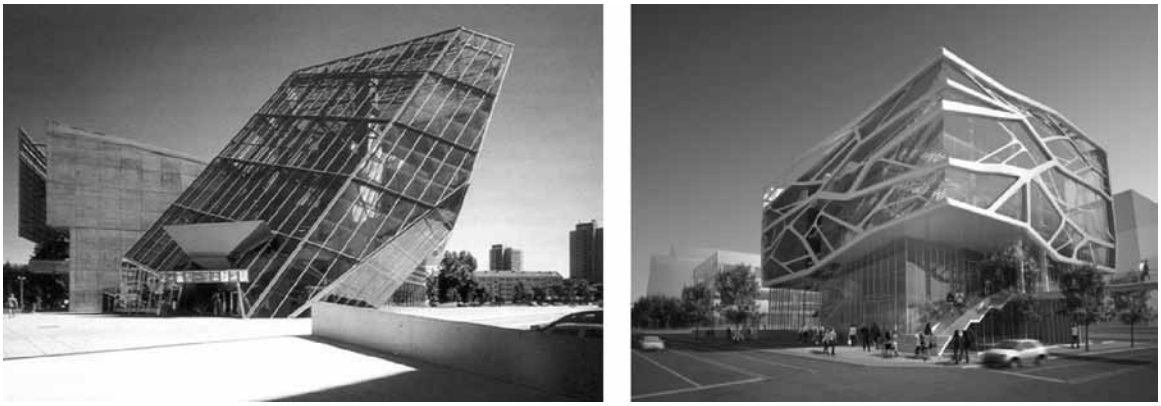
3 http://www.e-celikyapi.com/clkkul.htm

Lead is a soft and easily malleable metal. It is used as a plate in buildings. Moreover, some paint materials contain high amounts of lead.

Metal ores are non-renewable resources. Turkey has various rich mine reserves thanks to its geological position. Therefore, it is one of the important countries in world mining in terms of underground resources. Negative conditions like loss of soil, air and water pollution happening while extracting mines from quarries disturb the natural balance. Similarly, carbon dioxide emission during mine processing and metal material production lead to an increase in air pollution, and increased water consumption brings with it unfavorable conditions like disturbance of ecological balance. Wastes produced after processing cause environmental and water pollution. Lead releases a toxic substance when exposed to high temperatures and this substance poses a threat to human health.

The energy amount used during mine extraction and metal material production is incredibly high. Moreover, steel is one of the highest energy containing materials. The most positive aspects of metal materials with respect to environment is their recyclability. For instance, 1/3 of the aluminum produced in the world is made out of recycled aluminum.[4]

Glass: Glass is an inorganic based material mainly composed of silica (SiO_2) that becomes fluid in very high temperatures and solidifies when cooled. Since it is rapidly cooled during its production, it has an amorphous nature. This feature brings transparency and durability to glass.[5] The first glass materials made by man were found in Egypt and Eastern Mesopotamia in about 3500 BC. After about 2000 years of the invention of glass, blow glass technique was invented and durable thin transparent plates could be produced for windows. With today's advancing technology, as a building material, glass offers an unlimited design freedom and authenticity to designers both technically and aesthetically.



4UF A Cinema Center, Dresden, 1998 - Gimpo Art Center, South Korea, 2010

Figure 12. Glass as a construction material providing individual design (http://www.mimdap.org/w/?p=4149, http://www.tasarimplus.com/gimpo-sanat-merkezi-proje-tasarimi.html=

Because the raw material used in glass production is derived from the nature, it could not be exhausted. From this aspect it is a local material. Like other nature-oriented materials, natural habitat is harmed during raw material extraction. Raw materials used for glass making are mixed and smelt at a high temperature. Then, the smelt glass is cooled to a certain temperature and shaped depending on the desired type of glass. The energy amount used in these processes is substantially high. Hence, it is unfavorable in terms of energy.

Glass material has no health damaging effect during its use. Depending on the type of glass systems used it may contribute to the energy saving ability of the building and serve as a sunblind. After its lifecycle, it could be used again in glass making, i.e. it is recyclable, and this is positive aspect of glass.[6]

CONCLUSION

According to sustainable architecture approach, people should get their needs to survive without harming the nature and in a way accommodating themselves to it. Therefore, in the production and use of buildings that satisfy the basic requirement of people, it is aimed to use scarce resources carefully, minimize their damages to the environment and reduce energy consumption. Environmental effects occurring during building constructions are attributable to building materials and production methods of these materials to a great extent.

In sustainable architecture approach, materials to be used in building design are expected to be local and renewable resource-based, low energy-consuming in their use, recyclable and not harming the nature and human health during their production and use. The duty of designers here is to pay attention to these features in material selection while taking public and environmental health into account.

4 Onat, M., (2004), "Yapı Malzemelerinin Ekolojik Bir Yaklaşımla Değerlendirilmesine Yönelik Bir Çalışma", GYTE FBE, Y.Lisans Tezi
5 Ünal, O., "Yapı Malzemesi Ders Notları", www.teknolojik arastirmalar.com/eegitim/yapi_malzemesi
6 Onat, M., (2004), "Yapı Malzemelerinin Ekolojik Bir Yaklaşımla Değerlendirilmesine Yönelik Bir Çalışma", GYTE FBE, Y.Lisans Tezi

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EFFECTS OF ELEMENTAL SULPHUR AND FARMYARD MANURE ON PH AND SALINITY OF CALCAREOUS SANDY LOAM SOIL AND SOME NUTRIENT ELEMENTS IN TOMATO PLANT

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ABSTRACT

A pot experiment was conducted to study the influence of elemental sulphur (S) and farmyard manure on soil pH, EC and N, S, P concentrations of tomato grown in a calcareous sandy loam soil. Sulphur was applied at 0, 50, 100, 150, 200, 400 mg kg^{-1} and farmyard manure at 0, 3 ton da^{-1} to soil. Three weeks after applications, tomato seedlings were planted and 8 weeks later, the plants were harvested to determine N, S, P concentrations and dry matter yield. Soil pH and EC were determined in the soil samples taken at 3 different periods. Effects of sulphur and farmyard manure applications were not significant on N, P concentrations and dry matter yield of tomato plant. S concentration of tomato plant was increased by sulphur alone. Soil pH was decreased and soil EC was increased in both 2nd and 3rd soil sampling period by the sulphur applications. As a result of farmyard manure application, soil pH decreased in the 2nd soil sampling period but increased in the 3rd soil sampling period. Also, soil EC was significantly increased in 1st and 3rd soil sampling period. Farmyard manure had no significant effect on S supply to tomato plant. The N:S ratio of tomato plant was decreased by sulphur alone. However, the sulphur with farmyard manure applications decreased N:S ratio in lesser extend compared to the S applications.

Keywords: Elemental sulphur, farmyard manure, soil pH, soil EC, calcareous soil, tomato, N, P, S, N:S ratio

INTRODUCTION

Sulphur is considered as the fourth major plant nutrient element. Many crops contain as much sulphur as phosphorus and it ranks in importance with nitrogen and phosphorus in the formation of protein. It is an integral component of certain vitamins and enzymes. Plants can take up sulphur (S) from the soil as sulphate (SO_4^{-2}) ions and from the atmosphere in a gaseous from as SO_2 through the stoma in leaves. Elemental sulphur is biologically oxidized to H_2SO_4 under aerobic conditions in soils. The oxidation of S to H_2SO_4 is particularly beneficial in alkaline soils to reduce pH and supply SO_4 to plants. Utilization of S is allowed by organic farming standarts. Elemental S is applied to and mixed with soil in organic farming. Sulphur amounts to be applied to soil to adjust the soil pH 6.5 are given in Table 1 [8].

Soil pH	Sulphur amounts (kg da^{-1})		
	Sand soil	Loam soil	Clay soil
8.5-6.5	220	280	340
8.0-6.5	130	170	220
7.5-6.5	60	90	110

Table 1. Sulphur amounts to be applied to soil to adjust the soil pH 6.5.

Potential sources of plant-available S include animal manure and organic soil S. Usually, more than 95% of soil S is bonded in organic forms; several hundred kilograms of organic S are present in the upper layers of most soils. Although not readily available to the plant, the large organic S fraction may supply S to S-deficient plants [11]. Animal manure is one of the most important materials used in organic farming due to its positive effects on soil physical, chemical and biological properties. Animal manure is a very variable matrix. Its composition is a product of many factors, including animal species, feed composition, production system and time and conditions of storage [12]. Animal manure contains varying amounts of sulphur compounds along with other plant nutrients. When the manure is returned to the soil, the sulphur and other plant nutrients contained in it become available for crop use. However, the supply of animal manure is generally inadequate for the plant nutrient requirements of modern, intensive agriculture [3].

In this study, our objectives were to determine the influence of elemental sulphur (S) and farmyard manure on soil pH and EC and nitrogen (N), sulphur (S) and phophorus (P) concentrations and dry matter yield of tomato (*Lycopersicum esculentum*) grown in a calcareous sandy loam soil.

MATERIALS AND METHODS

Soil was air dried and passed through a 4 mm sieve. A total of 9 kg of sieved soil was placed in pots with holes at the bottom. Elemental sulphur was applied at six levels (S_0:0, S_1:50, S_2:100, S_3:150, S_4:200, S_5:400 mg kg^{-1}) and farmyard manure at two levels (FYM_0:0, FYM_1:3 ton da^{-1}) according to completely randomized design factorial with 4 replicates to soil. After the experimental set up, the soil samples were taken at 3 different periods (1st sampling period: at the time of the application materials were mixed to soil; 2nd sampling period: 3 weeks after applications; 3rd sampling period: at the end of the experiment or 11 weeks after applications) to examine changes in pH and EC values. Three weeks after applications, tomato seedlings were planted. During the growing period; 8.5 kg N da^{-1} (NH_4NO_3, 33 %), 3.7 kg P_2O_5 da^{-1} (MAP, 61 % P_2O_5), 10 kg K_2O da^{-1} (KNO_3, 46 % K_2O), 0.62 kg MgO da^{-1} ($MgNO_3$, 16 % MgO) and 1.73 kg microelement fertilizer da^{-1} (Hortrilon, 5 % Fe, 2.5 % Mn, 0.5 % Zn, 2.5 % Cu) were applied each pot. Eight weeks later, the plants were harvested to determine dry matter yields (g pot^{-1}), the concentrations of total S (by using the turbidimetric $BaSO_4$ method) [17], total P (by using spectrophotometry) [16] dried shoots after wet digestions [17]. Total N was determined by a modified Kjeldahl procedure [17].

The soil pH was measured in H_2O (1:2.5 soil:deionized water) and the soil EC value was determined directly on the saturation paste. The soil particle size analysis was done by using the hydrometer method [5] and the $CaCO_3$ content was determined by using a Schibler calcimeter. Organic matter was determined by using modified Walkley-Black Procedure [4]. The total N of soil was done by using modified Kjeldahl Procedure [15]. Extractable P concentration was extracted by $NaHCO_3$ and determined by a molybdate colorimetric method [23]. The extractable SO_4-S of soil was determined by using the turbidimetric method [15]. The data were analyzed by standard ANOVA procedures and their significances were always based on the $p<0.05$ level using the LSD tests.

A calcareous sandy loam soil was used in this experiment. Selected soil chemical and physical properties are given in Table 2.

Parameter	Soil
Sand (%)	63.52
Clay (%)	18.48
Silt (%)	18
Texture	Sandy loam
pH	7.80
$CaCO_3$ (%)	18.92
EC (dS m^{-1})	2.07
Organic matter (%)	2.27
Total N (%)	0.049
Extractable-P (mg kg^{-1})	34.57
Extractable-SO_4 (mg kg^{-1})	2.40

Table 2. Physical and chemical properties of soil used.

RESULTS AND DISCUSSION

The effects of applications of elementel sulphur and farmyard manure on soil pH were presented in Table 3. While the effects of elementel sulphur and farmyard manure applications on soil pH were not significant in 1st soil sampling period, they were significant on soil pH in 2nd and 3rd soil sampling period. According to the results, soil pH was reduced by the sulphur and farmyard manure applications. These effects were particularly determined in the 2nd soil sampling period (after 3 weeks the application materials were mixed with the soil) with the highest sulphur level. The highest decrease of soil pH was occured by the S_5FYM_0 and S_5FYM_1 treatments in both 2nd soil sampling period and 3rd soil sampling period. Especially, while the pH of control soil (S_0FYM_0) increased probably due to irrigations in the 2nd soil sampling period, soil pH decreased in the case of sulphur and sulphur with farmyard manure applications to soil. Elemental sulphur is biologically oxidized to H_2SO_4 in soil under aerobic conditions. The oxidation of S to H_2SO_4 is particularly beneficial in alkaline soils to reduce pH, supply SO_4 to plants, make P and micronutrients more available, and reclaim soils [6]. Erdal et al. [9] reported that application of elemental S to the soil resulted in 0.11-0.37 unit decrease in soil pH. In another study, soil pH was declined by 0.37-0.51 units after the applications of elemental S [25]. The acidifying effect of S has been reported by several authors and similar results were found by Soliman et al. [26] and Neilsen et al. [22]. Although soil pH was decreased by sulphur application in calcareous soils, the response is often depend on the amount of $CaCO_3$ present (buffering capacity) in soils. In New Mexico soils, sulphur was not completely oxidized, and H_2SO_4 produced was quickly neutralized by $CaCO_3$ [21]. Kaplan and Orman [18] reported that application of elemental S decreases the soil pH up to the 5th week after which the pH started to increase.

Table 3. Effects of elemental sulphur (S) and farmyard manure (FYM) on soil pH

Sulphur doses	**Soil pH**								
	1st soil sampling			**2nd soil sampling**			**3rd soil sampling**		
	FYM_0	**FYM_1**	**Means**	**FYM_0**	**FYM_1**	**Means**	**FYM_0**	**FYM_1**	**Means**
S_0	7.80	7.78	7.79	8.03 a[1], **A**[2]	7.85 a, **B**	7.94	7.92 a, **A**	7.93 a, **A**	7.93
S_1	7.79	7.76	7.78	7.83 b, **A**	7.81 b, **A**	7.82	7.80 bc, **B**	7.91 a, **A**	7.86
S_2	7.81	7.78	7.80	7.76 c, **A**	7.76 cd, **A**	7.76	7.83 b, **B**	7.91 a, **A**	7.87
S_3	7.79	7.81	7.80	7.77 c, **A**	7.77 c, **A**	7.77	7.83 b, **A**	7.84 b, **A**	7.84
S_4	7.75	7.79	7.77	7.78 c, **A**	7.73 d, **B**	7.76	7.82 b, **A**	7.82 b, **A**	7.82
S_5	7.82	7.82	7.82	7.65 d, **A**	7.66 e, **A**	7.66	7.77 c, **B**	7.81 b, **A**	7.79
Means	7.79	7.79		7.80	7.76		7.83	7.87	
ANOVA[3]									
S	N.S.			**			**		
FYM	N.S.			**			**		
S*FYM	N.S.			**			**		

[1]Means in the same column followed by the same letter are not significantly different

at 5 % probability level by LSD test.

[2]Means in the same row followed by the capital and bold same letter are not significantly different at 5 % probability level by LSD test.

[3]Significance levels:** p< 0.01; N.S.: Non Significant

Table 4. Effects of elemental sulphur (S) and farmyard manure (FYM) on soil EC

Sulphur doses	**Soil EC (dS m^{-1})**								
	1st soil sampling			**2nd soil sampling**			**3rd soil sampling**		
	FYM_0	**FYM_1**	**Means**	**FYM_0**	**FYM_1**	**Means**	**FYM_0**	**FYM_1**	**Means**
S_0	2.04	2.36	2.20	4.20	4.59	4.39 d[1]	2.38	2.60	2.49 e
S_1	2.31	2.42	2.37	5.06	4.58	4.82 c	2.91	3.03	2.97 d
S_2	2.31	2.44	2.38	5.45	5.10	5.28 b	3.38	3.39	3.38 c
S_3	2.16	2.42	2.29	5.30	5.85	5.58 b	3.57	4.03	3.80 b
S_4	2.29	2.42	2.35	5.49	5.62	5.56 b	3.72	4.26	3.99 b
S_5	2.22	2.43	2.32	6.00	6.46	6.23 a	4.46	4.83	4.64 a
Means	2.22 **B**[2]	2.41 **A**		5.25	5.37		3.40 **B**	3.69 **A**	
ANOVA[3]									
S	N.S.			**			**		
FYM	**			N.S.			**		
S*FYM	N.S.			N.S.			N.S.		

[1]Means in the same column followed by the same letter are not significantly

different at 5 % probability level by LSD test.

[2]Means in the same row followed by the capital and bold same letter are not

significantly different at 5 % probability level by LSD test.

[3]Significance levels: ** p< 0.01; N.S.: Non Significant

Soil EC was significantly increased by the sulphur applications (Table 4). This effect was particularly significant with the highest sulphur level in the 2nd soil sampling period. Also, soil EC increased with 3 ton da^{-1} farmyard manure applications in each three soil sampling period. However, the effect was statistically significant only in 1st and 3rd sampling period. The generated salinity was high after three weeks of sulphur application, which means that plants growing in such soils were faced high salinity problems. Addition of sulphur to two calcareous soils was found to significantly decrease the soil pH and increase the salinity [1]. Similar results were reported by Kaplan and Orman [18] such that while the soil pH was decreased, soil EC was increased in the calcareous soil by the sulphur applications.

The effects of applications of elemental sulphur and farmyard manure on total nitrogen, sulphur, phosphorus concentrations, N:S ratio and dry matter yields (g pot^{-1}) of tomato plant were presented in Table 5.

Table 5. Effects of elemental sulphur (S) and farmyard manure (FYM) on N, S, P concentrations, N:S ratio and dry matter yield of tomato plants

Sulphur doses	N (%)			S (%)			P (%)			N:S			Dry Matter (g pot^{-1})		
	FYM_0	FYM_1	Means	FYM_0	FYM_1	Means	FYM_0	FYM_1	Means	FYM_0	FYM_1	Means	FYM_0	FYM_1	Means
S_0	2.40	2.23	2.31	0.41	0.49	0.45 bc[1]	0.21	0.19	0.20	5.85 a, **A**[2]	4.55 ab, **B**	5.20	49.16	52.47	50.81
S_1	2.09	2.11	2.10	0.41	0.42	0.42 c	0.19	0.18	0.18	5.10 b, **A**	5.02 a, **A**	5.06	56.50	54.05	55.27
S_2	2.06	2.23	2.15	0.53	0.50	0.51 ab	0.20	0.20	0.20	3.89 c, **A**	4.46 ab, **A**	4.18	55.59	55.14	55.36
S_3	2.09	2.04	2.07	0.53	0.45	0.49 ab	0.18	0.19	0.18	3.94 c, **A**	4.53 ab, **A**	4.24	54.67	56.12	55.40
S_4	2.14	2.22	2.18	0.52	0.46	0.49 ab	0.18	0.19	0.18	4.12 c, **B**	4.82 ab, **A**	4.47	55.32	55.43	55.38
S_5	2.06	2.13	2.09	0.59	0.50	0.55 a	0.20	0.17	0.19	3.49 c, **B**	4.26 b, **A**	3.88	54.53	53.66	54.09
Means	2.14	2.16		0.49	0.47		0.19	0.19		4.37	4.60		54.29	54.48	
ANOVA[3]															
S	N.S.			**			N.S.			***			N.S.		
FYM.	N.S.			N.S.			N.S.			N.S.			N.S.		
S*FYM	N.S.			N.S.			N.S.			***			N.S.		

[1]Means in the same column followed by the same letter are not significantly different at 5 % probability level by LSD test.

[2]Means in the same row followed by the capital and bold same letter are not significantly different at 5 % probability level by LSD test.

[3]Significance levels: *** $p< 0.001$; ** $p< 0.01$; N.S.: Non Significant

The effects of application materials were not statistically significant on N concentration of tomato plant. However, N concentrations of tomato plants were lower than the control in all the sulphur applications. Kirkby and Mengel [19] found that high contents of sulphate in plant tissue were associated with reduced uptake of nitrate and phosphate. Orman [24] reported that although total nitrogen concentration of sorghum plant was not significantly affected by the sulphur applications to the extremely calcareous soil, the nitrogen concentration was less than the control (without sulphur). Also, total N concentration of tomato plant was significantly decreased by the sulphur applications in the hydroponic culture [13].

The P concentration of tomato plant was not significantly affected by the sulphur and farmyard manure applications. Orman [24] reported that S application to an extremely calcareous soil resulted in lower P concentration in sorghum plants compared to control. Warman and Sampson [27] reported that various amounts of S additions in K_2SO_4 and gypsum forms did not affected P concentrations of canola and spring wheat grown in a loam soil (11.6 mg extractable SO_4 kg^{-1}) and two sandy loam (9 mg extractable SO_4 kg^{-1} and 12.3 mg extractable SO_4 kg^{-1}) soils.

The S concentration of tomato plant was increased by sulphur alone. Ergle and Eaton [10] and Chapman [7] found that plants were capable of accumulating higher amounts of sulphate in their leaves when sulphate concentration increased in the growing media. The S concentration of tomato plant was not significant affected by the farmyard manure application. Knudsen and Adviser [20] reported that the oilseed rape response to S was lower on the lightest soil in trials with applications of organic manure while the plant response to additional applications of inorganic S remained high. They concluded that an application of organic manure did not prevent a S deficiency. Eriksen [12] found that application of mineral S fertilizer dramatically increased seed yield and S uptake of oilseed rape. In contrast, application rate equivalent to 25 and 50 ton slurry ha^{-1} did not affect seed yield and only slightly increased S uptake. The researcher suggested that, although animal manure can hold a considerable amount of S, it is of little value a source of sulphate for plants.

Interactive effects of sulphur and farmyard manure on the N:S ratio of tomato plant were found to be significant. The N:S ratio of tomato plant was decreased by sulphur alone. The sulphur with farmyard manure applications, however, decreased this ratio in lesser extend compared to the S applications. This is probably due to nitrogen present in farmyard manure. Accumulation of S in plant tissue could lead to an imbalance between S and other nutrients and, consequently, reduced the uptake of certain nutrients and plant growth. Janzen and Bettany [14] found that maximum rapeseed yield was obtained only when the availability of N and S were in approximate balance. The optimum ratio of available N to available S in the soil was estimated to be 7:1. They found that excessive sulphur application relative to N availability produced excessive accumulation of S in plant tissue and reduced seed yields. Abo-Rady et al. [1] reported that a N:S ratio of 9.4 to 6.4 might be considered suitable for date palm growth since the growth of seedlings was optimal in the control plants and in the plants with S rates up to 5000 µg S g^{-1}. Based on our experiment, N:S ratio of 5.06 to 4.47 might be considered suitable for tomato plants.

The dry matter yield of tomato plant was not significantly affected by the sulphur and farmyard manure applications. However, sulphur application had a positive effect on dry matter yield of tomato. While the 50.81 g pot^{-1} of dry matter was obtained as a result of S_0 application, this value was increased 6%-8% by sulphur applications in increasing doses. Kaplan and Orman [18] reported that the sorghum dry matter yield was increased by the sulphur applications. Abo-Rady et al. [1] indicated that growth of date palm seedlings was reduced at S rates over 5000 μg g-1, possibly due to the salinity and imbalance between N and S. The amount of tomato dry matter was increased to 6.9 g, 8.0 g and 9.3 g by 0, 16, 32 ppm S doses respectively in the hydroponic culture [13]. Abo-Rady and Nabulsi [2] carried out a pot experiment to investigate on the effect of 0-10 g pot^{-1} elemental sulphur to soil on barley dry matter yield. They found that dry matter yield of barley was reduced at S doses over 6 g pot^{-1} to soil.

CONCLUSIONS

According to the results of this research, elemental sulphur could be recommended as a suitable material in order to supply S to plants and to lower the soil pH. However, sulphur generated salinity in the soil. Therefore, high rates sulphur should be avoided, especially in coarse-textured soils. The fact that elemental sulphur increases soil salinity should be taken into consideration and this effect should be managed in agricultural lands under salinity risk. On the other hand, application of farmyard manure to soil showed significant but inconsistent effect on soil pH, increased soil salinity and had no significant effect on S supply to tomato plant. The N:S ratio of tomato plant was decreased by sulphur alone. However, the sulphur with farmyard manure applications decreased N:S ratio in lesser extend compared to the S applications. This is probably due to nitrogen present in farmyard manure. Because of the importance of N:S ratio in optimum nutrition of plants, especially when high rates of sulphur applied, nitrogen should be increased accordingly to maintain an optimum N:S ratio.

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CONSUMER BELIEFS AND JUDGEMENT OF TRUST IN CASE OF ORGANIC FOODS IN HUNGARY

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ABSTRACT

Organic products could mean a strategic breakthrough in Hungary as well. Our aim was to analyze consumer beliefs and their effect on trust in case of organic foods. We carried out a quantitative survey using a 1,200 member countrywide panel. According to the results one of the main consumer expectations is trust. In short term super- and hypermarkets play an important part in the increased turnover of organic foods, but trust is lost. Beside maintaining quality, in the middle and long term it is the authentic character, personal contacts and emotive communication that can help preserve the market position.

Keywords: consumer, beliefs, trust-model, health, contact, strategy

INTRODUCTION

In the last about twenty years organic production has undergone a transformation and a significant development in the whole world. *Organic products, which were regarded first as "fashion products", have become a consumer trend.* In the Western European countries – serving as a model for Hungary – easily segmentable organic-food consuming groups have formed and organic products have become more regular for human consumption.

The market of organic products is quite small in Hungary. However, based on its development potential it has strategic importance. According to a 'GfK Hungaria' Central and East European lifestyle survey, about 65% of Hungarians consider organic foods the ideal nutriment of future 3]. The aim of our research was to reveal the changes of consumer preferences and beliefs, as well as to examine their effect on the reliability of organic products. On the basis of the results we will make a proposal on creating middle- and long-term strategies.

MATERIALS AND METHODS

In the survey both secondary and primary sources of information were used. *The secondary research* aimed to examine the main specialities of the organic food market and consumer behaviour

Thereafter a nation-wide survey involving 1200 respondents was carried out. Sampling was representative on the structure of the country's population according to gender, age, qualifications, settlement size and regions [9]. *Random walking method* was used to ensure total randomness in selecting people with an equal chance. The main idea of the method was that every interviewer was given a randomly selected settlement with a randomly selected address, where from – in the increasing order of the house-numbers – they started the interviews at the third house on the same side of the street. After finishing the interview they continued the work at the next third house. The design of the sampling also ensured for the interviewer to know what to do in case of detached houses or blocks of flats. From among the tenants of the visited homes, the interviewers selected the person *(quoted sampling)* for the interview who met the previously defined demographic quotas (gender, age, qualification). The interviewers recorded the visited addresses, as well as the ones without successful interviews on a so called *contact sheet*. This method ensured the traceability of the interviewing process. In order to ensure whole anonymity and data security, the personal details of the interviewed people were not recorded.

During the p*ersonal interview carried out in the home of the respondents, standard questionnaires* were used, when the respondents were given a card set with the optional answers, and the answer was written on the questionnaire by the interviewer. The answers given were processed by mathematical-statistical software, SPSS 16.0 version. In case of *scale-type questions mean scores and ratios* were calculated. In case of other questions, the data were presented in *cross-tables* and expressed in ratios. *Chi-square test* was used to test the difference and to define the level of significance of ratios. The multivariable statistical analysis was based on *ANOVA* [9] [6].

ORGANIC FOOD MARKET IN HUNGARY

Main characteristics of organic farming: In Hungary controlled organic farming was carried out on 122 816 hectares in 2008 [7, pp.23]. Production structure can be characterized by the dominance of crop production (arable production). Organic animal production has a slight role and a lot of people are unsuccessfully seeking organic fruits and vegetables. Real data, however, on ecological production and the share of distribution channels are still in a kind of "mystic fog". They are available mostly only after some years' delay, so the market itself has already passed the point the data describe. In this way, only estimates are available about the trade of organic foods, and an officially trusted data-collecting and informing organization still does not exist.

The total turnover of the ecological products is about 30-35 million EUR in Hungary. It is less than 1% of total food turnover. The consumption level of organic foods is even lower, about 0.5% of the total [1]. *The organic production is export-oriented in Hungary*: a greater part (90-95%) of products get abroad unprocessed. Hungarian organic foods barely appear in retail market, consumers can obtain only imported and much poorer quality products. *The market has demand and supply characters at the same time*, but supply and demand don't often meet on the market.

Tendencies of organic food purchase: At the beginning in Hungary, organic products were available usually from the producers and in only unprocessed form. By the middle of 90's the majority of the sales had been settled by organic markets and bio and reform stores. By the millennium the network of specialist stores had become stronger, organic food had become available at several places in the towns of the country, too. By that time processed organic products had appeared in hyper- and supermarkets. At first, the presence of organic foods was almost unperceivable in these stores, but since then the volume has been increasing, and they are winning over more and more customers from bio and reform stores [11].

In the past years more and more positive changes could be perceived regarding the alternative distribution channels. Local delivery, which used to be almost unknown, moved out of the standstill, and 100% organic food packages are available in more and more cities. Besides seasonal vegetables and fruits, traders offer processed foods such as milk and dairy products, meat products, vegetable pastes and tropical fruits as well. The number and assortment of bio and reform shops is growing, too. However, the most successful sales channel is the organic market. In the market of the Buda part of the capital the demand is almost limitless [1]. The consumers, impressed by the imposing environment and the opportunity of direct purchase from producers, pay higher prices for organic products almost unnoticed. The alternative channels became stronger and parallel with them the trade of organic foods also increased, which is observable both in demand and supply. The increasing demand is primarily directed towards basic foods (milk and dairy products, bakery products, vegetables and fruits). The turnover of processed, ready-to-cook products is low; they are present on the shelves only as assortment widening products.

The belief that 'what looks good cannot be healthy' places a limit to buying vegetables and fruits. Many people do not trust organic foods even if they can see the control certificate or the organic label on them. Another hindrance is price-sensitivity among customers of organic foods: cheaper products are more popular. The influence of price on shopping decisions can particularly be seen in case of basic foods. During shopping, people go to stores where they usually shop, and where everything is available in one place. Therefore, a re-arrangement of the retail structure can be perceived and the winners will be the hyper- and supermarkets. Besides their easy availability, their main attractive factors are convenience and the lower prices of basic organic foods. Organic foods have not appeared in Hungarian discounts yet at all.

CONSUMERS' JUDGEMENT OF ORGANIG FOOD

Consumer behaviour is changing permanently by trends. In consumers' decisions naturalness, quality, reliability and authenticity are becoming more and more stressed. It is the same in Hungary, where we have carried out a survey with the consumers to examine the changes.

Results of quantitative research: According to former researches 60% of consumers have bought any kind of organic food in Hungary [2, pp.3] [5] [11]. However, the real trade does not support this favourable ratio. In order to receive more realistic results, first the interviewers made the consumers familiar with the term a main features of organic foods. They asked the consumers questions only after this.

First we looked for an answer to – in the form of open question – what kind of organic foods consumers had bought before. The results also gave an answer to how many percent of them have ever put organic products in their basket. The result may not be surprising: it turned out that the majority (59.2%, 710 persons) – as far as they could remember – have never bought such a product. The result is attributable to – besides giving the term – the fact that today consumers have a wider knowledge about organic products and that they are much more able to separate them from their own products or other products of the village [10].

A wider range of information and a more diversified selection available are reflected by the fact that almost 70 different – already bought – products were listed among the answers. The most frequently chosen products were fruits and vegetables (14.4%), milk and dairy products (6.9%) and bakery products (3.4%); however, organic specialities such as herbteas, sprouted seeds and pulses, soya products, rice and brownsugar have also been bought. Further 144 persons (14.4%) could not nominate the product though they have already bought one

In the next question the importance of ten different features characteristic of organic foods was analysed (Table 1).

Table 1 Importance of features characteristic of organic foods according to consumers[1]

Characteristic features	Statistics	
	Mean	**Standard deviation**
Free of chemicals	4.77	0.56
Reliability	4.71	0.64
Health benefits, health protection	4,70	0,61
Natural tastes	4.66	0.66
Certification, production strictly controlled	4.60	0.76
Environment-friendly	4.60	0.73
Big vitamin value	4.58	0.71
High nutrient value	4.41	0.82
Non GMO	4.35	1.00
Animal welfare	4.16	1.07

(n=1200) [1] 1-not important at all; 5-especially important

The results show that all of the listed characteristics are of importance in case of organic foods. Definitely the most important one is that the product is chemical-free, which is a synonym for organic food for most of the people. The food scandals of the last years may have a great influence on that reliability is one of the most important characteristics. This is important for the marketing of organic products (direct marketing). Following the positions of health benefits, health protection and naturalness, it is surprising that certification of the production control was also highly ranked. This fact reflects that the behaviour of the consumers has become more conscious: they know and are looking for markings of certifications. The next question was used to find an answer to how the consumers accept the higher price today (which was limited in the past). Both the amount of the acceptable premium price and the reasons supporting the acceptance decisions were asked on *(Figure 1).*

The results of the complex question clearly show that a significant part of the consumers (40.1%) are *willing to pay a higher price for organic products*. The reasons for paying premium price are mainly to protect their health and to avoid risks of diseases. It is evident that organic foods will never become mass products, so the high ratio of opposers is not surprising *(16.7%)*, which is similar to that of other countries with developed organic market.

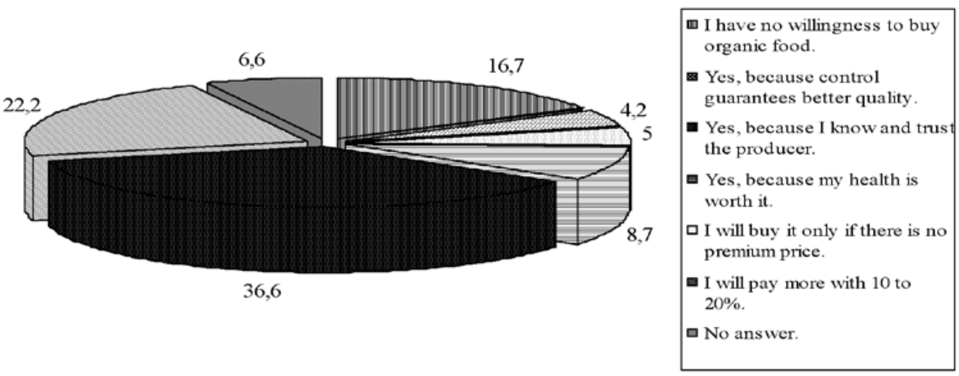

Fig 1: The consumers' answers on the price of organic foods (n=1200), %

Model of organic food-trust

Such initiatives started in the trade of organic foods after the millennium – because of the not negligible effect of the increasing number of food scandals – that are able to deepen consumer trust. Using the results of primary and secondary researches we have tried to show with a so-called *organic food trust model* (Figure 2) what is necessary to develop consumer trust.

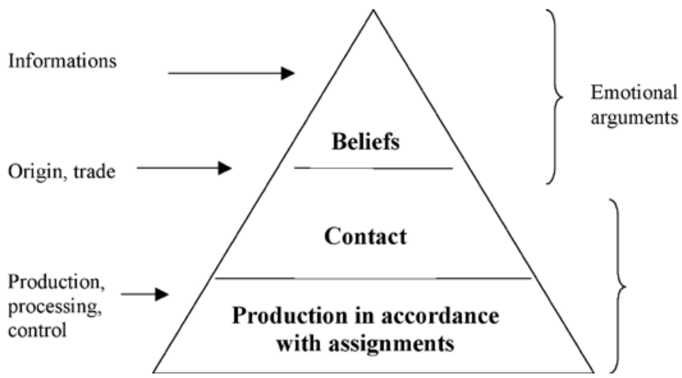

Figure 2: Model of organic food-trust

Strict assignments regard the production and processing of organic foods, and also the forming and operation of the controlling system, on which on the basis of the instructions of IFOAM on the one hand uniform, on the other hand *more superior standards* have been elaborated. This means the elementary level of the model, that is the essential requirement of the reliability of organic foods. The middle level got the *contact* name which relates to the meeting of the consumer and of the organic food. This level is influenced by the origin of products and the quality of trade (sales channel). The majority of the consumers' decisions is characterized by racionalism – due to the relative objective traceability of the processes. The third element of trust is *beliefs* that are drafted by consumers – properly or wrongfully – based on the available information. However, these beliefs are associated with *feelings (emotions),* their reception depends on the information channel and the consumers' intellectual level as well.

The most crucial part of the model is contact, according to the results trust needs to be enhanced most at this level. It is particularly true if we take the tendency in the western countries into consideration, according to which the multinational retail chains (super- and hypermarkets, discounts) gain bigger and bigger power in forming regulation beside selling, too. Under their influence the advantage, which distinguishes organic foods from conventional products is lost and as a result of price cut they become the same mass-products (conventionalism).

According to Gross's researches – as a counter-trend – consumers in Western European countries, where organic markets are well-developed, look for *organic foods from a trustworthy source and as far as possible organic foods produced locally* [4]. These consumers do not believe in the cheap organic products of discounts. The Organic Plus Strategy has been made up upon similar consideration and puts stress on the increased expectations of the consumers, among them on reliability [8].

CONCLUSIONS AND RECOMMENDATIONS

It is obvious that low price and mass-production is beneficial to business on the market of organic products in the short run, but in this form trust will be lost. Thinking in middle and long run, beside keeping quality (product-strategy), it is the authentic character, the maintenance of personal connections (selling strategy) as well as the trustworthy, emotional communication that can help to stay on the market.

The *demand character of the market* has a powerful effect on the market of organic foods, which makes the members of the product chain comfortable. Because more and more imported organic products are on the shelves, it is obvious that intervention is necessary.

The results of the research show that *consumers have had increased information for the past 3-5 years*, they have become more familiar with the main characters and effects of the organic foods. Consciousness of dietary knowledge and campaign-style programs can increase the number of the consumers of organic products. The role of collective marketing is outstanding in the course of this, which is the task not only of the Hungarian Agrarmarketing Centrum and the Hungarian Bioculture Association, but traders should also join this activity. It is necessary to put special emphasis on interest free information, on filtering false claims to avoid misbeliefs.

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ANIMAL WELFARE APPLICATIONS IN TURKEY WITHIN THE CONCEPT OF ORGANIC ANIMAL PRODUCTION

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ABSTRACT

Organic farming is gaining increasing interest from farmers, politicians, and consumers worldwide especially in Europe and for the last few years in Turkey. Generally, organic farming aims at creating a sustainable agro-ecological system based on local resources. For this respect, it is important to provide healthy animal origin products produced from local resources for human being and the next generations to come. There has been genuine interest among the pioneers of organic farming in creating livestock systems that better fulfill animal needs than do the industrialized systems in conventional agriculture.

Therefore, this paper focuses on effects of some animal husbandry practices on animal welfare within the concept of organic animal production and critically reviews the applications during the EU integration process in Turkey.

Key words: Animal welfare, organic farming, animal production, Turkey

INTRODUCTION

Animal welfare plays an important role in organic agriculture. Throughout the history of agriculture and in all facets of animal production, the welfare of farm animals has been impacted by a variety of economic, political, and social forces. Organic animal production is impacted by the same forces, but responds to them from within its own philosophical frame of reference. Concentration and centralization of the processing industry and increased societal awareness and concern about animal welfare issues have raised concerns about animal welfare during transportation and slaughter. In both organic and conventional agriculture, the accelerating rate of change affects all aspects of production and processing [1].

Aspects of animal welfare are central to all organic standards. Organic farming is the only farming system in the EU defined by regulation (Regulation 2092/92), which lays down minimum rules for organic animal production. Animals must have access to the outdoors and the number of animals per unit area must be limited. Drug and feed supplements are restricted and much of the food that the animals eat must be produced on their home farm, or organic farms in the region [2] [8].

Furthermore, the rapid growth of the organic movement and the growing food safety concerns of all consumers, results in governmental regulatory frameworks creating new challenges at a similar rate. Therefore, many beef producers are investigating ways of increasing their present production or diversifying their existing conventional beef rearing practices as a means of meeting the increased demand for organic meat as well as taking advantage of new marketing opportunities in the markets of big cities in Turkey and Europe [6] [7] [9] [14].

Organic animal production, in which ecological balance, animal welfare and health aspect in product quality are taken into consideration and emphasized, has a certain potential in Turkey. However, currently this potential is not put into use. The reasons can be stated as follows: organic plant production has developed due to the request of foreign countries, plant production is not integrated with animal production, organic feeds are rare and, especially many farmers are small land owners and are not organized to meet the prices of inspection and certification. According to the Turkish view, during the transition to the EU membership, main targets are to improve the income distribution, to overcome poverty and to activate the dynamics in agriculture. Therefore, investments in organic plant and animal production could be one of the opportunities for this transition period [11] [14].

THE ROLE OF ANIMALS IN ORGANIC FARMING

Farm animals are an important an integrated part of most organic farms. They make valuable contributions to the productivity and sustainability of organic agricultural systems. In addition to this strong economic bond between humans and animals in organic farming, there also is a moral (and sometimes emotional) bond to animals as sentient and fellow beings on this planet. This imposes a responsibility on humans for the welfare of farm animals. However, the development of organic animal husbandry has been slower than the organic plant production [3]. There are several reasons for this, historical and philosophical as well as the fact that research on animal production often is more expensive and difficult to carry out compared to crop research. However, organic animal research has increased considerably in several European countries lately and resulting from this, improved efficiency and productivity can be expected in organic animal production, as well as better animal welfare [3] [11].

There is a big interest in organic farming in Europe, both among politicians, consumers and farmers. Organic agriculture is subsidized by the EU, and the Commission is currently working on an Action Plan for organic food and agriculture. Animals are an important part of most organic farms and research to develop better organic systems is now performed in many European countries. Thus as a country trying to be a member of EU it is expected in Turkey organic animal production to increase during the years to come. At the same time there are challenges and dilemmas that the organic movement and organic farmers must face and solve to improve animal production and to maintain credibility and trust among consumers, for example in relation to animal welfare [1] [4].

Under organic rules, all aspects of animal welfare must be tightly controlled, including rearing, shelter, feeding, transportation and slaughter. Therefore, this paper put more emphasis on animal shelter, transportation and handling of animals at slaughter in Turkey within the context of welfare in organic animal production.

Transport

The EU regulation 1/2005/EC which contains important details in terms of animal welfare during transport must be complied with the rules that determine and regulate the provisions of organic principles. According to regulations, no person shall transport any animal in a way that causes, or is likely to cause, injury or unnecessary suffering to that animal [3].

In order to fulfill the requirements of the regulation:

1) Animals should have food, water and 24 hours rest before starting a journey.

2) Animals must be fit for the journey.

3) Competent and trained people should load, transport and unload the animals. This should be done calmly and without rushing.

4) The vehicle should meet statutory construction requirements and be appropriate for the species transported and for the journey. It should be driven carefully with consideration for the animals. If necessary, the driver should stop to check the animals during the journey.

5) The vehicle should give the animals enough floor space and headroom. It should protect them from the weather and have effective air circulation.

6) Partitions should be used where necessary, to divide the vehicle (to prevent animals falling or being injured) or to divide separate groups of animals (where different social groups are being transported).

7) Correct documents must be completed and carried in the vehicle.

8) Relevant cleaning and disinfection rules must be complied with.

Ideally transport times should be short and animals should be unloaded as soon as they arrive at the abattoir. The journey time should not be more than 8 hours (including loading and unloading and time at market) [3].

However, in Turkey animals are subjected to longer transport times than 8 hours especially during sacrifice festive. The below regulations are not obeyed and not tightly controlled in general.

The transport of livestock in Turkey is carried out by trucks, trains and by walking animals. But the livestock transfer by walking is prohibited by law [4]. Transport by truck is the most reliable way in Turkey. Under the current conditions in Turkey, animal health and welfare are still ignored even if the covered trucks and vans are used for transporting animals. Most importantly, the vehicles used for transport are not designed in order to facilitate the normal movement of animals and to meet their necessary needs such as water, feed, bedding and ventilation etc.

Loading and Unloading

The necessary attention is not paid when animals are loaded into trucks for selling at markets or slaughtering. The slaughterhouse should have suitable equipment and facilities for unloading animals and they should be unloaded with the minimum of delay and without causing stress or suffering [3]. If delay is unavoidable, livestock should be protected from adverse weather conditions and provided with adequate ventilation. Arrival and waiting times should be monitored by an official veterinarian to make sure they are acceptable. Action should be taken if these times regularly exceed 30 minutes. While animals being unloaded from vehicles the appropriate ramps are not used in slaughterhouses and animals are forced walking together and faster than the normal walking speed [11].

Animals should ideally be able to walk off wagons onto a secure level area leading directly into the lairage, avoiding any sharp turns.

The unloading area should be covered and the maximum ramp angle should be 20°. A designated and competent member of staff should assess the health and well-being of the animals on arrival [3]. There may be a need for immediate slaughter, where an animal is injured, or for isolation where animals are suspected of disease. (Investigations should follow in both cases.). There may exceptionally be occasions (eg due to traffic problems or breakdowns in the slaughter line) when animals have to stay in the delivery wagon, but alternative arrangements should be made wherever possible.

Lairage

Optimum lairage times vary according to type of animal, but as a general rule, they should be as short as possible and lairage capacity should be matched to the throughput of the slaughterhouse. However not many local slaughter houses in Turkey have lairage facilities [3].

According to the organic principles, every animal should be protected from adverse weather conditions and provided with adequate ventilation. Water must be available to all animals at all times in the lairage. The amount of water required depends on number of animals, their diet at source, journey time, weather and other factors. A sufficient quantity of wholesome feed should be given on arrival and twice dailym thereafter, but not within 12 hours of slaughter. The feed should be organic and records should be kept to prove organic status and quantity of feed given.Animals should have sufficient space to stand up, lie down and turn around without difficulty when penned. Overcrowding may not be an issue when animals are slaughtered quickly after arrival but they need more space if held overnight or after long periods at market or in transit [3].

An adequate supply of suitable bedding should be provided for all animals kept in lairage overnight, unless the lairage has a slatted or mesh floor. Where a field is used as lairage, the animals should be checked regularly and provided with water, feed and protection from adverse weather. Any animals that might injure each other on account of their sex, age, origin or any other reason should be kept and lairaged apart from each other.

Handling

There are three generally accepted definitions of animal welfare that need to be considered in the context of organic animal welfare philosophy at slaughter plants.

1) The subjective experience approach uses the feelings that animals experience in their lives as a measure of welfare [12]. If they "feel good", if they experience pleasure or satiety for example, they have good welfare. If they feel pain or fear they have poor welfare.

2) The biological functioning approach [12] argues that if an animal is functioning well biologically it has good welfare. Good biological functioning is defined by an unimpaired ability to perform normal biological functions, for example, normal growth, milk production, and reproductive functions.

3) The natural living approach measures animal welfare by the ability of the animal to live according to its nature. In this approach, the ability of the animal to respond to its external and internal environments with the expression of its innate behaviours is the measure of its welfare [12].

Handling at slaughter facilities and plants

Upon arrival at the slaughter plant, cattle are typically unloaded from the trucks and moved into holding pens. Plants should prefer to hold only as many cattle as the facility can kill in that day since longer holding times inevitably result in prolonged stress for the animals and decreased meat quality. There is a wide variation among plants which can be attributed to differences in the physical structures such as the handling facilities as well as the personnel differences in management and employees in Turkey [4]. There are sometimes large numbers of animals ready for slaughter at any one time and sometimes no animals to be slaughtered at all during the week. It seems in Turkey that the smaller facilities which process fewer animals at one time and may be able to incorporate specific animal welfare standards into their handling procedures. This does not necessarily mean that the handling and slaughter is any more or any less humane at smaller facilities. Only that these smaller plants do not have full-time veterinary inspectors and since the meat processed at these facilities tends to be sold directly to the butchers or consumers and not through the large retailers there is not the public scrutiny of these facilities. Thus, such poor practices may go undetected in Turkey. However, plants slaughtering fewer animals in a day do not have the time pressures that handlers in larger plants have to keep the line moving. In some slaughterhouses animals are taken collectively to the killing area and the necessary precautions are not taken for animals not to see each other. In the killing area a good drainage system does not exist in slaughterhouses and the animals get disturbed by noise and the smell of blood. Furthermore, workers in slaughter houses either have no or inadequate knowledge about animal health and welfare.

Animal sheds

A proper ventilation system is necessary to prevent the draft effects on animals. However, especially in small-scale farms animals are kept in confined barns without good ventilation. In animal sheds floor type and the lack of bedding affects animal welfare. The slopes of the ground should never exceed 10% [13].

All cattle should be kept outdoor during the grazing period, except for fattening cattle for the last 3 months of the fattening period [5]. In principle, all cattle should be kept in groups and tie-up systems are forbidden and all cattle should have access to an outdoor area throughout the year. The regulation specifies minimum space allowance per animal as shown in Table 1.

Table 1 Minimum space requirements for some farm animals.

Animal	Indoor Space (m^2/Animal)		Outdoor Space (m^2/Animal)
Calf and Breeding Bulls	CA (kg)	Space (m^2/an)	(m^2/an)
	< 100	1.5	1.1
	< 200	2.5	1.9
	< 350	40	3
	350 <	5	3.7
	>350 per 100 kg CA	At least 1m^2/100 kg	At least 0.75 m^2/100 kg
Dairy Cow		6	4.5
Breeding Stock		10	30
Sheep and Goat		1.5 Sheep / Goat 0.35 Lamb	2.5 Sheep / Goat 0.5 Lamb

Source: [5] [8].

Calves should be kept in groups from 1 week of age. The high requirements for space allowance, for bedding and access to outdoor areas is in general seen as positive in relation to animal welfare allowing the cattle to move and to display normal behavior [5] [6].

CONCLUSION

It is recommended that the government should develop appropriate policies for widespread adoption of organic agriculture by individual farmer households. Specifically, government should encourage farmers to establish effective organizations and control mechanisms to improve animal health and welfare issues [10].

An important target is to develop a monitoring system by which everybody can see that their personal concerns about the way animals are kept, managed and handled are addressed in a serious way. Not only will the monitoring scheme give a measure of welfare to consumers and retailers, but farmers and slaughterhouses will be able to use the results of the individual measures to identify strengths and weakness in their housing and management practices.

Housing conditions for livestock in Turkey must meet the livestock's biological and ethological needs. The livestock must have easy access to feed and water. The building must permit natural ventilation and light to enter as it is mentioned in the articles of the EU regulation.

The current suggestion in the EC 1804/99 regulation that 'systematic operations which lead to stress, harm, disease or the suffering of animals during the production, handling, transport or slaughtering stages should be reduced to the minimum'. However, the current animal husbandry practices in Turkey fail to prevent suffering and distress, and do not allow for the expression of normal animal behavior within the important aspects of animal welfare such as housing, transport, handling and slaughtering. Therefore, appropriate personnel, equipment, and facilities are essential to attain the highest standards of animal welfare in any organic livestock production system.

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CHALLENGES IN THE IMPLEMENTATION OF THE ORGANIC REGULATIONS ON ANIMAL PRODUCTION AT THE FARM LEVEL IN TURKEY

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ABSTRACT

In this paper, the challenges related to the organic animal production conditions of Turkey were identified and discussed in relation to the issue of harmonising organic standards. It also highlights the problems encountered in implementing organic livestock regulations at farm level in Turkey and proposes some recommendations and the measures needed to be taken to improve organic livestock production.

It is concluded that there is a need for strategies which ensure that the goals of good animal production practices and food safety on organic farms to improve organic animal production can be achieved in Turkey by measures that are adapted to local conditions.

Key words: organic farming, animal production, farm level, regulation, Turkey

INTRODUCTION

Animal production is an important part of organic farming that aims at achieving a balanced relationship between the soil, the plants and the animals in a farming system. Each component is as important as the other in contributing to the overall effect and in fulfilling the key values of naturalness, harmony, local circulation of resources and the principle of precaution. Consumers expect the food from organic production to be of a certain quality that makes it different from conventionally produced food. Acknowledged consumer interests cover a wide range of issues, from the nature of farming as a whole (environmentally friendly, socially just, animal welfare friendly) to the concern over own health [1].

Development approaches for organic animal production in developing countries has to be based on realistic and practical situations. First, one must recognize the limitation and complexities of export market for animal products, while there exists greater market opportunities for organic animal products locally, for instance indigenous chicken meat and eggs. Practical approaches for organic farming should be based on and developed from locally existing animal production systems which already have close resemblance to prescribed organic practices, such as those mentioned earlier for ruminant and indigenous chicken production. The local standards and guidelines for organic animal farming ought to be initially considered and developed from such existing animal husbandry practices. Further development of such standards will be a continuous process based on practical experiences gained from production, processing, and marketing of the resulted organic animal products [2].

The success of the promotion of organic animal farming at national level will depend on many important factors including government policies and legislative supports, socio-economic infrastructure, farm training and extension as well as other technical supports.

Organic farming works to minimize animal stress through good management techniques, providing good housing, adequate bedding and mixed or clean grazing (which helps keep down parasite-related diseases). On organic farms, 'native' breeds often play an important role in ensuring the positive health of animals. They have adapted to include suitability to locality (climate, elevation and soils), hardiness, disease resistance, temperament, and ability to thrive on a high roughage diet [2].

One of the main objectives of organic agriculture is to optimise the use and the efficiency of nutrients limited in their availability within the farm system, and, simultaneously, to produce animal products of high quality in a way that is compatible with the needs of both the animals and the environment [2]. Realising such a system-oriented approach usually requires a complete re-organization of the farm, in which cropping has to be tailored to the concerns of animal husbandry and the size and type of animal husbandry adapted to home-grown feedstuffs. The aim is to achieve animal and environment compatible production of animal products principally through precautionary and avoidance strategies [4].The EU Regulation (EEC-No. 1804/1999 amending 2092/91) was introduced to harmonise the rules of organic livestock production across member states and to set a minimum standards. It follows a systems oriented approach to obtain a good status of animal health and food safety at farm level through various provisions, such as on feeding, husbandry and housing as well as disease prevention and treatment [3] [5].

This paper examines the challenges and highlights the problems encountered in implementing organic livestock regulations at farm level in Turkey and propose some recommendations and measures needed to be taken to improve organic livestock production.

AREAS OF CONSIDERATION FOR ORGANIC LIVESTOCK PRODUCTION

Organic production practices are just one of the many options available to livestock producers to grow and market quality livestock and wholesome end-products. Organic livestock management practices offer unique rewards and challenges to the livestock producer regardless of the animal species produced. Organic livestock production often necessitates the integration of animal pasture-crop production to be successfully. The following of considerations need to be addressed to successful produce certified organic livestock and products [3] [4] [13].

Origin of Livestock

Livestock and products from the livestock that are sold, labeled, or advertised as organic must be from livestock that originate from animals that were managed under continuous organic management [9].

Availability of the various local breeds and types of farm animals reared in Turkey and their characteristics make them more suitable for organic systems. As in the Mediterranean countries, mixed flocks of large and small ruminants are common practice in Turkey. The breeds of sheep, goats and cattle used are disease resistant and adapted to the prevailing climate and food supply but differ mostly in size, with most genotypes being small. As it is reported by [5] that generally, production objectives vary between farms within and between different areas, but the main objective is milk production, and meat production is seeing as by-product of dairy cattle.

Organic standards recommend a closed herd policy as the ideal practice and the selection of animals characterised by vitality and long productive life. Breeding for disease resistant and longevity becomes a key issue, in this respect [5]. Furthermore, since organic farms are allowed (EC 1804/99) to bring in replacement animals, specific measures should be taken to prevent the introduction of disease through these animals. Emphasis should be made on the quarantine of all imported animals for at least three weeks. It is important that during the quarantine period, a qualified veterinarian should examine all animals regularly for signs of diseases.

Livestock Feed and Feeding Management

Livestock that are produced under organic management must have their total ration that is comprised of agricultural products including pasture, forage, and crops that are organically produced and handled organically. There are certain nonsynthetic and synthetic substances that can be used as feed additives and supplements. Dairy cattle under 9 months of age are allowed 20% of their feeds come from nonorganic sources. Plastic pellets, urea, manure, mammalian or poultry slaughter by-products are not allowed [9].

Feeding management with 100% organic feed can be a problem in Turkey as well as in some countries. This is primarily due to lack of vitamins and/or proteins in the fodder. In general, good feed storage and good feeding practice are very important factors and should be highlighted in organic standards [9] and included in conversion programmes of the government.

The implementation of the articles related to feeding strategies that should be practised in organic systems seems to be difficult and current practices on organic farms do not fully comply with the requirements of the regulation. Farmers should be encouraged to produce their own protein feed and concentrate, but some difficulties in relation to monogastric animals will remain for the years to come. Problems with protein supply for monogastric animals are reported to exist [10] [11] [13] and availability of certain organic feeds are limited, and importing such feeds result in high transport costs and high feed prices. This creates problems not only for sheep and poultry production but also for cattle production.

The current farming practices are the main reason for animal health problems, resulting from badly-balanced diets with home grown components, replacing maternal milk with not permitted milk replacer or early weaning, which compromises the immune status of especially young animals, failure to provide sufficient forage in the diet of herbivores or any in the diet of poultry. It is likely that in the majority of cases the farmers are not aware that the requirements of the regulation are aimed at promoting animal. Furthermore, many farmers face the difficulty in obtaining organic feedstuffs since in the country there are small number of organic livestock farmers and therefore a small market for organic products including feed for the animals.

Living Conditions

An organic livestock producer must create and maintain living conditions that accommodate natural behavior and health of the animal. The living conditions must include access to outdoors, shade, shelter, fresh air, direct sunlight suitable to the species, and access to pasture for ruminants [9].

Livestock housing is one of the main areas of non-compliance with the EU regulations related to animal living conditions in Turkey, particularly the issues of tethering (including tethering outside at pasture) and failure to meet the minimum space requirements for animals. This is partly due to the fact that farmers have no option but to continue to use old buildings with insufficient light and slatted floors, as they lack the capital required to modify these buildings or built the new ones. Insufficient bedding material is also an issue in Turkey.

Generally farmers are unaware not only that improvement of the living conditions of the animals is expected to improve their lives and, subsequently, both the product and the process quality, but also improved housing conditions are expected to minimise the risk of disease (including zoonotic diseases) and disease treatment with medicines, creating a reduced risk for contagion and residues and development of antimicrobial resistance.

The EU Regulation provides a framework which should ensure that the living conditions of organic livestock are acceptable, and better than the minimum conditions required in conventional livestock production. A high level of animal health and welfare and food safety is mainly ensured through the quality of the farm management, and the daily practices and routines. However, farmers are under pressure as conventional prices, and when faced with limited resources and conflicting aims farmers do not always give animal health the highest priority. Thus, there is a need for strategies which ensure that the goals of good animal health and food safety on farms can be achieved throughout the country by measures that are adapted to local conditions [4] [5] [6].

Waste and Manure Management

Organic livestock producers are mandated to manage manure so that is does not contribute to the contamination of crops, soil, or water and optimizes recycling of nutrients [4]. Manure can be valuable resources if well managed. However, in Turkey small farmers do not have proper waste and manure management facilities, and most of them are unaware that manure can be a source of water pollution, odor, flies, parasites and other nuisances and can contaminate drinking water, harm wildlife and reduce property values. Manure management is an important issue in the health of livestock mud and manure can cause abscesses thrush, rain scaled and other diseases in livestock. Especially in small farms dried manure produces molds that contribute to respiratory problems in animals. By adopting simple and low cost best management practices for storing, handling, managing and utilizing manure, the environment and the health farm animals will benefit [12].

As it is known manure management practices within animal sheds and facilities deserve careful attention. However, since most animals are kept in stalls or cubicles, it is difficult for farmers to remove manure from their facilities due to limited equipments. They should be informed about several alternatives for handling manure that include land disposal, stockpiling for future handling, removal from housing site, and composting in order to eliminate environmental pollution impacts and nuisances such as odor and flies.

Health Care

Organic livestock production practices require the producer to establish preventative health care practices. The health care practices include selecting the appropriate species and type of livestock, providing adequate feed, create an appropriate environment that minimizes stress, disease, and parasites, administration of vaccines and veterinary biologics, animal husbandry practices to promote animal well-being in a manner that minimizes pain and stress. Producers can not provide preventative antibiotics. Producers should not only be encouraged to treat animals with appropriate treatment, including antibiotics and other conventional medicines when needed but also informed that treated animals can not be sold or labeled as organic. Farmers should also be informed that the use of hormones, antibiotics or other drugs for growth promotion is prohibited. In fact the use of antibiotics as growth promoters has been prohibited in the EU because of concerns about increasing levels of antibiotic resistance vindicates the stance taken by the organic movement over many years [5]. The distinction between organic and non-organic farming with regard to the use of veterinary drugs is that organic farmers are only permitted to treat sick animals, whereas non-organic farmers may give them to healthy animals routinely as a precaution. However, the routine use of drugs is the cornerstone of many farmers in Turkey, regardless of concerns over pathogens becoming immune to certain antibiotics. The farmers should be informed that routine drug use also weakens an animal's immune system, increasing reliance on drugs. The EU regulation defining organic production states that an organic animal can only receive a maximum of three complete courses of antibiotics in one year before losing its organic status. The requirement of this regulation is hard to be achieved without implementation of the health management plan which should be aimed at training and education of the farmers. There is general agreement that animal health plays a dominant role in organic livestock production, but opinions as to what constitutes an acceptable health status are likely to differ between consumers, farmers and also between veterinarians [5] [6]. The impact of the EU Regulation on animal health and food safety on organic farms is therefore difficult to either describe or assess. It is difficult to assess whether any or which requirements in the organic production standards directly influence on animal health for several reasons.

Record Keeping

Organic livestock operations need to maintain records for a number of reasons. Certainly, records are important for financial management of the organic livestock enterprise. Likewise, records are important for the verification of organic status of animals, production, harvesting, and handling practices associated with the organic products and animals. Records are mandated to be maintained for 5 years, and must demonstrate compliance with the Organic Food Production Act. Farm records need to be used effectively to evaluate the animal health status of organic livestock. There is a requirement for training of advisors and inspectors in the use of basic epidemiological methods to achieve this [11]. Although the government has launched a record keeping project there are still many instances of poor farm record keeping. Very often in farms, especially small farms, farmers do not keep accounts and documentation of purchases of veterinary medicines, feeds and feed additives. Many farmers tend to enter conversion unprepared, ill-informed and not motivated by conversion subsidies and with the mistaken view that what they practise already is organic farming, simply because they do not use artificial fertiliser.

CONCLUSIONS

The variation between farms is greater than the difference between farming systems. A high incidence of disease is often found to be associated with the farm management, resources limitations and the lack of training and education of farmers in disease prevention and animal health promotion. Veterinarians, consultants and inspectors also often lack training in organic principles, and conversion plans from conventional to organic farming seldom cover the livestock enterprises. Therefore, there are certain problems to be faced at farm level in the beginning of conversion period to organic animal production. These problems can be summarized as [7]:

1- Small herd sizes and insufficient capacity

2- Production for household support

3- Giving not enough importance to animal health and welfare,

4- Lack of farmers organizations and unions

5- Shortage of technical knowledge and technical staff in organic animal production

6- Limited research on organic animal production

7- Difficulties in implementation of organic agriculture policies and lack of subsidies

8- Inadequacies in the quality-control services,

9- Eating habits of consumers and lack of consumer awareness,

10- Fluctuations in prices of animal products,

11- Lower domestic demand for organic products depending on the per capita income,

12- Availability of competitive countries in foreign markets, and

13- Reality of transition to organic animal husbandry in some sectors (agricultural medicines, veterinary medicines, chemical fertilizer, mixed fodder and additives) causing economic downturn and important unemployment problems.

The recommendations and the actions need to be taken can be highlighted in three areas:

1) There is a need to raise awareness and educate organic livestock farmers and all professionals that encouraging animal health and welfare and active disease prevention are fundamental principles of organic livestock farming. Improving knowledge by offering training to the whole profession should result in more support for farmers in developing robust systems and should enable local solutions to be found to local problems.

2) In most areas and regions the organic sector is not well developed and farmers, their advisors and other professionals have only limited experience with organic farming. In other regions such as in the north east of the country, substantial potential exists. There is a need to inseminate organic agricultural information and regulations by non-governmental or governmental extension services and best practices in health management and disease prevention across the country.

3) There is a need to strengthen the relationship between farmers, advisers and veterinarians. This will also require an exploration of how this relationship varies with different farming systems and who becomes responsible for implementing the whole organic animal production regulations and aspects.

Therefore, there is a need for strategies which ensure that the goals of good animal production practices and food safety on organic farms can be achieved in Turkey by measures that are adapted to local conditions.

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AN EVALUATION OF POTENTIALITY OF NATURAL GRASSLANDS IN THE EASTERN PART OF TURKEY FOR IMPROVING ORGANIC LIVESTOCK PRODUCTION WITH SPECIAL REFERENCE TO KARS PROVINCE

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ABSTRACT

It was estimated that 28% of Turkey is covered by pastures and grasslands. The total coverage of grasslands was estimated at 21 million ha. In general, the animal husbandry is carried out under extensive conditions and based on grasslands in the Eastern part of Turkey where Kars province is located and 41.4% of the whole grassland area of the country is present. Kars province has a unique place in the region in terms of both the number of cattle and sheep and the larger area of natural grassland available.

This paper aims to evaluate the current status of natural grasslands in the region and discuss its potentiality for improving organic farming and it is concluded that grazing management systems should be improved and local farmers should be trained and educated about organic farming practices and regulations.

Key words: grassland, livestock, organic farming, animal, production, Turkey.

INTRODUCTION

Grasslands are defined as all plant communities where grasses and herbaceous plants predominate in the absence of trees and shrubs. They cover a broad range of soil types, including mineral and calcium rich soils which give rise to species rich calcareous grasslands; deeper neutral soils where tall grasses and herbs tend to predominate giving rise to neutral grasslands; and mineral deficient acid soils which are species poor but contain plants specific to this environment [1].

In organic farming, the components of the whole farm system interact closely and grassland plays the central role in this intricate web, including the arable cropping phase. Grassland is important particularly in relation to nitrogen supply via its influence on N-fixation, soil organic matter, structure and biological activity and it also has a major role to play in restricting the build-up of arable weeds and soil-borne crop diseases in arable rotations. Ruminant livestock share this central role with grassland on most successful organic farms, and the success of the livestock enterprise is intimately tied up with the management and productivity of the grassland [4] [5].

Grasslands are being deteriorated due to the unplanned and irregular grazing systems applied, as well as mismanagement of grasslands, in general. In the development of this region with high altitude, cold climate and hard topography, animal husbandry is a vital agricultural activity. Some grassland management strategies are necessary for sustainable animal grazing practices. Therefore, ecology financial support should be considered to be included in local resource inventory, in order for determining such strategies [2].

This paper aims to evaluate the current status of natural grasslands in the region and discuss its potentiality for improving organic livestock production farming and it is concluded that grazing management systems should be improved and local farmers should be trained and educated about organic farming practices and regulations. Furthermore, organic production methods and certification standards applied to grasslands will certainly contribute to the maintenance of the ecosystem, add value to grassland products, assure income generation to farmers, and promote animal welfare in the area.

CURRENT STATUS AND POTENTIAL OF THE GRASSLANDS IN THE REGION

The grasslands account for 27.9 % of all area of Turkey, equivalent to 21,475 million hectare. In general, the animal husbandry is carried out under extensive conditions and based on grasslands in the eastern part of Turkey where Kars Province is located and 41.4 % of the whole grassland area of the country is present. Kars province has a unique place in the region, in terms of both the number of cattle and sheep and the larger area of grassland available [2] [6]. Grassland in the East Anatolia region is very rich in forage and pasture plants and a gene centre for a number of them such as lucerne *(Medicago)*, clover *(Trifolium)*, vetch *(Vicia)*, sainfoin

(*Onobrychis)*, and chickling vetch (*Lathyrus)*. The area is generally at high altitude and the pastures are severely degraded by heavy grazing. The most persistent grass species of the pastures are fescue (*Festuca*) and wheat grass (*Agropyron*). Although this is the coldest part of the country and heavy grazing has been going on for many decades causing serious genetic erosion, it is still possible to find very valuable plants in the pastures. This is because the native pasture plants are highly persistent and very well adapted to the conditions of the area [3] [9] [13]. Present conditions of natural pasture in the region: About 37% of the pastures of Turkey are here. There are fewer livestock in this area so pasture condition is better than in the rest of the country. The climate is also very well suited to pasture growth. The flora is very rich in most of the desired pasture plant species: *Agropyron* spp., *Festuca ovina, Koelaria cristata, Bromus* spp.*, Poa bulbosa, Medicago* spp.*, Onobrychis* spp.*, Trifolium* spp.*, Sanguisorba* spp.*, Artemisia fragrans, Thymus squarrosus,* and *Teuchrium* spp. are the major plant species. Because of the harsh topographic and climatic conditions in most of the region, Eastern Anatolia is essentially an animal husbandry region [3] [8] [9] [13].

Degradation of existing grassland is the number one problem facing agricultural production, rural development and environmental improvement in Turkey. Degraded grasslands mainly due to the over grazing produces much less and poorer quality herbage biomass. Consequently, it causes serious problems with livestock production and environmental protection [3] [8] [10]. Table 1 shows the land use types and the change in grasslands between the years 1984 and 2005 in the area.

Table 1. Land use type in Kars province and comparison between the years 1984 and 2005.

	1984		2005		Change	
	Area (ha)	**%**	**Area (ha)**	**%**	**Area (ha)**	**%**
Lake	2.682.7	0.28	3.640.80	0.38	958.1	0.1
Forest	41.486.5	4.33	49.534.60	5.17	8048.1	0.84
Grasland	636.477.1	66.4	543.060.70	56.7	93416.4	-9.8
Agriculture	277.374.9	29	360.252.10	37.6	82.877.20	8.65
Urban	95.8	0.01	1.628.80	0.17	1533	0.16
Total	958.117	100	958.117	100		

Source: Bozkurt et al. (2009), [7].

The results of a 3 year study conducted by Bozkurt et al. [7] showed that the allocated grasslands for agriculture use and degradated grasslands due to mismanagement have a great potential in relation to biomass, high stocking rate, rich nutritive value and botanical composition. The tendency in reduction of grassland would jeopardise national animal production sector and sustainable animal husbandry based on grassland in the region in respect for economic dynamics [7] [14].

In the last decades, Turkey has seen a dramatic degradation of natural grasslands, leading to decreasing areas of well-managed natural grasslands. This is the effect of an economic system that favours standardized "bulk" production of food and fibre, and disfavours small scale farmers in Turkey's economic periphery since it does not give full value to the variety of public goods produced on marginal grasslands. The management is threatened by the economic changes induced by increased globalisation and a high demand for cereals and other cash crops. In fact natural grasslands in the area form base for the farmer's production of food for their livelihood. The existing natural grasslands still have a great potential that there can also be a production of specialised products such as organic meat, branded cheese such as Kars cheddar cheese, and herbal medicine. These grasslands have a unique flora and fauna, and grassland habitats are among the most species-rich in the world [2] [11].

The natural grasslands in the area have highly appreciated values for recreation and as a component in a desired landscape view, thereby forming a prerequisite for the economically important tourism in rural areas. Furthermore, grasslands are important for the local cultural identity in the area, and to cultural history, being used in festivities and traditions, and forming a link to pre-industrial life and economy. Last but not least, they are an important positive factor concerning climate change, they provide ecosystem services supporting the entire agricultural landscape (such as pollination, pest control, and nutrient catchment), thereby making them a requirement for an ecologically sustainable agricultural production at large. Accordingly, the increasing loss of natural grasslands is a serious threat to the rural economy, to biodiversity conservation, to natural and cultural heritage, and to a sustainable rural development [1].

PRINCIPLES OF ORGANIC FARMING RELATED TO GRASSLAND

Grassland, and in particular forage legumes, plays a major role in almost all successful organic systems, because nitrogen (N) is the most important nutrient for most crops, and organic farming principles and standards place strong emphasis on building soil fertility with minimal use of non-renewable resources [4]. The detailed husbandry standards of organic farming are primarily based on the principles of enhancement and exploitation of the natural biological cycles in soil (e.g. N_2-fixation, nutrient cycling), in crops (e.g. manipulation of competitive ability of crops and populations of natural predators of crop pests) and in livestock (e.g. rumen digestion in ruminants, development of natural immunity in young animals, interruption of host-pathogen relationships). In addition, there is strong emphasis on optimizing animal welfare, avoidance of pollution and improvement of wildlife habitats on the farm [4] [5].

EU Regulation 2092/91 (CEC, 1991) sets out the minimum standards for organic crop production in Europe and defines how certification procedures must operate. The important elements in this in relation to grassland are as follows [4] [5]:

- seeds must have been grown organically (for at least one generation). Because of the shortage of organically grown herbage seed, EU Regulation 2092/91 currently (2003) contains a derogation that permits the use of seed from conventional production if organically grown seed of that species is not available;
- manurial supply to crops must be based on a balanced rotation including legumes, and effective nutrient cycling systems within the farm;
- only fertilizers from an approved list are permitted, and then only in certain circumstances. Generally, these approved fertilizers are either manures or mineral fertilizers such as lime and rock phosphate, that are slowly soluble in the soil. Soluble mineral fertilizers are, for the most part, prohibited. Use of conventional manure is restricted to situations where its use can be justified to the certification body (e.g. where a soil nutrient deficiency exists);
- livestock must have access to pasture during the growing season;
- ruminant livestock must be fed a diet that is at least 60 percent green forage, on a daily dry matter basis (i.e. maximum 40 percent concentrates).
- until August 2005, a derogation permits the use of up to 10 percent of non-organic feedstuffs in the annual dry matter intake of ruminants (25 percent on a daily basis). No feedstuffs are permitted that originate from genetically engineered crops; and
- livestock health policy must be based on preventative management strategies – aimed at minimizing disease challenge and maximizing the animal's ability to withstand the challenge; no routine treatment of healthy animals with drugs, except in the case of a known farm problem. However, chemotherapy of individual sick animals is permitted, although withdrawal periods are extended. Maximum of two courses of treatment permitted per individual per annum.

It can be seen from the above that the central feature of organic farming is an ecological approach to the management of the system. Soil and manure management, and grassland and livestock husbandry, are modified in order to maximize biological N_2 fixation and soil N mineralization, to minimize nutrient losses from the farm, and to minimize disease and parasite problems in livestock. Ultimately the objective is to achieve moderate levels of output from healthy and stress-free animals living in harmony with their environment, with little or no veterinary drug input, little or no fertilizer input, and little or no pesticide input [4] [5].

In contrast, conventional systems have at their disposal a wide range of fertilizers, crop protection chemicals and veterinary drugs, which enables the farmer to overcome to a large extent the natural ecological constraints of soil, crop and livestock ecosystems. The objective in conventional systems has tended to be to maximize output per unit area, whereas the organic farmer has deliberately chosen to restrict output per unit area in order to preserve fossil energy, minimize chemical input, and enhance biodiversity and animal welfare [4].

A FUTURE PERSPECTIVE ON ORGANIC GRASSLAND

In fulfilling the principles of organic livestock farming, the two major strategic objectives of farmers are to maximize the efficiency of internal nutrient cycling, thus minimizing the need for nutrient inputs, and to minimize problems by modifying the management system. These objectives are much easier to achieve in the sphere of grassland-based livestock systems than in the arable farming sphere: a wide range of herbage legumes is available to ensure an adequate N supply; there is built-in nutrient cycling by animals eating the herbage; and management opportunities exist for minimizing weed and pest problems [4]. Grassland management objectives on organic farms are not necessarily prioritised in the same order as on conventional farms. Whilst maximizing herbage and livestock output per hectare may be the common overall aim, the restrictions of the organic standards in relation to plant nutrient inputs and routine veterinary treatment of livestock mean that strategies to maintain high animal health status and to maintain soil nutrient status are equally, if not more important, than maximising herbage output per hectare in the short-term. In fact, although many conventional farmers considering converting to organic farming would be mostly concerned about maintaining herbage productivity, in systems with a high proportion of young stock such as calves and lambs, it may not be herbage production which forces a limit on stocking rate, but the risk of parasitic gastro-enteritis caused by worm invasion [5].

At the farm system level, organic livestock should be in harmony with their environment. This includes relationships with other stock, with the nutritional and physical environments to which they are exposed, and the interaction they have with humans. In this context, there is a need for further development and adoption of grassland management techniques for parasite control in livestock and efficient grazing systems. A better understanding is required of the complex links between parasite epidemiology, weather conditions, botanical composition of the sward, sward structure, grazing systems, stocking rate and stock handling [4] [5]. Another area where grassland management has a role in animal health is in mineral nutrition, particularly the balance of minerals in the herbage. In conventional farming, mineral imbalances are sometimes caused through fertilizer applications. There should be a lower risk in organic farming, where external nutrient inputs are minimized, but nevertheless greater knowledge and understanding is required. This may involve greater acceptance and use of unimproved natural pastures or, in sown swards, the use of seed mixtures with a wider range of species. Such swards and mixtures would also offer an opportunity for self-medication by animals [4].

While the agronomy of the major legumes is now sufficiently well understood to provide reliable herbage production guidelines for most farmers, there is still a need for more reliable forage conservation techniques in the area, for example by the introduction of new varieties or species and better soil management, in particular through improved soil aeration. Control of perennial weeds, particularly docks, is still one of the major problem areas in organic grassland and simple and reliable control techniques have still to be developed. Given the complexity of vegetation dynamics in grass swards, it is likely that simple solutions are not possible and that a weed control strategy is necessary [4].

CONCLUSION and RECOMMENDATIONS

Turkey is surrounded with seas from three sides, with different ecological characters, has altitude differences exceeding 5000 meters from the sea level and various climatic zones arising from those features. Therefore, Turkey has become one of the most important countries is in its geography from the point of wetlands [10]. The integration of plant and animal production is very important in these wetlands, as by introducing fodder crops into rotations programs and by providing manure, soil structure and soil nutrition content will be improved, and the cost of organic plant and animal production will be decreased [12] [14]. It may be easy to convert to organic management in animal production, if this integration takes place.

As it was concluded by [12] the north and the east parts of Turkey are especially suitable for organic animal production, with their capacity of pastures and meadow and stock of large and small animals. Also the agricultural structure, customs and the natural and economical conditions are considered to lend themselves for the development of organic farming [11]. It will be easy to convert to sheep meat and milk production in the east and the southeast regions, as sheep nutrition is based on pasture and meadow. Organic milk and beef production has a good potential, as plenty of fodder crops and wintering land is available in the northern regions [11] [12]. Grassland should be improved and fodder crops should be increased in Turkey, production of fodder crops are the basic branch to provide the integration of plant and animal production and this integration is the basic principle of organic agriculture [12].

Since the remaining natural grasslands are therefore increasingly important for biodiversity as they support a much wider variety of native grasses and herbs. The use of chemical fertiliser should not be recommeded in spite of its affect on herbage increase as the results of a study conducted [3] in the area indicated that there was no use in applying fertiliser to improve grazing performance of beef cattle in the highlands of the eastern part of Turkey in order to sustain the quality of animal production systems and environment due to the long term adverse affects of artificial fertilizer on environment.

Most of the grasslands are being plowed to gain agricultural areas in the past to meet the food demand of the livestock in the area. This trend should come to an end because almost all potential areas for organic grassland could have already been invaded for the next decades to come. The grasslands in the region should be well managed by applying the most appropriate grazing systems such as rotational grazing in order to prevent not only the destruction of existing pasture but also establishing better stocking rates and stock handling and to avoid over or insufficient grazing in some areas. Furthermore, there is a need for training and education of the farmers in the area about grassland management systems, including conservation of grass, grazing systems and the implementation of practical aspects of organic grassland. Organic production methods and certification standards applied to grasslands will certainly contribute to the maintenance of the ecosystem, add value to grassland products, assure income generation to farmers, and promote animal welfare in the area.

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STOCKLESS ORGANIC FARMING IN THE UK – LESSONS TO BE LEARNED FOR KOREA

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ABSTRACT

Several research reports show that long-term soil fertility can be attained with suitable rotation design primarily using legumes and the occasional addition of naturally occurring mineral rock. The N budget can be positively balanced through biological fixation by legumes. The levels of P, K and other minerals have not been shown to be severely depleted from stockless organic production over 11-year rotations. Pests, diseases and weeds problems do not seem specifically different in stockless organic farming. Analysis of farm economic data in the UK also illustrates that stockless organic arable rotations are consistently more profitable than conventional stockless arable rotations. Stockless organic farming could become feasible by reinforcing several organic farming practices even though performance varies between regions, farmers, crops, and climatic conditions. Korean organic farming needs to pay more attention to this stockless system to tackle high input issues and attain better sustainability utilizing its own knowledge and conditions effectively.

Key words; stockless, organic farming, soil fertility, Korea, UK

INTRODUCTION

Since 1990 in the UK, the possibility of the introduction of organic farming without livestock has been reviewed through the government supported research program (OF0102, e.g.)[3]. For further development of the organic industry, reduced external input practices need to be popularized in major arable areas as well as traditionally small scale production. Stockless organic crop production means 'lack of livestock and animal manure inputs in organic production'[4]. In stockless systems, fertility building leys are cut/topped and mulched in without grazing and no animal-based manures are brought-in[5]. For those farmers who want to convert to organic, 3 options may be possible to take; to either invest capital for the introduction of livestock such as fence and storage facilities (stock-based), to rely on brought in organic fertilizer (semi-stockless) or to develop an alternative self-sufficient system without animals (stockless). The requirement to introduce livestock may act as a barrier to organic conversion due to high costs associated with capital investment in housing etc., as well as the new types of management skill required to farm livestock successfully[6]. With regard to semi-stockless system, organic fertilisers and manures could be brought in at relatively high cost or could be produced on the farm, though the costs of this are also likely to be relatively high because of high organic feed and animal keeping cost, etc[7-9]. Furthermore, relying on purchased organic fertilizers does not seem appropriate for long term sustainable farming and does not match well with organic principles which pursue holistic production by using renewable resources within closed systems[10] and minimizing external inputs[11]. The purpose of this study is to review how stockless organic production has performed in the UK recently, and its potential application to the long term development of Korean organic farming by stockless organic production.

MAJOR ISSUES OF STOCKLESS ORGANIC FARMING

Soil and crop nutritional source. Nutrients for soil and crops are largely within farm sources such as fertility-building leys or cover crops in between main crops; leguminous break crops (e.g. beans or peas) between rotations for N replenishment; on-farm plant wastes and some from outside the farm (e.g. purchased manure from neighbour organic farming or commercial organic fertilizer). Organic farms of course are characterised by using no synthetic fertility sources.

Soil nutrients (N, P, K) budgets. Studies have shown that soil mineral nitrogen was found to be at at higher levels post conversion to organic, especially in red clover-based fertility building systems (85.4 to 98.6 kg N/ha)[25]. The same trend was confirmed in the 2nd and 3rd year of following organic production[26]. When N, P, and K farm level budgets were compared between stockless and stock-based organic arable farming (Table 1)[27] [28] [29], stockless organic farms showed that the N was positively balanced by 7-96kg N/ha/year. Major N losses were crop off-take (82 kg N/ha/year) and leaching (44 kg N/ha/year) in stockless organic farming[27]. According to Schmidt (1999), even one year clover green manure positively impacted on potato yield. N import seems higher than N export throughout most rotations so that N budget does not seem to be issue in stockless organic farming. The level of P and K content seemed unaffected severely after stockless organic conversion and maintenance (Table 1). On-farm level investigation showed P and K budgets were slightly lower (-5 kg P and -37 kg K) in 5-year stockless rotation than in stock-based organic farming (11 kg P and -4 kg K)[27]. Another P and K budget in stockless organic farming was 1.9 kg P and -20 kg K (Table 1)[28]. In a German 5-year experiment on stockless organic production, the change of soil K and P was from 15.6 to -13.2 mg K/kg and -22.7 to -26.2 mg P/kg between the beginning and end point[30]. Meanwhile, there was no significant effect of different conversion strategies on P and K level[26]. From above, it might be carefully said that K and P level are largely being kept stable without drastic decreases during conversion and of stockless organic rotation production. However, if there is no input with P and K in the longer term, it may be unavoidable that these elements decrease over time in stockless organic farming[28].

Nutrients budgets	Stockless organic farming			Stock organic farming		
	N	P	K	N	P	K
1[27]	7	-5	-37	27	11	-4
2[28]	96	1.9	-20			
3[31]		-9.5 - 2.9	-38 - -20		-16.2 - 33.9	-64 - 26
4[29]	9 - 64	-8 - 4	-62 - 19			

Table 1. N, P and K budgets (kg/ha/year) between stockless and stock-based organic farming.

Soil organic matter changes. In field experiments of stockless organic production, organic matter content slightly dropped (from 3.2% to 2.5% after 3 years but stabilized at 2.5%) or increased slightly (from 2.0% to 2.5%) in the UK[32]. The total amount of crop and weed residues added to soil during the conversion period was high, ranging from 18.1 t/ha to 20.6 t/ha with 2-year red clover leys followed by a hairy vetch ley and second year red clover[25]. So, organic matter level is generally considered to be kept stable due to the better incorporation of material from fertility building leys and recycling of plant wastes without losing nutrients by animal uptake and sale out of farming system under stockless organic production.

Pest and disease control. A variety of pest and disease prevention measures[33] are more likely to be adopted under stockless organic systems because it has relatively shorter term rotations than mixed farming systems[5]. Some stockless field trials showed that pest and diseases could be controlled effectively by the rotations and pests and diseases have not emerged as severe problems in stockless rotations [32, 34]. Some pests and diseases such as slugs on potatoes and calabrese and nematodes and weevils on potatoes are occurring in the UK[34], however the issue of pest and disease in organic farming may not make big difference between stockless and stock-based organic farming. Given the various farming conditions such as soil, temperature, rainfall and crop species, careful cropping order in rotations and biological and agronomical measures would be more important factors within and surrounding farming sites.

Weed problems. The level of annual weed species has increased in stockless organic production fields, particularly perennial grasses such as couch and creeping thistle have emerged as a real problem in 11-year stockless organic fields in the UK[32]. In the experiment by the University of Nottingham, there was lower weed abundance in the first year of organic production after two-year red clover leys rather than one-year red clover plus one-modified year (Huxham *et al.*, 2005). The weed biomass was proven to be lower in high fertility building strategies than exploitative cash crop introduction in the second year stockless organic conversion. In the following 2nd and 3rd year stockless organic production, larger number of weeds was recorded in cash crop strategies in conversion[26]. These results may imply that a longer, more dominant and better established ley period (e.g., red clover) could be more effective for the suppression of weed abundance in the following year by giving less chance to sunlight and losing seed viability without any further addition of fresh weed seeds[35]. Leake (2000) also reported that using red clover during fertility building could reduce weed establishment due to its stronger weed competitiveness. Consequently, well established longer fertility building leys will become effective tools in the following stockless organic production. The appropriate adoption of cultural practices considering break crop, cover crop, intercropping and undersowing techniques will be also effective for weed control in both stockless and stock-based organic farming alongside with the improvement of manual and mechanical weeding measures[16, 36]. It still need further research considering the different climates, cultivation conditions and crops as well as neighbouring weed species. **Productivity and economic viability.** Yield may be greatly affected by the soil fertility, crop and variety choice, rotational design, farm management practices as well as internal/external input level and other physical elements such as climate and soil and the species of legume sown before main crop due to the differences of N fixation rate[13, 36]. Sweet beets yield was highest after white clover, red clover and lucerne leys among 10 legumes for fertility building in Sweden [37]. In a German experiment on stockless organic farming, the yield was affected by both the amount and quality of off-farm plant-based N source [30]. Individual productivities of stockless organic production compared to stock-based organic production were 83.5% in potato, 109.2% in winter wheat, 128% in spring wheat, 117% in winter bean, 103% in spring bean and 80% in winter oats[32]. Total average productivity of stockless organic production was 97.0 % compared to stock-based organic production. From above, the productivity of stockless organic production is regarded as almost the same level with stock-based organic production. The results of two stockless organic production projects (Project 'OF0112 and 145' by the UK government) have shown that stockless arable rotations are consistently more profitable than conventional[38]. Stockless yields were lower than conventional yields by 44% in potato and 22% in winter wheat but the rolling average profits were higher than conventional yield by 165% in potato and 121% in winter wheat due to the organic premium. However, the economic viability of stockless organic production can be said to be dependent on many elements including soil condition, choice of crop, the selling price, productivity and cultural conditions.

CONCLUSIONS: RELEVENCE OF STOCKLESS ORGANIC PRODUCTION TO KOREAN ORGANIC FARMING

Several cases have shown that stockless organic arable production could be agronomically viable based on green manure during the fertility building ley [3, 22, 38, 39]. The soil N level could be maintained at a similar or same level and no drastic decrease of P and K level seems to occur even after organic conversion without livestock and fertilizer import[39, 40]. These soil fertility conditions may however vary according to the growing conditions and differences of rotational practices and additional P and K input may be needed for longer term sustainability[41]. Nevertheless, stockless organic farming has been showing its feasibility in the UK from the evidences provided. Some UK organic arable farmers have been running stockless systems for more than 20-30 years[13], although there has been relatively little research on stockless organic production. Consequently, it may be carefully said that the current stockless organic production can be a viable option at the appropriate considerations. At the moment, Korean organic farming faces several problems including high dependency on external inputs, intensive production practices, poor livestock related infrastructure as well as poor discrimination from other Environmentally Friendly Agriculture (EFA) practices [42-44]. Current Korean practices are no more than alternative farming using expensive outsourced materials to replace the chemicals[43]. So, stockless organic farming seems to be a feasible option for Korea in several aspects, by avoiding the requirement for livestock and their associated capital costs and minimizing external inputs for which current Korean organic farming is viewed as unsustainable, by being better matched with Korean agricultural conditions which are dominated by plant rather than livestock production and which therefore are based on similar knowledge and experiences of farming, as well as by being a good means to meet discriminated consumer demands for sustainable food sources.

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Turkish Presentations

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ORGANİK ÇİLEK YETİŞTİRİCİLİĞİNDE BAZI BESİN UYGULAMALARIN MEYVEDEKİ ASKORBİK ASİT (C VİTAMİNİ), ELLAJİK ASİT VE NİTRAT İÇERİKLERİ ÜZERİNE ETKİSİ

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ÖZET

2005 ve 2006 yıllarında Eğirdir (Isparta) Bahçe Kültürleri Araştırma Enstitüsünde yapılan bu çalışmada organik çilek yetiştiriciliğindeki bazı uygulamalar ile konvansiyonel yetiştiricilikteki uygulamanın meyvedeki askorbik asit (C vitamini), ellajik asit ve nitrat içerikleri üzerine etkisi belirlenmiştir. Çalışmada Camarosa çilek çeşidi kullanılmış ve denemede 18 farklı uygulama yapılmıştır. Dikim frigo fide ile temmuz ayının üçüncü haftasında yapılmış olup sulamada damla sulama yöntemi kullanılmıştır. Elde edilen verilere göre; meyvedeki askorbik asit içeriği 74,62-99,57 mg/100g, ellajik asit içeriği 0,487-0,498 mg/100g arasında değişmiş ve uygulamalar arasındaki fark önemli bulunmamış, nitrat içeriği ise 1,43-4,57 mg/kg arasında değişmiş ve uygulamalar arasındaki fark önemli bulunmuştur.

Anahtar Kelimeler: Organik çilek, besin uygulamaları, askorbik asit, ellajik asit, nitrat

GİRİŞ

Organik tarım, giderek yoğunlaşan tarımsal girdi kullanımından kaynaklanan çevre ve sağlık sorunlarının çözümünde alternatif bir yöntemdir [1]. Organik tarımın giderek yaygınlaşmasıyla, organik yetiştiricilikte kullanılabilecek bitki gelişim düzenleyici ve besin içerikli preparatların üretimi de çoğalmaya başlamıştır. Organik yetiştiricilikte; toprak özellikleri bakımından iyi durumda olan toprakların korunması, yapısı bozulmuş toprakların ise iyileştirilmesi esastır. Özellikle bitki besleme uygulamalarında toprağın yapısını bozan değil aksine düzelten materyallerin kullanılmasına dikkat edilmelidir.

Türkiye'de çilek yetiştiriciliği sıcak iklime sahip sahil bölgelerde tek yıllık olarak yapılırken, daha serin olan yüksek bölgelerde çok yıllık olarak yapılmaktadır. Türkiye toplam çilek üretimi yaklaşık 250 bin ton [4] olup, bu üretimin yaklaşık 9 bin tonu organik olarak yapılmaktadır [5]. Organik çilek üretimi tüm dünyada olduğu gibi Türkiye'de de hızla artış göstermektedir. Bunun en büyük nedeni, çileğin değişik toprak ve iklim koşullarında ekonomik olarak yetiştirilebilmesidir. Çilek, pazarda taze meyvenin az olduğu dönemlerde olgunlaşması nedeniyle de iyi bir pazar avantajına sahiptir. Çileğin insan sağlığı ve beslenmesi açısından sağladığı yararlardır çok fazladır. Özellikle C vitamini bakımından zengin olan bu meyvenin 100 gramında 100 mg'a kadar çıkabilen C vitamini bulunmaktadır [18]. Çeşitlere göre çileğin; şeker miktarı 5,40-11,00 g/100ml, organik asit miktarı ise 1,20-1,80 g/100ml arasında bildirilmektedir [9]. Olgun çilek meyvesinin yaklaşık % 90'ı su, % 10'u ise suda çözünebilir kuru madde miktarından oluşmaktadır [11].

İnsan sağlığı açısından anti kanserojen, anti mutajen ve kardiyovaskuler hastalıklar açısından ellajik asit önemli bir fenolik bileşiktir. Çilekte fenolik bileşikler bakımından en fazla bulunanını ellajik asittir [13] [12]. Bir çok meyveye göre çilek daha yüksek ellajik asit içermekte olup [19], meyvelerdeki ellajik asit miktarların çeşitlere göre ve hasat olgunluğuna göre değişmektedir [14]. Ohio'da yapılan bir çalışmada, Jewel çilek çeşidinin Earlyglow ve Kent çeşitlerine göre daha düşük ellajik asit içerdiği belirlenmiştir [9]. Araştırıcılar [6] 6 çilek çeşidi ile yaptıkları çalışmada meyvelerindeki ellajik asit içeriklerinin 0,9-1,9 mg/100g arasında değiştiğini belirtmektedirler. Çilek çekirdekleri meyve etine göre çok daha fazla ellajik asit içermektedir [14]. Benzer bir sonuç olarak ahududu çekirdeklerin %88, etinin ise %12 ellajik asit içerdiği belirlenmiştir [7].

Meyve–sebze yetiştiriciliğinde dikkat edilmesi gereken önemli bir konu; yenilen kısımların nitrat ve nitrik içeriklerinin insan sağlığına zarar vermeyecek sınırlar içerisinde olmasıdır. Özellikle organik meyve yetiştiriciliğinde bu konu daha da önem kazanmaktadır. Araştırıcılar nitratların ve nitritlerin sebzelerde, meyvelerde, yem bitkilerinde, tatlı sularda doğal olarak bulunduğunu, besinlerdeki fazla nitrat ve nitritler direkt olarak insan ve hayvan sağlığını tehdit ettiğini bildirmişlerdir [14] [15].

MATERYAL VE YÖNTEM

Çalışma Eğirdir Bahçe Kültürleri Araştırma Enstitüsünde 2005 ve 2006 yıllarında yürütülmüştür. Bitkiler 30 cm yükseklikte, 100 cm genişliğindeki seddeler üzerine 30 cm X 30 cm kare şeklinde dikilmiştir. Dikim frigo fidelerle temmuz ayında yapılmış olup, deneme, tesadüf blokları deneme desenine göre 5 tekerrürlü olacak şekilde 2 yıllık olarak kurulmuştur. Bitkisel materyal olarak Camarosa çeşidi kullanılmıştır. Sulama, damla sulama ile yabancı ot mücadelesi el çapası ve malç (siyah polietilen) kullanılarak yapılmıştır.

Çalışmada etkisi denenen uygulamalar; 1- Organik yetiştiricilik (15 farklı besin uygulaması ile besin uygulaması olmayan K-1 uygulaması), 2- Konvansiyonel yetiştiricilik, 3- Kontrol (K-2)' dür Besin uygulamaları olarak; organik yetiştiricilikte Çizelge 1'de görüldüğü gibi; çiftlik gübresi (ÇG), yeşil gübreleme (YG), klinoptilolit (Kln), deniz yosunu (DY) ve bunların kombinasyonları denenmiş, konvansiyonel yetiştiricilikte ise toprak analiz sonuçlarına göre dikim öncesi; azot, birinci yıl; azot ve fosfor, ikinci yıl; azot, fosfor ve potasyum uygulaması yapılmıştır. Ayrıca ikinci yıl hem organik parseldeki tüm uygulamalara hem de konvansiyonel parsele demir uygulaması yapılmıştır. Kontrolde ise hiçbir besin ve zirai mücadele uygulaması yapılmamıştır.

ÇG	ÇG+YG	ÇG+YG+DY	YG+DY
YG	ÇG+Kln	ÇG+YG+Kln+DY	YG+Kln+DY
Kln	ÇG+DY	ÇG+Kln+DY	Kln+DY
DY	ÇG+YG+Kln	YG+Kln	K-1

Çizelge 1. Organik yetiştiricilikteki besin uygulamaları

Çalışmada askorbik asit (C Vitamini) analizi için meyveler hasat edilir edilmez laboratuvar ortamına getirilerek +4 ^{0}C'li soğutuculara konmuş ve aynı gün analiz işlemlerine başlanmıştır. Metafosforik asitle ekstrakte edilen örnekler filtre edilerek yüksek HPLC sıvı kromatografisinde okunmuştur [19]. Analizde kullanılan HPLC cihazı Agilent 1100, dedektörü Diod Array dedektör olup akış hızı 1000 ml/dakikadır. Okumalar 251 nm dalga boyunda yapılmış ve elde edilen sonuçlar mg/100g olarak tespit edilmiştir.

Ellajik asit içeriğini belirlemek için meyveler derimden sonra sıvı azotta dondurulmuş ve analiz yapılıncaya kadar derin dondurucuda bekletilmiştir. Ellajik asit ektraksiyonu için 3 g meyve alınmış ve 10 ml aseton:su (1:4 oranında) ile karıştırılıp 0.1 ml TFA (Trifluoressiqsaure asetik asit) eklenerek 100 ^{o}C' lik su banyosunda 1 saat ekstrakte edilmiştir. Örnekler filtre edilerek Shimadzu WP marka HPLC sıvı kromatografisinde 200-600 nm dalga boyunda okunmuş ve elde edilen sonuçlar mg/100 g olarak tespit edilmiştir. Kullanılan dedektör Fotodiod Array dedektör, kolon Nucleosil C 18 (150 mm x 4,6 mm) olup akış hızı 1 ml/dakika dır. Solvent A: % 2,5 Formik asit (HCOOH) suda, Solvent B: % 2,5 Formik asit Asetonitril içinde karıştırılarak hazırlanmıştır [13].

Nitrat İçeriğinin belirlenmesi için tesadüfi olarak alınan 500 g meyvede önce nitrit miktarı tespit edilmeye çalışılmış ama örneklerin hiç birinde nitrit tespit edilememiş ve formülde sıfır "0" değerini almıştır. Nitrit tayini için, numune sıcak su ile (40-45 ^{o}C) ekstrakte edilerek proteinler potasyum hegzasiyanoferrat ve çinko asetat ile çöktürülüp süzülmüştür. Filtrata sülfanilamid klorid ve n-(1-naftil) etilendiamin dihidroklorür ilave edilerek kırmızı bir kompleks oluşturulmuş ve Biocrom 8500 II marka spektrofotometrenin 538 nm dalga boyunda okunmuştur. Nitrat tayini için; Nitrit tayinindeki filtrat metalik kadmiyum ile nitrite indirgenerek elde edilen filtrat, renk reaktifi ile kırmızı bir kompleks oluşturulmuş ve Biocrom 8500 II marka spektrofotometrenin 538 nm dalga boyunda okunarak aşağıdaki formülle hesaplanmıştır [2].

NO_3 (ppm)= 1.348 x [(Seyreltme oranı x spektrofotometrede okunan değer)-(NO_2 kons.)]

ARAŞTIRMA BULGULARI VE TARTIŞMA

Askorbik Asit (C Vitamini) :Çilek meyvesi bir çok meyveye göre daha fazla askorbik asit (C vitamini) ihtiva etmektedir. Askorbik asit değerleri Çizelge 2'de gösterilmiştir. Bu değerler incelendiğinde istatistiksel açıdan yıllar arasındaki fark ile uygulama x yıl interaksiyonu önemli bulunurken, uygulamalar arasındaki fark önemli bulunmamıştır. Elde edilen verilere göre en yüksek değer birinci yıl K-2'den (93,58 mg/100 g), ikinci yıl ÇG+YG+DY (99,57 mg/100g) uygulamasından elde edilmiş, en düşük değer ise birinci yıl Kln+DY (74,62 mg/100g), ikinci yıl ÇG+Kln+DY (88,77 mg/100 g) uygulamasından alınmıştır. Yıllara göre askorbik asit incelendiğinde birinci yıl ortalaması 86,06 mg/100g iken, ikinci yıl ortalaması 94,49 mg/100g olmuştur. Finlandiya'da yapılan bir çalışmada konvansiyonel ve organik olarak yetiştirilen çileklerde C vitamini bakımından aralarında fark belirleyemediklerini ve C vitamini miktarının çeşitlere göre 32,40-84,70 mg/100g arasında değiştiğini belirtmişlerdir [9]. Araştırıcılar [18], çileğin 100 gramında 100 mg'a kadar çıkabilen C vitamini bulunmakta olduğunu belirtmektedir. Bu veriler bizim bulgularımızı desteklemektedir.

Ellajik Asit: İnsan sağlığında anti kanserojen, anti mutajen ve kardiyovasküler hastalıklar açısından ellajik asitin önemli bir yeri vardır. Ellajik asit değerleri Çizelge 2'de gösterilmektedir. Bu değerler incelendiğinde, istatistik bakımdan uygulamalar ve yıllar arasındaki fark ile uygulama x yıl interaksiyonu önemli bulunmamıştır. Camarosa çilek çeşindeki ellajik asit miktarının uygulamalara göre değişmediği ve değerlerin 0,487 mg/100g ile 0,498 mg/100g arasında bulunduğu görülmüştür. Araştırıcılar, çileğin olgun meyvelerinde 0,36 mg/100g ellajik asit tesbit etmişlerdir [13]. Başka bir çalışmada organik ve konvansiyonel yetiştiricilikten elde edilen meyveler arasında toplam fenolik asit miktarı (ellagic, p-coumaric, caffeic ve ferulic asit) açısından farklılık görülmediği belirtilmiştir [12]. Bu veriler bizim bulgularımızla örtüşmektedir.

Uygulamalar	Askorbik Asit (mg/100 g)			Ellajik Asit (mg/100g)		
	2005	2006	Ortalama	2005	2006	Ortalama
ÇG	89,53 $^{a-f}$	92,80 $^{a-e}$	91,17	0,492	0,491	0,492
YG	93,55 $^{a-e}$	95,45 $^{a-c}$	94,53	0,492	0,489	0,491
Kln	90,47 $^{a-f}$	93,59 $^{a-e}$	92,03	0,490	0,488	0,489
DY	85,32 $^{a-f}$	95,11 $^{a-c}$	90,22	0,494	0,494	0,494
ÇG+YG	77,29 $^{d-f}$	95,68 $^{a-c}$	86,48	0,493	0,493	0,493
ÇG+Kln	93,49 $^{a-e}$	94,52 $^{a-d}$	94,00	0,494	0,496	0,495
ÇG+DY	92,35 $^{a-e}$	98,06 ^{ab}	95,21	0,495	0,493	0,494
ÇG+YG+Kln	90,27 $^{a-f}$	99,35 ^{a}	94,81	0,495	0,489	0,492
ÇG+YG+DY	86,76 $^{a-f}$	99,57 ^{a}	93,17	0,494	0,490	0,492
ÇG+YG+Kln+DY	76,82 ^{ef}	89,86 $^{a-f}$	83,34	0,494	0,491	0,492
ÇG+Kln+DY	81,98 $^{b-f}$	88,77 $^{a-f}$	85,36	0,489	0,497	0,493
YG+Kln	82,82 $^{a-f}$	92,47 $^{a-e}$	87,64	0,496	0,497	0,497
YG+DY	86,05 $^{a-f}$	97,87 ^{ab}	91,96	0,496	0,487	0,491
YG+Kln+DY	85,86 $^{a-f}$	96,41 ^{ab}	91,13	0,493	0,496	0,495
Kln+DY	74,62 ^{f}	92,21 $^{a-e}$	83,41	0,490	0,498	0,494
K-1	89,19 $^{a-f}$	91,88 $^{a-e}$	90,54	0,494	0,494	0,494
Konvansiyonel	78,86 $^{c-f}$	89,11 $^{a-f}$	83,98	0,491	0,491	0,491
K-2	93,58 $^{a-e}$	98,01 ^{ab}	95,80	0,490	0,492	0,491
Ortalama	86,06 ^{b}	94,49 ^{a}	90,26	0,492	0,492	0,492
$D_{\%5}$ (yıl)	2,03			öd		
$D_{\%5}$ (uyg)	öd			öd		
$D_{\%5}$ (uyg x yıl)	17,09			öd		

Çizelge 2. Askorbik Asit (C Vitamini) ve Ellajik Asit Değerleri (**öd:** önemli değil)

Nitrat: Meyvedeki nitrat miktarları Çizelge 3'de gösterilmiştir. Bu değerler incelendiğinde, istatistiksel açıdan uygulamalar ve yıllar arasındaki fark ile uygulama x yıl interaksiyonu önemli bulunmuştur. Denemedeki verilere göre en yüksek değer birinci yıl (4,57 mg/kg) ve ikinci yıl (4,06 mg/kg) konvansiyonel yetiştiricilikten elde edilirken, en düşük değer birinci yıl DY (1,68 mg/kg), ikinci yıl K-1'den (1,43 mg/kg) alınmıştır. İçerdikleri nitrat miktarına göre çilek meyvesi orta nitratlılar grubuna (200-600 mg/kg) girmektedir [2]. Denemeden elde edilen veriler değerlendirildiğinde uygulamaların hiç birinde bu sınırlara ulaşılmamıştır (0-200 mg/kg) yer almıştır.

Uygulamalar	Meyvede Nitrat (mg/kg)		
	2005	2006	Ortalama
ÇG	3,60 $^{a-d}$	2,03 ^{ef}	2,82 ^{bc}
YG	1,98 ^{ef}	1,68 ^{ef}	1,83 $^{d-f}$
Kln	2,17 $^{d-f}$	1,62 ^{ef}	1,90 $^{c-f}$
DY	1,68 ^{ef}	1,73 ^{ef}	1,70 ^{ef}
ÇG+YG	2,91 $^{b-f}$	2,47 $^{c-f}$	2,69 $^{b-d}$
ÇG+Kln	3,86 $^{a-c}$	1,92 ^{ef}	2,89 ^{b}
ÇG+DY	3,08 $^{b-d}$	2,03 ^{ef}	2,53 $^{b-f}$
ÇG+YG+Kln	2,79 $^{b-f}$	2,57 $^{c-f}$	2,68 $^{b-d}$
ÇG+YG+DY	2,97 $^{b-e}$	1,96 ^{ef}	2,46 $^{b-f}$
ÇG+YG+Kln+DY	3,09 $^{b-d}$	1,87 ^{ef}	2,48 $^{b-f}$
ÇG+Kln+DY	2,57 $^{c-f}$	2,17 $^{d-f}$	2,37 $^{b-f}$
YG+Kln	2,42 $^{c-f}$	2,21 $^{d-f}$	2,32 $^{b-f}$
YG+DY	2,38 $^{c-f}$	1,87 ^{ef}	2,13 $^{b-f}$
YG+Kln+DY	2,55 $^{c-f}$	2,21 $^{d-f}$	2,38 $^{b-f}$
Kln+DY	2,84 $^{b-f}$	2,40 $^{c-f}$	2,62 $^{b-e}$
K-1	1,90 ^{ef}	1,43 ^{ef}	1,67 ^{f}
Konvansiyonel	4,57 ^{a}	4,06 ^{ab}	4,31 ^{a}
K-2	1,88 ^{ef}	1,81 ^{ef}	1,85 $^{d-f}$
Ortalama	2,70 ^{a}	2,14 ^{b}	2,42
$D_{\%5}$ (yıl)	0,173		
$D_{\%5}$ (uyg)	0,917		
$D_{\%5}$ (uyg x yıl)	1,480		

Çizelge 3. Meyvede Nitrat Değerleri

SONUÇ

Organik çilek yetiştiriciliğindeki uygulamalar ile konvansiyonel çilek yetiştiriciliği askorbik asit (C vitamini) ve ellajik asit değerleri bakımından karşılaştırıldığında aralarındaki farkın istatistiksel açıdan önemli olmadığı görülmektedir. İki yılın ortalamasına göre askorbik asit 83,34-95,80 mg/100 g, ellajik asit 0,489-0,495 mg/100g arasında değişmiştir. Organik olarak yetiştirilen çileğin konvansiyonel olarak yetiştirilenlere göre daha sağlıklı olduğu bilinmektedir. Bununla birlikte nitrat ve bazı metallerin belirlenen sınırlardan daha yüksek olması insan sağlığını tehdit etmekte ve kansere kadar varan hastalıkların oluşmasına neden olabilmektedirler. Elde edilen nitrat değerlerine göre; hem birinci yıl (4,57 mg/kg) hem de ikinci yıl (4,06 mg/kg) konvansiyonel yetiştiricilikten elde edilen değerlerin organik yetiştiricilikteki değerlerden (1,43-3,60 mg/kg) daha yüksek olduğu tespit edilmiştir. Çilek meyvesi göre orta nitratlılar grubunda belirtilmesine rağmen [2] denemedeki tüm uygulamalardan elde edilen değerler düşük nitratlılar grubunda yer almıştır. Bu bulgulara göre hem organik ve hem de konvansiyonel yetiştiricilikten elde edilen tüm ürünlerin nitrat yönünden güvenli olduğu söylenebilir.

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TÜRKİYE SEBZE GENETİK KAYNAKLARININ ORGANİK BİTKİ ISLAHI İLE ORGANİK ÇEŞİT GELİŞTİRİLMESİNDE KULLANILABİLİRLİKLERİNİN DEĞERLENDİRİLMESİ

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ÖZET

Bitki genetik kaynaklarının korunması, dünyada teknolojik, sosyoekonomik ve politik gelişmelere bağlı olarak son yıllarda oldukça hızlı bir ilerleme göstermiştir. Organik tarımda genetik kaynakların değerlendirilmesi, doğrudan bu çeşitlerin yetiştiriciliğinin ve tüketiminin teşvik edilmesi yada dolaylı olarak bu çeşitlerden yeni çeşitler geliştirmek üzere ıslah çalışmalarında etkin olarak değerlendirilmesi yoluyla gerçekleştirilmektedir. Bu çalışmada, organik tohum üretimi için organik bitki ıslahının önemi, Türkiye sebze genetik kaynaklarının mevcut potansiyeli ve mevcut genetik kaynakların ülkemizde organik sebze çeşitlerinin geliştirilmesinde değerlendirilebilirlik durumları incelenmiştir.

Anahtar Sözcükler: sebze, genetik kaynaklar, organik ıslah, çeşit, organik tohum, Türkiye

GİRİŞ

Günümüzde yetiştirdiğimiz ve kullandığımız kültür bitkileri ve çeşitler, yüzyılların ve hatta bin yılların ürünleri olup, aralıksız olarak süregelen bitki ıslahı çalışmaları sonunda oluşmuştur. Günümüzde organik tarım için organik ıslah yeni bir taleptir [1]. Uluslararası Ekolojik Tarım Hareketleri Federasyonu (IFAOM) organizasyonuna göre organik bitki ıslahı, organik tarım ve biyoçeşitlilik potansiyelinin artırılabilmesi için bitkilerin geliştirilmesi olarak tanımlanmaktadır [2]. Biyo-çeşitliliğin devamında bir çoğaltma birimi olarak tohum hayati bir önem taşır. Mevcut biyo çeşitliliğin korunması için organik üreticisi ve ıslahçı birlikte çalışmalıdır. Organik bitki ıslahı ile elde edilen tohumlar, GDO riski taşımaz. Organik bitki ıslahı, az dış girdi ve yüksek ürün kalitesiyle özellikle bölgesel bazda yapılan tarımda bitkilerin daha iyi yetişmesine sağlayacaktır (2). Organik ıslahı, klasik ıslah yöntemlerine göre bazı güçlükler içermektedir [3]. Bunlar; ıslah süreci daha uzun sürmesi, ıslah etkinliğinin daha zayıf olması, maliyetin daha fazla oluşu, gen kaynakları temininde ki sıkıntı (geleneksel ıslah programları ile materyal değişimi yasak) ve biyotik ve abiyotik stres koşullarına dayanıklılığın hızlı gerçekleşmemesi şeklinde özetlenebilir.

Organik bitki ıslahının uygulanmasında güçlükler olmasına rağmen, organik tarımda uyulması gereken temel kurallar vardır. Klasik ıslah ve biyoteknolojide kullanılan bazı uygulamalara organik ıslah çalışmalarında ya izin verilmemekte (Direkt gen aktarma, ışın ve kimyasal mutasyonlar, protoplast füzyonları) yada geçici olarak kullanımına tolere edilerek (embriyo kültürleri, in vitro tozlamalar, ovaryum ve anter kültürleri) izin verilmektedir [3].

Organik tohum üretiminde organik çeşit ıslahının önemi

Tohumculuk sektörünün temel uygulama alanı, bitki ıslahı ve çeşit geliştirme üzerinedir. Islahçılar mevcut genetik çeşitlilikten yararlanarak, adaptasyon, verim, kalite, hastalık ve zararlılara dayanıklılık yönünden istenilen özelliklere sahip makineli tarıma uygun, bakımı kolay ve ekonomik bitki çeşitlerini seçme veya geliştirme yolunda önemli başarılar elde etmiştir [4]. Organik tarım, yetiştiricilik özellikleri nedeniyle bu sistemin gerektirdiği koşullara uygun çeşit seçimini zorunlu kılmaktadır**.** Böylece organik üretim için gerekli olan organik tohum talebi yeni bir üretim ihtiyacını ortaya çıkarmıştır. Dünyada son yıllarda tarımsal ve ekonomik öneme sahip pek çok bitki türünde mevcut sorunların çözümüne yönelik olarak yürütülen çalışmaların sonucunda organik ıslah ile geliştirilmiş çeşitlerin organik tohum üretimleri yapılmaktadır. Organik tarımda organik çeşitler; doğal yollarla çoğaltılması, sürdürülebilir olması, tarımsal biyoçeşitlilik için yüksek değerler taşıması, daha iyi korunma ve dayanıklılık mekanizmaları (kalın mumsu tabaka, tüylülük vb gibi) sağlaması, daha güçlü kök sistemleri ve daha iyi mikorizal ilişki oluşturmaları nedeniyle büyük bir öneme sahiptirler [3]. Buna karşın organik çeşitlerin gelişmesi için yapılan çalışmalar henüz yeterli düzeyde değildir. Günümüzde birçok or-ganik üreticisi halen,konvansiyonel yöntemler ile ıslah edilmiş modern çeşitleri kullanmaktadırlar [5]. Ancak bu çeşitlerin organik tarım şartlarına en uygun çeşitler oldukları söylenemez. Bu bakımdan organik yetiştiriciliğe iyi adapte olmuş, güvenilir, kaliteli, stabil verime sahip, "organik çeşitlere" ihtiyaç vardır [6].

Türkiye Sebze Genetik Kaynaklarının Mevcut durumu ve Organik Tohum Üretiminde Çeşit Geliştirilmesi Amacıyla Değerlendirilmesi

Ülkemiz, önemli gen merkezlerinden biri olup hem gen kaynakları ve hem de genetik çeşitlilik yönünden büyük bir önem arz etmektedir. Ülkemizin, Yakındoğu ve Akdeniz gibi iki orijin ve farklılık merkezi üzerinde bulunduğu, bilimsel olarak kabul edilmiştir [7]. Florasında 163 familyaya ait 1225 cins ve 9000 tür bulunan ve bunlardan 3000 türü endemik nitelikte olan Türkiye'nin; 203 familyaya bağlı 2500'ü endemik 12.000 türe sahip tüm Avrupa ülkeleri ile karşılaştırıldığında bitkisel gen kaynakları bakımından ne kadar zengin bir ülke konumunda olduğu kolaylıkla anlaşılır. Bu nedenle genetik materyalin korunması ve kullanımına ilişkin çalışmaların Türkiye için ayrı bir önemi vardır [8,9]. Birçok bitki türünün gen merkezi Anadolu sınırları içinde yer almaktadır. Bunlar arasında birçok tarla bitkisini hariç tutarsak, ülkemiz bazı sebze türlerinin orijini olup, birçoğunun da mikro gen merkezi durumundadır [9]. Ülkemiz gen merkezi konumunda olmadığı birçok bitki türü için de çok yüksek düzeyde genetik varyasyon barındırmaktadır. Ege Tarımsal Araştırma Enstitüsü bünyesinde bulunan Ulusal tohum gen bankasında 1964-2009 yılları arasında toplanmış bulunan sebze genetik materyallerin dağılımları Tablo 1'de verilmiştir. Ülkemizde yerel sebze genetik kaynaklarımızın ıslahı ve organik tohum üretiminde değerlendirilebilme durumu üzerinde üniversiteler, araştırma enstitüleri, üretici birlikleri ve özel sektör tarafından son yıllarda sayıları az da olsa bazı araştırma ve çalışmalar yapılmaya başlanmıştır. Ege Üniversitesi Ziraat Fakültesi tarafından 2007 yılında yürütülen çalışmada organik tarım koşulları altında yetiştirilen bazı eski yerel domates populasyonları verim ve kalite özellikleri yönünden incelenmiştir. İncelenen eski yerel sofralık domates populasyonlarından bazıları organik ıslah programları için ümitvar bulunmuştur. Araştırma sonucunda 5, 6 ve "PI 10931561AI" numaralı domates tiplerinin verim özellikleri, 4 ve TR43730 nolu populasyonların ise meyve kalite özellikleri yönünden seçilerek ıslah programına alınmasına karar verilmiştir [10]. Ondokuz Mayıs Üniversitesi Ziraat Fakültesi tarafından yerli yaprak lahana genetik materyalleri içerisinden ıslah edilerek geliştirilen yaprak lahana çeşitlerinin (Balkaya, Yanmaz, Elif ve Ayça) organik tohum üretimlerine önümüzdeki yıllarda başlanılacaktır.

Atatürk Bahçe Kültürleri Araştırma Enstitüsü tarafından domates (Invictus Lot 335 çeşiti), biber (Yalova yağlık 28 çeşiti), patlıcan (Pala 49 çeşiti) ve pırasada (İnegöl 92 çeşiti) sertifikalı organik sebze tohumluk üretimini başlatmıştır. Tohumluğu üretilen çeşitler, bu kuruluş tarafından ıslah çalışmaları ile geliştirilen çeşitlerdir. Bu türlerin dışında lahana (Yalova sarmalık) ve ıspanakta (Matador) organik tohumluk üretim çalışmaları halen devam etmektedir [11].

Özel sektör kuruluşları içerisinde ise Asgen Tarım, 2005 yılında organik sebze tohum üretimi çalışmalarına başlamıştır. 2008 yılında 1 adet sertifikalı, 4 adet geçiş süreci çeşit ile organik sebze tohum üretimi yapılmıştır (12).

Erzurum Organik Tahıl Üreticileri Birliği (EOTÜB) tarafından hazırlanan „Organik Tohum Üretimi" projesiyle, 2010 yılından itibaren Türkiye'nin 111 çeşit yerli tohumu, Erzurum'da oluşturulacak 200 dekarlık alanda organik olarak üretilmesi planlanmaktadır (13). Bu proje ile, Bursa'nın pembe domatesi, Uşak'ın uzun kabağı ve Kırkağaç kavunu gibi Türkiye'ye özgü farklı birçok ürünün tohumunun üretimi, 2010 Mayıs ayında üretime başlanacağını bildirilmiştir.

SONUÇ

Sebze ıslah çalışmalarında karşılaşılan en büyük sıkıntı, ticari isteklere ve gereksinimlere cevap verecek nitelikli genetik materyalin bulunmasıdır. Genetik kaynakların karakterizasyonları yapıldıktan sonra ıslah programlarında değerlendirilmesi ve organik tohum üretiminde kullanılması hem çeşitliliğin korunması ve hem de bitkisel üretimin sürdürebilirliği açısından son derece önemlidir. Ülkemizde organik sebze tohum üretimindeki bu eksikliğin giderilmesine yönelik ulusal düzeyde çok sayıda araştırma ve çalışmalara ihtiyaç vardır.

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Familya	Bilimsel ismi	Materyalsayıları	Familya	Bilimsel ismi	Materyalsayıları
Solanaceae	*Capsicum annuum*	1060	*Leguminosae*	*Phaseolus vulgaris*	4
	C. annumvar. grossum	37		*Phaseolus vulgaris*	1273
	C. annum var. longum	26		*Pisum spp.*	160
	C. frutescens	15		*Vicia faba*	341
	Lycopersiconesculentum	4		*Vicia spp*	6
	Lycopersicon esculentum	540		*Vicia spp.*	1069
	Solanum melongena	465		*Vicia spp.*	821
Beta	*B. adanensis*	16	*Cucurbitaceae*	*C. melo*	571
	B. corolliflora	26		*C. melo flexuosus*	74
	B. intermedia	58		*C. sativus*	297
	B. lomatogona	91		*Cucumis* spp.	8
	B. macrohirza	6		**C. lanatus**	358
	B. maritime	37		*C. pepo*	160
	B. trigyna	11		*C. moschata*	93
	B. trojona	17		*C. maxima*	29
	B. vulgaris	123		*Cucurbita spp.*	455
	B. vulgaris var. altissima	7		*L. siceraria*	172
	B. vulgaris var.cicla	52		*E. elaterium*	5
Brassicaceae	*Brassica oleracea*	198	*Umbelliferae*	*Apium graveolens*	1
	Brassica spp.	3		*Apium graveolens*	7
	Brassica spp.	77		*Anethum graveolens*	20
	Brassica rapa	24		*Daucus carota*	100
	Brassica napus	15		*Daucus spp.*	66
	Brassica campestris	1		*Petroselinum spp.*	107
	Brassica nigra	65	*Amaryllidaceae*	*Allium cepa*	3
	Brassica cretica	6		*Allium cepa*	107
Compositae	*Lactuca sativa*	2		*Allium porrum*	1
	Lactuca sativa	189		*Allium porrum*	68
	Lactuca sativa	112		*Allium sativum*	360
				Allium spp.	112

Tablo 1. Türkiye sebze genetik materyallerinin familyalarına göre dağılımı (AAR I, 1964-2009)

BURDUR YÖRESİNDE KÜLTÜRÜ YAPILAN ANASON, KİŞNİŞ VE REZENEDE ORGANİK TARIMA GEÇEBİLME OLANAKLARI

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ÖZET

Bu çalışma, Türkiye'nin anason (*Pimpinella anisum* L.), kişniş (*Coriandrum sativum* L.) ve rezene (*Foeniculum vulgare* Mill.) ihtiyacının büyük oranda karşılandığı Burdur ili çevresinde yürütülmüştür. Yörede münavebeli tarım yapıldığı ve herhangi bir pestisit uygulaması yapılmadığı ancak bazı üreticilerin herbisit kullandıkları saptanmıştır. Araştırmada, uçucu yağ oranları su distilasyonu yöntemiyle volumetrik olarak ve uçucu yağdaki bileşen ve oranları ise GC/MS ile belirlenmiştir. Buna göre uçucu yağ oranları anason, kişniş ve rezenede sırasıyla ortalama % 3,20, % 0,40 ve % 1,90 olduğu bulunmuştur. Anason uçucu yağında ana bileşenin % 95,55 oranında Anethole, kişnişte % 80,90 oranında Linalool ve rezene de % 96,94 oranında Anethole bulunmuştur.

Anahtar kelimeler: *Pimpinella anisum* L., *Coriandrum sativum* L. ve *Foeniculum vulgare* Mill., uçucu yağ, Anethole, Linalool.

GİRİŞ

Ülkemizde tıbbi ve aromatik bitkilerden sağlanan organik ürünler doğadan toplama ve kültür ortamında yetiştirme şeklinde olmaktadır. Ancak doğadan toplanan bitki materyallerinde toplama yeri ve toplama yöntemi özellikle ürünün organik olması ve doğada sürdürülebilirliğinin korunması adına önemli konu başlıklarıdır. Bunun dışında doğadan toplanan materyallerde botanik tanımlama, olgunlaşmada homojenlik ve kalitede standart sağlayabilmek mümkün olmamaktadır. Bu gibi temel sebeplerden özellikle gıda, kozmetik, ilaç, içecek ve temizlik sanayi birçok alanda yaygın olarak kullanılan anason (*Pimpinella anisum* L.), kişniş (*Coriandrum sativum* L.), ve rezene (*Foeniculum vulgare* Mill.) yetiştiriciliğinde de organik tarım sistemine geçmek gerekmektedir. Şemsiyeçiçekliler=Maydanozgiller (Umbelliferae=Apiaceae) familyasına bağlı olan bu bitki türleri, rezene dışında tek yıllık otsu bitkilerdir. Anason bitkisinin meyveleri, kişnişin yeşil aksamı ve meyveleri, rezenenin ise yeşil aksamı, kökleri ve meyveleri halk arasında yaygın olarak kullanılmaktadır [1]. Anason meyvesinde % 1-4 oranında bulunan uçucu yağın ana bileşeni *trans*-anethole [(*E*)-anethole]' dür [2] ve uçucu yağın % 80-90'ını oluşturmaktadır[1]. Anason ve anason uçucu yağı tat verici olarak gıdalarda, alkollü (bitterler, brendiler, rakı, likörler, vs.) ve alkolsüz içkilerde, donmuş süt mamullerinde, şekerlemelerde, unlu mamullerde, jel ve pudinglerde, et ve et mamullerinde kullanılmaktadır. Ayrıca anason uçucu yağından ilaç, kozmetik ve temizlik mamullerine koku verici olarak da yararlanılmaktadır. Tıp ve eczacılıkta ise karminatif, stimülan, hafif spazmolitik, zayıf antibakteriyal ve ekspektoran etkileri sebebiyle öksürük ilaçları ve pastillerin terkibine girmektedir [2]. Kişnişin hava kurusu meyvelerinde ise % 0.03-2.6 oranında uçucu yağ ve % 9.9-27.7 oranında sabit yağ bulunmaktadır. Uçucu yağın ana bileşeni olan Linalool % 19-82 oranında, sabit yağın ana bileşeni olan Petroselinik asit ise % 54.6-75.5 oranında bulunmaktadır [3]. Kişniş halk arasında gaz giderici, yatıştırıcı, iştah açıcı ve kuvvet verici olarak bilindiği gibi, şekercilikte ve özellikle likör yapımında da kullanılmaktadır [1][4].

Rezenenin, *Foeniculum vulgare* var. *vulgare* (acı rezene) ve *Foeniculum vulgare* var. *dulce* (tatlı rezene) olmak üzere iki önemli varyetesi bulunmaktadır. Rezene meyvesi % 10-20 arasında değişen sabit yağ, uçucu yağ (acı rezenede % 3-6, tatlı rezenede % 2-4) ve % 15-20 oranında da protein içermektedir. Uçucu yağın ana bileşeni olan *trans*- anetol acı rezenede % 30-60 ve tatlı rezenede ise %60-80 oranında bulunmaktadır[5].

Bu çalışmada, geniş kullanım alanı olan ve ülkemizde kültürü yapılan anason, kişniş ve rezene bitkilerinin yörede agronomik açıdan hangi yöntemlerle yetiştirildiği belirlenmiştir. Ayrıca kalite ve standartlara uygunluğun belirlenmesi amacı ile de meyvelerinden elde edilen uçucu yağ oranları, uçucu yağ bileşenleri ve bileşen oranları saptanmıştır. Geniş kullanım alanı olan bu bitkilerin Burdur yöresinde organik olarak üretilebilme olanakları araştırılmıştır.

MATERYAL ve YÖNTEM

Araştırma, 2009 yıllında, Akdeniz Bölgesi ile İç Anadolu Bölgesi arasında geçit konumunda bulunan Burdur ili Karamanlı ilçesinde tarımı yapılan anason (*Pimpinella anisum* L.), kişniş (*Coriandrum sativum* L.) ve rezene (*Foeniculum vulgare* Mill.) meyvelerinden alınan örneklerde yürütülmüştür. İlçede anason, kişniş ve rezene tarımı yapılan arazilerde ekim öncesinde 2 kez güz sürümü yapılmaktadır. Ekimler, o yılın hava koşullarına göre şubat sonu mart başında yapılmakta ve dekara 1250 gr tohum gelecek şekilde serpme ekim yöntemiyle yapılmaktadır. Bazı üreticiler ekim ile birlikte dekara 15-30 kg DAP, dekara 30 kg 20:20:0 ve 10 kg üre gübresi vermektedirler. Yetiştirme periyodunda bitkinin ihtiyacına göre iki kez salma sulama yapılmaktadır. Hasatlar, yine o yılın iklim koşullarına göre temmuzun son haftası ile ağustosun ilk haftalarında yapılmaktadır. Yetiştirme periyodunda herhangi bir pestisit uygulaması yapılmamaktadır. Yabancı ot mücadelesi, herbisit uygulaması ve el çapası ile yapılmaktadır. Her iki yılda bir diğer kültür bitkileri ile münavebe uygulanmaktadır. Anason meyveleri 13 farklı üreticiden alınırken, 10 farklı üreticiden kişniş ve 5 farklı üreticiden rezene meyveleri temin edilmiştir. Alınan meyve örnekleri bekletilmeden değirmende parçalanmış ve distilasyon işlemine alınmıştır. Uçucu yağ oranları üç tekerrürlü olarak su distilasyonu yöntemi ile Neo-Clevenger apareyi kullanılarak 3 saatte elde edilmiş ve kuru madde üzerinden mililitre/100 gr (%) olarak hesaplanmıştır [6]. Uçucu yağ bileşenleri GC/MS analizi ile Süleyman Demirel Üniversitesi Uygulama Merkezinde Shimadzu GC/MS-QP 5050 A kullanılarak gerçekleştirilmiştir.

BULGULAR VE TARTIŞMA

Anason, kişniş ve rezene meyve örneklerine ait ortalama uçucu yağ oranları, uçucu yağ kompozisyonları ve standart sapma değerleri çizelgede verilmektedir. Çizelge incelendiğinde anason meyvelerinde uçucu yağ oranının ortalama % 3,20 olduğu ve uçucu yağın ana bileşenin % 95,55 ile anethole olduğu görülmektedir. Yapılan diğer araştırmalarda anasonda ana bileşenin anethole olduğu, en düşük ve en yüksek oranların % 76,9-95,21 arasında değiştiği bildirilmiştir [7][8][9]. Kişnişte uçucu yağ oranının ortalama % 0,40 olduğu ve ana bileşenin % 80,9 ile linalool olduğu çizelgeden görülmektedir. Diğer araştırmacılar olgun kişniş meyvelerinde ana bileşenin Linalool olduğunu ve oranların % 79,86-87,54 arasında değiştiğini belirtmişlerdir [10][11][12]. Rezenede uçucu yağ oranının ortalama % 1,90 olduğu ve ana bileşenin % 96,94 oranında anethole olduğu ilgili çizelgeden görülmektedir. Yapılan diğer araştırmalarda rezenede anethole oranlarının % 81.63-96,74 arasında değiştiği bildirilmiştir [13][14].

	Rt	**ANASON**	**KİŞNİŞ**	**REZENE**
Allyl anisole	48,6	1,49	-	3,06
Anethole	50,6	95,55	-	96,94
Chamigrene/humulene	50,6	1,20	-	-
2-dodecenal	59,9	-	1,80	-
Geraniol	58,5	-	2,91	-
Geranyl acetate	53,3	-	14,39	-
Linalool	40,0	-	80,9	-
Uçucu yağ oranı %	-	3,20±0,08	0,40±0,13	1,90±0,28

Çizelge: Anason, kişniş ve rezenede uçucu yağ ve bileşen oranları (%)

SONUÇ

Çalışma sonucunda yörede yetiştirilen anason, kişniş ve rezene meyvelerinin ana bileşen yönünden diğer çalışmalar ile paralellik gösterdiği hatta bazılarının yüksek değerlere sahip olduğu görülmektedir. Yapılan önceki bir çalışmada, yörede ekim öncesi ve sonrası pestisit uygulamasının yapılmaması, her iki yılda bir kez münavebe uygulanması gibi doğaya dost önlemler adı geçen agro-ekosistemlerdeki yararlı böcek türlerinin biyolojik çeşitliliklerinin artışını, zararlı türlerin ise yararlı böcek türleri sayesinde baskı altında tutulduğunu gösterdiği belirtilmektedir [15]. Buradan da hareketle, yörede yetiştirilen bitkilerin kalite yönünden de standartlara uygunluğu ve yetiştiriciliğin tam olarak konvansiyonel yöntemlerle yapılmıyor olduğu düşünüldüğünde, üreticilerin organik tarım konusunda bilinçlendirilmesi halinde organik üretim yapan çoğunluğun sağlanabilmesi ile kontrol ve sertifikasyon masraflarının da düşeceği göz önüne alınarak yörede organik tarıma geçiş sürecinin başlatılabileceği düşünülmektedir.

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SÜRDÜRÜLEBİLİRLİK, AGROTURİZM VE PEYZAJ MİMARLIĞI

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ÖZET

Ekonomik turizm ya da topluma dayalı sürdürülebilir turizm olarak da ifade edilen agroturizm, alışılmış uygulamaların dışında temel amacı alternatif turizm seçenekleri kapsamında turistlerin tarımsal aktivitelere katılması, çiftlik yaşamının deneyimlenmesi gibi coğrafi, kültürel ve geleneksel özelliklere dayandırılmış, kentsel-kırsal ve sosyal iletişimi güçlendiren, çevreye en az zarar veren, modern ancak geleneksel bir turizm yaklaşımı; iş etkinliği ve deneysel tatile doğru bir geçiştir. Bu poster bildiride, genel anlamda sürdürülebilir turizm yaklaşımı irdelenerek agroturizm tanımlanmış, alt bileşenleri ve kaynak potansiyeli ortaya konmuştur. Daha sonra, agroturizm/tarım turizmi kapsamında farklı coğrafi, iklimsel ve çevre özellikleri ile büyük çeşitliliğe ve potansiyele sahip olan Türkiye'nin farklı yörelerinde başlatılan örnek uygulamalar tartışılmış ve peyzaj mimarlığı açısından değerlendirilmiştir.

Anahtar Kelimeler: Türkiye, sürdürülebilirlik, agroturizm, tarım turizmi, kırsal turizm, çiftlik turizmi

GİRİŞ

Tarım ve turizm gibi sürdürülebilirlikleri doğal kaynaklara bağlı olan iki önemli ekonomik faaliyet, yanlış uygulamalar nedeniyle çoğu kez çevreye büyük zarar vermekte ve sektör olarak bu olumsuz gelişmelerden etkilenmektedirler. Çünkü, bir bölgenin doğal çevresi ve ekosistemi, o bölgede turizmin geleceğinin güvence altına alınması ve turizmin yaratabileceği olumsuz etkilerin en alt düzeye indirilebilmesi için korunması gereken en önemli kaynak olmaktadır [3]. Tarım ve turizme kaynak oluşturan bu değerlerin koruma-kullanım dengesinin sağlanması ve gelecek nesillere aktarılmasında; sürdürülebilir kalkınma ilkeleri temeli üzerinde gelişme gösteren ve toplumsal sorumluluk, ekonomik verimlilik ve ekolojik duyarlılık içeren sürdürülebilir turizmin önemi büyüktür. Sürdürülebilir turizm kapsamında gelişen agroturizm ise tarım ve turizm faaliyetlerini birleştiren önemli sosyo-ekonomik ve kültürel bir etkinliktir. Özellikle kırsal alanlarda gerçekleştirilen ve doğa temelli bir turizm türü olan agroturizmin önemini vurgulamak amacıyla yapılan çalışmada, Türkiye'de agroturizm kapsamında gerçekleştirilen örnek projeler incelenerek çevre kaynakları peyzaj mimarlığı meslek disiplini çerçevesinde değerlendirilmiştir.

TURİZM VE SÜRDÜRÜLEBİLİRLİK

Genel anlamı ile çevre kaynaklarının doğru, sağlıklı ve etkin kullanımı yolu ile gelecek kuşaklara aktarımını hedefleyen sürdürülebilirlik kavramı bugün hayatın her alanında etkin olmakta ve uygulanması için yöntemler tartışılmaktadır. Sürdürülebilir turizm de bu kapsamda ortaya çıkmış, turizm kaynaklarının tüketiminin engellenmesini öngörürken yerel ölçekte korumacı ve ekonomik girdi sağlayan ve yerel halk katılımı ile gerçekleştirilebilecek bir olgu olarak gelişmiştir. Sürdürülebilirlik; "bugünün ihtiyaçlarını karşılarken doğal kaynakları korumak ve gelecek nesillere iyi bir çevre bırakmak için yapılan faaliyetler" olarak tanımlanmış [1]; bu kavram ilk kez Mart 1980'de yayımlanan Dünya Koruma Stratejisi (WCS-The World Conservation Strategy) ile kamuoyunun dikkatini çekmiştir [2]. 1988 yılında ise Dünya Turizm Örgütü (WTO-World Tourism Organisation) tarafından sürdürülebilir turizmin ilkeleri belirlenmiş ve sürdürülebilir turizm "kültürel bütünlüğü, temel ekolojik süreçleri, biyolojik çeşitlilik ve yaşam destek sistemlerini korurken aynı zamanda ekonomik, sosyal ve estetik ihtiyaçları da sağlayabilecek şekilde tüm kaynakların yönetimi olarak öngörülmüştür" şeklinde tariflenmiştir [5]. Sürdürülebilir kalkınmada doğal çevreyi tahrip etmeden ve bugünün gereksinimlerini, gelecek nesillerin gereksinimlerini karşılama olanaklarından ödün vermeden karşılamak esastır. Bu temel ilkeler kapsamında gelişen sürdürülebilir turizm, yerel toplumların yaşam kalitesini geliştiren, ziyaretçiler için kaliteli deneyim sağlayan, doğal, tarihi ve sosyo-kültürel kaynakları uzun vadede koruyan, geliştiren ve aynı zamanda yerel ekonomik gelişmeyi de destekleyen bir turizm türüdür. Sürdürülebilir turizmin gelişmesindeki en önemli faktör ise doğal çevrenin korunması, yenilenmesi ve ekolojik dengenin sürdürülebilirliğinin sağlanmasıdır.

AGROTURİZM

Alternatif turizm arayışları kapsamında gündeme gelen ve bir sürdürülebilir turizm ve ekoturizm türü olan agroturizm yani tarım turizmi de çevre duyarlı, insanlara ve çevreye saygılı, endüstrileşmemiş bir turizm biçimi olup daha çok kırsal alanlarda uygulama olanağı bulan bir turizm yaklaşımıdır. Büyük şehirlerin sınırları içinde ya da çevresindeki mücavir alanlarda çiftçilik yapan üreticilerin şehre yakın olmalarının sağladığı doğrudan satış olanağını kullanmaları yolu ile başlayan agroturizm, üretici-tüketici ekseninde gerçekleştirilmektedir. Ziyaretçilerin daha çok çiftlik evlerinde ya da küçük pansiyon veya otellerde ağırlanmasına yönelik sorumlu bir turizm türü ve iş etkinliği olan agroturizm, kentsel-kırsal anlamda sosyal iletişimin doğrudan kurulmasına da katkı sağlamaktadır. Dünya'nın bir çok ülkesinde yaygın bir şekilde uygulanmakta olan agroturizm uygulamaları kapsamında Türkiye'de de uygun tarım alanları için projeler ve uygulamalar gerçekleştirilmektedir. T.C. Kültür ve Turizm Bakanlığı tarafından 2007 yılında hazırlanan Türkiye Turizm Stratejisi 2023 Eylem Planı'nda; ekoturizm bölgelerinin belirlenmesinde doğa temelli turizmin planlı gelişimi strateji olarak belirlenmiş, Karadeniz Bölgesi'nde yer alan Bolu, Zonguldak, Bartın, Kastamonu ve Sinop illerini kapsayan bölge, Antalya'nın iç kesimlere doğru doğusu, Torosların eteklerinde Antalya ve Mersin'in birleştiği alanlar ve "GAP Ekoturizm Koridoru" biyolojik çeşitlilik ve ekoturizm potansiyeli açısından Türkiye Turizm Stratejisi'nde öncelikle ekoturizmin geliştirileceği bölgeler olarak belirlenmiştir. Bu alanlarda doğal kaynakların kullanımında, sürdürülebilirlik ilkesine bağlı kalmak ve biyolojik çeşitliliği koruyarak ekoturizmin yaygınlaştırılmasını sağlamak hedeflenmektedir. Söz konusu bu bölgelerde, koruma ve kullanma dengeleri gözetilerek doğaya uygun yerel mimari özelliklerini taşıyan yapılaşma, pansiyonculuk, agroturizm faaliyetleri, yerel halkın kalkınmasına katkı sağlayacak el sanatları ve yöresel örneklerin sunulduğu atölyeler, markalaşma yönünde ilk adımları oluşturabilecek yöresel ürünlerin değerlendirilmesi öngörülmektedir [4]. Buğday Ekolojik Yaşamı Destekleme Derneği'nin Ekolojik Tarım Turizm Bilgi ve Tecrübe Takası (TaTuTa) Projesi ile, ekolojik yaşam hareketinin içindeki gruplar ve bireyler arasındaki iletişimin güçlenmesi amaçlanmakta ve Türkiye'nin 34 farklı noktasında bulunan 72 adet çiftlikte agroturizm uygulama olanağı bulmaktadır. Agroturizm faaliyetlerinin yaygınlaştırılması amacıyla gerçekleştirilen bir diğer çalışma ise; Eğirdir Gölü Yönetim Planı'dır. Bu plan ile yörenin sahip olduğu kaynakların sürdürülebilir ve yöre halkının sosyo-ekonomik yapısını da dikkate alan kullanımlarla korunması amaçlanmaktadır. Bu kapsamda Yalvaç ilçesi (Aşağıtırtar, Taşevi ve Aşağıkaşıkara köyleri), Eğirdir ilçesi (Mahmatlar, Balkırı, Beydere ve Bağören köyleri ile Barla kasabası), Senirkent ilçesi (Akkeçili, Garip ve Gençali köyleri), ve Gelendost ilçesi (Avşar, Yenice ve Yeşilköy köyleri) agroturizme potansiyel alanlar olarak saptanmıştır. Çukurova Kalkınma Ajansı (ÇKA)'nın, Kırsal Kalkınma Mali Destek Programı kapsamında ise; Mersin ili Erdemli ilçesi Közbucağı köyünde agroturizmin desteklenmesi amacıyla Agroturizmin Geliştirilmesi Projesi yapılmakta ve bu proje ile yerel halkın tarımsal faaliyetlerden ek gelir sağlamaları amaçlanmaktadır. Ayrıca Uzungöl'de Ekolojik Tarım Turizmi Projesi ile Trabzon ili Çaykara ilçesinde bulunan yörenin doğal peyzaj özelliklerinin yanı sıra organik tarım ürünlerinin sunulması hedeflenmektedir. Tarihi Bodrum-Aspat Tarım Turizmi Projesi ile ise; farklı meslek disiplinlerinin bir arada çalışmaları sağlanmakta ve özellikle zeytin, incir, bağ yetiştiriciliği açısından Dünya'nın en eski bölgesi konumunda olan yörenin sahip olduğu tarihi, doğal ve kültürel değerlerinin sürdürülebilirliğinin sağlanması amaçlanmaktadır. Bir diğer çalışma; Türkiye ve Yunanistan'da faaliyet gösteren ve çeşitli kadın derneklerinin Ege Denizi'nin iki yakası arasında ve daha sonra tüm Dünya'da barışı sağlamak amacıyla kurdukları "WINPEACE" (Women's Initiative for Peace) kapsamında yürütmeyi düşündükleri Karaburun Yarımadası'nda Agroturizm Projesi'dir. Bu projede; Sarpıncık, Parlak ve Küçükbahçe köylerinde bulunan kadınların birlikte kuracakları bir kooperatif aracılığı ile evlerinin bir bölümünü turizme hazırlamaları, konuk kabul etmeleri ve ürettikleri ürünleri pazarlamaları gibi konulara yer verilmiştir.

SONUÇ VE ÖNERİLER

Turizm, ulusal ve uluslararası düzeyde ülkelerin ekonomik, sosyal ve kültürel kalkınma süreçlerine yardımcı olan önemli bir sektördür. Ancak turizmde sınırlandırılmayan plansız gelişmeler yerel kimliğin kaybedilmesi ve çevrenin bozulması gibi olumsuz etkilere de neden olabilmektedir. Özellikle kırsal alanlarda yapılan bilinçsiz ve plansız turizm yatırımları, çevre değerlerinin bozulmasına ve geleneksel kültürün zarar görmesine neden olmaktadır. Bu olumsuzlukları önlemek için öncelikle bütüncül planlama gereği yörelerin sahip olduğu kırsal peyzaj özelliklerinin ve geleneksel ürünlerinin koruma-kullanma dengesi içerisinde sürdürülebilirliklerini sağlarken yerel halkın katılımını da amaçlayan bir planlama, yönetim ve izlemeye gereksinim duyulmaktadır. Bu amaçla, kırsal alanlarda agroturizme potansiyel kaynak oluşturan her yöre için yerel halkın gelir sağlamasını destekleyici özel politika ve stratejiler geliştirilmeli ve bu konuda hükümetlerin, çevre ve diğer sosyal grupların, özel sektörlerin, akademik ve yerel kuruluşların birlikte çalışmaları sağlanmalıdır. Ayrıca bu tür yörelerde ulaşım, altyapı ve üstyapının geliştirilmesine ilişkin stratejiler geliştirilmeli ve bu bağlamda mali destek sağlanmalıdır. Anadolu geleneksel kültürünün korunması ve geliştirilerek değerlendirilmesinde büyük önem taşıyan, yerel halka ve çevreye karşı saygılı, endüstrileşmemiş bir turizm türü olan agroturizm, Türkiye'nin bu anlamda sahip olduğu zenginlikler ve çeşitlilik gereği mutlaka yaygınlaştırılması gereken bir alternatif turizm yaklaşımıdır. Yerel halkın agroturizm faaliyetleri içerisindeki görev ve yetki alanları belirtilmeli ve onları bu faaliyetlere teşvik edici uygulamalar gerçekleştirilmelidir. Bu amaçla, agroturizme potansiyel oluşturan yörelerde pansiyonculuğun geliştirilmesi için yerel halka maddi ve teknik destek sağlanmalı, özellikle turizmden doğrudan etkilenecek olan yerel halkın katılımı ile her düzeyde özenli bir planlama yapılması amaçlanmalıdır. Agroturizme bağlı olarak gerçekleştirilen festivaller ve köy pazarları, yerel ekonomiyi desteklemekte ve yerel halk için kültürlerini tanıtma fırsatı vermektedir. Ziyaretçilere tarımsal aktivitelere katılma ve çiftlik hayatını tanıma-yaşama imkanı da sağlayan agroturizm kapsamında; el sanatları atölyelerinde halı-kilim dokuma, topraktan çömlek yapma, ahşap oyma, sepet örme, ekmek pişirme, tarhana, erişte, reçel ve turşu yapma vb. gibi çok sayıda aktivite gerçekleştirilmektedir. Bu nedenle, agroturizme kaynak oluşturan bu yöresel ürünlerin festival, fuar, konferans vb. gibi aktivitelerle tanıtımı yapılmalıdır. Bu tür aktiviteler yöre halkına ekonomik destek sağlama, geleneksel kültürü yaşatma bağlamında büyük faydalar sağlarken, turistik çekiciliğin artmasında da etken olmaktadır. Tarım faaliyetlerinin yoğun olarak gerçekleştirildiği bölgelerin en önemli sorunlarından biri işsizlik sorunudur. Bu nedenle bu tür yörelerde agroturizm ve ekoturizme kaynak oluşturan çevresel oluşumların/değerlerin sürdürülebilir kullanımını ve yerel halkın sosyo-ekonomik anlamda gelişimini destekleyen turizm türlerinin etkinliği arttırılmalıdır. Böylece gerek yerel halk için istihdam sağlanmış, gerekse kırsal alanlardan kentlere yapılan göçler önlenmiş olacaktır.

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YEŞİL ÇATI VE YEŞİL DUVARLAR

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ÖZET

Yeşil çatı ve yeşil duvar sistemleri, kentleşmenin olumsuz etkilerini en aza indirgeyerek kentleşme ile kaybolan yeşil alanların tekrar kazanımı prensibine dayanmaktadır. Kentte azalan yeşil alan miktarını, yeşil çatı ve yeşil duvar uygulamaları ile arttırarak kent ekolojisine ve kentin sürdürülebilirliğine önemli katkılar sağlanmaktadır. Bu çalışmada; dünyada yeşil çatı ve yeşil duvarların çıkış noktası, gelişimi ve bugünkü durumu açıklanmış, yeşil çatı ve yeşil duvarların oluşturulmasında uygulanan yöntemlere değinilmiştir. Yeşil çatı ve yeşil duvarların ekonomik, kent ekolojisi, kent estetiği, kent sağlığı ve kentsel yaşam kalitesine katkıları açıklanarak Türkiye'de ve diğer ülkelerde uygulanmış yeşil çatı ve yeşil duvar örneklerine yer verilmiştir.

Anahtar kelimeler: sürdürülebilir tasarım, kent ekolojisi, yeşil alan, yeşil çatı, yeşil duvar

GİRİŞ

Yeşil alanlar, kentin içinde yer aldığı doğal çevrenin kent içindeki uzantılarıdır. Ancak günümüzde kentler hızla genişleyerek doğal çevreyi ve mevcut yeşil alanları tüketmektedir. İklim değişikliği ve su sıkıntısı gibi nedenlerle yeşil alanların nitelik ve niceliğini yitirmesi ile yeşil alan oluşturmak için arazi sıkıntısı olan kentlerde alternatif yeşil alanların oluşturulması zorunluluk haline gelmiştir. Kent ölçeğinde dolu mezarlıklar, tarihi mezarlıklar, eski demiryolu kenarları, karayolları, kent içindeki caddeler, işlevini tamamlamış ve kullanılmayan eski sanayi ve endüstri alanları, su kıyıları ve çeşitli nedenlerle terk edilmiş yerleşim alanları yeşil alana dönüştürülebilir. Bina ölçeğinde ise **çatı ve duvar yüzeyleri**, teraslar, balkonlar, bahçeler ve avlular yeşil alan olarak kentsel açık-yeşil alan sistemine dahil edilebilir. Böylece kent ölçeğinde azalan yeşil alan miktarını ve niteliğini mimari ölçekte yeşil çatı ve duvar uygulamaları ile arttırmak mümkündür.

YEŞİL ÇATI VE YEŞİL DUVARLARIN GELİŞİMİ

Doğal alanların yok olması, kentte yeşil alanların nitelik ve nicelik yönünden yetersiz duruma gelmesi, enerji kaynaklarının pahalılığı, eskiden kalma ve yağmur suyu tahliyesinde yetersiz olan kanalizasyon sistemlerinin neden olduğu sorunlar Avrupa'da yeşil çatı ve yeşil duvar endüstrisini başarılı hale getirmiştir. Birçok Avrupa hükümeti, çevre sorunlarını ve kentleşmenin neden olduğu sorunları yok etme çabası içinde, yeşil çatıların yaygınlaşmasını ekonomik olarak desteklemektedir. Avrupa'da özellikle Almanya, imar yönetmeliklerinde lider olup yeşil çatı düzenlenmesini teşvik etmektedir. Almanya'da kentlerin ekolojik durumunun iyileştirilmesi için yeni yapılara ait çatıların yeşil çatı olarak düzenlenmesi kanun haline getirilmiştir. Asya'da ise Japonya yeşil çatı teknolojisinin merkezi olup Tokyo, tüm yeni inşaatların en az %20'sinin çatılarının zorunlu olarak yeşil çatı hale getirildiği ilk şehirdir. Amerika'da ise yeşil çatı ve duvarlar, sürdürülebilir tasarım ve yeşil mimarlık hareketinin bir parçası olarak yayılmaya başlamış ve son yıllarda uygulamalarda artış görülmektedir. Amerika'da Park Tower Condominum ve The Conference Centre; Japonya'da Congress Centre Tokyo ve Exhibition Centre; Çin'de Integer Exhibition Pavillon ve Kadoorie Park; Singapur'da HDB-Pilot Project ve Subaru Showroom; İsviçre'de Zurich Airport ve Apartments Wollerau; İspanya'da Underground Garage ve Recycling Plant; Polonya'da University Library ve Warta Headquarter; Hollanda'da Park de Rietlanden, Jan de Louterhof ve Australiegebouw; İtalya'da Environmental Park Turin; Almanya'da Rehabilitation Spa Building, Siemens AG ve BMW Office Building; Danimarka'da Bruuns Galleri ve Novo Nordisk uygulanmış başarılı yeşil çatılar arasında yer almaktadır [2].

Şekil 1 Yeşil çatı örnekleri (Singapur, Japonya, Çin) [3]

Japonya'da Itabashi Station; Fransa'da Musée du quai Branly ve Caisse Populaire Terrebonne; Kanada'da Queen's University; İspanya'da Atocha Station; Singapur'da Silver Towers ve NPARKS Living Wall, Kanada'da Sustainable Building Centre (SBC), International Flora Exhibit ve Vancouver Aquarium uygulanmış başarılı yeşil duvarlardır [3].

Şekil 2 Yeşil duvar örnekleri (Fransa, Almanya, ABD) [3]

Türkiye'de ise Ankara (Mesa Hastahanesi), İstanbul (Meydan M1 Alışveriş Merkezi, Kanyon Alışveriş Merkezi, Metro Gross Market ve Maslak Plaza), İzmir (Soyak Yenişehir), Gebze (Türkcell Ar-Ge binası), Nevşehir (H. Avni İncekara Fen Lisesi yurt binası) ve Bodrum'da (Grancha Sağlık Tesisleri) uygulanan yeşil çatılar ilk örnekleri oluşturmaktadır (Şekil 3) [4].

Oldukça başarılı yeşil çatı uygulamalarına rağmen henüz Türkiye'de yeşil duvar uygulaması yoktur. Ancak Dünya'daki gelişmeleri yakından takip eden Türkiye'de zamanla yeşil duvar uygulamalarına başlanacaktır.

Şekil 3 Türkiye'den yeşil çatı örnekleri (Ankara, İstanbul, İzmir) [4]

YEŞİL ÇATI VE YEŞİL DUVAR UYGULAMA YÖNTEMLERİ

1990 yılında Almanya'da Çevre Düzenlemesi ve Peyzaj Geliştirme Araştırma Derneği (FLL-The Landscaping and Landscape Development Research Society) tarafından oluşturulan "yeşil çatıların planlanması, uygulanması ve bakımı için rehber" yeşil çatı uygulamasında esas alınan belgedir. Bu rehber farklı bölge ve iklim şartlarında uygulanabilir niteliktedir. Yönetmelik tüm yeşil çatı problemleri için çözüm üretmemesine rağmen yeşil çatıların yüksek kalitesi ve güvenli inşaatı için temel araçtır. FLL, 25 yıldır yeşil çatı teknolojisi için standartlar üzerinde çalışmakta ve inşa edilen yaklaşık milyonlarca metre kare yeşil çatı deneyimine dayandığı için çok iyi bir rehberdir [5]. Çatı tiplerine göre farklı uygulama yöntemleri geliştirilmiştir. Yeşil çatıların oluşturulmasında, yoğun, yarı-yoğun ve seyrek bitkilendirme uygulanan yöntemlerdir. Yeşil çatı katmanları, çatıdan itibaren su yalıtımı tabakası ve çatı konstrüksiyonu, kök tutucu tabaka, mekanik etkilere karşı koruyucu tabaka, filtre ve drenaj tabakası, bitki taşıyıcı tabaka ve bitkilerden oluşmaktadır [6].

Yeşil çatılar için olduğu gibi yeşil duvarlar için henüz bir rehber ve standartlar yoktur. Yeşil duvarlar, binaların dış cephesine uygulandığı gibi iç mekanda da uygulanmakta; geniş cepheleri kapladığı gibi küçük yüzeylerde de uygulanabilir niteliktedir. Yeşil duvarlarda, farklı bitki türlerinden oluşan bitkilendirme yapılmaktadır. Bitki türleri uygulanan bölgenin ekolojik koşullarına ve binanın durumuna göre belirlenmektedir. Yeşil duvar katmanları, duvardan itibaren sırasıyla taşıyıcı çerçeve, bitkilendirilmiş panel (toprak ve bitki) ve sulama sisteminden oluşmaktadır [3].

YEŞİL ÇATI VE YEŞİL DUVARLARIN KENTE KATKILARI

Yeşil çatı ve yeşil duvarlar kente ekolojik, ekonomik, estetik, eğitim, sosyo-kültürel, kent sağlığı ve kentsel yaşam kalitesi yönünden katkı sağlamaktadır.

Yeşil çatı ve yeşil duvarlar, kentsel ısı adasının etkilerini azaltmaktadır. Toz ve partikülleri tutarak hava kalitesini iyileştirmekte ve CO2 miktarını azaltmaktadır.

Çatı üzerindeki bitki örtüsü, binanın çatı ve dış cephe sistemini dış etkilere (sıcaklık, asit yağmuru ve UV ışınlarına) karşı korumaktadır.

Ses ve elektromanyetik yalıtımı sağlamaktadır. Bitki örtülerinin ses dalgalarının bir kısmını absorbe ettiği bilinmektedir. Çatı bahçelerinin 2-10 dB arası gürültüyü azalttığı tespit edilmiştir. Son yıllarda sağlık riski olduğu belirlenen cep telefonu baz istasyonlarının elektromanyetik dalgalarının binalara nüfuzunu azaltmaktadır.

Biyoklimatik konfor koşullarını iyileştirmektedir. Kış aylarında ısıyı binanın içerisinde tutmakta, yaz aylarında ise sıcaklığı 6-7 ^{o}C düşürmektedir. Binanın izolasyonunda çok etkili bir uygulamadır. Yapılarda ısıtma-soğutma sistemleri maliyeti ve kullanılan enerji yönünden tasarruf sağlamaktadır. Böylece CO2 emisyonunun azalmasına da katkı sağlamaktadır [2].

Yağmur suyunu kontrol altına almaya yardımcı olmaktadır. Yağmur suyunun büyük bir miktarını absorbe ederek atık su miktarını azaltmakta ve suyun arınmasını sağlamaktadır. Bitki katmanının çok yönlü kullanımıyla kentin su yönetimine katkı sağlamaktadır. Böylece yeşil sistemlere yatırım yapmak, kanalizasyon sistemi ve su arıtma sistemi açısından büyük ölçüde etkili olmaktadır. Yağmur sonrası diğer çatı türlerine göre daha fazla su tutmaktadırlar. Böylece daha yavaş buharlaşma sayesinde havadaki doğal nem daha sağlıklı mikro-klima yaratmaktadır [3].

Kentte sağlıklı mekanlar oluşturmakta; insanlar üzerinde rahatlatıcı etki yaratarak fiziksel ve psikolojik yönden olumlu etkiler meydana getirmektedir.

Kentlerde çeşitli hayvanlar için habitat oluşturmaktadır. Özellikle kuşlar, kelebekler, arılar, kınkanatlılar, salyangozlar gibi canlılara yaşam ortamı oluşturur ve böylece kent ortamında doğa ile yakınlık hissi vermektedir. Bitki ve hayvan varlığı sayesinde çocuklar için eğitim amaçlı kullanılabilecek mekanlar oluşturmaktadır.

Kent içinde yapının ön plana çıkmasını ve tercih edilmesini sağlamaktadır. Bulunduğu yapıya kattığı estetik değer ve peyzaj özellikleri ile yapının ekonomik değerini arttırmaktadır [2].

SONUÇ

Günümüz yapılaşmalarının büyük bir bölümünde doğal çevre ile ilişkiler göz ardı edildiği için kentlerde birçok sorunla karşı karşıya kalınmaktadır. Yeşil çatı ve duvarlar, bu sorunların çözümünde veya azaltılmasında önemli bir role sahip olup özellikle işlevleri ile ekosistemlerin sürdürülebilirliğine katkı sağlanmaktadırlar.

Yeşil çatı ve duvarlar, kentsel açık-yeşil alanların yerini tutamaz ancak alternatif olarak önemli katkı sağlamaktadırlar. Kentsel peyzajda süreklilik oluşturarak kentsel yeşil alanları birbirine bağlayıp bir sistem oluşmasına yardımcı olmaktadırlar. Bunların yanı sıra yeşil çatı ve duvarlar, işlevleri ile yapılara sürdürülebilir olma niteliği kazandıran önemli sistemlerdir. Ayrıca son 30 yıl içinde, yeşil çatı ve duvarlar, sürdürülebilir kentsel gelişmenin çok önemli bir bileşeni haline gelmiştir.

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ORGANİK VE GELENEKSEL YÖNTEMLERLE ÜRETİLEN GIDALARDA SEKONDER METABOLİTLER

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ÖZET

Ekonomik refah düzeyinin artmasına paralel olarak tüketilen gıdanın kalitesi ve sağlık açısından bir risk taşıyıp taşımaması daha da önem kazanmaktadır. Son yıllarda istenen seviyede olmasa da tüketici beklentilerini karşılayabilmek için organik gıda üretimi artmaktadır. Organik ürünlerle ilgili farklı iki yaklaşım bulunmaktadır. Bu gıdaların geleneksel yöntemle üretilen ürünlere göre insan sağlığı açısından daha yararlı olduğu, ikinci yaklaşım ise geleneksel yönteme göre önemli bir farklılığın olmadığını, hatta bu ürünlerin bazı zararlı bileşenler içerebileceği ifade edilmektedir. Organik üretim sırasında zararlılarla mücadelede yapay koruyucular kullanılmadığı için, bitkide doğal savunma sisteminin sonucu 'sekonder metabolit' olarak adlandırılan maddelerin miktarlarının arttığı ve bu maddelerden bazılarının insan sağlığı açısından zararlı olduğu ifade edilmektedir. Bu çalışmada gıda güvenliği kapsamında geleneksel ve organik ürünlerde sekonder metabolitlerin varlığı ve insan sağlığı açısından risk oluşturma durumu yapılan çalışmalar ışığında değerlendirilmiştir.

Anahtar Kelimeler: Geleneksel gıda, organik gıda, sekonder metabolitler

GİRİŞ

Organik gıda üretimde bilindiği üzere genetik mühendislik uygulamaları, hiçbir aşamasında yapay ve benzeri gübreler, zirai mücadelede ilaçları, çeşitli amaçlarla kullanılan düzenleyiciler, hormonlar, antibiyotikler, koruyucular, renklendiriciler, katkı maddeleri, kimyasal kaplama ve parlatıcı maddeler ve kimyasal ambalaj malzemeleri kullanılmalıdır [1]. Son yıllarda toplum refahının artması ile birlikte pestisitler ve katkı maddeleri ile ilgili artan endişeler, tüketicileri daha sağlıklı olduğu düşünülen organik gıdalara yönlendirmiştir.

Organik gıdaların mantarlar ve bitkiler tarafından üretilen doğal toksik bileşikleri nispeten yüksek miktarda içerebilecekleri, geleneksel gıdaların ise pestisitler gibi sentetik toksinleri içerdikleri ifade edilmektedir [2]. Çoğu zaman organik ve geleneksel ürünler mineral, vitamin, protein ve karbonhidrat içeriğindeki farklılıklar bakımından karşılaştırılırken, daha da önemlisi insan sağlığı açısından değerlendirilmesidir. Geleneksel yöntemle üretilen ürünlerde endişe kaynağı olan pestisit kalıntısı ve organik gıdalar ise pestisitler kadar zararlı olduğu ifade edilen bazı sekonder metabolitlerin varlığı açısından karşılaştırılmalıdır [3]. Bu çalışmada geleneksel ve organik ürünlerde sekonder metabolitlerin varlığı ve insan sağlığı açısından risk oluşturma durumları yapılan çalışmalar ışığında değerlendirilmiştir.

SEKONDER METABOLİTLER

İnsan ve hayvanlarda olduğu gibi bitkiler de zararlı saldırılarından korunmak için çeşitli savunma sistemlerine sahiptirler. Bitkiler tarafından bazı biyokimyasal olaylardan sonra sentezlenen, bitki-zararlı ilişkilerinde önemli rol oynayan, geniş ve farklı çeşitleri olan organik bileşikleri üretirler. Zararlılar üzerinde davranışsal ve fizyolojik etkilere sahip olan bu metabolitler çok farklı kategorilere ayrılabilir [4][5]. Bunların en önemlilerinin alkoloidler, glikozitler, fenoller, terpenoidler, taninler ve saponinler olduğu ifade edilmektedir [6]. Tarımda bu maddeler, zararlılara karşı yüzyıllardan beri doğrudan veya dolaylı olarak kullanılmıştır. Başka bir çalışmada ise bu bileşenlerin çoğunun terpenoidler, alkaloidler ve fenolik bileşikler olmak üzere üç büyük grup içerisinde sınıflandırılabileceği belirtilmektedir [5].

Terpenoidler, asetat/mevalonat yoluyla sentezlenen beş karbon ünitesinin birleşmesiyle oluşur. Birçok bitki terpenoidleri toksindir, bitkiyi otçul hayvanlardan ve farklı saldırganlardan korurlar. Alkaloidler ise çoğunlukla amino asitlerden sentezlenir, azot içeren bileşikler çeşitli otçul hayvanlara karşı bitkiyi korur ve birçok önemli farmakolojik etkinliğe sahiptirler. Fenolik bileşikler ise öncelikle şikimik asit ürünleri yoluyla sentezlenir ve bitkilerde bazı önemli rollere sahiptirler [5] [7].

Özellikle insanlar tarafından tüketilen bitkilerdeki sekonder kimyasallar daha önemlidir. Çoğu ilaçların temeli bu kimyasallara dayanır ve sekonder kimyasallar keyif verici ve uyarıcı olarak çok geniş kullanıma sahiptir (alkoloidlerden nikotin ve kokain, terpenoidlerden ise kannabinol gibi) [8]. Kükürt içeren sekonder metabolitlerden (glikozitler) olan siyanojenik glikozidin tahıllarda varlığının hayvanlar ve insanlar için ciddi sorunlara neden olabileceği ifade edilmektedir [9].

ORGANİK VE GELENEKSEL GIDALARDA SEKONDER METABOLİTLER

Tarımsal üretim için kullanılan yöntemler (organik, geleneksel vs.) gıdalardaki doğal bitki toksinleri ve mikotoksin düzeylerini etkileyebilir. Yapılan bazı araştırmalar organik gıdaların organik olmayan gıdalardan daha yüksek düzeyde doğal bitki toksinlerine sahip olabileceğini göstermektedir. Doğal bitki toksinlerinin üretimi ile bitki sekonder metabolitlerinin üretimi benzerlik göstermektedir. Yapılan birkaç çalışmada organik gıdalardaki mikotoksin seviyelerinin daha yüksek bulunduğu ifade edilmiştir [10].

Gıdalarda olası doğal toksinler mikotoksinler, alerjenler, kimyasal faktörler ve bitki toksinleri olmak üzere dört grupta incelenmektedir. İnsan sağlığı açısından daha önemli olan mikotoksinlerin bazıları ergot alkaloidler, islanditoksin, okratoksin A, trikotesenler, sitrinin, patulin ve aflatoksindir [11].

İspanya ve Portekiz' den temin edilen organik ve organik olmayan 83 tahılda (42 organik ve 41 organik olmayan) kansorejen bir sekonder metabolit olan okratoksin A (OTA) varlığını belirlemek için yapılan bir çalışmada alınan sonuçlar oldukça düşündürücüdür. Bu çalışmada pirinç, mısır, yulaf, buğday, arpa ve çavdardan oluşan örneklerin % 22' sinde değişen oranlarda OTA belirlenmiştir. OTA belirlenenlerin % 72' si organik, % 28' si ise organik olmayan tahıl örnekleridir. Organik tahıllardaki ortalama OTA 1.64 ng/g iken, organik olmayanlarda bu değer 0.05 ng/g olarak bulunmuştur [12].

Bir diğer çalışmada bazı Avrupa ülkelerinde 21 yıl boyunca yetiştirilen organik ve organik olmayan buğday örnekleri temel bileşenler ve pişme kalitesi açısından incelenmiştir. Organik ürünlerde fungusitler kullanılmamasına rağmen mikotoksin içerikleri organik olmayanlara göre daha düşük, fakat aralarındaki fark ise istatistiksel olarak önemsiz bulunmuştur [13].

İsveç' de yapılan bir çalışmada 31 organik süt çiftliğinden bir yıl süresince ayda bir kez çiğ süt örnekleri toplanmış ve bunlarda protein, yağ, somatik hücre sayısı, selenyum analizi yapılmıştır. Alınan sonuçlara göre; yağ ve protein açısından organik ve organik olmayan sütler arasında önemsiz farklılıklar bulunmuştur. Ancak üre ve somatik hücre içeriği organik sütte daha düşük olmuştur [14]. Öte yandan yapılan bir çalışmada, organik sütün geleneksel süte göre oldukça üstün olduğu vurgulanmaktadır. Organik sütlerdeki E vitamini (tokoferol), ß-karoten, omega-3 yağ asidi ile lutein ve zeaksantin antioksidanlarına daha yüksek oranda sahip olduğu belirtilmektedir [15].

SONUÇ

Organik gıdalar ve geleneksel yöntemlerle üretilen gıdaların sekonder metabolit içerikleri hakkındaki çalışmalarda elde edilen bulgular arasında farklılıklar bulunmaktadır. Konu ile ilgili çalışmalar uzun yıllar aldığından tatmin edici çalışma sayısı oldukça azdır. Farklı bitki zararlıları üzerinde etkili olan sekonder bileşiklerin insan sağlığı üzerindeki etkilerinin de araştırılması oldukça önemlidir.

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TÜRKİYE'DE ORGANİK SEBZE TOHUMCULUĞU

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ABSTARCT

Organic agricultural researches were started in vegetable department of Atatürk Central Horticultural Research Institute in 1998. Initially, we studied on organic fresh tomatoes and spinach growing than leek production in organic agricultural condition. Organic certificated vegetable seed production has been released since 2005 with combined knowledge that is coming from vegetable seed production activity and organic vegetable researches experiences. Thus, the institute started firstly organic vegetable seed production in Turkey. Produced organic vegetable seeds are sold to private sectors and organic vegetable producers. All varieties are open pollinated and developed in the same institute by breeding programme. Thirteen different vegetable varieties seeds that are belonging to seven different vegetable species have been produced organic certificated. These vegetable species are tomato (Rio Grande-processing, Invictus Lot 335-table conception), pepper (Yalova Yağlık 28-processing, Yalova Çarliston 341-table conception), egg plant (Pala 46, Balıkesir 76), okra (Yalova Akköy 41), leek (İnegöl 92), spinach (Matador) and cabbage (Yalova 1, Yalova Sarmalık). Up to day, private sectors The studies have been maintained for other vegetable species and varieties.

Keywords: Organic seed, production, vegetable

ÖZET

Organik tarım çalışmaları Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü sebzecilik bölümünde 1998 yılında başlamıştır. İlk olarak organik tarım koşullarında domates ve ıspanak yetiştiriciliği daha sonra da pırasa yetiştiriciliği ile çalışmalar sürdürülmüştür. Organik sebze araştırmaları ve konvansiyonel sebze tohum üretim faaliyetlerinden gelen tecrübe ile 2005 yılından beri organik sertifikalı sebze tohumu üretimi yapılmaktadır. Böylece Enstitü Türkiye'de ilk defa organik sebze tohumu üretimine başlamıştır. Üretilen organik sebze tohumları özel sektöre ve üreticilere satılmaktadır. Bütün çeşitler açık tozlanan ve Enstitüdeki ıslah programlarıyla geliştirilen çeşitlerdir. 7 farklı türe ait on üç farklı sebze çeşidinin tohumu organik sertifikalı olarak üretilmektedir. Bu sebze çeşitleri domates (Rio Grande – sanayi t,p,nde, Invictus lot 335- sofralık tipte), biber (Yalova Yağlık 28-sanayi, Yalova Çarliston 341-sofralık), patlıcan (Pala 49, Balıkesir 76), bamya (Yalova Akköy 41), pırasa (İnegöl 92), ıspanak (Matador) ve lahana (Yalova1 ve Yalova Sarmalık). Son zamanlarda özel sektör de diğer sebze türleri ile çalışmalarına devam etmektedir.

Anahtar Kelimeler Organik tohum, üretim, sebze

GİRİŞ

Sebze üretimi, tarımın yoğun emek ve girdi kullanımını gerektiren bir alt koludur. Bitkisel üretimin ana girdisi tohumdur. Bütün dünyada olduğu gibi organik bitkisel üretimde ilk yıllar organik tarım koşullarında elde edilmiş "organik çoğaltım materyali" temin etme güçlüğü çekilmiştir. Bu nedenle başlangıç materyalinin, üretim ve depolama aşamasında kullanılan girdilerin tanımlanabilir olması kaydı ile konvansiyonel tarım koşullarında üretilen çoğaltım materyallerinin kullanımına izin verilmiştir. Ancak Avrupa Birliği ülkeleri başta olmak üzere artık başlangıç materyalinin de organik tarım koşullarında üretilmiş çoğaltım materyalleri olması gerekliliği aranmaktadır. Bu nedenle, her ülkenin alt yapısını bu yönde tamamlamasının gerekliliği vurgulanmaktadır [1].

Türkiye'de organik sebze tohumculuğunu hem organik sertifikasyona uygun hem de tohum üretimi sertifikasyonuna uygun olarak şu anda bir kamu bir de özel sektör olmak üzere iki kuruluş yapmaktadır. Bazı özel sektör tohumculuk kuruluşları da alt yapılarını oluşturmaya başlamışlardır.

MATERYAL ve YÖNTEM

Ülkemizde organik sebze tohumu üretimi yapan kuruluşlar sertifikasyon firmaları ve TÜGEM kayıtlarından araştırılmışlardır. Enstitümüz dışında bir tohum firmasının daha bu konuda çalıştığı tespit edilmiştir. Ayrıca ülkemiz mevzuatları (organik tarım konunu ve yönetmeliği) ile AB mevzuatları da incelenmiştir [1], [2].

Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü ve bir tohumculuk firmasının ürettiği organik sebze tohumları, yasal düzenlemeler bu çalışmanın materyal ve yöntemini oluşturmuştur.

BULGULAR ve TARTIŞMA

Ülkemizde organik sebze tohumu üretimine alt yapı hazırlamak üzere ilk çalışmalar Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü'nde 2005 yılında başlatılmıştır. Bu güne kadar yapılan çalışmalar ile organik tarım koşullarında 7 farklı sebze türüne ait 11 çeşitte organik sertifikalı tohum üretimi gerçekleştirilerek özel tohum firmaları, organik sebze üreticileri ve araştırmacıların kullanımına sunulmuştur [3]. Enstitüde, organik sertifikalı tohumu üretilen sebze tür ve çeşitleri; domates (Rio Grande-sanayilik, Invictus Lot 335-sofralık), biber (Yalova Yağlık 28-sanayilik, Yalova Çarliston 341-sofralık), patlıcan (Pala 49, Balıkesir 76), bamya (Yalova Akköy 41), pırasa (İnegöl 92), ıspanak (Matador) ve Lahana (Yalova 1, Yalova Sarmalık)'dır. Çizelge1'de enstitümüzde üretimi yapılan tür, çeşit ve sertifikalandırmaya başlanıldığı yıllar gösterilmektedir.

Sebze türü	Sebze çeşidi	Sertifikalandırma yılı
Domates	Invictus Lot 335	2007
	Rio Grande	2006
Biber	Yalova Yağlık 28	2006
	Yalova Çarliston 341	2007
Patlıcan	Pala 49	2006
	Balıkesir 76	2008
Pırasa	İnegöl 92	2006
Lahana	Yalova Sarmalık	2006
	Yalova 1	2008
Ispanak	Matador	2006
Bamya	Yalova Akköy 41	2008

Çizelge 1. Atatürk Bahçe Kültürleri Merkez Araştırma Enstitüsü'nde organik sebze tohumu üretimi yapılan tür ve çeşitler

Bundan sonraki çalışmaların hedefi farklı sebze tür ve çeşitlerinde organik tohum üretim araştırmalarının ve organik koşullarda yetiştirilebilirliklerinin sürdürülmesidir. Elde edilen bulgular Tarım ve Köyişleri Bakanlığı'nın organik tarım kanun ve yönetmeliklerini hazırlayan birimlere, araştırma enstitülerine, üniversitelere, özel sektör tohumculuk kuruluşları, üretici ve tüketicilere iletilecektir. Böylece üzerinde çalışma yapılan türlerin tohum üretim aşamalarında karşılaşılan sorunları ve organik tarım koşullarında uygulanabilecek çözüm önerilerine yönelik bilgiler paylaşılmaya devam edilecektir.

Türkiye'de tohumculuk alanında faaliyet gösteren özel sektör firmalarından şu an itibariyle sadece 1 tanesi sertifikalı organik sebze tohumculuğunda üretim çalışmaları yapmaktadır. Firmanın üretim yaptığı türler; domates, biber, pırasa, kavun, kabak, karpuz, hıyar, patlıcan, fasulye, ıspanak, barbunya ve bal kabağıdır. Söz konusu firmanın üretimin yaptığı domates biber pırasa, kavun, karpuz ve kabak türlerinde organik sertifikalı ve geçiş sürecine dahil olan çeşitleri mevut iken, diğer türlerde şu an itibariyle (hıyar, patlıcan, fasulye, ıspanak, barbunya ve bal kabağı) sadece geçiş süreci tohumları bulunmaktadır [5].

Bu kurumlar haricinde organik sebze üretimi yapan kuruluşlar tohumlarını, organik sebze tohumu üretimi yapan bu iki kurumdan, kendi gen kaynaklarından, köy popülâsyonları ve/veya çeşitlerinden elde edebilmektedirler.

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ORGANİK MANTAR YETİŞTİRİCİLİĞİNDE KOMPOST (COMPOST IN ORGANIC MUSHROOM GROWING)

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ABSTARCT

Organic agriculture is a kind of production type showing a huge degree of progress in recent years. It is a high possibility that the increase of demand in organic crops is a reflection of organic mushroom growing. One of the most important stages of mushroom production is production of compost. It is necessary that the preparation of compost needed for agriculture must be suitable for the qualities of materials stated in organic agriculture regulation.

The mushroom compost is obtained by mixing animal manures (chicken manure, horse manure, etc…), vegetal materials (straw, cotton pulp, wood shavings, etc…) and some other additives. Obtained composts for organic cultivation that hygiene and quality properties are great importance. Therefore, the implementation of pasteurization with steam is needed for the procedure of purifying the mushroom compost from diseases and insects. The waste of compost obtained after organic mushroom growing has the potential of being used in organic growing areas as fertilizer or in organic animal nutrition.

The evaluations have been made about organic mushroom growing which has not still been applied in widespread extent with this article in spite of offering a considerable potential. At this point is very important in the production of mushroom experience in the assessment of the Korkuteli-Antalya region was based

Keywords: Organic mushroom, mushroom compost, pasteurisation

ÖZET

Organik tarım, son yıllarda oldukça yüksek gelişme ivmesi gösteren bir üretim şeklidir. Organik ürünlere olan talebin artması organik mantar üretimine de yansıması yüksek bir olasılıktır. Mantar üretiminin en önemli aşamalarından birisi kompostun üretilmesidir. Yetiştiricilik için gerekli olan kompostun hazırlanmasında materyallerin özelliklerinin organik tarım yönetmeliğinde belirtildiği şekilde olması gerekmektedir. Mantar kompostu, hayvansal gübrelerin (tavuk gübresi, at gübresi vs.), bitkisel materyallerin (saman, pamuk küspesi, talaş vs.) ve bazı katkı maddelerinin birlikte karıştırılarak kompostlaştırılmalarıyla elde edilir. Organik mantar yetiştiriciliği için elde edilen kompostun niteliği ve hijyen özellikleri büyük önem taşımaktadır. Bu nedenle mantar kompostunun hastalık ve zararlılardan arındırılması işlemi için buharla pastörizasyon uygulaması yapılması gerekmektedir. Organik mantar yetiştiriciliği sonunda oluşan atık kompost da organik esaslara göre hazırlanması nedeniyle, yine organik üretim yapılan alanlarda toprak iyileştirici olarak veya organik hayvancılıkta beslemede kullanılma potansiyeline sahiptir.

Bu makale ile önemli bir potansiyel arz etmesine rağmen henüz yaygın ölçüde yapılmayan organik mantar üretimi konusunda çeşitli değerlendirmeler yapılmıştır. Bu noktada mantar üretiminde çok önemli tecrübeleri bulunan Korkuteli-Antalya yöresi değerlendirmede esas alınmıştır.

Anahtar Kelimeler: Organik mantar, mantar kompostu, pastörizasyon,

Giriş

Dünya'da mantarın kültüre alınarak yetiştirilmesi farklı görüşlere dayanmakla birlikte daha çok tesadüfî olarak başlamıştır. Mantarın doğada hayvan gübreleri üzerinde daha iyi yetiştiği dikkati çekmiştir. Kirli mantarların yıkanması sonucu elde edilen yıkama suyunun döküldüğü yerlerde mantarın daha fazla yetiştiği belirlenmiştir. Bu görgü ve incelemeler insanları at ve eşek gübreleri üzerine yıkanmış mantar suyu dökerek üretim yapma aşamasına götürmüş, böylece başlayan ilk mantar üretim çalışmaları neyin nerede nasıl yapılacağını ortaya çıkarmıştır (1). Türkiye'de ise mantar üretimine giriş 1970'li yıllarda başlamış ve bugün ise mantarcılık Türkiye'de oldukça büyük gelişme göstermesine rağmen hala istenen düzeylere ulaşamamıştır. Mantar üretimi günümüzde ev altı işletmeleri ve otomasyonlu ve yüksek kapasiteli tesislerde olmak üzere 2 şekilde gerçekleştirilmektedir.

Dünyada mantar üretimi 2007 yılı FAO verilerine göre yaklaşık olarak 3.448.206 ton olarak belirtilmiştir (2). Ülkemizde ise bu rakam yaklaşık olarak 70.000 tonun üzerinde olduğu tahmin edilmektedir (3). Türkiye'de mantar üretim miktarındaki düşük değerler mantar tüketim alışkanlığının fazla olmamasından kaynaklanmaktadır. AB ülkelerinde yıllık kişi başına mantar tüketimi 2.5 kg iken Türkiye'de bu değerin 400-500 g seviyelerinde olması bunun bir sonucudur (4). Türkiye'de mantar üretimi daha çok Marmara, Ege, İç Anadolu ve Akdeniz Bölgesinde gerçekleştirilmektedir. Bu bölgelerde mantar yetiştiriciliğinin artmasının nedeni büyük pazar olanaklarına sahip olması ve mantar üretimi için gerekli malzemelerin kolaylıkla sağlanabilmesidir. Mantar yetiştiriciliğinin en yoğun olduğu bölge Marmara bölgesidir. Gerek üretici sayısı, gerekse üretim alanı ve miktarı yönünden en büyük pay bu bölgeye aittir (5). Ancak son yıllarda Akdeniz bölgesinde özellikle Antalya-Korkuteli yöresi mantar ve kompost üretiminde söz sahibi olmaya başlamış hatta kompost üretiminde Türkiye kompost üretiminin yaklaşık olarak yarısını karşılar düzeye gelmiştir (4).

Organik tarım bilindiği üzere; üretimde kimyasal girdi ve ilaç kullanmadan yönetmelikler çerçevesinde izin verilen girdiler kullanımı ile yapılan, üretimden tüketime kadar her aşaması kontrollü ve sertifikalı tarımsal üretim biçimidir (6). Kaynakların en iyi şekilde kullanımına dayanarak yanlış uygulamalar sonucu bozulan doğal dengeyi korumayı amaçlayan organik tarım sisteminde, sentetik kimyasal gübrelerin, ilaçların ve hormonların kullanımı yasaklanmıştır. Toprak verimliliği, hastalık ve zararlılardan korunmada uygun çeşit seçimi, ürün rotasyonu, bitki atıklarının değerlendirilmesi, yeşil gübreleme, organik atıkların kullanılması, hayvan gübresi ve biyolojik kontrol gibi yöntemler esas olarak belirlenmiştir. Organik tarım yüksek kaliteyi hedefleyen bir tarım sistemidir. Başlıca amacı toprak-bitki-hayvan ve insan arasındaki yaşam zincirinde üretim optimizasyonunu sağlıklı bir şekilde sağlayabilmektedir. Organik tarımla ilgili tüm ulusal ve uluslararası standartlar araziden rafa kadar ürünün izlediği tüm aşamaların kontrolünü ve sertifikasyonu zorunlu tutmaktadır. Sertifikasyonla, organik ürün tüketerek hem sağlıklı yaşamayı hem de doğayı korumayı hedefleyen tüketicilere bir güvence verilmektedir. Ayrıca organik üretim yapan üreticinin standartlara uygun üretimini belgelendirerek ispatlamasına ve ürününü hak ettiği değerde pazarlamasına imkân sağlamaktadır (7).

Türkiye'de organik tarımın son 5 yıllık gelişmesi farklılıklar göstermekle birlikte üretilen ürün sayısı 5 yılda yaklaşık % 42, üretici sayısı yaklaşık % 17, yetiştiricilik yapılan alan miktarı yaklaşık % 0,7 ve genel organik ürün miktarı da yaklaşık olarak % 40 oranında artış sağlamıştır. Bu değerler içerisinde doğal toplama alanı % 43 oranında azalma göstermiş ve bu azalmaya rağmen kültürel üretim miktarı arttığı için toplam ürün miktarı da artış göstermiştir. Yani organik üretimin arttığı bu değerlerden anlaşılmaktadır (8).

Organik tarımda mantar yetiştiriciliği Dünya genelinde ve Türkiye'de çok fazla yaygınlaşmamış bir üretim şeklidir. Mantar üretiminde özellikle hastalık ve zararlılardan koruma amaçlı uygulamalar nedeniyle karşılaşılan zorluklar bu üretim şeklinin uygulamada artmasını engellemiştir. Ancak son yıllarda bazı alanlarda kültüre alınan mantar türlerinde organik üretim yapılmaya başlanmıştır. Son yıllara kadar organik mantar olarak doğadan kültüre alınmadan toplanan mantar türleri mevcut potansiyeli oluştururken şimdilerde organik tarım esaslarına göre organik mantar yetiştiriciliği yapılmaya çalışılmaktadır. Organik tarımda mantar yetiştiriciliği için kullanılan kompostun da organik esaslara göre hazırlanması gerekmektedir. Bu durumda kompost yapımında kullanılacak materyallerin temin edildikleri kaynakların önemi ortaya çıkmaktadır. Kompost yapımında farklı materyaller değerlendirilerek kompostlanmakta ve elde edilen bu kompostlarda mantar üretimi gerçekleştirilmektedir. Normal koşullarda üretilen kültür mantarında son yıllarda daha çok buğday samanı ve tavuk gübresi karışımları tercih edilmekte ve bu materyaller kompostlamada kullanılmaktadır. Bu materyallerin organik esaslara göre üretildikleri yerlerden sağlanmaları ve kompostlanmaları sonucu oluşan kompostun organik mantar yetiştiriciliğinde kullanılması ile organik mantar üretimi gerçekleştirilebilir.

5262 no'lu Organik Tarım Kanunu 01.12.2004 tarihli resmi gazete de yayınlanarak yürürlüğe girmiş olup, bu kanunun uygulanmasıyla ilgili olarak, organik tarımın esasları ve uygulanmasına ilişkin yönetmelik de 10.06.2005 Tarih ve 25841 sayılı resmi gazete'de yayımlanarak yürürlüğe girmiştir (9). Hazırlanan ve 2008 yılında değişikliğe uğrayan yönetmelikte belirtilen esaslara göre organik mantar üretimi ve mantar kompostu hazırlığı ile ilgili maddeler şu şekilde belirtilmiştir.*Organik mantar üretimi*

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Organik mantar üretiminde; kompost yapımında aşağıdaki bileşenleri içeren karışımlar kullanılır.

a) Bu Yönetmeliğin Ek-1 (A) bölümünün ilk dört satırında yer alan çiftlik gübreleri, söz konusu çiftlik gübrelerinin bulunamadığı durumlarda ise, % 25 oranında bu kısımdaki gerekleri karşılayan çiftlik gübreleri,

b) Organik üretim metoduna göre üretim yapılan arazilerden elde edilen saman benzeri tarımsal kaynaklı ürünler,

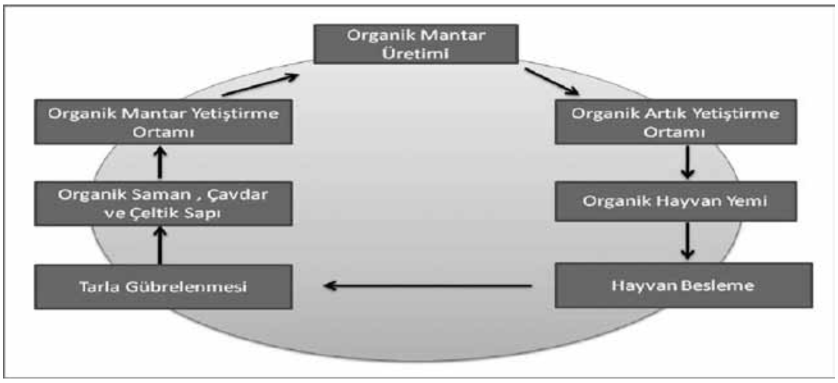
c) Kimyasal olarak muamele görmemiş torf,

d) Kesildikten sonra kimyasal muamele görmemiş odun,

e) Doğal yapısındaki toprak ve sulama suyu özelliğindeki su,

f) Bu Yönetmeliğin Ek-1 (A) bölümünde kullanımına izin verilen mineral maddeler.

Organik mantar üretiminde organik tarımın diğer alanlarıyla birlikte üretim yapmak zorunludur. Kompost hazırlığında kullanılacak materyallerin organik tarımda elde edilecek ürünlerden sağlanması gerekliliği nedeniyle bir organik üretim döngüsü oluşmaktadır (Şekil 1).



Şekil 1. Organik mantar üretiminde oluşturulan organik üretim döngüsü (10)

KOMPOSTLAMADA KULLANILABILECEK MATERYALLER VE ÖZELLIKLERI

Organik mantar üretimi ile ilgili yönetmelikte de belirtildiği üzere organik mantar üretimi için gerekli olan kompostun hazırlığında organik esaslar dikkate alınması gerekmektedir. Kompostlamada kullanılacak materyallerden bitkisel materyaller; buğday samanı, çeltik veya çavdar sapları, kaba yonca, parçalanmış mısır sap ve koçanları, keten tohumu, ayçiçeği atıkları, suya küspesi, pamuk küspesi, pancar küspesi, pirinç kavuzları, fındık kabukları, çay atıkları, değirmen atıkları, ağaç yongası, talaş, kepek, bazı organik üretilen sebze artıkları (lahana, karnabahar, fasulye, bezelye vs.), hayvansal materyaller ise; at gübresi, tavuk gübresi güvercin gübresi, koyun ve sığır gübresi vs olarak belirtilebilir (1) . Bu materyallerin organik esaslara göre elde edilmiş olmaları gerekmektedir. Ayrıca bu materyallerin belli oranlarda karıştırılmaları ile elde edilmek istenilen komposta bazı katkı maddelerinin ilave edilmesi kompostun niteliğini artırmaktadır. İlave edilecek katkı maddeler organik tarım yönetmeliğinde izin verilen miktarlarda olmak zorundadır. Örneğin kireç, alçı, mermer tozu, Thomas unu, kaya fosfatlar, kan ve kemik unları vs. olarak belirtilebilir. Bitkisel materyaller içerisinde belirtilen kepek, talaş, küspe gibi materyaller de katkı maddeleri olarak değerlendirilebilmektedir.

Bitkisel ve hayvansal materyallerle organik mantar yetiştiriciliğinde kullanılmak üzere hazırlanan kompostlarda sabit karışım oranları olmayıp materyallerin besin içerikleri ve karıştırılabilirlikleri dikkate alınarak uygulamalar yapılabilir. Agaricus bisporus (beyaz şapkalı mantar) yetiştiriciliğinde önceki yıllarda daha çok at gübresi tercih edilmekteydi. Ancak at gübresinin teminindeki güçlükler nedeniyle alternatif materyaller kullanılmaya başlanmıştır. Buğday samanı ve tavuk gübresi kullanılarak hazırlanan kompostlar son yıllarda daha çok tercih edilmekte ve bu materyallerin karışım oranları materyallerin özelliklerine göre değişmektedir. Bu iki temel materyale ilave olarak alçı, organik yöntemlerle elde edilmiş kepek, melas, zeytin prinası ilaveleri yapılabilmektedir. Ayrıca tavuk gübresi yerine koyun gübresi, buğday samanı yerine çavdar sapı, mısır koçanı gibi materyaller kullanılabilir. Tablo 1'de farklı materyallerden oluşmuş kompost karışımları görülmektedir.

Materyaller	**Taze Ağırlık (Kg)**	**Kuru Ağırlık (Kg)**	**Nem (%)**
Buğday Sapı	1000	800	20.0
Tavuk Gübresi	1000	220	78.0
Alçı	90	90	-
Toplam	2090	1110	-
Materyaller	**Taze Ağırlık (Kg)**	**Kuru Ağırlık (Kg)**	**Nem (%)**
Buğday Sapı	1000	800	20.0
Ayçiçeği Sapı	300	75	25.0
Tavuk Gübresi	200	44	78.0
Zeytin Prinası	100	25	25.0
Alçı	30	30	-
Toplam	1630	974	-
Materyaller	**Taze Ağırlık (Kg)**	**Kuru Ağırlık (Kg)**	**Nem (%)**
Çavdar Sapı	1000	800	20.0
Tavuk Gübresi	500	110	78.0
Kepek	300	261	13.0
Alçı	60	60	-
Toplam	1860	1231	-

Tablo 1. Farklı materyallerden hazırlanan örnek kompost karışımları (1)

Tablo 1'de verilen örnek karışımlara azot takviyesi yapmak için kan ve kemik unu, melas gibi azotça zengin materyaller ilave edilerek hem besin kapsamı arttırılabilir. Hem de karışımın C/N oranı kompostlaşma için istenilen düzeylere getirilebilir. İdeal kompostlaşma için gereken C/N oranı 25-30/1 olarak belirtilmektedir ve mevcut materyallerle bu oranlar sağlandığı takdirde başarılı bir kompostlaşma işlemi gerçekleştirilebilir (11). Kompost karışımına giren materyallerin toplam azot seviyeleri % 1.5-2.5 arasında tutulmalıdır. Bu oran artarsa 1. Fermantasyonda amonyak çıkışının uzun süre devam etmesine neden olur. Böylece komposttaki fazla amonyak nedeniyle zararlı mürekkep mantarı oluşumu gözlenir (1). Azot miktarı az olursa C/N oranı artacağından ideal kompostlaşma sağlanamaz.

Kayın mantarı (Pleurotus spp.) üretiminde ise buğday samanı, çeltik sapı, pirinç kavuzu, mısır sapı, parçalanmış mısır koçanı, kavak, kayın, meşe talaşları, fındık zurufu gibi her türlü organik materyal karışımını kullanılması uygundur. En yaygın olarak kullanılan materyaller çeltik sapı, pirinç kavuzu, buğday samanı ve parçalanmış mısır koçanıdır. Tablo 2'de kayın mantarı için önerilen materyallerin örnek karışım oranları verilmiştir.

Materyal	%	Materyal	%
Buğday samanı	60	Buğday samanı	50
Mısır koçanı	20	Mısır koçanı	50
Pirinç kavuzu	20		
Materyal	**%**	**Materyal**	**%**
Buğday samanı	50	Talaş	75
Buğday kepeği	25	Buğday kepeği	25
Fındık zurufu	25		

Tablo 2. Farklı materyallerden hazırlanan örnek kompost karışımları (10)

KOMPOSTUN HAZIRLANMASI

Organik materyallerin temin edilmesinden sonraki aşama kompostlanmalarıdır. Kompostlaşma işlemi materyallerin mikroorganizma aktivitesi ile ayrışmaları ve kompost adı verilen yapıya dönüşmeleridir. Beyaz şapkalı mantar (Agaricus bisporus) üretiminde at gübreli veya sentetik kompostlar kullanılırken, kayın mantarı üretiminde ise çeltik sapı, pirinç kavuzu, buğday samanı ve parçalanmış mısır koçanı kullanılmaktadır. Genel kompostlama ilkeleri uygulanmakla birlikte materyallerin yapısal özellikleri ve kompostlama süreleri dikkate alındığında farklı yöntemler uygulanabilmektedir.

Beyaz şapkalı mantar (Agaricus bisporus) için hazırlanan kompostlarda fermantasyon 2 aşamada gerçekleşmektedir. 1. fermantasyon aşamasında ön ıslatma, yığın oluşturma ve aktarmalar gerçekleşirken, 2. fermantasyon aşamasında pastörizasyon ve olgunlaşma prosesleri gerçekleşir. 1. fermantasyon olarak adlandırılan aşamada materyaller (Sap-saman, çeltik kavuzu, mısır koçanı, ayçiçeği atıkları, suya küspesi, pamuk küspesi vs.) %75 oranında nem içerecek şekilde ıslatılmalıdır. Daha sonra üzerine tavuk gübresi, koyun gübresi, kepek, melas vs. gibi diğer materyaller ve katkı maddeleri ilave edilerek homojen bir şekilde karışmaları sağlanmalı ve bir yığın oluşturulmalıdır. Yığın yüksekliği ve büyüklüğü yığının işlenmesine olanak verecek şekilde düzenlenmelidir. Yığında biyolojik aktivite başlar ve fermantasyon işlemi gerçekleşerek organik bileşikler parçalanarak kompost oluşmaya başlar. Bu süre materyallerin özelliklerine ve ortam sıcaklığına da bağlı olarak değişmekle birlikte yaklaşık olarak 18–34 gün aralığında değişir. 1. fermantasyon olarak adlandırılan bu aşamada oluşan kompostun rengi siyahımsı, %70–72 oranında neme sahip, pH seviyesi 8,0-8,2 civarında, azot içeriği %1,8-2,0 düzeylerinde, kolay parçalanabilen bir yapıda olmalıdır (10). Bu aşamada 1000 kg kompost 720 kg su içerir ve 280 kg kuru maddeye sahiptir. Bu kuru madde miktarının da 84 kg'ı kül ve 196 kg'ı organik kısımdır (12). 1.fermantasyon aşamasında kompost sıcaklığı 65–70 ^{o}C'ye kadar yükselir ve mikroorganizmaların faaliyeti durma noktasına gelir. Bu sıcaklık organik materyallerin parçalanma ve ayrışmaları için gereklidir.

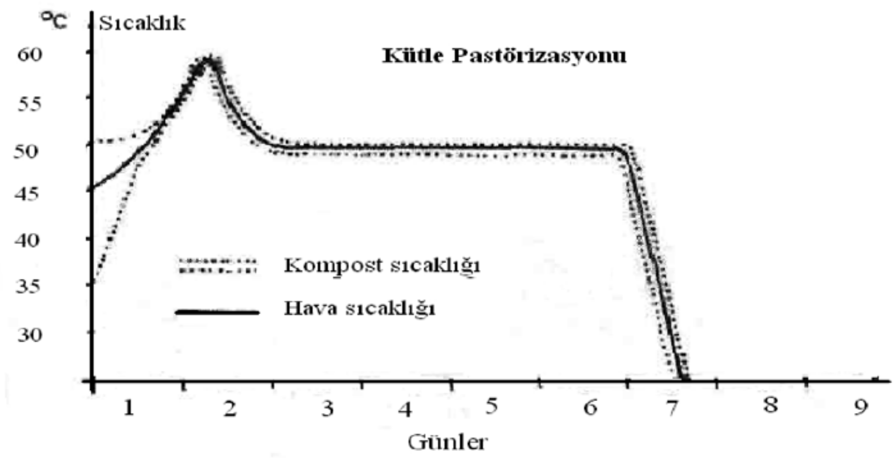
2. fermantasyon aşaması olarak adlandırılan süreç ise pastörizasyon ve olgunlaşma aşamalarını kapsamaktadır. Pastörizasyon, kompost içerisindeki sinek, kırmızı örümcek, nematod, fungal ve bakteriyel hastalıklar gibi zararlı mikroorganizmaların öldürülmesi amacıyla kompostun, 58–60 ^{o}C'de 6–8 saat yüksek oransal nemde tutulması işlemidir. Bu organizmalar yüksek nemde 55 ^{o}C'nin üzerinde ölürler. Kuru koşullarda bazı mikroorganizmalar yüksek sıcaklığa direnç gösterebildiklerinden kompost ve odanın ısıtılmasında buhar kullanılmalıdır. Olgunlaştırma aşamasında ise kompost içerisindeki besinleri mantar miselleri tarafından alınabilir formlara dönüştüren termofilik mikroorganizmaların etkinliklerini optimum koşullarda sürdürebilmesi için kompostun 48-50^{o}C'lerde 5–6 gün tutulması işlemidir (5).

Kayın mantarı (Pleurotus spp.) üretimi için kompost hazırlama ise buğday samanı, çeltik sapı, pirinç kavuzu, mısır sapı, parçalanmış mısır koçanı, kavak, kayın, meşe talaşları vs. 5-6 cm uzunluğunda kesilerek ideal boyutlara getirilir. Üzerine kireç ilavesi ile ıslatılır ve nem düzeyi arttırılır. Üzeri plastik örtü ile kapatılarak fermantasyonun başlaması sağlanır ve 1-2 gün karıştırılarak homojenlik sağlanır. 1.fermantasyon aşaması hızlı gelişen bu tür kompost oluşumunda ilave azot ihtiyacına karşı organik tarımda müsaade edilen azotça zengin organik bileşik ilavesi gereklidir. Bu amaçla tavuk gübresi, koyun gübresi, kan ve kemik unu gibi azotça zengin bileşikler ilave edilebilir. 2.fermantasyonda ise sıcak suya daldırma yöntemi ile pastörizasyon gerçekleştirilir. Kayın mantarı için hazırlanan kompostlarda prosesler beyaz şapkalı kültür mantarlarında hazırlananlara göre daha basittir ve süreç daha kısadır. Bu mantar türü doğada daha çok ağaçlar üzerinde saprofit olarak yaşayabilmektedirler. Dolaylı olarak ağacın selüloz ve lignini ayrıştırarak besin elementi haline dönüştürmektedir. Bu nedenle hazırlanan kompostlarda kompostlama süresinin çok uzun tutulmasına gerek görülmemektedir (13).

KOMPOSTUN PASTÖRIZASYONU

Kompostun içerisindeki nematod, sinek, böcek gibi zararlıların, kurt ve larvaların, yumurtaların, arzu edilmeyen küf, mantar ve bakterilerin ve bunların sporlarının öldürülmesiyle kompostun hijyenik açıdan temiz olması sağlanır. Bu amaçla yapılan uygulama pastörizasyon olarak adlandırılır (1). Geleneksel kompostlamada pastörizasyon buharla ve kimyasal olarak gerçekleştirilirken organik tarım esasına göre hazırlanan kompostta ise sadece buharla pastörizasyon yapılmalıdır.

Kompostun hijyenik özelliklerinin sağlanmasında en etkin olarak kullanılan yol buharla pastörizasyondur. Bu yöntemde 58–60 ^{0}C'de 6-8 saat yüksek oransal nemde kompostları ısı muhafazalı ortamda bekletme esasına dayanmaktadır. Bu süreçte kompost içerisindeki termofilik bakterilerin yaşaması için ortama hava verilmesi gerekmektedir.



Şekil 2. Pastörizasyon ve olgunlaştırma aşaması ısı çizelgesi (1)

Pastörizasyonda ihtiyaç duyulan pastörize odasında % 1–2 meyilli beton bir zemin üzerinde 50 cm yükseklikte ızgaralı bir zemin daha bulunmaktadır. Izgaralı zeminden taze havanın ve buharın kompost içerisine üflenmesi sağlanır. Verilen taze hava her ton kompost için 150–200 m^3 olarak hesaplanır. Yaklaşık 60 ^{0}C'de 6–8 saat veya 10 saat tutulduktan sonra odaya taze hava verilerek pastörizasyon sırasında oluşan amonyak, karbondioksit ve diğer zararlı gazların ortamdan uzaklaşması sağlanır. Kompost sıcaklığı 4–5 gün 48-54 ^{o}C'de tutulur ve komposttan amonyak kokusunun tamamen atıldığı zaman pastörizasyon işleminin tamamlandığını gösterir. Ortama taze hava verilerek 24 saatte kompost sıcaklığı 25 ^{o}C'ye düştüğünde komposta misel ekimi yapılacak hale gelmiştir (10).

OLGUN KOMPOSTUN ÖZELLIKLERI

2.fermantasyonu tamamlayan kompostun fiziksel ve kimyasal özellikleri 1.fermantasyon dönemine göre değişiklikler gösterir. Oluşan bu değişiklikler pastörizasyon ve olgunlaşma aşamalarında meydana gelen parçalanma ve ayrışma olaylarından kaynaklanmaktadır. Kompostta istenen maddelerin oluşması 50-55 ^{o}C'deki sıcaklıkta çalışan termofil bakteriler, actinomycetesler ve 45-50 ^{o}C'deki termofil mantarlar tarafından gerçekleştirilir. 50-55 ^{o}C'de amonyak en iyi şekilde proteinlere, 40-50 ^{o}C'de organik maddeler fenol oksitlere dönüşür. Mikroorganizma faaliyeti bu sıcaklık derecelerinde arttığı için komposttaki suda çabuk eriyen şekerli maddeler bu organizmalar tarafından besin olarak kullanılır (1).

Olgunlaşmayı tamamlayan kompostta birtakım değişiklikler olur. Bu değişiklikler 1.fermantasyon aşamasındaki kompostan farklılıklar gösterir ve şu şekilde belirtilebilir (1,5).

- Tamamı homojen yapıdadır.
- Kompost nemi % 64-67 arasındadır. Avuç içinde sıkıldığında parmak aralarından su çıkmaz, ele yapışmaz ve eli kirletmez.
- Kompost pH'sı 7,0-7,5 aralığındadır.

- Kompostun rengi koyu kahverengi ve mattır.
- Sıcak kompostta amonyak kokusu duyulmaz. Bunun yerine tatlımsı hoş bir koku hissedilir.
- Kompost üzerinde ve içerisinde mavimsi beyaz Humicola ve beyaz Actinomycetes gelişmesi açıkça görülür.
- Kompostun azot oranı % 2,0-2,2 arasında, amonyak 5-10 ppm düzeyindedir. Başlangıçta 30/1 olan C/N oranı pastörizasyon ve olgunlaştırma sonunda 17/1'e düşmüştür.

SONUÇ

Bu makalede organik koşullarda kültür mantarı üretimi için gerekli olan kompostların materyal özellikleri, kompostun yapımı, hijyen durumu ve potansiyeline vurgu yapılamaya çalışılmıştır. Dünya'da ve Türkiye'de organik mantar üretimi oldukça düşük seviyededir. Bu amaçla organik esaslara uygun olarak yetiştirilen ürünlerin organik tarımın diğer alanlarında kullanılma olanakları değerlendirilerek yeni üretim alanları oluşturulabilir. Organik buğday üretiminden ve organik tavukçuluktan sağlanan samanların gübrelerin organik mantar üretiminde kullanılacak kompostlar için gerekliliği dikkate alınarak bazı katkı maddeleri ile ideal kompostlar hazırlanabilir ve organik mantar üretimi sağlanabilir. Bu amaçla organik tarımın diğer organik üretim alanlarıyla birlikte hareket etme zorunluluğu görülmektedir. Ayrıca mantar üretimi açısından tecrübe gerekliliği de dikkate alındığında üretimin yoğunlaştığı alanlardan faydalanılması üretimin yaygınlaştırılma sürecini azaltabilir. Organik mantar üretiminden arta kalan mantar kompostu artıkları da yine kompost hazırlıklarında katkı maddesi olarak kullanılabileceği gibi organik hayvan yetiştiriciliğinde besin rasyonlarına ilave edilerek de kullanılabilmektedir.

Türkiye'de mantar üretiminde önemli yeri bulunan Antalya-Korkuteli yöresi organik mantar üretimi için önemli tecrübe ve Ar-Ge merkezi olabilir. Geleneksel yöntemlerle üretim bakımından incelendiğinde Antalya-Korkuteli ülkemizde mantar ve kompost üretiminde önemli bir paya sahiptir. 2008 yılında Korkuteli'nde üretilen mantar kompostu yörede faaliyet gösteren önder ve büyük firmalara göre yaklaşık olarak 125.000–150.000 ton/yıl, Türkiye'nin toplam mantar kompostu üretiminin ise 250.000–300.000 ton/yıl rakamlarına ulaştığı tahmin edilmektedir (3). Bu yüksek potansiyelin organik mantar üretimiyle desteklenerek arttırılması ülke ekonomisine ve tarımsal üretime önemli katkılar sağlayabilecektir. Organik mantar üretimiyle organik tarımın diğer üretim alanlarına da katkı sağlanabilir. Kompostta kullanılacak materyallerin (saman, tavuk gübresi vs.) ekonomik değerleri, atık olarak kullanılma potansiyelleri ve organik ürünler artacaktır. Böylece geleneksel yöntemle yapılan mantar üretiminin yanında organik mantar üretimi de teşvik edilerek hem pazar çeşitliliği hem de farklı ürünlerin kitlelere ulaşmasıyla mantar tüketim miktarlarının artması sağlanabilecektir. Ayrıca organik mantar üretimindeki kontrollü ve sertifikalı üretim yöntemleri ile geleneksel yetiştiricilikte daha sağlıklı hale getirilebilir ve organik üretimde kazanılacak tecrübe diğer yetiştiricilik alanlarına aktarılarak geleneksel yöntemlerin modifikasyonu sağlanabilir.

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TOPRAK ENZİMLERİ VE ÖZELLİKLERİ

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ÖZET

Toprak ekosisteminin yapı ve işlevinin anlaşılabilmesi için toprak mikroorganizmalarının populasyon büyüklüğü ve aktivitelerini yönlendiren faktörlerin analizi önemlidir. Bu amaçla toprak enzimleri, toprak mikrobiyal aktivitesi ve toprak verimliliğinin bir göstergesi olarak kullanılmaktadır. Monokültür veya ekim nöbeti altındaki tarım topraklarında çeşitli toprak enzimlerinin dağılımı ve aktiviteleri geniş bir araştırma konusu oluşturmuştur. Buna karşın doğal ekosistemlerde biyotop karakterizasyonunda enzimler kullanılarak ekolojik bir ilişkinin araştırılması ender olarak yer almakta ve bu konuda fazla bir araştırma bulunmamaktadır. Bu çalışmayla toprak enzimlerinin özellikleri, verimliliğe etkileri üzerine yapılmış alıştırmalar değerlendirilerek toprak enzimleri ile ilgili yapılacak çalışmalara bir altlık oluşturulmaya çalışılmıştır.

Anahtar Kelimeler: Toprak enzimleri, enzim özellikleri, katalaz enzimi, üreaz enzimi

GİRİŞ

Enzimler, hücrelerde biyokimyasal reaksiyonları katalize eden protein yapısında moleküllerdir. Hücrelerde çok önemli metabolik görevleri olan enzimler çeşitli amaçlarla kullanılmak üzere günlük ve ekonomik hayata girmiştir [7]. Enzimatik reaksiyonların toprağın verimliliği ile çok yakın bir ilişkisi bulunduğu, artık her araştırmacı tarafından kabul edilen bir gerçektir. Son yıllarda toprak enzimlerinin kökeni, yayılışı, işlevi ve kinetik özellikleri hakkındaki sorulara sadece biyojeokimya açısından değil, aynı zamanda tarım, ekoloji, endüstri, tıp, uzay ve hatta hukuk bilimleri alanlarında da yanıt bulunmaya çalışılmıştır [3] [4].

TOPRAK ENZİMLERİ

Toprak ekosisteminde, karbon, azot, kükürt ve diğer besin elementlerinin döngüsünde enzimler hayati rol oynarlar [5]. Topraklar, içerdikleri çok değişik özelliklere sahip organik maddeyi ayrıştıran geniş bir mikrobiyal flora içermektedir. Organik maddenin içermiş olduğu değişik substratların ayrıştırılmasına pek çok farklı türden mikroorganizma ardışık olarak katılır ve bu sırada biyokimyasal ayrışma işlevinin gerçekleşebilmesi için substrat çeşidine göre farklı nitelikte ekstraselüler enzimleri salgılarlar. Böylelikle doğadaki besin elementi döngüsünde yaşamsal bir rol oynarlar [1]. Topraklarda yaklaşık olarak 100 enzimin faaliyeti tanımlanmıştır [5]. Topraklar için diğer enzimlerin varlık veya faaliyetini belirleyebilecek teknikler henüz geliştirilmemiştir [2]. Bu enzimler çoğunlukla **oksidoredüktazlar, hidrolazlar** ve **transferazlar** şeklinde gruplanırlar (Çizelge 1).

	ENZİMLER	**KATALİZLENEN REAKSİYON**
Oksidoredük-tazlar	Katalaz	$2H_2O_2$——>$2H_2O+O_2$
	Katekol oksidaz	o-difenol+1/2 O_2 ——> o-kinon+H_2O
	Dehidrogenaz	XH_2+A ——> X + A H_2
	Difenol oksidaz	p-difenol + 1/2 O_2 ——> p-kinon + H_2O
	Glükoz oksidaz	Glikoz + O_2 ——> glukonik asit + H_2O
	Peroksidaz ve polifenol oksidaz	A + H_2O_2 ——> okside A+ H_2O
	Ürat oksidaz (urikaz)	Ürik asit + O_2 ——> allantoin + CO_2
T.f.	Transaminaz	R_1R_2-CH-NH_3+R_3R_4 CO ——>R_3R_4-CH-N+H_3+ R_1R_2 CO
	Transglikosilaz ve Levansükraz	n$C_{12}H_{22}O_{11}$+ROH ——> H ($C_6H_{10}O_5$) n OR+n$C_6H_{12}O_6$
Hidrolazlar	Asetilesteraz	Asetik ester + H_2O——> Alkol+asetik asit
	α veβ amilaz	1,4 glikozidik bağların hidrolizi
	Asparaginaz	Asparagin+ H_2O ——>Aspartat+ NH_3
	Selülaz	β-1,4 glukan bağlarının hidrolizi
	Deamidaz	Karboksilik asit amid + H_2O ——> Karboksilik asit + NH_3
	β - Fruktofuranozidaz (invertaz, sükraz, sakkaraz)	β-fruktofuranozid+H_2O—>ROH+ Früktoz
	α- ve β- galaktozidaz	Galaktozid+ H_2O ——> ROH+galaktoz
	α- ve β- glikozidaz	Glikozid+ H_2O ——> ROH+glikoz
	İnulaz	β- 1,2 fruktan bağlarının hidrolizi
	Likenaz	β - 1,3 selotrioz bağlarının hidrolizi
	Lipaz	Trigliserid+3H_2O—>gliserin+yağ asitleri
	Metafosfataz	Metafosfat ——> ortofosfat
	Nükleotidaz	Nükleotidlerin defosforilasyonu
	Fosfataz	Fosfat esterleri+H_2O ——> ROH+fosfat
	Fitaz	İnositol hekza fosfat + 6 H_2O ——> inositol+ 6 fosfat
	Proteaz	Proteinler ——> peptidler ve amino asitler
	Pirofosfataz	Pirofosfat + H_2O ——> 2 ortofosfat
	Üreaz	Üre ——> $2NH_3$ + CO_2

Çizelge 1. Topraktaki Enzimler [6]

Bu enzimlerin kaynağını belirlemek için, bazı araştırmacılar enzimlerin total mikro flora ile olan ilişkilerini göstermiş, diğerleri ise bazı özel bakteri ve mantar gruplarının daha güvenilir bir gösterge olduğunu bulmuşlardır. Diğer yandan, en iyi korelasyon organik karbon, pH, bitki kökleri, toprak faunası, ve hatta toprak yüzeyindeki liken ve alglerle elde edilmiştir[1].

Oksidoreduktaz dehidrogenaz organik maddelerin oksidasyonundaki hidrojeni transfer ederek oynadığı rolden dolayı toprakta bir dereceye kadar fazla çalışılmıştır. Katalaz aktivitesi hidrojen peroksid (H_2O_2) veya tespit edilen hidrojen peroksid (H_2O_2) miktarına eklenen oksijenden serbest kalan oksijen oranını baz alır. Bazı hidrolaz ve transferazlar yoğun olarak araştırılmıştır çünkü çeşitli organik bileşiklerin dekompozisyonunda rol oynar ve bu yüzden besin döngüsünde ve toprak organik madde formasyonunda önemlidir [2].

Abiotic toprak enzimlerinin işlevsel rolü, deneysel olarak henüz kesin bir şekilde gösterilmemektedir. Sonuçta toprak enzimleri büyük ölçüde, yaşayan organizmaların aktivitelerinden ayırt edilemeyen abiotic enzimatik aktivitelerin ölçülmesiyle belirlenmektedir. Dahası, abiotik enzimlerin toprak organizmaları ile önemli ilişkisi olduğu hipotezi mevcuttur.

SONUÇ

Ekosistem içindeki bütün besin öğeleri, besin ve enerji kaynağı olarak toprağa, parçalanmaya ve kompleks organik döngüye bağlıdır. Toprağa düşen bitkisel ve hayvansal artıklardaki besin elementleri yüksek polimer bileşikler halinde kaldıkları sürece, yüksek bitkiler ve mikroorganizmalar bunlardan doğrudan doğruya yararlanamazlar.

Enzimlerin başlıca görevi; yüksek moleküllü organik maddeleri basit, yani hücreye geçebilecek ve organizma tarafından yararlanabilecek şekle sokmaktır. Enzimler bütün madde değişimi reaksiyonlarına katılırlar ve enzimsiz hayat olayları oluşamaz.

Enzimler biyokimyasal reaksiyonların hızını artıran ve protein yapısında olan biyokatalizörlerdir. Enzimler biyolojik sistemlerdeki düzenleyicilerdir ve özel aktivatörlerdir çünkü onlar maddelerle stereo spesific (dayanıklılıklarını azaltacak) biçimde (örneğin elektronik konfigürasyonlarını değiştirerek), enerji aktivasyon reaksiyonunu (reaksiyonun ilerlemesi için gerekli enerji miktarını) azaltarak kombine olurlar.

Toprak ekosisteminde, karbon, azot, kükürt ve diğer besin elementlerinin döngüsünde enzimler hayati rol oynarlar. Topraklarda yaklaşık olarak 100 enzimin faaliyeti tanımlanmıştır. Bu enzimler çoğunlukla oksidoredüktazlar, hidrolazlar ve transferazlar şeklinde gruplanırlar. Toprakta meydana gelen reaksiyonlar bakımından en önemli enzimler Hidrolaz, Aldolaz, Dehidrogenaz, Oksidaz, Redüktaz, Enolaz, Karboksilaz, Dekarboksilaz ve Katalaz enzimleridir.

Toprak enzimleri, toprak mikrobiyal aktivitesi ve toprak verimliliğinin bir göstergesi olarak kullanılmaktadır. Monokültür veya ekim nöbeti altındaki tarım topraklarında çeşitli toprak enzimlerinin dağılımı ve aktiviteleri geniş bir araştırma konusu oluşturmuştur. Buna karşın doğal ekosistemlerde biyotop karakterizasyonunda enzimler kullanılarak ekolojik bir ilişkinin araştırılması ender olarak yer almakta ve bu konuda fazla bir araştırma bulunmamaktadır. Bu alandaki çalışmalar yoğunlaştırılmalı ve konu ile ilgili bilgi eksiklikleri giderilmeye çalışılmalıdır.

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ORGANİK VE GELENEKSEL OLARAK YETİŞTİRİLEN KAYISI (PRUNUS ARMENIACA L.) ÇEŞİTLERİNİN POMOLOJİK ÖZELLİKLERİ (DETERMINATION OF POMOLOGICAL CHARACTERISTICS OF ORGANIC AND CONVENTIONAL APRICOT CULTIVARS PRUNUS ARMENIACA L.)

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ABSTRACT

This study was carried out on 'Hasanbey', 'Hacıhaliloğlu' and 'Kabaaşı' apricot cultivars and a wild apricot type grown in Malatya province (Eastern Anatolia of Turkey) between 2007 and 2008 years. In this study, conventional and organic fruit samples of these cultivars and type were analyzed for some important pomological characteristics such as fruit size, fruit weight, total soluble solids, pH, titreable acidity color values (L, a, b). The experimental design was completely randomized plots with three factors (cultivation techniques, cultivars, years) and with three replicates. In the results, it was determined that significant differences for fruit weight changed according to cultivation techniques (organic and conventional) and cultivars; fruit weight, total soluble solids, pH, titreable acidity and L color value changed according to 'cultivation techniques X cultivar X year' interaction; a and b color values changed according to 'cultivation techniques X cultivar' interaction.

Keywords: Apricot, *Prunus armeniaca* L., Organic, Conventional, Pomology

ÖZET

Bu çalışma 2007 ve 2008 yıllarında Malatya (Türkiye) ilinde yetiştirilen 'Hasanbey', 'Hacıhaliloğlu' ve 'Kabaaşı' kayısı çeşitleri ile bir zerdali tipinde yürütülmüştür. Çalışmada bu çeşitleri bir arada bulunduran biri organik, diğeri de geleneksel yöntemlerin uygulandığı bahçelerdeki örnekler kullanılmıştır. Deneme deseni tesadüf parsellerine göre, 3 faktörlü (yetiştirme tekniği, çeşit ve yıl) ve 3 tekerrürlü olara düzenlenmiştir. Ağaçlardan alınan örneklerde meyve iriliği, meyve ağırlığı, suda çözünür kuru madde miktarı (SÇKM), pH, titre edilebilir asitlik (TA) ile L, a ve B değerleri olarak da renk ölçümleri yapılmıştır. Çalışma sonucunda, meyve iriliği yetiştirme tekniği (organik ve geleneksel) ve çeşitlere göre; meyve ağırlığı, suda çözünür kuru madde miktarı, pH değerleri, titre edilebilir asitlik ve L renk değerleri 'yetiştirme tekniği x çeşit x yıl' interaksiyonuna göre; a ve b renk değerleri de 'yetiştirme tekniği x çeşit' interaksiyonuna göre önemli düzeyde farklı çıkmıştır.

Anahtar Kelimeler: Kayısı, *Prunus armeniaca* L., Organik, Geleneksel, Pomoloji

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GİRİŞ

Uzun yıllardan beri dünyanın en önemli kayısı üretim merkezlerinden birisi olması dolayısıyla, Anadolu kayısının ikinci anavatanı durumunda bulunmaktadır. Özellikle ekolojik şartlarının uygunluğu Türkiye'yi dünya taze ve kuru kayısı üretiminde söz sahibi ülke konumuna getirmiştir. Önemli düzeydeki üretim miktarı ile de Malatya ili gerek ülkemizde ve gerekse dünyada önemli bir kayısı üretim bölgesidir [1].

Geleneksel yetiştiriciliğin yaygın olduğu Malatya ilinde, organik yetiştiricilik özellikle son yıllarda kayısıda ağırlık kazanmış ve bunda özellikle dünya ülkelerinde organik ürünlere olan ilginin artmış olması etkili olmuştur. Bundan dolayı, bu eğilimin bölgede organik üretimi önemli düzeyde daha da artırması tahmin edilmektedir [2].

Kayısı ve diğer bazı türler kendilerine uygun olan ekolojilerde yüzyıllardır kaliteli olarak yetiştirilmekte ve bu ürünlerde gerçekleştirilen organik tarım tekniği, esasen geleneksel tarım yöntemlerinden de çok farklı olmamaktadır. Organik tarım, özellikle uzun yıllar sonuçları dikkate alındığında, ürün miktarı ve kalitesini önemli düzeyde ve olumlu yönde etkilemektedir [3].

Meyvelerin kalitesini tanımlamada birçok kimyasal özellikleri yanında, fiziksel özellikleri de kullanılmaktadır. Daha geniş anlamda kullanılan pomolojik özellikler üzerine ekoloji, çeşit, bakım ve beslenme şartları gibi bir çok faktör de etkili olmaktadır. Bu çalışmada da, özellikle son yıllarda ülkemiz için de önem arz eden organik yetiştiricilik ile ilgili olarak, Malatya ilinde yetiştirilen önemli kayısı çeşitlerinde, pomolojik özelliklerin organik ve geleneksel yetiştirme tekniklerine göre değişimi araştırılmıştır.

MATERYAL VE YÖNTEM

1. Materyal

Çalışmada materyal olarak kullanılan geleneksel kayısı örnekleri Malatya Meyvecilik Araştırma Enstitüsü'ne ait kayısı koleksiyon bahçesinde 15 yaşındaki Hacıhaliloğlu', 'Kabaaşı' ve 'Hasanbey' kayısı çeşitleri ile bir zerdali tipinden, organik kayısı örnekleri ise il merkezine 20 km uzaklıkta bulunan bakımı çok iyi olan organik kayısı yetiştiriciliği ve ihracatı yapan Eşref doğan isimli üreticinin bahçesinde 10 yaşındaki aynı çeşitlerden alınmıştır.

2007 ve 2008 yıllarında, ağacın tamamını yansıtması için, örnekler her bir ağacın farklı yöneylerinden karışık olarak alınmıştır. Pomolojik analizler her çeşide ait ağaçların çeşitli yönlerinden tesadüfen alınan 20 meyvede yapılmıştır.

2. Yöntem

2007 ve 2008 yıllarında yürütülen bu çalışma tesadüf parselleri deneme desenine göre, 3 faktörlü olarak, planlanmıştır:

Faktör A: Yetiştirme tekniği (Cultivation technique)

A1: Geleneksel (Conventional)

A2: Organik (Organic)

Faktör B: Çeşit (Cultivar)

Faktör C: Yıl (Year)

Deneme 3 tekerrürlü ve her tekerrürde 3 ağaç olacak şekilde düzenlenerek, sonuçlarla ilgili istatistiki analizler TARIST programında, gruplandırmalar LSD'ye göre yapılmıştır.

Örneklerde meyve iriliği (meyve eni, meyve boyu ve meyve kalınlığı değerlerinin aritmetik ortalaması olarak, mm), meyve ağırlığı (g), suda çözünür kuru madde miktarı (%), pH, titre edilebilir asitlik (malik asit, %) ve L-a-b renk değerleri (Minolta CR-200) belirlenmiştir.

SONUÇLAR VE TARTIŞMA

Yapılan istatistiki analizler sonucunda, meyve iriliği çeşitlere ve yetiştirme sistemlerine göre önemli derecede farklılık arz etmiş olup, yıllar ve diğer interaksiyonlar önemsiz çıkmıştır (Çizelge 1). En iri meyveler 'Kabaaşı' çeşidinde 41.33 mm olarak ve en küçük meyveler zerdali tipinde 37.507 mm olarak belirlenmiştir. Yetiştirme sistemlerine göre ise 39.183 mm (geleneksel) ile 40.211 mm (organik) arasında değişim göstermiştir.

Meyve ağırlığında bütün faktörler ve interaksiyonlar önemli çıkarken, en ağır meyveler (44.900 g) 2008 yılında organik 'Kabaaşı' çeşidinde, en hafif meyveler, sırasıyla, 2008 yılında organik (34.167 g) ve geleneksel (35.000 g) zerdalide, 2007 yılında organik zerdalide (35.533 g), 2007 yılında organik 'Hacıhaliloğlu' (35.700 g), 2008 yılında geleneksel 'Hacıhaliloğlu' (36.000 g) ve organik 'Hacıhaliloğlu' (37.033 g)'nda belirlenmiştir.

Suda çözünür kuru madde miktarı yetiştirme tekniği X çeşit X yıl interaksiyonuna göre önemli çıkarken, % 20 (Geleneksel 'Hasanbey' 2008, geleneksel 'Kabaaşı' 2007 ve2008), ile % 24 (geleneksel X 'Hacıhaliloğlu' X 2007, organik X 'Hacıhaliloğlu' X 2007 ve organik X zerdali X 2007) arasında değişim göstermiştir.

pH en düşük düzeyde zerdalinin geleneksel 2007 (3.5), organik 2008 (3.5) ve geleneksel 2008 (3.6); en yüksek düzeyde 'Hasanbey' 2007 organik (5.1) ve geleneksel (5.0), 'Hacıhaliloğlu' 2008 geleneksel (5.0) ve 'Hasanbey' 2008 organik (4.9) kombinasyonlarında belirlenmiştir.

Meyve suyunda titre edilebilir asitlik % 0.200 ('Hasanbey' X 2008 X organik) ve % 0.210 ('Hasanbey' X 2007 X geleneksel) ile % 0.820 (zerdali X 2007 X geleneksel ve % 0.880 (zerdali X 2008 X geleneksel) arasında değişmiştir.

Renk değerlerinde ise, L değerinin 50.000 (organik X zerdali X 2008) ile 76.300 (organik X 'Kabaaşı' X 2008) arasında değiştiği ve bunu 'Kabaaşı' (74.400) ve 'Hacıhaliloğlu' (74.400) çeşitlerinin 2007 yılı organik örneklerinin takip ettiği görülmektedir. Sonuçlara göre, organik ürünlerin parlaklık değerinin daha yüksek olduğu söylenebilir.

a renk değerinin 'yetiştirme tekniği X çeşit' interaksiyonunda +4.100 ('Hacıhaliloğlu' çeşidinin organik ürünlerinde) ile +11.900 ('Kabaaşı' çeşidinin geleneksel ürünlerinde) arasında değiştiği ve genel olarak geleneksel ürünlerde daha yüksek olduğu, çeşitler bazında ise +4.375 ('Hacıhaliloğlu') ile +11.233 (zerdali) arasında değiştiği; kısaca geleneksel ürünlerde ve zerdalide kırmızı rengin daha fazla oluştuğu söylenebilir.

b renk değerinin 'yetiştirme tekniği X çeşit' interaksiyonunda +35.400 (organik X zerdali) ile +50.933 (geleneksel X 'Hasanbey') arasında değiştiği belirlenmiştir. Genel olarak bu değerin organik ürünlerde daha yüksek yani organik ürünlerde sarı renk değerinin daha fazla olduğu söylenebilir.

Sonuç olarak, kayısıda incelenen çeşitlerde, önemli bazı pomolojik özelliklerin yetiştirme tekniklerine, çeşitlere ve çalışma yıllarına göre farklılık arz ettiği ortaya çıkmış olup, meyve kalite özellikleri bakımından özellikle organik yetiştirme tekniğinde daha iyi sonuçlar elde edilebileceği söylenebilir.

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Çizelge 1. Geleneksel (A1) ve organik (A2) olarak yetiştirilen çeşitlere ait meyve örneklerinde meyve özelliklerinin yetiştirme sistemi (A), çeşit (B) ve yıllara (C) göre değişimi.

Variation of fruit characteristics according to cultivation technique (A), cultivars (B) and years (C) on conventional (A1) and organic (A2) products.

Meyve iriliği (mm, fruit size)

B	C	A: A1	A: A2	B X C
'Hasanbey'	2007	39.333	40.600	39.967
	2008	38.303	41.663	39.983
	A X B	38.818	41.132	39.975 ab[1]
'Hacıhaliloğlu'	2007	38.900	40.233	39.567
	2008	39.823	40.533	40.178
	A X B	39.362	40.383	39.873 b[1]
'Kabaaşı'	2007	40.070	41.363	40.717
	2008	41.767	42.533	42.150
	A X B	40.918	41.948	41.433 a[1]
zerdali wild apricot	2007	38.030	36.997	37.513
	2008	37.233	37.767	37.500
	A X B	37.632	37.382	37.507 c[1]
	A	39.183 b[2]	40.211 a[2]	
	2007			39.441
	2008			39.953
A X C	2007	39.083	39.798	
	2008	39.282	40.624	

[1]LSD (0.01): 1.529
[2]LSD (0.05): 0.805

Meyve ağırlığı (g, fruit weight)

B	C	A: A1	A: A2	B X C
'Hasanbey'	2007	44.800 ab[1]	44.000 ab[1]	44.400 a[3]
	2008	43.300 ab[1]	43.900 ab[1]	43.450 a[3]
	A X B	43.900 a[2]	43.950 a[2]	43.925 a[4]
'Hacıhaliloğlu'	2007	42.367 b[1]	35.700 c[1]	39.033 bc[3]
	2008	36.000 c[1]	37.033 c[1]	36.517 cd[3]
	A X B	39.183 b[2]	36.367 c[2]	37.775 b[4]
'Kabaaşı'	2007	43.367 ab[1]	44.600 ab[1]	43.983 a[3]
	2008	44.400 ab[1]	45.900 a[1]	45.150 a[3]
	A X B	43.883 a[2]	45.250 a[2]	44.567 a[4]
zerdali wild apricot	2007	44.900 ab[1]	35.533 c[1]	40.217 b[3]
	2008	35.000 c[1]	34.167 c[1]	34.583 d[3]
	A X B	39.950 b[2]	34.850 c[2]	37.400 b[4]
	A	41.729 a[5]	40.104 b[5]	
	2007			41.908 a[6]
	2008			39.925 b[6]
A X C	2007	39.958 b[7]		
	2008	40.250 b[7]		

[1] LSD (0.05): 2.923
[2] LSD (0.01): 2.779
[3] LSD (0.01): 2.779
[4] LSD (0.01): 1.965
[5] LSD (0.01): 1.389
[6] LSD (0.01): 1.389
[7] LSD (0.01): 1.965

Çizelge 1'in devamı (continuation of Table 1)

Suda çözünür kuru madde miktarı (%, total soluble solids)

B	C	A: A1	A: A2	B X C
'Hasanbey'	2007	22.000 bc[1]	22.000 bc[1]	22.000
	2008	20.000 d[1]	21.000 cd[1]	20.500
	A X B	21.000 bc[2]	21.500 b[2]	21.250 c[3]
'Hacıhaliloğlu'	2007	24.000 a[1]	24.000 a[1]	24.000
	2008	22.500 bc[1]	23.000 ab[1]	22.750
	A X B	23.250 a[2]	23.500 a[2]	23.375 a[3]
'Kabaaşı'	2007	20.000 d[1]	24.000 a[1]	22.000
	2008	20.000 d[1]	22.000 bc[1]	21.000
	A X B	20.000 c[2]	23.000 a[2]	21.500 c[3]
zerdali wild apricot	2007	21.000 cd[1]	24.000 a[1]	22.500
	2008	22.000 bc[1]	23.000 ab[1]	22.500
	A X B	21.500 b[2]	23.500 a[2]	22.500 b[3]
	A	21.438 b[4]	22.875 a[4]	
	2007			22.625 a[5]
	2008			21.688 b[5]
A X C	2007	21.750	23.500	
	2008	21.125	22.250	

[1] LSD (0.05): 1.139
[2] LSD (0.01): 1.083
[3] LSD (0.01): 0.765
[4] LSD (0.01): 0.541
[5] LSD (0.01): 0.541

pH

B	C	A: A1	A: A2	B X C
'Hasanbey'	2007	5.00 a[1]	5.10 a[1]	5.05
	2008	4.50 ab[1]	4.90 a[1]	4.70
	A X B	4.75 ab[2]	5.00 a[2]	4.88 a[3]
'Hacıhaliloğlu'	2007	4.70 ab[1]	4.60 ab[1]	4.65
	2008	5.00 a[1]	4.00 bc[1]	4.50
	A X B	4.85 a[2]	4.30 bc[2]	4.58 a[3]
'Kabaaşı'	2007	4.60 ab[1]	4.60 ab[1]	4.60
	2008	4.00 bc[1]	4.80 a[1]	4.40
	A X B	4.30 bc[2]	4.70 ab[2]	4.50 a[3]
zerdali wild apricot	2007	3.50 c[1]	4.60 ab[1]	4.05
	2008	3.60 c[1]	3.50 c[1]	3.55
	A X B	3.55 d[2]	4.05 cd[2]	3.80 b[3]
	A	4.36	4.51	
	2007			4.59 a[4]
	2008			4.29 b[4]
A X C	2007	4.45	4.725	
	2008	4.28	4.300	

[1] LSD (0.01): 0.7681
[2] LSD (0.01): 0.5431
[3] LSD (0.01): 0.384
[4] LSD (0.01): 0.272

Çizelge 1'in devamı (continuation of Table 1)
Titre edilebilir asitlik (%, titreable acidity)

B	C	A: A1	A: A2	B X C
'Hasanbey'	**2007**	0.210 g[1]	0.220 fg[1]	0.215 e[3]
	2008	0.360 de[1]	0.200 g[1]	0.280 de[3]
	A X B	0.285 e[2]	0.210 f[2]	0.248 c[4]
'Hacıhaliloğlu'	**2007**	0.400 cde[1]	0.430 cd[1]	0.415 b[3]
	2008	0.250 fg[1]	0.400 cde[1]	0.325 cd[3]
	A X B	0.325 e[2]	0.415 cd[2]	0.370 b[4]
'Kabaaşı'	**2007**	0.310 ef[1]	0.430 cd[1]	0.370 bc[3]
	2008	0.383 cde[1]	0.460 c[1]	0.422 b[3]
	A X B	0.347 de[2]	0.445 c[2]	0.396 b[4]
zerdali wild apricot	**2007**	0.820 a[1]	0.650 b[1]	0.735 a[3]
	2008	0.880 a[1]	0.600 b[1]	0.740 a[3]
	A X B	0.850 a[2]	0.625 b[2]	0.738 a[4]
	A	0.452 a[5]	0.424 b[5]	
	2007			0.434
	2008			0.442
A X C	**2007**	0.435	0.433	
	2008	0.468	0.415	

[1] LSD (0.01): 0.100
[2] LSD (0.01): 0.07071
[3] LSD (0.01): 0.07071
[4] LSD (0.01): 0.050
[5] LSD (0.05): 0.026

B	C	A: A1	A: A2	B X C
'Hasanbey'	**2007**	68.300 bc[1]	66.300 cde[1]	67.300
	2008	65.367 de[1]	64.300 e[1]	64.833
	A X B	66.833 de[2]	65.300 e[2]	66.067 b[4]
'Hacıhaliloğlu'	**2007**	70.400 b[1]	74.400 a[1]	72.400
	2008	70.333 b[1]	70.400 b[1]	70.367
	A X B	70.367 bc[2]	72.400 b[2]	71.383 a[4]
'Kabaaşı'	**2007**	70.000 b[1]	74.400 a[1]	72.200
	2008	68.000 bcd[1]	76.300 a[1]	72.000
	A X B	69.000 cd[2]	75.200 a[2]	72.100 a[4]
zerdali wild apricot	**2007**	50.400 fg[1]	52.967 f[1]	51.683
	2008	51.000 fg[1]	50.000 g[1]	50.500
	A X B	50.700 f[2]	51.4833 f[2]	41.092 c[4]
	A	64.225 b[5]	66.096 a[5]	
	2007			65.896 a[6]
	2008			64.425 b[6]
A X C	**2007**	64.775	67.017	
	2008	63.675	65.175	

[1] LSD (0.05): 2.655
[2] LSD (0.01): 2.524
[3] LSD (0.01): 2.779
[4] LSD (0.01): 1.785
[5] LSD (0.01): 1.262
[6] LSD (0.01): 1.262

Çizelge 1'in devamı (continuation of Table 1)

a

B	C	A: A1	A: A2	B X C
'Hasanbey'	**2007**	10.000	9.200	9.600
	2008	9.500	9.000	9.250
	A X B	9.750 b[1]	9.100 b[1]	9.425 b[2]
'Hacıhaliloğlu'	**2007**	3.500	4.200	3.850
	2008	5.800	4.000	4.900
	A X B	4.650 c[1]	4.100 c[1]	4.375 c[2]
'Kabaaşı'	**2007**	12.700	4.200	8.450
	2008	11.100	4.500	7.800
	A X B	11.900 a[1]	4.350 c[1]	8.125 b[2]
zerdali wild apricot	**2007**	11.333	12.600	11.967
	2008	10.000	11.000	10.500
	A X B	10.667 ab[1]	11.800 a[1]	11.233 a[2]
	A	9.242 a[3]	7.337 b[3]	
	2007			8.467
	2008			8.113
A X C	**2007**	9.383	7.550	
	2008	9.100	7.125	

[1] LSD (0.01): 1.855
[2] LSD (0.01): 1.312
[3] LSD (0.01): 0.927

b

B	C	A: A1	A: A2	B X C
'Hasanbey'	**2007**	51.400	49.000	50.200
	2008	50.467	50.000	50.233
	A X B	50.933 a[1]	49.500 abc[1]	50.217 a[2]
'Hacıhaliloğlu'	**2007**	48.500	49.000	48.750
	2008	47.000	48.000	47.500
	A X B	47.750 c[1]	48.500 bc[1]	48.125 b[2]
'Kabaaşı'	**2007**	47.100	49.000	48.050
	2008	47.900	51.000	49.450
	A X B	47.500 c[1]	50.000 ab[1]	48.750 ab[2]
zerdali wild apricot	**2007**	35.500	36.800	36.150
	2008	38.000	34.000	36.000
	A X B	36.750 d[1]	35.400 d[1]	36.075 c[2]
	A	45.733	45.850	
	2007			45.788
	2008			45.796
A X C	**2007**	45.625	45.950	
	2008	45.842	45.750	

[1] LSD (0.05): 2.014
[2] LSD (0.01): 1.914

KONVANSİYONEL VE ORGANİK OLARAK YETİŞTİRİLEN TAZE VE GÜNKURUSU KAYISI (PRUNUS ARMENIACA L.) MEYVELERİNİN A VİTAMİNİ DÜZEYLERİ* (THE VITAMIN A LEVEL OF FRESH AND DRIED APRICOTS PRUNUS ARMENIACA L. GROWN AS CONVENTIONALLY AND ORGANICALLY)

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ABSTRACT

In this study, the vitamin A changes in the fruit samples of fresh and dried apricots grown as conventionally and organically in Malatya in 2007 and 2008, in Malatya the vitamin A levels weere determined with HPLC in the fresh or dried Hasanbey, Hacıhaliloğlu, Kabaaşı apricot varieties and in the samples of an Zerdali type which are grown in the mentioned systems. In 2007 among organically cultured fresh apricots, while the highest vitamin A amount was found in Hacıhaliloglu variety which were in the samples of variety X application X growing with a 27,9µg/g-portion, the lowest vitamin amount was determined with a 1,8 µg/g vitamin A amount in the apricot samples belonging to sun dried Zedali type which was grown conventionally. When it comes to 2008, the highest vitamin A amount was seen with a 25,3 µg/g dry matter in the Kabaasι variety that were grown organically and whose fresh fruit samples were taken, the lowest amount was identified in the wild apricot samples (2,3µg/g vitamin A) which were grown conventionally and subjected to sun dried application. In both of the periods when the analysis were carried out, the vitamin A levels showed differences in statistical sense by depending upon three factors (variety X application X cultivation technique).

Keywords: Apricot, *Prunus armeniaca,* conventionally, organically, vitamin A

Özet: Bu çalışma ile Malatya yöresinde organik ve konvansiyonel sistemlerde yetiştirilen kayısıların taze ve güneşte kurutulmuş (gün kurusu) meyve örneklerinde A vitamini değişimleri belirlenmiştir. 2007 ve 2008 yıllarında Malatya ilinde belirtilen sistemlerde yetiştirilmiş taze, güneşte kurutulmuş Hasanbey, Hacıhaliloğlu, Kabaaşı kayısı çeşitleri ve bir Zerdali tipine ait örneklerde A vitamini düzeyleri HPLC ile tespit edilmiştir. 2007 yılında organik olarak yetiştirilen ve taze örneklerin çeşit X uygulama X yetiştirme sistemi içerisinde bulunan Hacıhaliloğlu çeşidinde 27,9µg/g ile en yüksek A vitamini değeri belirlenirken, en düşük değer ise 1,8 µg/g A vitamini miktarı ile ile konvansiyonel olarak yetiştirilen gün kurusu zerdali tipine ait kayısı numunelerinde tespit edilmiştir. 2008 yılında ise en yüksek A vitamini değeri 25,3 µg/g ile organik yetiştirilen ve taze meyve örnekleri alınan Kabaaşı çeşidinde görülmüş, en düşük değer konvansiyonel olarak yetiştirilen ve gün kurusu uygulamasına tabi tutulmuş zerdali (2,3µg/g A vitamini) numunesinde tespit edilmiştir. Analizlerin yapıldığı her iki dönemde A vitamini düzeyleri 3 faktöre bağlı olarak (çeşit x uygulama x yetiştirme sistemi) istatistiki anlamda değişiklikler göstermiştir.

Anahtar Kelimeler: Kayısı, *Prunus armeniaca*, Konvansiyonel, Organik, A vitamini

GİRİŞ

Ülkemiz, gerek kayısı çeşitlerinin kalitesi, gerekse sahip olduğu ekolojik üstünlükler nedeniyle rakip ülkelere kıyasla doğal bir rekabet avantajına sahiptir. Malatya ili Türkiye'nin en önemli kayısı üretim merkezi olması itibariyle, kayısı yetiştiriciliğinde ve kuru kayısı ihracatımızda özel bir önemi bulunmaktadır.

Kayısı insan sağlığı bakımından önemli bir yere sahiptir. Kayısının mineral bileşimi incelendiğinde; potasyumca zengin, sodyumca fakir ve A vitaminin karotence zengin olması beslenmemiz için önemlidir. Ayrıca bu yapısı ile kayısı özellikle vücutta kan basıncının düzenlenmesinde büyük önem taşımaktadır. Örneğin, 250 g yaş kayısı ve 30 g kuru kayısı günlük provitamin A ihtiyacının tamamını karşılamaktadır.

Meyve ve sebzelerde sadece provitamin-A bulunur. Diğer adı 'retinol' olan A vitamini ise, sadece hayvansal ürünlerde, özelikle bazı balıkların yağında bol miktarda bulunur. Karotenoid maddelerden en az 10 tanesi, A vitamini aktivitesine sahiptir. Yani karotenoid maddelerinden 10 tanesine yakını provitamin – A niteliğindedir. Ancak bunların içinde en önemlileri beta-karoten, alfa-karoten ve kriptoksantindir. Bitkisel kaynaklı A vitamini denince, çoğu kez beta-karoten akla gelmektedir [3]. Kayısı meyveleri polifenoller, karotenoidler ve vitaminler gibi fitokimyasalları farklı oranlarda içerdikleri gibi, bu bileşikler tada, renge ve besinsel değerlerine göre değişim göstermektedirler [4].

Kayısı önemli provitamin olan karotenoidler için en iyi kaynaklardan biridir. Özellikle β-karoten toplam karotenoid içeriğinin % 50'den fazlasını içermektedir [8]. β - karoten kayısı meyvesinde çok miktarda ve kayısı ürünlerinde α-karoten, zeaxentin ve luteinde az miktarda bulunmaktadır [6]. Karotenoidler vücutta serbest radikallerin neden olduğu hasara karşı hücre korumada önemli rol oynayan antioksidanlardır. Serbest radikal hasarlarına karşı vücudun savunma mekanizmasının güçlenmesinde, yaşlılığın geciktirilmesi ve hastalıklardan korunmada fonksiyonel bir gıda olan kayısının sağlıklı ve kaliteli bir yaşam için topluma önerilebileceği rapor edilmiştir [12]. Karotenoid pigmentlerine ilaveten kayısıda bulunan başlıca antioksidan bileşikleri: izoklorojenik asit, kaffeik asit, 4-metilkateşol, klorojenik asit, kateşin epikateşin, pirogallol, kateşol, flavonoller ve p-kumarik asit türevleridir [7, 9].

Kayısının bileşimi itibari ile bir takım fonksiyonel özelliklere sahiptir, fakat bu tür özelliklerinin belirlendiği araştırma çalışmaları sınırlıdır. Kayısının insan sağlığına faydalarına yönelik çalışmaların artması, kayısının ne şekilde tüketilebileceği ve faydaları konusunda tüketicilerin pek bilgi sahibi olmadıkları açıktır.

Kayısı tarımsal ürünler içerisinde, muhafaza edilirken rengi en çok değişikliğe uğrayan meyvelerden birisidir. Bu yönüyle kayılara uygulanan kükürtleme; meyve etinin kayısıya özgü açık renk alması ve muhafaza esnasında oluşan renk değişiminin önlenmesi amacıyla yapılmaktadır. Aynı zamanda kükürtleme hastalık ve haşerelerin zararını asgariye indirerek, kayısıların depolarda daha uzun muhafaza edilmesini sağlamaktadır [5, 10]. Uygulamalarımızda olmamasına rağmen kayısı yetiştiriciliğinde kükürtleme çokça uygulanan ve tüketiciye hazırlamada kullanılan bir yöntemdir.

Kayısı meyvesi, antioksidan özellik gösteren karotenoidler ve fenolik maddeler yönünden oldukça zengindir. Türk kayısıları genellikle diğer coğrafi bölgelerde yetişen kayısılara göre daha yüksek antioksidan kapasiteye sahip olması ve bununla birlikte karbonhidrat niceliğinin dünyadaki yetiştirilen kayısı çeşitlerinden daha yüksek olmasından dolayı enerji değerleri de oldukça yüksek bulunmuştur [1, 3]. Çalışmamızın temel amacı olan ve insan sağlığında önemli bir yer teşkil eden A vitamini oranlarının kayısıda tespit edilmesi ile kayısının daha faydalı bir ürün olduğu vurgulanacaktır.

Yapılan çalışmada 2007-2008 yıllarında farklı kayısı meyvelerinde (Hasanbey, Hacıhaliloğlu, Kabaaşı çeşitleri ve Zerdali tipi) taze ve güneşte kurutulmuş kayısılardaki A vitamini miktarları incelenmiştir.

MATERYAL VE YÖNTEM

Materyal:

Bu araştırma, 2007-2008 yıllarında iki yıl süre ile yürütülmüştür. Geleneksel olarak yetiştirilen kayısı örnekleri Malatya Meyvecilik Araştırma Enstitüsü'ne ait kayısı koleksiyon bahçesindeki 8 x 8 m aralık ve mesafede dikilmiş 15 yaşındaki Hacıhaliloğlu, Hasanbey, Kabaaşı ve Zerdali ağaçlarından, organik kayısı çeşitleri ise Malatya merkeze bağlı, organik kayısı yetiştiriciliği ve ihracatı yapan bir çiftçinin bahçesindeki 10 yaşındaki kayısı ağaçlarından sağlanmıştır.

Yöntem:

2007-2008 yıllarında yürütülen çalışmanın deneme deseni tesadüf parsellerine göre, 3 tekerrürlü her tekerrürde 3 ağaç kullanılacak şekilde düzenlenmiştir. Kayısı çeşitlerine ait hem organik hem de geleneksel tarzda yetiştirilen meyveler gün kurusu olarak da isimlendirilen şekliyle doğrudan güneşte kurutulmuştur. Kayısı örneklerinde A vitamini ekstraksiyonu için; A Vitamini tayini aşağıdaki işlem basamağına göre yapılmıştır:

- 20 g kayısı örneği alınarak etanol içinde homojenize edilerek son hacim 50 ml'ye tamamlanmıştır.
- Ekstraktan 5 ml alınarak Metanol-Hekzan ekstraksiyonu yapılmış, Çözgenler sıvı azot atmosferinde vakumda uzaklaştırılmıştır.
- Kurumuş ekstrakt 0.5 ml metanolde çözülmüş ve HPLC'de A vitamini miktarı ölçümleri yapılmıştır.

A vitamini HPLC analizinde Eluent A da metanol:asetonitril:kloroform (47:42:11) kullanılmıştır ve ölçümler 326 ve 296 nm dalga boylarında yapılmıştır.

İstatistiki değerlendirmeler için oluşturulan varsyans analizleri TARİST ve ortalamaların karşılaştırılması MSTATC programına göre yapılmıştır.

TARTIŞMA VE SONUÇ

2007 yılı örneklerinde A vitamini düzeyleri bakımından bütün faktörler ve bu faktörler arasında karşılıklı ilişkiler istatistiki bakımdan %1 seviyesinde önemli çıkmıştır (Çizelge 1). İlk yıl uygulamalarında A vitamini değerleri açısından Kayısı çeşitleri ve Zerdali tipinde yetiştirilme şekli ile uygulama arasında istatistiki farklar ortaya çıkmış, organik yetiştirilen kayısı örneklerinin A vitamini değerleri, konvansiyonel örneklere göre istatistiksel olarak daha yüksek sonuçlar verdiği görülmüştür ($p<0.01$).

Organik olarak yetiştirilen ve taze örneklerin çeşit X uygulama X yetiştirme sistemi içerisinde bulunan Hacıhaliloğlu çeşidinde 27,9µg/g ile en yüksek A vitamini değeri belirlenirken, en düşük değer ise 1,8 µg/g A miktarı ile ile konvansiyonel olarak yetiştirilen gün kurusu zerdali tipine ait kayısı numunelerinde tespit edilmiştir. Organik olarak yetiştirilen gün kurusu Kabaaşı çeşidi, gün kurusu Hacıhaliloğlu çeşidinin yanında taze örnekleri alınmış Zerdali tipi ve Hasanbey çeşidinin meyve örneklerinde A vitamini miktarları da 10 µg/g'ın üzerinde bulunmuşlardır.

Organik Zerdali numunelerinde A vitamini 6.0 µg/g kuru madde şeklinde görülürken Hasanbey çeşidi organik olarak yetiştirilen kayısılar içerisindeki 3.2 µg/g değeri ile en A vitamini içeren çeşit olmuştur Genel ifadeyle taze ve gün kurusu uygulamaları dahil edilerek; organik sistemde yetiştirilen kayısı örneklerindeki A vitamini miktarlarının konvansiyonel olarak yetiştirilen kayısı örneklerine göre daha fazla çıktığını söylemek mümkündür.

Çeşitler Varieties	**Uygulama Application**	**Yetiştirme Sistemi Cultivation technique**		**Uygulama X Çeşit Aplication X Variety**
		Konvansiyonel(µg/g) Convantionally (µg/g)	**Organik (µg/g) Organically (µg/g)**	
Hasanbey	Taze Fresh	7.700 EF[1]	11.300 D[1]	9.500 C[2]
	Gün Kurusu Dried	3.100 HI[1]	3.200 HI[1]	3.150 D[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	5.400 EF[3]	7.250 C[3]	6.325 B[7]
Hacıhaliloğlu	Taze Fresh	8.400 EF[1]	27.900 A[1]	18.150 A[2]
	Gün Kurusu Dried	3.500 H[1]	13.500 C[1]	8.500 C[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	5.950 DE[3]	20.700 A[3]	13.325 A[7]
Kabaaşı	Taze Fresh	8.900 E[1]	24.900 B[1]	16.900 B[2]
	Gün Kurusu Dried	4.300 H[1]	14.500 C [1]	9.400 C[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	6.600 CD[3]	19.700 A[3]	13.150 A[7]
Zerdali	Taze Fresh	7.100 FG[1]	11.400 D[1]	9.250 C[2]
	Gün Kurusu Dried	1.800 I[1]	6.000 G[1]	3.900 D[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	4.450 F[3]	8.700 B[3]	6.575 B[7]
Yetiştirme Sistemi Cultivation technique		5.600 B[4]	14.087 A[4]	
Uygulama Aplication	Taze Fresh			13.450 A[5]
	Gün Kurusu Dired			6.238 B[5]
Yetiştirme Sistemi X Uygu-lama Cultivation technique X Apli-cation	Taze Fresh	8.025 C[6]	18.875 A[6]	
	Gün Kurusu Dried	3.175 D[6]	9.300 B[6]	

[1]LSD (% 1): 1.449 • [2]LSD (% 1): 1.025 • [3]LSD (% 1): 1.025 • [4]LSD (% 1): 0.512 • [5]LSD (% 1): 0.512 • [6]LSD (% 1): 0.7245 • [7]LSD (% 1): 0.725

Çizelge 1. 2007 yılında kayısıların farklı çeşit, uygulama ve yetiştirme tekniklerinde belirlenen A vitamin düzeyleri

Table 1. The vıtamın A level of aprıcots as determined at different variety X application X cultivation technique in 2007

2008 yılına ait organik örneklerin A vitamini değerleri, konvansiyonel örneklere göre istatistiksel olarak daha yüksek sonuçlar verdiği görülmüştür ($p<0.01$). En yüksek A vitamini değeri 25,3 µg/g kuru madde ile organik yetiştirilen ve taze meyve örnekleri alınan Kabaaşı çeşidinde görülmüş, en düşük değer ise 2007 yılı verilerine paralel şekilde konvansiyonel olarak yetiştirilen ve günkurusu uygulamasına tabi tutulmuş zerdali (2,3µg/g A vitamini) numunesinde tespit edilmiştir. Organik yetiştirilen ve taze olarak incelenen Kabaaşı çeşidini, 24 µg/g A vitamini ile taze Hacıhaliloğlu, 13.5 µg/g A vitamini ile organik gün kurusu Hacı haliloğlu, 12.6 µg/g A vitamini değeri ile organik gün kurusu Kabaaşı ve 11.4 µg/g A vitamini ile organik taze Zerdali tipi izlemiştir ($p<0.01$). En düşük A vitamini değeri 2007 verilerinden biraz yüksek bulunmasına rağmen yine konvansiyonel olarak yetiştirilen gün kurusu zerdali tipine ait numunelerde (2,3 µg/g kuru madde) elde edilmiştir (Çizelge 2).

Çeşitler Varieties	**Uygulama Application**	**Yetiştirme Sistemi Cultivation technique**		**Uygulama X Çeşit Aplication X Variety**
		Konvansiyonel(µg/g) Convantionally (µg/g)	**Organik (µg/g) Organically (µg/g)**	
Hasanbey	Taze Fresh	7.200 G[1]	9.300 EF[1]	8.250 D[2]
	Gün Kurusu Dried	3.100 K[1]	6.200 HI[1]	4.650 E[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	5.150 D[3]	7.750 C[3]	6.450 B[7]
Hacıhaliloğlu	Taze Fresh	8.400 F[1]	24.000 B[1]	16.200 B[2]
	Gün Kurusu Dried	6.000 I[1]	13.500 C[1]	9.750 C[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	7.200 C[3]	18.750 A[3]	12.975 A[7]
Kabaaşı	Taze Fresh	10.200 E[1]	25.300 A[1]	17.750 A[2]
	Gün Kurusu Dried	4.300 J[1]	12.600 C[1]	8.450 D[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	7.250 C[3]	18.950 A[3]	13.100 A[7]
Zerdali	Taze Fresh	7.100 GH[1]	11.400 D[1]	9.250 C[2]
	Gün Kurusu Dried	2.300 K[1]	5.600 I[1]	3.950 F[2]
	Yetiştirme Sistemi X Çeşit Cultivation technique X Variety	4.700 D[3]	8.500 B[3]	6.600 B[7]
Yetiştirme Sistemi Cultivation technique		6.075 B[4]	13.488 A [4]	
Uygulama Aplication	Taze Fresh			12.862 A[5]
	Gün Kurusu Dired			6.700 B[5]
Yetiştirme Sistemi X Uygulama Cultivation technique X Aplication	Taze Fresh	8.225 C[6]	17.500 A[6]	
	Gün Kurusu Dried	3.925 D[6]	9.475 B[6]	

[1]LSD (% 1): 0.9137 • [2]LSD (% 1): 0.6461 • [3]LSD (% 1): 0.6461 • [4]LSD (% 1):0.323 • [5]LSD (% 1): 0.323 • [6]LSD (% 1): 0.4569 • [7]LSD (% 1): 0.457

Çizelge 2. 2008 yılı farklı çeşit, uygulama ve yetiştirme tekniklerinde belirlenen A vitamin düzeyleri

Table 2. The vıtamın A level of aprıcots as determined at different variety X application X growing systems in 2008

Her iki yılın organik Kabaaşı, Hacıhaliloğlu, Hasanbey ve Zerdali deki A vitamini miktarları geleneksel olarak yetiştirilen kayısılardan daha yüksek çıkmıştır.

Kayısıların işlem görme şekillerine göre organik ve konvansiyonel olarak yetiştirilen kayısılardaki A vitamini miktarlarının tüm kayısılarda birbirine paralel bir sıralama sergilediği görülmüştür.

Meyvelerin önemli vitaminleri ile alakalı yapılan bir diğer çalışmada kayısı meyvelerinin kuruma esnasında C vitamininin kaybolduğu, A vitamininin ise % 30 parçalandığı belirtilmektedir. Konu ile ilgili çalışan araştırıcılar 100 g yaş kayısıda 2700 IU A vitamini, 67.2 mg C vitamini bulunduğunu; kükürtlenerek güneşte kurutulmuş 100 gr kayısının yaşa göre % 13'lük kayıpla 2530 IU A vitamini ve % 74'lük kayıpla 17.4 mg C vitamini; kükürtlenmeden güneşte kurutulmuş 100 g kayısının ise % 14'lük kayıpla 1800 IU A vitamin ve % 96'lık kayıpla 3.0 mg C vitamini içerdiğini ifade etmişlerdir [2]. Çalışmamızda elde ettiğimiz sonuçlarda görüldüğü gibi organik ve geleneksel kayısı çeşitlerinin tümünde gün kurusu ve kükürtlenmiş örneklerde bariz şekilde A vitamini miktarlarında önemli oranlarda kayıplar görülmüştür. Bu yönü ile değerlendirildiğinde de elde ettiğimiz sonuçlar literatürle benzerlik göstermektedir.

Uzelac ve ark. [11] farklı kayısı çeşitlerinde taze kayısı ile işlenerek püre haline getirilmiş kayısılardaki kateşin, epikateşin, klorogenik asit, kaffeik asit, p-kumarik asit, ferulik asit ve rutin miktarlarını incelemişler, tüm çeşitlerde belirgin düzeyde polifenol miktarlarında azalmaların olduğunu rapor etmişlerdir. Çalışmamızda bulmuş olduğumuz sonuçlarda da kayısının işlem görme şekillerine göre A vitamini miktarlarının değişmiş olduğu görülmektedir.

Yapılan çalışma da, elde etmiş olduğumuz veriler neticesinde kullanmış olduğumuz geleneksel ve organik Hasanbey, Hacıhaliloğlu, Kabaaşı kayısı çeşitleri ve Zerdali meyvelerinde, insan sağlığı ve beslenmesi açısından önemli olan A vitamini değerleri her kayısı numunesinde farklı miktarlarda bulunmuştur. İki yıl süreyle ayrı ayrı değerlendirildiğinde A vitamini düzeyleri tek faktöre bağlı olmaksızın 3 faktöre bağlı (çeşit X uygulama X yetiştirme sistemi) olarak farklılıklar göstermiştir. Farklı uygulamaların denenebileceği taze ve kuru kayısılarda, insan beslenmesi için en ön sırayı alacak ve vitamin değerlerini en üst noktada tutacak metotların göz ardı edilmemesi gerekmektedir.

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ORGANİK VE GELENEKSEL OLARAK YETİŞTİRİLEN TAZE KAYISILARIN (PRUNUS ARMENIACA L.) POLİFENOL MİKTARLARI (AN INVESTIGATION ON CONTENTS OF POLYPHENOLS IN ORGANIC AND CONVENTIONAL FRESH APRICOT CULTIVARS PRUNUS ARMENIACA L.)

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ABSTRACT

In this study, fresh fruit samples of 'Hacıhaliloğlu', 'Kabaaşı' and 'Hasanbey' apricot cultivars, and a wild apricot type grown in Malatya region (Eastern of Turkey) as conventional and organic were analyzed in order to determine their phenolic contents (catechin, epicatechin, chlorogenic acid, caffeic acid, p-coumaric acid, ferrulic acid and rutine) in 2007 year. In the results, the polyphenol content of organically grown samples were found to be higher than the conventional cultivars in all samples ($p<0.05$). The most abundant phenolics in 'Hacihaliloğlu' (148.26 µg/g dry matter) cultivar was quarcetin-3-rutinoside (rutine), whereas the less abundant phenolics was *p*-coumaric acid in 'Hasanbey' (0.21 µg/g dry matter) cultivar.

Keywords: Apricot, *Prunus armeniaca*, Polyphenol, Organic, Conventional

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ÖZET

Bu çalışma, 2007 yılında, Malatya bölgesinde (Türkiye) organik ve geleneksel olarak yetiştirilen 'Hacıhaliloğlu', 'Kabaaşı', 'Hasanbey' kayısı çeşitleri ile bir zerdali tipinin taze örneklerindeki polifenol (kateşin, epikateşin, klorogenik asit, kaffeik asit, p-kumarik asit, ferulik asit ve rutin) içeriklerini belirlemek amacıyla yürütülmüştür. Elde edilen sonuçlar neticesinde, organik kayısı çeşitlerinde polifenol miktarları geleneksel olarak yetiştirilen çeşitlerden daha yüksek bulunmuştur ($p<0.05$). Tüm kayısı numuneleri içerisinde, organik olarak yetiştirilen Hacıhaliloğlu çeşidinde (148.26 µg/g kuru madde) en yüksek düzeydeki polifenol quercetin-3-rutinoside (rutin) olarak bulunmuş ve bu miktarın, diğer polifenollerle kıyaslandığında, en fazla bulunan polifenol olduğu tespit edilmiştir. En az miktardaki polifenole (p-kumarik asit) ise geleneksel olarak yetiştirilen Hasanbey çeşidinde (0.21 µg/g kuru madde) belirlenmiştir.

Anahtar Kelimeler: Kayısı, *Prunus armeniaca* , Polifenol, Organik, Geleneksel

GİRİŞ

Malatya ili Türkiye'nin en önemli kayısı üretim merkezi olup, kuru kayısı ihracatında özel bir önemi bulunmaktadır. Türkiye yaş kayısı üretiminin yaklaşık % 50'sinden fazlasını sağlayan bu ilde üretim yoğun olarak kuru kayısıcılığa yönelik olup, üretilen kayısının önemli bir bölümü (% 90) kurutulmakta ve kurutulan kayısının yaklaşık % 90-95'i ihraç edilmektedir. Malatya'nın önemli kurutmalık kayısı çeşitleri 'Hacıhaliloğlu' ve 'Kabaaşı' olup, toplam üretimin % 73'ünü 'Hacıhaliloğlu', % 17'sini ise 'Kabaaşı' oluşturmaktadır [1].

Yüksek düzeyde antioksidan ve fenolik madde içeren kayısı serbest radikal hasarlarına karşı vücudun savunma mekanizmasının güçlenmesinde, yaşlılığın geciktirilmesi ve hastalıklara karşı korunmada, sağlıklı ve kaliteli bir yaşamda fonksiyonel bir gıda maddesidir [2].

Polifenollerin antioksidan özellikleri sebebi ile kronik hastalıkları hafifletme özellikleri vardır [3]. Fitokimyasalların içerik ve miktarları farklıdır, fakat bu durum; gün ışığına, toprağa, mevsim, olgunlaşma durumuna, tarım bölgesine ve meyve çeşidi gibi değişik faktörlere bağlıdır [4]. Antioksidan içeriği meyve ve sebzelerin kalitesi açısından önemli bir parametre haline geldiği için; hasat sonrasında antioksidan içeriklerindeki değişimlerin değerlendirilmesi son derece dikkat çeken bir konu olmuştur [5]. Fenolik bileşikler, ikinci bitki metabolitleridir. Meyvelerdeki bu bileşiklerin bileşimi her bir tür ve çeşit için karakteristiktir. Nicel farklılıklar meyve çeşidine, türüne, olgunlaşma safhasına ve çevresel şartlara ve meyve olgunluğuna bağlıdır [6].

Yapılan bir çalışmada değişik kayısı çeşitlerinde polifenol düzeylerine bakılmış ve klorogenik asitin kayısıda en fazla bulunan polifenol olduğu rapor edilmiştir [7]. Kayısıda diğer polifenolik bileşiklerin; neokloregenik asit, kaffeik asit, p-kumarik asit, ferulik asitin, hatta kateşin ve epikateşinin de kayısıda bulunduğu tespit edilmiştir [8]. Kayısıdaki flavonollardan olan kaemferol ile kuarçetin, rutinozit ve glikozit (şeker) formda yoğun bir şekilde meydana gelirler. Bununla birlikte kuarçetin 3- rutinoside (rutin) kayısıda fazla bulunmaktadır [9]. Hatta bazı kayısı çeşitlerinde Aeskuletin ve skopoletin azda olsa tespit edilmiştir [10]. Fakat kayısı meyvelerinde farklı olgunlaşma aşamalarındaki biyokimyasal değişikliklerle ilgili çok az çalışma bulunmaktadır. Yapılan bir çalışmada, amino asitler olgunlaşmaya doğru azalmış ve eriyen karbonhidratlar artmıştır [11]. Diğer bir çalışmada, klorogenik asit, kaemferol -3- rutinozit miktarı değişmiş ve kuarçetin -3-rutinozit 11 kayısı çeşidinin 3. olgunlaşma aşamasında da elde edilmiştir [12].

Kayısı, erik ve şeftali kaemferol ve kuarçetin türevlerini önemli miktarda içerir. Klorogenik asit kayısıda çok bulunan fenoldür ve rutinde yoğun bulunan bir flavonoidir. Kayısı diğer polifenollerden (+)– kateşin, (-)– epikateşin ve prosiyanidinleri de içerir, flavonoidlerin büyük kısmı kabuk bölgesinde, klorogenik asit et kısmında toplanmıştır [13].

Geleneksel tarım üretim yöntemleri ile üretilen ürünlerde fenolik bileşiklerin seviyesinin insan sağlığı için gerekli olandan daha düşük olduğu konusunda artan bir görüş vardır. Geleneksel yöntemlerindeki pestisit ve gübre seviyeleri bitkilerdeki doğal fenolik üretimi dağılımını etkilemektedir [7]. Toprak kalitesi, iklim, böcek ve otçul zararlıların baskıları bitkilerin beslenme seviyelerinde etkilidirler Ancak farklı kültürel uygulamalarının etkilerinin bitkilerdeki ikinci metabolitlerin üretimine etkileri ile ilgili çok az bilgi bulunmaktadır [14].

Antioksidantlar bakımından zengin gıdalar, kalp hastalıkları, çeşitli kanser tipleri [15], Parkinson, ahlzeimer ve iltihaplı hastalıkların yanı sıra yaşlanma ile oluşan tüm hücresel sorunların [16] önlenmesinde etkin rol oynamaktadır.

Bu çalışma da Malatya ilinde organik ve geleneksel yöntemlerle yetiştirilen 'Hacıhaliloğlu', 'Kabaaşı' ve 'Hasanbey' kayısı çeşitleri ile bir zerdali tipinin taze örneklerindeki polifenol içeriklerinin değişimini belirlemek amacıyla yürütülmüştür.

MATERYAL VE METOT

1. Materyal

Çalışmada materyal olarak kullanılan geleneksel kayısı örnekleri Malatya Meyvecilik Araştırma Enstitüsü'ne ait kayısı koleksiyon bahçesinde 15 yaşındaki 'Hacıhaliloğlu', 'Kabaaşı' ve 'Hasanbey' kayısı çeşitleri ile bir zerdali tipinden, organik kayısı örnekleri ise il merkezine 20 km uzaklıkta bulunan bakımı çok iyi olan organik kayısı yetiştiriciliği ve ihracatı yapan Eşref doğan isimli üreticinin bahçesinde 10 yaşındaki aynı çeşitlerden alınmıştır.

2. Yöntem

2007 yılında yürütülen bu çalışma tesadüf parselleri deneme desenine göre 2 faktörlü (çeşit: 'Hacıhaliloğlu', 'Kabaaşı' ve 'Hasanbey' kayısı çeşitleri ile bir zerdali tipi ve yetiştirme tekniği: organik-geleneksel), 3 tekerrürlü ve her tekerrürde 3 ağaç olacak şekilde planlanmış, istatistiki analizler SPSS 16.0 programında, gruplandırmalar DUNCAN'a göre yapılmıştır.

Kayısı örneklerinden polifenol ekstraksiyonu için Dionex ASE-200 Model hızlandırılmış ekstraksiyon cihazı kullanılmıştır. Polifenollerin analizinde Agilent 1100 serisi yüksek performanslı sıvı kromotgrafi (HPLC) cihazı ve dedektör olarak DAD, UV kullanılmıştır.

SONUÇLAR VE TARTIŞMA

Organik ve geleneksel olarak yetiştirilen 'Hacıhaliloğlu', 'Kabaaşı', 'Hasanbey' kayısı çeşitleri ile zerdali tipinin taze örneklerindeki kateşin düzeyleri incelendiğinde; organik olarak yetiştirilen bütün meyve örneklerindeki kateşin miktarlarının geleneksel olarak yetiştiren kayısılardan istatistiksel olarak daha yüksek olduğu belirlenmiştir ($p<0.05$).

Tüm kayısı numuneleri içerisinde, organik olarak yetiştirilen 'Hacıhaliloğlu' çeşidinde (148.26 µg/g kuru madde) en yüksek düzeydeki polifenol quercetin-3-rutinoside (rutin) olarak bulunmuş ve bu miktarın, diğer polifenollerle kıyaslandığında, en fazla bulunan polifenol olduğu tespit edilmiştir. En az miktardaki polifenole (p-kumarik asit) ise geleneksel olarak yetiştirilen 'Hasanbey' çeşidinde (0.21 µg/g kuru madde) belirlenmiştir (Çizelge 1).

En yüksek kateşin miktarı organik olarak yetiştirilen 'Hacıhaliloğlu' (22,98 µg/g kuru madde) çeşidinde bulunurken, en düşük düzeydeki kateşin miktarı geleneksel olarak yetiştirilen 'Hasanbey' (5.53 µg/g kuru madde) çeşidinde tespit edilmiştir. Organik ve geleneksel olarak yetiştirilen kayısı çeşitlerine göre; kateşin miktarının sıralaması faklı olmakla beraber, 'Hasanbey' çeşidindeki miktar her iki yetiştirme tekniğinde de en düşük düzeyde çıkmıştır.

Epikateşin düzeyleri incelendiğinde; en yüksek epikateşin miktarı organik olarak yetiştirilen Hasanbey (14.12 µg/g kuru madde) ve 'Kabaaşı' (13.33 µg/g kuru madde) çeşitlerinde görülürken, en düşük düzeydeki epikateşin miktarı geleneksel olarak yetiştirilen zerdalide (4.87 µg/g kuru madde) bulunmuştur.

Klorogenik asit düzeyleri incelendiğinde; organik 'Hacıhaliloğlu' çeşidinin en yüksek (13.75 µg/g kuru madde), geleneksel zerdalinin (3.89 µg/g kuru madde) ve 'Kabaaşı' (4.03 µg/g kuru madde) çeşidinin en düşük düzeyde içerdiği belirlenmiştir. Bu arada, geleneksel 'Haıchaliloğlu' çeşidinin klorogenik asit (10.07 µg/g kuru madde) miktarı diğer organik ve geleneksel ürünlerden de daha yüksek bulunmuştur.

Kaffeik asit düzeyleri incelendiğinde; en düşük düzeylerin geleneksel ve organik zerdalide (sırasıyla 1.42 ve 1.60 µg/g kuru madde), en yüksek düzeylerin organik 'Hasanbey' ve 'Kabaaşı' çeşitlerinde (sırasıyla 4.72 ve 4.70 µg/g kuru madde) bulunduğu görülmüştür.

P-kumarik asit düzeyleri 0.21 µg/g kuru madde (geleneksel 'Hasanbey') ile 0.72 µg/g kuru madde organik 'Hacıhaliloğlu' arasında değişmiştir.

Taze kayısı örneklerinde ferrulik asit düzeyleri 1.89 µg/g kuru madde (geleneksel zerdali) ve 2.30 µg/g kuru madde (geleneksel 'Hasanbey') ile 22.91 µg/g kuru madde (organik 'Hacıhaliloğlu') arasında belirlenmiştir.

Çalışmada tüm kayısı numuneleri içerisinde en yüksek düzeyde belirlenen polifenol olan rutin en fazla olarak organik 'Hacıhaliloğlu' çeşidinde (148.26 µg/g kuru madde) ve en az olarak geleneksel 'Hasanbey' çeşidinde (69.19 µg/g kuru madde) belirlenmiştir.

Çalışmamızda incelediğimiz kayısı çeşitlerindeki kateşin, epikateşin, klorogenik asit, kaffeik asit, p-kumarik asit, ferulik asit ve kuarçetin 3- rutinoside (rutin) rutin miktarları her çeşitte farklı miktarlarda bulunmuştur. Tüm çeşitlerde en yüksek düzeydeki polifenol rutin bulunurken, en az düzeydeki ise p-kumarik asit olarak tespit edilmiştir. Çalışmamızda olduğu gibi, diğer çalışmalarda da polifenol miktarlarının kayısı çeşidine bağlı olarak değiştiği ve bu farklılıkların güneşlenme, toprak özellikleri, olgunlaşma seviyesi, tarımın yapıldığı bölge ve meyve çeşidinden kaynaklandığı da ifade edilmektedir [4,6]. Antioksidan içeriğinin meyvelerin kalitesine önemli derecede etki etmesinden dolayı hasat sonrasında antioksidan içeriği değişimlerinin değerlendirilmesi de son derece dikkat çeken bir konu olmuştur [5]. Geleneksel tarım üretim yöntemleri ile üretilen ürünlerde fenolik bileşiklerin seviyesinin insan sağlığı için gerekli olandan daha düşük olduğu konusunda artan bir görüşü ve geleneksel tarımsal yöntemlerindeki pestisit ve gübre seviyelerinin bitkilerdeki doğal fenolik dağılımını etkilediğini dikkate aldığımızda [7] çalışma sonuçlarımızdan da anlaşılacağı üzere en yüksek polifenol düzeyleri organik ürünlerde belirlenmiştir.

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Çizelge 1. Organik ve geleneksel kayısılardaki polifenol düzeyleri düzeyleri (µg/g kuru madde)

Poliphenol levels (µg/g dry matter) in organic and conventional fresh apricot fruits.

Çeşit (Cultivars)	**Yetiştirme sistemi (Cultivation technique)**	**Kateşin (Catechin)**	**Epikateşin (Epicatechin)**	**Klorogenik asit (Chlorogenic acid)**	**Kaffeik asit (Caffeic acid)**	**p-kumarik asit (p-coumaric acid)**	**Ferulik asit (Ferrulic acid)**	**Rutin (Rutine)**
'Hasanbey'	Geleneksel (Conventional)	5.53^{c}	8.72^{c}	5.06^{de}	4.39^{ab}	0.21^{e}	2.30^{e}	69.19^{e}
	Organik (Organic)	7.37^{bc}	14.12^{a}	6.09^{cd}	4.72^{a}	0.60^{bc}	7.20^{cd}	107.89^{b}
'Hacıhaliloğlu'	Geleneksel (Conventional)	9.58^{bc}	9.61^{c}	10.07^{b}	2.53^{d}	0.39^{cd}	10.90^{b}	95.42^{c}
	Organik (Organic)	22.98^{a}	12.46^{ab}	13.75^{a}	4.07^{b}	0.72^{a}	22.91^{a}	148.26^{a}
'Kabaaşı'	Geleneksel (Conventional)	12.21^{bc}	5.41^{d}	4.03^{e}	3.14^{c}	0.30^{de}	6.57^{d}	95.94^{c}
	Organik (Organic)	15.30^{abc}	13.33^{a}	6.26^{cd}	4.70^{a}	046^{cd}	8.43^{c}	105.72^{bc}
'Zerdali' Wild apricot type	Geleneksel (Conventional)	14.62^{abc}	4.87^{d}	3.89^{e}	1.42^{e}	0.34^{de}	1.89^{e}	83.43^{d}
	Organik (Organic)	17.25^{ab}	10.41^{bc}	7.00^{c}	1.60^{e}	0.44^{cd}	6.00^{d}	105.00^{bc}

ORGANİK TAVUKÇULUĞUN ESASLARI

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ÖZET

Organik üretim, biyolojik çeşitliliği, doğal kaynakların korunmasını, hayvan refahı standartlarının yükseltilmesini ve tüketicilerin doğal koşullarda üretilmiş ürünleri tercih ettiği bir üretim modelidir. Son yıllarda bitkisel ve hayvansal üretimde tüketicilerin organik ürünlere olan talebinin artması, üreticilerin bu üretime geçiş yapmasında büyük paya sahiptir. Organik yumurta ve organik tavuk eti üretimi, Avrupa'da belirli markalar altında yıllardır başarıyla uygulanmaktadır. Organik tavukçuluğu geleneksel üretim modellerinden ayıran temel özellikler; yem, barınaklar, üretim periyodu ve üretimde kullanılan genotiplerdir. Tavuklar, organik hammaddelerden üretilen yemler ile beslenip, doğal ortamlarında sergileyebildikleri davranışlarına imkan veren barınaklarda büyütülürler. Organik üretimde tercih edilen yavaş gelişen piliçler, entansif üretimin aksine minimum 81 günlük bir üretim döneminde pazarlama ağırlığına ulaşmaktadırlar. Bu çalışmada, organik tavukçuluğun esasları başlığı altında, bu üretimde kullanılacak genotipler, yemlemede kullanılacak hammaddelerin özellikleri, barınaklar ve kesim gibi özellikler üzerinde durulmuş, geleneksel üretimden farklılıklar ortaya konulmuştur.

Anahtar Kelimeler: Organik üretim, Tavuk eti, Yumurta, Genotip

GİRİŞ

Son yıllarda tüm tarımsal üretim dallarında organik üretimde artış gözlenmektedir. Bu artışta en önemli etken, tüketicilerin daha sağlıklı olduklarına inandıkları ürünleri tüketme isteği en önemli rolü oynamaktadır. Ürünlerdeki "gıda güvenliği" ve "doğallık" tüketiciler tarafından aranan özellik haline gelmiştir [1]. Bunun sonucunda da üreticiler doğal yollardan üretime yönelmiş ve alternatif üretim teknikleri uygulamaya başlamışlardır. Tavukçuluk alanında özellikle bazı Avrupa ülkelerinde yıllardır başarılı bir şekilde sürdürülmekte olan organik üretimin bazı gereklilikleri bulunmaktadır. Yirminci yüzyılın ortalarından itibaren, tavukçuluktaki genetik seleksiyon, besleme, yetiştirme teknikleri ve veterinerlik hizmetlerindeki ilerlemelere bağlı olarak, tavuk etinin maliyeti diğer türlere göre daha düşük olmaktadır [2]. Fiyatının uygun olması nedeniyle, tavuk eti tüketimi Dünya'da % 29 [3], ülkemizde ise % 53 [4] seviyelerine ulaşmıştır. Entansif broiler üretiminde, piliçler 2-2.5 kg'lık pazarlama ağırlığına ortalama 42 gün gibi kısa bir sürede ulaşmaktadırlar. Bu hızlı gelişmeleri, hayvan refahı ve özellikle metabolik bozukluklar ile bacaklarda problemlere yol açmaktadır [5]. Bütün bu etkenler ışığında, hayvan refahını ön planda tutan, tüketiciler tarafından daha sağlıklı, lezzetli ve doğal bulunan organik tavuk eti üretim sistemlerine olan talep gün geçtikçe artmaktadır. Yumurta tavukçuluğunda üretim ise genel olarak çok katlı kafes sistemlerinde yapılmaktadır. Bu üretim modelinde 18-19 haftalık yaşa gelmiş olan yarkalar, yaklaşık olarak 2000 cm^2 taban alanına sahip kafeslere 2-5 adet olmak üzere yerleştirilirler. Çok katlı kafeslerde, tavukların hareket alanları kısıtlı hatta imkansız hale gelmiştir. Hayvan hakları savunucuları, tavukların doğal ortamlarında sergiledikleri davranışlarını rahatça ortaya koyabilecekleri üretim modellerine geçişin hızlandırılmasını istemektedir. Tüketicilerden gelen taleplerin artması ile birlikte, yumurta tavukçuluğunda gezintili alana sahip veya organik üretim modelleri yaygınlaşacaktır. Bu çalışmada, organik tavuk eti ve yumurtası üretiminde kullanılan genotipler, yetiştirme teknikleri, barınaklar, yemler, kullanılan ekipmanlar, nakliye ve kesim gibi özellikler hakkında bilgi verilmektedir.

Genotip: Organik hayvancılıkta, tür ve ırk seçimlerinde, üretimin yapılacağı bölgenin koşulları göz önüne alınır, hastalığa dayanıklı tür ve ırk seçimine dikkat edilir. Organik tavuk eti üretiminde yavaş gelişen genotipler tercih edilir. Avrupa Birliği düzenlemeleri de organik tavuk yetiştiriciliğinde yavaş gelişen bölgesel piliçlerin kullanılması gerekliliğini ortaya koymaktadır [6]. Bu genotipler, konvansiyonel üretimde kullanılan etlik piliçlerin 42 günde ulaştıkları 2-2,5 kg'lık pazarlama ağırlığına 60-120 gün gibi sürelerde ulaşırlar. Islah ve besleme alanında yapılan ilerlemelerle entansif üretimde etlik piliçlerin kesim yaşı düşürülmüş ve büyüme oranı arttırılmıştır. Büyüme oranı gibi, yemden yararlanma ve et verimi de gelişmiş; ancak, yaşama gücü, iskelet yapı bütünlüğü, kalp sağlığı ve bağışıklık sistemi bozulmuştur [7]. Yavaş gelişen genotiplerde kaslar, organlar ve iskelet yapısı birlikte geliştiklerinden bu tür sağlık problemlerinin görülme riski azalır. Kısa sürede gelişen piliçlerde sıklıkla rastlanan abdominal yağ miktarı yavaş gelişen genotiplerde daha az miktarlarda bulunur. Ayrıca cinsel olgunluğa yakın yaşlarda kesilen piliçlerin etlerinin daha lezzetli oldukları belirtilmektedir [8]. Bütün bu nedenlerden dolayı, serbest gezintili ve organik üretim sistemlerinde yavaş gelişen etlik piliçler kullanılmaktadır. Dünyanın birçok bölgesinde yerel tavuk ırklarının ıslahı ve/veya seleksiyonu ile bölgesel yavaş gelişen genotip elde etme çalışmaları yapılmaktadır. Ülkemize ait yavaş gelişen etlik piliç materyalinin elde edilmesine yönelik çalışmalar Ondokuz Mayıs Üniversitesi Ziraat Fakültesinde tarafımızca yürütülmektedir. Ankara Tavukçuluk Araştırma Enstitüsünde bulunan ağır yapılı yumurtacı ebeveyn hatlarının seleksiyonu ve hızlı gelişen etlik piliç ebeveynleri ile melezlenmesinden elde edilmesi planlanan döllerin, kısmen de olsa ülkemiz tavukçuluğuna katkı sağlaması planlanmaktadır.

Barınaklar: Organik tavukçulukta barınakların olmazsa olmaz özelliği gezinti alanına sahip olmalarıdır. Barınaklar sabit veya taşınabilir olabilir. Sabit barınaklar belirli bir mevkide, taşınabilir barınaklar ise meyve bahçeleri, tarım alanları veya ormanlık bölgelere yerleştirilebilirler ve yer değiştirebilir özelliktedirler. Etlik piliçler 5-6 haftalık yaşa geldiklerinden itibaren gezinti alanına çıkabilmelidirler. Sabit barınaklarda m^2'de en fazla 10, taşınabilir barınaklarda ise m^2'de en fazla 16 hayvan bulunabilir. Yumurta tavukları için bu sayı m^2'de 6 hayvandır. Ayrıca kümeslerde tünek ve 8 tavuk için bir folluk gözü bulundurulmalıdır. Kümeslerde zeminin en az üçte biri düz bir yapıda olmalı, sap-saman, kum, talaş veya kısa çim gibi maddelerle kaplı olmalıdır. Hayvan başına 2 m^2'lik gezinti alanı olmalıdır. Barınağın her 100 m^2'si için gezinti alanına açılan 4 metrelik bir çıkış olmalıdır [6]. Gezinti alanları bitki örtüsü ile kaplanmalı, tavuklar için yeterli miktarda suluk, yemlik ve olumsuz hava koşullarından (güneş ışığı, yağmur v.b.) koruyucu alanlar bulunmalıdır. Tavuklar gün ışığından yeterince faydalanabilmelidirler. Her bir barınakta maksimum 4800 etlik piliç, 3000 adet yumurta tavuğu bulundurulabilir. Kümeslerde gün ışığı ve yapay aydınlatmanın süresi toplam 16 saati geçemez [9]. İki üretim dönemi arasında barınaklar boş bırakılmalı, binalar ve teçhizatlar dezenfekte edilmeli, yeşil alanlar dinlendirilmelidir [10].

Besleme: Organik üretimi, diğer üretim sistemlerinden ayıran esas etken yemdir. Tüm organik standartlar, yemlerin %100 organik olmasını istemekte, ancak bazı durumlarda rasyonda bir miktar organik olmayan hammaddelere de izin verilebilmektedir [11]. AB düzenlemelerine göre rasyondaki hammaddelerin en az % 60'ı tamamen organik, en fazla % 20'si konvansiyonel yemlerden oluşabilir [6]. Yemler öncelikle hayvanların yetiştirildiği çiftliğin kendi arazisinden, eğer bu mümkün değilse aynı bölgedeki diğer organik arazilerden temin edilmeli ve rasyon en az % 70 tahıl içermelidir [12]. Entansif üretimde kullanılan hızlı gelişen piliçlerin, başlangıç rasyonlarında ham protein oranı %22, bitirme yemlerinde % 17 iken; yavaş gelişen piliçlerde bu oranlar başlangıçta %20, bitirme yemlerinde ise % 15 düzeylerindedir [10]. Rasyonların protein- enerji içerikleri belirlenirken; hayvanların gezinti alanından alacağı yem miktarı da göz önünde bulundurulmalıdır. Bitkisel kökenli organik olmayan, mineral ve hayvansal kökenli yem maddeleri, yem katkı maddeleri, yemin işlenmesine yardımcı maddeler belirli durumlarda kullanılabilir. Sentetik aminoasitler ile büyütme destekleyicilerinin kullanılması yasak olup, sınırlı yemleme de yapılamaz.

Hayvan sağlığı: Organik üretimde ilk önce hastalık önleyici tedbirler alınmalıdır. Bunun için uygun genotip seçimi yapılmalı, kalabalık ve sıkışıklığı önlemek için uygun yerleşim sıklığı sağlanmalıdır. Tüm tedbirlere rağmen hastalık veya yaralanma olduğu durumlarda hasta hayvan uygun bir barınakta izole edilmelidir. Yavaş gelişen piliçlerin üretim dönemi entansif üretime göre daha uzun olduğundan farklı aşılama programları uygulanır. Örneğin, hızlı gelişen etlik piliçler Marek hastalığına karşı aşılanmazken, yavaş gelişen etlik piliçlere üretim dönemlerinde Marek aşısı uygulanır [13]. Gaga kesimi yapılması yasaktır. İlaç ve antibiyotik kullanımı veteriner hekim nezaretinde uygun görülen durumlarda, sertifika kuruluşunun bilgisi dahilinde kullanılır, ancak kesimden 5 gün önce antibiyotik ve anti-koksidiyallerin uygulanması bitirilmelidir [14].

Nakliye – Kesim: Organik tavukların kesim yaşı minimum 81 gün olmalıdır. Kesimhaneye nakil süresiyle ilgili AB mevzuatında belirli bir kısıtlama yoktur, ancak farklı sertifika programlarında maksimum 8 saatlik yolculuk uygun görülmüştür. Hayvanların nakliyesi mümkün olan en kısa sürede stressiz bir şekilde yapılmalıdır. Kesim işlemi mümkünse ayrı bir kesimhanede, değilse, entansif üretilmiş piliçlerden sonra dezenfeksiyon işlemi uygulandıktan sonra yapılmalıdır. Ambalajlama esnasında da gerekli hijyen koşullara sağlanarak, ürüne gereken hassasiyet gösterilmelidir. Üretim süresi boyunca organik tavuk üretim koşullarına uygun biçimde yetiştirilen tavuk eti veya yumurtası, sertifikasyon kuruluşu tarafından verilen organik ürün etiketi ile ambalajlanarak pazara sunulur. Organik tavukçulukta civcivin yumurtadan çıkmasından elde edilen ürünün sofralara sunulmasına kadar geçen sürede tamamen hayvan refahını ön planda tutan, çevreye en az zararı veren koşullar geçerlidir.

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ORTA KARADENİZ KOŞULLARINDA ORGANİK MISIR YETİŞTİRİCİLİĞİ ÜZERİNE BİR ARAŞTIRMA

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ÖZET

Bu araştırmanın amaçlarından biri bir çok kısımlarında kimyasal ilaç ve gübre kullanılmadan üretim yapılan Karadeniz Bölgesi'nin orta yükseklikteki alanlarının organik tarım açısından değerlendirilebilmesine katkı sağlamaktır. 2004 ve 2005 yıllarında Samsun koşullarında yürütülen bu araştırmada, mısırların organik ve geleneksel şartlarda performansları incelenmiş, bölgede organik mısır tarımı yapma ihtimali açıklığa kavuşturulmaya çalışılmıştır. Çalışmada 1 şeker mısır, 4 cin mısır, 3 kendilenmiş hat ve 13 atdişi tek melez mısır çeşitleri kullanılmıştır. Denemeler tesadüf blokları deneme deseninde 4 tekerrürlü olarak yürütülmüştür. Organik ve geleneksel şartlarda elde edilen değerler arasındaki istatistiksel fark, incelenen özelliklerin çoğunda önemli bulunmuştur.

Anahtar Kelimeler: Organik tarım, mısır, tane verimi, verim unsurları

GİRİŞ

Daha önce yapılan ıslah çalışmaları birim alandan daha fazla verim elde edilmesine yönelik olduğundan ekolojik çevre göz ardı edilmiştir. Son yıllarda bunun sakıncalı olduğu fark edilerek, bir yetiştirme sisteminde ihtiyaç duyulan girdilerin sistemin kendi organik şartlarından karşılama yolları araştırma konusu olmuştur. 1990'lardan itibaren ekolojik tarım Avrupada çok hızlı bir gelişme göstermiştir. Tarım alanlarının % 1,4'ü, tarım işletmelerinin % 1,1'i ekolojik tarıma geçmiştir. ABD'de 1995 yılında 2,8 milyar USD olan ekolojik gıda pazarı % 26 artarak 1996'da 3,5 milyar USD'a ulaşmıştır [1]. Organik tarla bitkileri ABD'de organik gıda üretiminin kalbidir ve organik gıda sektörüne en geniş katkıda bulunurlar. Mısır, soya, buğday ve yulaf marketlerde tane ve yağı ile önemli ticaret ürünü olarak yer almaktadır [2]. Türkiye'nin de organik tarım pazarından hak ettiği payı alabilmesi için bu konuda gerekli araştırmaları yapmalıdır.

Türkiye için halihazırda ihracat açısından büyük önem arz eden organik tarım uygulamalarının gelecekte genişleme eğilimi göstereceği anlaşılmaktadır. Bu genişleme ve büyümenin önüne bilimsel olmayan bilgiler ışığında bir takım kısıtlamalar getirmek organik tarımın önünde engel oluşturacaktır. Bu yüzden karar vericilerin ve konu ile ilgili kanun, tüzük ve yönetmelik hazırlayanların organik tarımı zorlaştırmadan ziyade üretici için daha kolay ve maliyeti azaltan uygulamalar haline getirmeleri gerekmektedir. Esneklik gösterilmesi gereken alanlardan birisi kullanılacak çeşitler ve bunların elde edilme şeklidir [3].

Karadeniz Bölgesi organik tarım açısından çok önemli bir potansiyele sahiptir. Özellikle fındık yetiştiriciliği çok az kimyasal gübre ve ilaç kullanarak, hatta hiç kullanmadan yapılmaktadır [4].

Algan [5], Heissenhiber ve Ring (1992)'e atfen bildirdiğine göre, ekolojik tarım tekniğinin uygulandığı tek yıllık bitkilerde verim düzeyinin, geleneksel üretim tekniğinin uygulandığı tek yıllık bitkilerin verim düzeyinden % 7-43 daha düşüktür. Ancak verim düşüşü ekolojik tarıma başlanan ilk yıllarda fazla olmakta, sonraki yıllarda ise verim artmaya başlamaktadır.

Ching [6], Pensilvanya'da ekstrem iklim şartlarında organik gübreli, baklagil gübreli ve geleneksel tarım uygulamalarının riskleri ve faydalarını araştırmış, organik parselin suyu bünyesinde daha çok tuttuğu, mısır ve soya için ilk geçiş süreci yıllardan sonra organik parsel verimlerinin geleneksel parsele yaklaştığını ifade etmiştir.

Rzewnicki et al. [7], 12 mısır çeşidinin ABD'de Ohio bölgesinde 10 değişik yetiştirme ortamında performanslarını incelemişlerdir. Agrigold, Pioneer, Bird, Doebler, Schlesman, Steyer ve White Cap çeşitleri organik şartlarda diğerlerinden daha erken çıkış, Bird, Doebler ve Steyer çeşitleri daha hızlı bir büyüme göstermişlerdir. Bu araştırmada Agrigold A6447 çeşidi en yüksek verim vermiştir. French çeşidi 4 haftada en yüksek boya sahip olmuştur. Yerel çeşitler, sap kırılması ve yatma bakımından daha az performans göstermiştir.

Acar ve ark. [8], organik ve geleneksel koşullarda yetiştirilen cin mısırının verim, maliyet ve kalite kriterlerini karşılaştırmak amacı ile yürüttüğü araştırmada; organik şartlarda verimin, çalışılan her iki yılda da gelenekselden daha düşük çıktığını belirtmişlerdir. Ortalama sonuçlara göre organik mısırın verimi geleneksel mısırdan % 31 daha düşük gerçekleşmiştir. Organik mısırın brüt kârı geleneksel mısırdan % 25 daha düşük hesaplanmıştır. Cin mısırın organik ve geleneksel tarım yöntemleri ile üretilmesi sonucu ortaya çıkan verim, kalite ve brüt kâr karşılaştırması sonucunda geleneksel mısırın daha iyi olduğu kanaatine varılmıştır.

Öz ve Kapar [9], Samsun şartlarında 3 yıl yürüttükleri bir araştırmada 12 çeşit/çeşit adaylarının verim/verim unsurları ve stabilite durumlarını incelemişlerdir. Ortalama sonuçlara göre birim alan tane verimi 883-1212 kg/da, tepe püskülü gösterme süreleri 57.89-64.67 gün, bitki boyu 228-284 cm, ilk koçan yüksekliği 94-137 cm, hasatta tane nemi 20.0-25.0, tane/koçan oranı ise % 80.78 ile 85.0

arasında değişmiştir.

Bu çalışmanın amacı önemli bir tarımsal potansiyele sahip Karadeniz Bölgesi'nde organik tarımın uygulanabilirliği incelemektir. Ayrıca toprak, bitki, hayvan ve insan arasındaki doğal döngünün doğal kökenli ham maddeler kullanarak mümkün olduğunca bir işletmenin kendi içinden sağlanması fikrinin açıklığa kavuşturulmasına katkı sağlamaktır. Diğer bir amacı da organik koşullarda bir ıslah programına gerek olup olmadığı sorusuna cevap aramaktır.

MATERYAL VE METOT

Çalışma 2004 ve 2005'de Karadeniz Tarımsal Araştırma Enstitüsü'nün Samsun'da bulunan deneme arazisinde yürütülmüştür. Deneme yeri toprağı organik maddesi orta düzeyde, killi bünyeye sahip, fosfor ve potasyumu yeterli ve pH'ı 7.6'dır.

Ortalama sıcaklıklar 2004 yılında 19,0 ^{o}C, 2005 yılında ise 19,7 ^{o}C olarak ölçülmüş, bu rakamlar uzun yıllar ortalamasına yakındır. Nispi nem bakımından da deneme yılları ve uzun yıllar ortalaması birbirine yakındır. Bitki su ihtiyacı sulama yapılarak karşılanmıştır.

Organik parselde, deneme kurulmadan önce, 3 yıl arazi boş bırakılmış, hayvan gübresi uygulanmıştır. Bu dönemde fiğ ekilerek toprağa karıştırılmıştır. Mısır ekiminden bir önceki yıl organik soya fasulyesi yetiştirilmiştir. Yapılan toprak tahliline göre, toprakta yetersiz durumda bulunan, makro besin elementlerini karşılamak için % 3.5 N, % 3 P_2O_5 ve % 4 K_2O içeren organik gübreden 300 kg/da uygulanmıştır. Bitkiler çiçeklenmesini tamamladıktan sonra mısır kurdu ve mısır sap kurduna karşı *Trichogramma evanenscens* uygulaması ile biyolojik mücadele yapılmıştır. Geleneksel parselde ise bölge için tavsiye edilen gübreleme (18 kg/da N, 6 kg/da P_2O_5) ve diğer bakım işlemleri uygulanmıştır.

Araştırmada 1 şeker mısır, 4 cin mısır, 3 kendilenmiş hat ve 13 atdişi tek melez mısır çeşitleri kullanılmıştır. Denemeler tesadüf blokları deneme desenine göre 4 tekrarlamalı olarak yürütülmüştür. Parsel sıra araları 70, sıra üzeri 25 cm, parsel boyu ise 5 m'den oluşmuştur. Denemelerin mayıs ayı sonunda ekilmiş, eylül ayı ortasında hasat edilmiştir. Çıkıştan hemen sonra organik tarıma uygun bir pestisit şeker ve kepek ile karıştırılarak toprak altı zararlılarına karşı uygulanmıştır. Bitkiler 4-5 yapraklı oldukları dönemde birinci çapa, diz boyu olduklarında ise boğaz doldurma ile birlikte ikinci çapa uygulanmıştır. Bitkilerin çıkışı ile % 50 çiçeklenme arasındaki süre tepe püskülü gösterme süresi olarak alınmıştır. Her parselde on bitki üzerinde ölçümler yapılmıştır. Mısır bitkisi için ideal depolama nemi % 15 olduğundan, tane verimi bu orana göre hesaplanmıştır.

BULGULAR VE TARTIŞMA

İncelenen özelliklere ait karşılaştırmalı varyans analiz sonuçları Çizelge 1'de verilmiştir. Organik ve geleneksel şartlarda elde edilen değerler arasındaki fark, atdişi mısırlarda koçan çapı, cin mısırlarında koçan uzunluğu ve koçan çapı, kendilenmiş hatlarda koçan uzunluğu özelliklerinde istatistiksel olarak önemsiz, diğer özelliklerde önemli bulunmuştur. Uygulama x çeşit interaksiyonu, atdişi mısırlarda tane nemi bakımından önemli bulunmuştur.

Çizelge 1. Organik ve geleneksel sistemlerde denenen mısırların varyans analiz sonuçları

Özellikler	Atdişi Mısırlar		Cin Mısırlar		Kendilenmiş Hatlar	
	Uygulama	Yıl	Uygulama	Yıl	Uygulama	Yıl
1-Tane Verimi	**	*	**	ÖD	**	ÖD
2-Çiçeklenme Süresi	**	**	**	**	*	**
3-Bitki Boyu	**	ÖD	*	ÖD	**	ÖD
4-Hasatta Tane Nemi	**	**	**	**	**	**
5-Koçan Uzunluğu[1]	*	-	ÖD	-	ÖD	-
6-Koçan Çapı[1]	ÖD	-	ÖD	-	**	-

(*, **) Aynı harf ile gösterilen ortalamalar arasında kendi gurubu içinde% 5 ve %1 önemlilik düzeyinde fark yoktur.

[1]= 1 yıllık sonuçlar. ÖD: Önemli Değil

Tane Verimi

Araştırmada iki yılın ortalama değerleri incelendiğinde atdişi tane mısırların tane veriminin organik parselde 552-732, geleneksel parselde ise 997-1211 kg/da arasında değiştiği görülmektedir. Çeşitlerin ortalaması organik parselde 646, geleneksel parselde 1066 kg/da olarak gerçekleşmiştir. Atdişi mısır çeşitlerinin organik parseldeki ortalama verimlerinin geleneksel parsele göre azalması %39.4 olarak gerçekleşmiştir (Çizelge 2). İki uygulamada da çeşitler arasındaki fark önemsiz çıkmıştır. Organik uygulamada Tector, geleneknelde 31G98 çeşitleri en yüksek verimi vermiştir. Geleneksel uygulamada Tector çeşidi en son sırayı almasına rağmen bu çeşit organik uygulamada iyi bir performans göstermiş en az (%26.6) verim kaybı gerçekleştirmiştir (Çizelge 2).

Cin mısırlarının organik parsel ortalaması geleneksele göre % 36.5 daha az tane verimi vermiştir. Organik parselin iki yıllık ortalaması 329 kg/da iken, geleneksel parselde bu değer 518 kg/da olarak gerçekleşmiştir. Cin mısırlarında, organik parselde geleneksele göre verim kaybı en az (%27.8) Samsun Kompozit çeşidinde gerçekleşmiştir. Çeşitler arasındaki farklılık iki parselde de önemsiz bulunmuştur.

Kendilenmiş hatlar ortalama olarak organik parselde 338, geleneksel parselde 435 kg/da tane verimine sahip olmuştur. Organik parselde geleneksel parsel verimine göre %22.5 verim kaybı gerçekleşmiştir. Atdişi ve cin mısırlarda olduğu gibi her iki uygulamada da hatlar arasındaki fark istatistiksel olarak önemsiz bulunmuştur.

Şeker mısırında iki yılın ortalaması organik parselde 298, gelenekselde 374 kg/da bulunmuştur (Çizelge 2). Organik parselin geleneksel parsele göre verim kaybı % 20.3'dür.

Yapılan bir çalışmada [5] tek yıllık bitkilerde ekolojik ortamda verimin geleneksel ortama göre %7-43 arasında azalama olduğu ifade edilmektedir. Ancak bu düşüşün ekolojik tarımın ileri yıllarında daha az olduğu ifade edilmektedir. Kratochvil, geleneksel şartlarda yetiştirilen

Çizelge 2. Mısır hat ve çeşitlerinin tane verimi ve çiçeklenme süresi değerleri

Atdişi Mısır Çeşitleri	Tane verimi (kg/da)			Çiçeklenme süresi (gün)		
	Organik	Geleneksel	% Fark	Organik	Geleneksel	% Fark
Brasco	607	1071	-43.3	62.2	62.3 de**	-0.1
DK 743	688	1040	-33.8	64.2	64.8 a	-0.9
DK 626	592	1013	-41.6	63.6	63.1 cd	0.8
32 K 61	669	1189	-43.7	64.4	63.6 bc	1.3
Maveric	591	1022	-42.2	63.7	62.4 de	2.0
Tector	732	997	-26.6	63.1	62.7 ce	0.6
Vero	626	1021	-38.7	62.1	62.7 ce	-1.0
Doge	674	1089	-38.1	64.2	64.2 ab	0.1
Dracma	707	1018	-30.6	63.4	62.4 de	1.6
Luce	552	1050	-47.4	61.2	62.1 e	-1.3
33 94	625	1028	-39.2	61.4	61.9 e	-0.8
31 G 98	657	1211	-45.7	65.1	63.6 bc	2.4
Ada 9516	664	1092	-39.2	64.3	64.1 ab	0.4
Ortalama	646	1066	-39.4	63.3	63.1	0.4
VK (%)	17.9	14.7		2.94	1.16	
Cin Mısırlar						
Samsun Komp.	368	509	-27.8	64.2 b**	63.8 a**	0.7
Koç Kompozit	328	472	-30.5	64.8 b	63.1 b	2.7
Koç Cin	326	566	-42.4	66.3 a	64.0 a	3.6
Ant Cin 98	293	524	-44.1	64.8 b	62.9 b	3.1
Ortalama	329	518	-36.5	65.0	63.4	2.5
VK (%)	11.9	12.6		1.47	0.76	
Kendilenmiş Hatlar						
FRMo 17	345	451	-23.5	66.5	65.3 b*	1.9
FR 632	353	445	-20.7	66.7	65.3 a	2.2
Mo 20	315	410	-23.2	67.6	67.8 a	-0.3
Ortalama	338	435	-22.5	66.9	66.1	1.3
VK (%)	13.3	9.95		0.91	1.24	
Kompozit Şeker	298	374	-20.3	54	53	1.9

(*,**) Aynı harf ile gösterilen ortalamalar arasında kendi gurubu içinde % 5 ve % 1 önemlilik düzeyinde fark yoktur.

mısırın organik şartlardakinden daha yüksek verime sahip olduğunu ifade etmiştir [10]. Acar ve ark. yürüttükleri çalışmada organik ve geleneksel sistemde yetiştirilen cin mısırlarında verim bakımından çıkan farkın önemli olduğunu belirtmişledir [8]. Bu ifadeler bizim bulgularımızla paralellik göstermektedir.

Çiçeklenme Süresi

Araştırmada iki yılın ortalama değerlerinin analizi sonucunda organik parseldeki atdişi mısır çeşitleri arasındaki farklılık istatistiksel olarak önemsiz bulunmuştur. Geleneksel parselde ise mısır çeşitleri arasındaki farklılık istatistiksel olarak önemli ($p<0.01$) bulunmuştur. Organik parselde çeşitler 61.2 gün ile 65.1 gün, geleneksel parselde ise 61.9 ile 64.8 gün arasında çiçeklenmişlerdir. Organik parselde 31G98 çeşidi, geleneksel parselde DK743 en geç çiçeklenmiştir. İki yılın ortalamasına göre organik parsel 63.3, geleneksel parsel 63.1 günde çiçeklenmiştir (Çizelge 2).

Cin mısırları ortalama olarak organik şartlarda 65.0 günde, geleneksel parselde 63.4 günde çiçeklenmiştir. Çeşitler arasındaki farklılık istatistiksel olarak, iki uygulamada da önemli ($p<0.01$) bulunmuştur. Mısırlar organik parselde geleneksel parsele göre ortalama % 2.5 geç çiçeklenmişlerdir (Çizelge 2).

Kendilenmiş hatlar organik parselde geleneksel parsele göre ortalama %1.3 geç çiçeklenmişlerdir. Hatlar arasındaki farklılık istatistiksel olarak, organik parselde önemsiz, geleneksel parselde önemli bulunmuştur. Mo20 hattı iki uygulamada birbirine çok yakın zamanda çiçeklenmiştir (Çizelge 2).

Şeker mısırları organik parselde geleneksele göre %1.9 gün geç çiçeklenmiştir (Çizelge 2).

Belirli bir çeşit ve belirli bir coğrafi bölge için, çiçeklenme süresi geniş ölçüde hava sıcaklığına bağlıdır [11]. Çeşitler arasındaki farklılık, sıcaklık ve diğer çevre etkileri vejetatif gelişme periyodunun uzunluğuna diğer gelişme devrelerinden daha etkilidir. Vejetatif gelişme yavaş olursa bitkinin çiçeklenme ve tane olgunlaşması gecikir. Bitkinin vejetatif gelişme devresinde özellikle fosfor, potasyum ve çinko eksikliği etkisini gösterir [12]. Bizim çalışmamızda iki yıllık verilere göre iki uygulama arasındaki fark önemli bulunmuştur. Bunun sebebi bitkinin ihtiyaç duyduğu zaman besin elementlerinin alınabilirliği olabilir.

Bitki Boyu

Araştırmada iki yılın ortalamalarına göre atdişi mısırlarda her iki uygulamada da çeşitler arasındaki fark istatistiksel olarak önemli bulunmuştur. Bitki boyları ortalama olarak organik parselde ortalama 253, geleneksel parselde 291 cm kaydedilmiştir. Bu değerlere göre organik parseldeki çeşitler geleneksel parseldekilere göre %13 daha kısa boya sahip olmuşlardır. Organik parselde bitki boyu en fazla azalan bitki DK626 (%22,7), en az azalan ise Doge'dir (%6.1). Organik parselde Doge, geleneksel parselde 32K61 çeşitleri en yüksek bitki boyuna sahip olmuşlardır (Çizelge 3).

Cin mısırlarının bitki boyları organik parselde, geleneksel parsele göre ortalama %15.4 düşük çıkmıştır. Çeşitler arasındaki fark iki uygulamada da önemsiz bulunmuştur. Organik parselde en az boy azalması Antcin98 çeşidinde bulunmuştur.

Organik parselde kendilenmiş hatların bitki boyları geleneksele göre atdişi ve cin mısırlardan daha fazla azalmıştır (%23). Frmo17 hattının bitki boyunun fazla azalması dikkat çekmiştir.

Şeker mısırı organik parselde geleneksele göre % 20.3 oranında azalmıştır (Çizelge 3).

Yapılan bir çalışmada tavuk gübresinin mısır bitki boyuna diğer organik uygulamalardan daha olumlu etki gösterdiği ifade edilmiştir [13]. Daha önce, bizim yaptığımız çevrede yapılan bazı çalışmalarda [9], hibrit mısırların boyları 2.5-3 m arasında değişmektedir. Bu çalışmada da geleneksel olarak yetiştirilen mısırların bitki boyları benzer değerler almışlardır. Mısır bitkisinde en fazla büyüme çiçeklenme dönemine kadar geçen zamanda gerçekleşir. Bu döneme kadar besin elementlerinin bitkinin ihtiyaç duyduğu formda olması önemlidir[12]. Organik parselde bitki boylarının geleneksele göre düşük çıkmasının sebebi bu parselde besin elementlerinin yeterli de olsa bitkinin istediği zaman yarayışlı olup olmayışı ile ilgili olabilir.

Koçan Uzunluğu

Koçan uzunluğu bakımından iki uygulama arasındaki fark istatistiksel olarak önemsiz bulunmuştur (Çizelge 1). Atdişi mısırlar arasındaki fark, geleneksel parselde önemli ($p<0.01$), organik parselde önemsiz bulunmuştur. Çeşitler geleneksel parselde 19.0-23.3, organik parselde 18.0-21.7 cm arasında değerler almışlardır. Atdişi mısır çeşitleri koçan uzunluğu değerleri değişik dağılım göstermiş, bazı çeşitler organik parselde geleneksele göre daha yüksek değer almıştır. Geleneksel parselde Vero, organik parselde Dramca ve Brasco çeşitleri en yüksek değerler almışlardır. Ortalama olarak atdişi çeşitler organik parselde, geleneksele göre %5.2 daha az değer almışlardır (Çizelge 3).

Cin mısırların koçan uzunluğu değerleri geleneksel parselde 18.3-19.5, organik parselde 15.8-

Çizelge 3. Mısır hat ve çeşitlerinin bitki boyu ve koçan uzunluğu değerleri.

Atdişi Mısır Çeşitleri	Bitki boyu (cm)			Koçan uzunluğu (cm)		
	Organik	Geleneksel	Fark (%)	Organik	Geleneksel	Fark (%)
Brasco	235 d*	275 de**	-14.5	21.7	19.0 d**	14.2
DK 743	273 ab	293 ad	-7.0	20.3	20.3 bd	0.0
DK 626	231 d	299 ab	-22.7	18.0	19.3 d	-6.7
32 K 61	266 ac	310 a	-14.2	20.3	19.8 cd	2.5
Maveric	245 bd	289 be	-14.9	20.0	21.8 ac	-8.3
Tector	251 bd	280 ce	-10.3	19.3	19.0 d	1.6
Vero	252 bd	301 ab	-16.3	21.0	23.3 a	-9.9
Doge	284 a	302 ab	-6.1	20.3	23.0 a	-11.7
Dracma	241 cd	272 e	-11.5	21.7	22.0 ac	-1.4
Luce	252 bd	284 be	-11.3	18.7	22.5 ab	-16.9
33 94	238 d	291 be	-18.1	19.7	20.5 bd	-3.9
31 G 98	255 bd	292 ad	-12.6	19.0	21.8 ac	-12.8
Ada 9516	268 ac	297ac	-9.8	19.0	21.0 ad	-9.5
Ortalama	253	291	-13.0	19.9	21.0	-5.2
VK (%)	8.38	5.28		7.13	7.71	
Cin Mısırlar						
Sam. Komp.	213	253 ab*	-16.0	18.0	19.5	-7.7
Koç Komp.	206	262 a	-21.3	19.5	17.5	11.4
Koç Cin	209	244 b	-14.3	15.8	18.3	-13.7
Ant Cin 98	221	244 b	-9.3	18.0	18.3	-1.6
Ortalama	212	251	-15.4	17.8	18.4	-3.1
VK (%)	5.75	4.89		9.27	5.80	
Kendilenmiş Hatlar						
FRMo 17	165	282	-41.4	17.0 a*	17.5	-2.9
FR 632	183	217	-15.4	14.5 ab	15.0	-3.3
Mo 20	179	186	-4.0	13.9 b	15.0	-7.3
Ortalama	176	228	-23.0	15.1	15.8	-4.4
VK (%)	5.5	7.3		10.1	9.9	
Kompozit Şeker	298	374	-20.3	15	17	-11.8

(*, **) Aynı harf ile gösterilen ortalamalar arasında kendi gurubu içinde% 5 ve %1 önemlilik düzeyinde fark yoktur.

19.5 cm arasında değişmiş, ortalama olarak organik ortamda yetiştirilen çeşitler % 3.26 daha

az değer almışlardır. İki uygulamada da çeşitler arasındaki fark istatistiksel olarak önemsiz bulunmuştur. Geleneksel parselde Samsun kompozit, organik ortamda Koç Kompozit en uzun (19.5 cm) koçana sahip olmuşlardır. Koç Kompozit çeşidi diğerlerinin aksine organik parselde daha fazla koçan uzunluğuna sahip olmuştur (Çizelge 3).

Organik parselde kendilenmiş hatlar arasındaki farklılık istatistiksel olarak önemli, geleneksel parselde önemsiz bulunmuştur. Hatlar geleneksel parselde 15.0-17.5, organik parselde 13.9-17.0 cm arasında değerler almıştır. Ortalama olarak organik parselde geleneksele oranla % 4.4 değer kaybı meydana gelmiştir. (Çizelge 3).

Şeker mısırı organik uygulamada geleneksel uygulamaya göre %11.8 daha az koçan uzunluğuna sahip olmuştur (Çizelge 3).

Yapılan bir araştırmada tavuk gübresi uygulamasından elde edilen koçan uzunluğu değerlerinin diğer uygulamalardan daha yüksek çıktığı ifade edilmektedir [13]. Bizim çalışmamızda tüm mısırlarda organik ve geleneksel parsellerden elde edilen değerler arasında istatistiksel olarak fark önemli ($p<0.05$) çıkmıştır. Geleneksel parsellerden elde edilen değerler ortalama olarak organik parselden yüksek bulunmuştur.

Hasatta Tane Nemi

Araştırmada iki yılın ortalama değerlerine bakıldığında çeşitler organik parselde % 23.1-30.8, geleneksel parselde % 20.9-27.8 arasında değerler almışlardır. Bu ortalamalara göre her iki parselde de Maveric çeşidi en düşük hasat nemine sahiptir. Organik parselde Brasco, geleneksel parselde Ada.95.16 çeşitleri en yüksek hasat nemine sahip olmuştur (Çizelge 4). Ortalama olarak mısırların organik parselde geleneksel parsele göre daha yüksek (%17) neme sahip oldukları görülmektedir.

Cin mısırlarında da atdişi mısırlara benzer bir durum görülmüş, iki uygulamada da cin mısırlar arasındaki fark istatistiksel bakımdan önemli bulunmuştur. Mısırların iki yıllık hasat nemi ortalaması, organik parselde %25, geleneksel parselde %20 bulunmuştur. Ortalama olarak en düşük hasat nemine her iki parselde de Ant.Cin98 çeşidi sahip olmuştur (Çizelge 4).

Kendilenmiş hatların nem değerleri de atdişi ve cin mısırlara benzer şekildedir. Ortalama olarak geleneksel parselde organik parsele göre daha az hasat nemine sahip olmuştur. Geleneksel parselde hatların nem değerleri arasındaki farklılık istatistiksel bakımdan önemli ($p<0.01$) bulunmuştur. Şeker mısırı ise erken olgunlaştığı için hasat nemi iki uygulamada da aynı çıkmıştır (Çizelge 4).

Hasat esnasında mısırların nemi %30'un altına düşmüş olması gerekir [12]. Hasat tane nemi Karadeniz Bölgesi için önemli bir özelliktir. Toprak şartları uygun olduğunda erken ekim yapılabilirse, bölge için tavsiye edilen çeşitlerde hasat nemi uygun düzeye düşmektedir. Atdişi mısırlardan elde edilen değerler Öz ve Kapar [9]'a, cin mısırlardan elde edilen değerler de Acar ve ark. [8]'e, benzerdir. Bizim elde ettiğimiz sonuçlarda organik parselde tane neminin yüksek çıkmasında çeşitlerin ihtiyaç duyduklarında bitki besin elementlerini alıp-almaması ile ilgili olabilir. İhtiyaç duyulan zamanda alınamayan besin maddeleri bitkinin olumunun gecikmesine, dolayısı ile tane neminin fazlalığına sebep olmaktadır.

Koçan Çapı

Atdişi mısır çeşitleri koçan çapı değerleri arasındaki fark istatistiksel bakımdan iki uygulamada da önemli ($p<0.01$) bulunmuştur. Çeşitler organik parselde 38.9-50.2, geleneksel parselde 42.9-50.2 mm arasında değerler almışlardır. Geleneksel parsel ortalaması 47.1, organik parsel ortalaması ise 46.1 mm bulunmuş, organik parseldeki mısırlar geleneksel parseldekilere göre %2.0 daha az değere sahip olmuştur. İki uygulama arasında koçan çapı en fazla değişen çeşitler Brasco ve Doge olmuştur. Geleneksel parselde DK.626, organik parselde DK.743 çeşitleri en fazla koçan çapına sahiptir (Çizelge 4). Cin mısırı çeşitleri arasındaki fark iki sistemde de önemli çıkmış, ortalama olarak geleneksel parsel 20.0, organik parsel 25.0 mm koçan çapına sahip olmuştur. Koççin çeşidi iki uygulamada da en yüksek değere sahiptir. Koçan çapı değerleri bakımından kendilenmiş hatlar arasındaki fark iki uygulamada da önemsiz bulunmuştur. Geleneksel parselde Mo.20, organik parselde ise FRMo.17 hatları en fazla koçan çapına sahip olmuştur. Şeker mısırı iki uygulamada çok yakın değerler almıştır (Çizelge 4). Yapılan bir araştırmada tavuk gübresi uygulamasından elde edilen koçan çapı değerlerinin diğer ekolojik uygulamalardan daha yüksek çıktığı ifade edilmektedir [13]. Hasatta tane neminde olduğu gibi organik parseldeki mısırların koçan çapının gelenekseldekilerden yüksek çıkması bitkilerin gelişme ve olgunlaşma durumları ile ilgilidir. Bir çeşit farklı uygulamaların birinde daha fazla nem değerine sahip ise, nemi düşük olana göre tam olgunlaşmadığı söylenebilir. Bu da koçan çapı değerinin yüksek olması manasına gelir.

Çizelge 4. Mısır hat ve çeşitlerinin hasatta tane nemi ve koçan çapı değerleri.

Atdişi Mısır Çeşitleri	Hasatta tane nemi (%)			Koçan çapı (cm)		
	Organik	Geleneksel	Fark (%)	Organik	Geleneksel	Fark (%)
Brasco	30.8 a**	25.6 c**	20.4	47.5 ad**	43.2 e**	10.0
DK 743	30.7 a	26.4 b	16.5	50.2 a	50.0 ab	0.4
DK 626	28.8 ad	20.9 g	37.6	49.9 ab	50.2 a	-0.6
32 K 61	27.3 df	22.3 f	22.8	47.1 ad	46.5 cd	1.3
Maveric	23.1 g	21.3 g	8.3	45.7 cd	45.6 de	0.2
Tector	27.7 ce	25.6 c	8.5	46.7 ad	47.3 ad	-1.3
Vero	26.7 ef	26.4 b	1.3	45.7 cd	47.2 bd	-3.2
Doge	30.7 a	24.8 d	23.5	38.9 e	42.9 e	-9.3
Dracma	29.5 ac	25.6 c	15.3	46.0 bd	47.3 ad	-2.7
Luce	27.0 df	22.5 f	20.0	45.0 cd	48.2 ad	-6.6
33 94	25.6 f	20.0 h	28.3	48.6 ac	48.7 ac	-0.2
31 G 98	28.2 be	23.8 e	18.6	43.5 d	47.4 ad	-8.2
Ada 9516	29.8 ab	27.8 a	7.3	45.0 cd	47.6 ad	-5.5
Ortalama	28.2	24.1	17.0	46.1	47.1	-2.0
VK (%)	5.47			5.28	4.46	
Cin Mısırlar						
Sam. Komp.	25.4 ab*	20.7 a**	22.8	36.8	34.3	7.3
Koç Komp.	24.4 b	20.5 a	19.2	32.6	36.1	-9.7
Koç Cin	26.3 a	20.5 a	28.3	40.4	39.1	3.3
Ant Cin 98	24.0 b	17.6 b	36.4	33.9	34.9	-2.9
Ortalama	25.0	20.0	26.3	35.9	36.1	-0.6
VK (%)	5.25	1.68		8.25	11.51	
Kendilenmiş Hatlar						
FRMo 17	30.8	23.3 a**	-32.1	34.1	36.9	-7.6
FR 632	30.1	22.8 a	-32.3	30.3	36.1	-16.1
Mo 20	29.8	21.7 b	-37.4	32.2	37.6	-14.4
Ortalama	30.2	22.6	33.9	32.2	36.9	-12.7
VK (%)	2.5	1.2		5.20	10.34	
Kompozit Şeker	15	15	0	40.2	40.0	0.3

(*, **) Aynı harf ile gösterilen ortalamalar arasında kendi gurubu içinde% 5 ve %1 önemlilik düzeyinde fark yoktur.

SONUÇ

İki yıl süre ile Karadeniz Tarımsal Araştırma Enstitüsü'nün deneme alanında söz konusu materyaller ile yürütülen bu çalışma sonucunda organik şartlarda yetiştirilen mısırların geleneksel parseldekilere göre önemli oranda düşük verimler verdiği belirlenmiştir. Kendilenmiş hatlarda % 25 civarında olan bu oran cin mısırlarında ve atdişi mısır çeşitlerinde % 40 civarındadır. Ancak çeşitler tek tek incelendiği zaman bu oran bazı çeşitlerde % 20 civarında olduğu görülmektedir. Ayrıca geleneksel parselde iyi verim veren bazı çeşitlerin (32K61, 31G98, Doge, Ant.cin98) organik parselde de sıralamada iyi yerde olduğu görülmüştür. Dolayısıyla organik ve geleneksel şartlar için ayrı ıslah programları yürütmeye ihtiyaç olmadığı kanaatine varılmıştır. Bu değerler sonucunda organik olarak yetiştirilecek mısıra bu açığı kapatacak oranda fiyat verilmesi gerektiği anlaşılmıştır. Bu sağlanmadığı taktirde üreticilerin organik yetiştiriciliğe olumlu bakmayacağı aşikardır.

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BAZI BÖGÜRTLEN ÇEŞİTLERİNİN HAYRAT (TRABZON) EKOLOJİK KOŞULLARINA ADAPTASYONU

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ÖZET

Bu araştırma 2007-2009 yılları arasında Hayrat (Trabzon) ekolojisinde yerli ve yabancı orijinli 7 böğürtlen (Gazda, Orkan, Ness, Jumbo, Chester, Black Satin, Bursa-1) çeşidi üzerinde yürütülmüştür. Bu çalışma boyunca çeşitlerin fenolojik özellikleri, vejetatif gelişmesi, verim ve verim unsurları, meyvelerin duyusal, fiziksel ve kimyasal özellikleri incelenmiştir.

2007-2009 yılı ortalamalarına göre böğürtlen çeşitlerinde sürgün başına düşen verim Orkan, Jumbo, Ness ve Chester sırasıyla 1282.99, 759.88, 713.28, 697.92 g ile en verimli çeşitlerdir. 10 meyve ağırlığı bakımından Jumbo, Ness ve Orkan çeşitleri sırasıyla 49.49, 47.49 ve 43.93 g ile en yüksek değerlere sahiptir.

pH değerleri bakımından Jumbo, Gazda ve Ness sırasıyla 3.03, 2.95 ve 2.91 ile en yüksek pH değerine sahiptirler.

Üç yıllık deneme sonuçlarına göre Hayrat (Trabzon) koşullarında sırasıyla Orkan, Jumbo, Ness ve Chester çeşitleri öne çıkmaktadır.

Anahtar Kelimeler: *Rubus fruticosus* L., Orkan, Jumbo, Ness, Chester

ADAPTATION OF DIFFIRENT BLACKBERRY CULTIVARS IN HAYRAT PROVINCE (TRABZON/TURKEY)

ABSTRACT

This research was conducted on 8 blackberry cultivars (Gazda, Orkan, Ness, Jumbo, Chester, Black Satin, Bursa-1), in Hayrat (Trabzon) ecology between 2007-2009 years. İn the study phenological characteristics, vegetative growth performance, yield and yield compenents, sensible, physical and chemical characteristics of the fruit were determined.

According to the results of 2007-2009 years, yield per branch in blackberry cultivars Orkan, Jumbo, Ness ve Chester 1282.99, 759.88, 713.28 and 697.92 g respectively were determined as most productive cultivars. İn blackberry cultivars Jumbo, Ness ve Orkan with 49.49, 47.49 and 43.93 g had most average ten fruit weight.

According to the trials, in Hayrat (Trabzon) conditions Orkan, Jumbo, Ness and Chester are productive blackberry cultivars.

Key Words: *Rubus fruticosus* L., Orkan, Jumbo, Ness and Chester

GİRİŞ

Son yıllarda artan bir ivme kazanan üzümsü meyveler dünyada çok sevilen, degisik sekillerde degerlendirilebilen ve çok tüketilen meyve türleridir. *Rosaceae* familyasında *Rubus* cinsinin *Eubatus* alt cinsine giren bir üzümsü meyve olan bögürtlen Avrupa'da 17. yüzyılda kültüre alınmıs, 1930'lu yıllarda dikensiz bögürtlenler bulunmus ve son yıllarda degisik bölgelere adapte olabilen yüksek kaliteli bögürtlen çesitleri gelistirilmistir.

Dünya bögürtlen üretimi yaklaşık 200 bin da alanda 154.000 ton olduğu tahmin edilmektedir. Bu üretimin yaklasık % 50'si ABD ve % 30'u da Avrupa kıtasında gerçeklesmektedir[12]. Ülkemizde ise bögürtlen üretimi ile ilgili kayıtlara geçen veriler henüz yoktur. Bununla birlikte ülkemizin değişik yörelerinde kültür böğürtlen çeşitlerinin yetiştiriciliğinin yapıldığı bilinmektedir. Bursa ilinde 30 da alanda 24 ton bögürtlen üretimi oldugu bildirmektedir [1], [5].

Hall ve ark [8] Boysen ve Morion çesitlerinin adaptasyonun uzunca bir süre devam ettigini, ıslah çalısmalarında arzu edilen ana konuların meyve sertliginin gelistirilmesi, kolay tasınma, hastalık ve zararlılara dayanıklılık ve çevresel sartlara dayanıklılık oldugunu bildirmislerdir.

Dogu Karadeniz bölgesinde birçok meyve türünün yetistirildigini görmek mümkündür. Fındık, çay ve kivi dısındaki türlerle kurulmus kapama meyve bahçelerine nadir rastlanmaktadır.

Karadeniz bölgesinde dogal kosullarda yetisen geniş bir bögürtlen popülâsyonuna rastlanılmaktadır. Ülkemizde bögürtlenlerin adaptasyon çalısmalarına 1970'li yıllarda baslanmıs olup bu konuda yapılan en geniş ve en uzun soluklu çalışma Onur ve ark. tarafından 1997 yılında başlatılmıştır[11]. Bu araştırmada, 17 farklı kurumdan toplam 45 araştırıcının katılımı ile yürütülmüştür. Araştırma sonunda değişik ekolojilere adapta olan farklı türler tespit edilmiştir.

Bu çalısmanın amacı, Trabzon ili Hayrat ilçesinde bögürtlen çesitlerinin gelisme performanslarını incelemek, adaptasyon kabiliyetlerini saptamak ve yörede iyi gelisme gösteren yüksek verimli bögürtlen çesit ya da çesitlerini belirlemektir.

MATERYAL VE METOT

1. Materyal

Deneme, 2006 yılında kurulan Trabzon ili Hayrat ilçesi Çamlıtepe Mahallesinde Nuhoglu Vakfı örnek meyve bahçesinde 2007- 2009 yıllarında yürütülmüstür. Denemenin kuruldugu alan hafif meyilli olup denizden yüksekligi 235 m'dir.

Deneme alanı toprakları, killi-tınlı yapıda olup, asit karakter (pH= 4.96) özelligindedir. Öte yandan deneme alanının toprağı organik madde bakımından iyi (% 5.34), potasyum bakımından orta (112.00 ppm), fosfor bakımından zengin oldugu (17.23 ppm) oldugu tespit edilmistir. Arastırmayı yürüttügümüz meyve bahçesinde organik yetistiricilik yapılmaktadır. Araştırmanın yürütüldüğü bahçenin organik sertifikası EcocertSA tarafından verilmiştir (ECOCERTSA F32600 (TR OT 03) Sertifika no: 5360TR0800Z1t). Gübreleme ihtiyacı ahır gübresi ve organik gübrelerle giderilmistir. Gübreleme, yabancı otlarla mücadele ve diger kültürel islemler düzenli olarak yapılmıstır.

Arastırma 7 bögürtlen çesidi (Gazda, Orkan, Ness, Jumbo, Chester, Black Satin, Bursa-1,) üzerinde yürütülmüstür olup bitkiler 2x2m sıra arası ve sıra üzeri mesafelerde dikilmistir. Gazda ve Orkan çeşitleri Polonya'dan, diğer çeşitler Samsun Tarımsal Araştırma Enstitüsünden temin edilmiştir.

2. Metot

Bu çalısma Hayrat örnek meyve bahçesinde yetistirilen bögürtlen çesitlerinin gelisme performanslarını belirlemek amacıyla 2007-2009 yıllarında yürütülmüstür. Bitkiler 2006 yılında dikilmistir. Arastırma 3 tekerrürlü ve her tekerrürden 5 bitki kullanılarak tesadüf parselleri deneme deseninde kurulmustur. Hasat tüm meyveler olgunlasıncaya kadar devam etmistir. Her çesitten seçilen bitkilerden toplanan meyveler çalısmada kullanılmıstır. Her üç yılda da hasat döneminde toplanan meyve örnekleri laboratuara getirilerek incelenmistir. Çesitlerden elde edilen meyvelerden çok küçük olanlar degerlendirme dısında tutulmustur.

Çesitlerde fenolojik gözlemler olarak vejetatif gözlerin kabarma, sürme tarihi, ilk çiçeklenme ,tam çiçeklenme tarihi, son çiçeklenme tarihi, ilk hasat tarihi ve yaprakların dökülme tarihi kaydedilmistir.

Bitki özellikleri olarak çesitlerin bitki basına düsen sürgün sayısı, sürgündeki salkım sayısı, salkımdaki meyve sayısı ve sürgün basına düsen verim kriterleri incelenmistir.

Çesitlerin meyve eni ve boyu (mm), meyve agırlıgı (g), meyve sekli, meyve rengi, tat ve aroma, suda çözünür kuru madde miktarı, pH ve sitrik asit cinsinden titre edilebilir asit miktarı gibi özellikleri de saptanmıştır.

BULGULAR VE TARTIŞMA

Araştırmada kullanılan böğürtlen çeşitlerine ait fenolojik veriler Çizelge1 'de sunulmuştur. Çeşitlerin üç yıllık fenolojik gözlemleri incelendiginde fazla bir farklılıgın olmadıgı görülmektedir. Bögürtlen çesitleri için ilk yılda vejetatif gözlerin kabarma tarihleri 5 Mart (Chester) ile başlamakta ve 8 Mayıs'ta Orkan çeşidinde ilk çiçeklenme görülmektedir. Çeşitler 10-31 Temmuz tarihleri arasında hasat olumuna gelmektedir.

Böğürtlen çeşitlerinde 2007-2009 yıllarının ortalamasına göre sürgün başına salkım sayısı bakımından, 54.73 adet salkım ile Orkan çesidi sürgün basına en fazla salkım sayısına sahip iken, Jumbo 22.81 adet ve Gazda18.61 adet salkım ile sürgün basına düsen en az salkım sayısına sahip çesitlerdir (Çizelge 2).

Çeşitlerin ortalama meyve eni, boyu ve ağırlıkları Çizelge 4 'te sunulmuştur. 2007-2009 yıllarının ortalamalarına göre 20.01 mm Chester ve 19.47 mm ile Ness çesitleri meyve eni bakımından en yüksek degeri alırken, 14.35 mm ile Gazda meyve eni en az olan çesittir. Her üç yılın ortalamasına göre 49.49 g ile Jumbo ve 47.49 g ile Ness on tane meyve agırlıgı olarak en agır çesitler iken, 20.42 g ile Gazda en az meyve agırlıgına sahip çesittir.10.78 ile Gazda SÇKM içerigi en yüksek çesit iken, Black Satin 7.14 ve Bursa-1 6.75 ile SÇKM içerigi en düsük olan çesitlerdir. (Çizelge 5).

Agaoglu ve ark. [2] Ankara ekolojisinde yetistirilen 11 bögürtlen çesidinin pomolojik özelliklerinden meyve agırlıgı, toplam asit ve SÇKM. miktarlarını mukayese etmislerdir. Meyve agırlıgı bakımından Chester, Dirksen, Thornless ve Jumbo çesitlerinin, toplam asitlik bakımından Dirksen, Thornless, Bursa–2 ve Ness çesitleri, SÇKM miktarı açısından ise Bursa–2, Navaho ve Chester çesitlerinin en yüksek degerlere sahip olduklarını bildirmislerdir.

Cangi ve İslam [4] degisik bögürtlen çesitlerinin (Bursa-1, Bursa-2, Bursa-3, Bartın, Chester, Jumbo, Navaho, Ness Waldo, Arapaho, Cherokee) Ordu yöresine adaptasyonu belirlemek amacıyla yaptıkları bir çalısmada sürgün basına verimin 355.90-1940 g, ortalama meyve agırlıgının 1.88-4.00 g, SÇKM oranının % 9.93-12.74, arasında degistigini tespit etmislerdir.

Himelrick ve Nesbitt [9] 1999'da Alabama'daki Gulf sahil bölgesi Arastırma ve Yetistirme merkezinde, Apache, Navaho, Arapaho, Lonch Ness, Triple Crown ve Chester olmak üzere 6 çesit ile bögürtlen denemesi kurmuslardır. Chester ve Triple Crown da büyüme en kuvvetli, 2000 yılında ise bu iki çesitte soguklanma eksikliginden meydana gelmis seyrek çiçeklenme ve yapraksızlasmanın oldugu ortaya çıkmıstır.

Demirsoy ve ark. [5] 12 bögürtlen çesidi degerlendirilmis ve meyve iriligi, tat ve sürgün gelisimi bakımından en iyi performansı sırasıyla Ness, Chester, Bursa–1, Jumbo ve Bursa–2 çesitlerinin gösterdigini bildirmektedirler.

Çarşamba koşulları için Ness, Chester, Bursa-1, Jumbo ve Bartın çesitleri [3], Tokat yöresi için Jumbo ve Bursa 1 çeşitleri [6], Giresun yöresi için Ness, Chester, Bursa1 ve Jumbo çeşitleri [10], Isparta yöresi için ise Bursa–1, Jumbo ve Ness çeşitleri [7] tavsiye etmişlerdir.

Mevcut araştırma sonuçları ile literatür bulguları bazı özellikle bakımından örtüşmekte, bazı özellikler bakımından ise farklılık göstermektedir. Bu durumun bölgenin toprak ve iklim koşullarına bağlı olarak çeşidin gösterdiği performansa dayalı olduğu ifade edilebilir. Yine bakım koşullarının etkisi de önemsenmektedir.

SONUÇ VE ÖNERİLER

Trabzon Hayrat kosullarında yetistirilen bögürtlen çesitlerinde yapılan gözlemler sonucunda elde edilen fenolojik verilere göre Orkan, Jumbo ve Ness erkenci, Gazda, Black Satin ve Bursa-2 çesitleri geççi olarak sıralanabilir. Sürgün sayısı bakımından Gazda ve Orkan çesitleri en fazla sürgün veren çesitler olup bunları Ness,Chester ve Jumbo takip etmektedir. Orkan, Chester, Ness ve Black Satin en fazla salkım sayısına sahip olup bunları Bursa-1 ve Jumbo, Gazda ve çesitleri izlemektedir. Sürgün basına düsen verim yönünden Orkan ve Jumbo çesidi en yüksek verime sahip çeşitler olmuştur. Jumbo ve Ness meyve agırlıgı en agır olan çesitler; Gazda ve Chester meyve tadı en iyi olan çesitler; Gazda SÇKM miktarı en yüksek çeşit olmuştur.

Sonuç olarak, Trabzon ili Hayrat kosullarında bögürtlen çesitleri 3 yıl süresince, fenolojik, pomolojik ve morfolojik özellikler açısından incelenip bazı sonuçlara varılmıstır. Ancak çesitlerin gerçek adaptasyon durumlarının ortaya konulabilmesi için daha uzun süreli bir çalısmaya devam edilmesi gerekmektedir. Bu çalısmada elde edilen üç yıllık sonuçlar ile çesitlerin birçok özelliklerin adaptasyon ortaya çıkmaya başlamıştır.Bu çalışma 5 yıllık sonuçların alınmasına kadar devam ettirilecektir.

Teşekkür: Çalışmanın yürütülmesinde birçok yönden katkı sağlayan Vakıf müdüresi Sayın Filiz Nuhoğlu şahsında Nuhoğlu ve Aile Yakınları Vakfı'na teşekkür ederiz.

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Çesitler	Yıllar	Gözlerin Kabarması	Gözlerin Sürmesi	İlk Çiçeklenme	Tam Çiçeklenme	Hasat	Yaprak dökümü
Gazda	2007	18.03.07	18.04.07	12.05.07	20.05.07	16.07.07	01.12.07
	2008	13.03.08	10.04.08	12.05.08	22.05.08	10.07.08	27.11.08
	2009	15.03.09	16.04.09	13.05.09	20.05.09	31.07.09	02.12.09
Orkan	2007	15.03.07	28.03.07	09.05.07	19.05.07	19.07.07	13.12.07
	2008	14.03.08	24.03.08	09.05.08	20.05.08	13.07.08	03.12.08
	2009	16.03.09	27.03.09	08.05.09	18.05.09	31.07.09	12.12.09
Ness	2007	13.03.07	27.03.07	20.05.07	29.05.07	30.06.07	16.12.07
	2008	10.03.08	22.03.08	23.05.08	02.06.08	17.07.08	03.12.08
	2009	12.03.09	23.03.09	20.05.09	01.06.09	31.07.09	15.12.09
Jumbo	2007	11.03.07	28.03.07	22.05.07	01.06.07	04.07.07	17.12.07
	2008	10.03.08	24.03.08	25.05.08	06.06.08	20.07.08	05.12.08
	2009	11.03.09	27.03.09	21.05.09	01.06.09	31.07.09	16.12.09
Chester	2007	05.03.07	29.03.07	20.05.07	30.05.07	19.07.07	20.12.07
	2008	14.03.08	26.03.08	23.05.08	02.06.08	18.07.08	05.12.08
	2009	07.03.09	27.03.09	20.05.09	01.06.09	31.07.09	19.12.09
BlackSatin	2007	12.03.07	23.03.07	17.05.07	27.05.07	12.07.07	17.12.07
	2008	15.03.08	25.03.08	20.05.08	30.05.08	22.07.08	03.12.08
	2009	13.03.09	23.03.09	18.05.09	29.05.09	31.07.09	16.12.09
Bursa-1	2007	13.03.07	26.03.07	15.05.07	25.05.07	14.07.07	13.12.07
	2008	10.03.08	25.03.08	18.05.08	30.05.08	24.07.08	03.12.08
	2009	11.03.09	27.03.09	15.05.09	25.05.09	31.07.09	15.12.09

Çizelge 1. Bögürtlen çesitlerinin 2007- 2009 yılı fenolojik verileri

	Sürgün sayısı	Salkım sayısı	Salkımdaki tane sayısı	Sürgün başına verim (g)
Gazda	7.11a	18.61b	12.84	306.53c
Orkan	6.34a	54.73a	16.41	1282.99a
Ness	2.24b	31.06ab	17.61	713.28b
Jumbo	1.35bc	22.81b	13.17	759.88b
Chester	1.88bc	34.66ab	14.14	697.92b
Black Satin	1.13c	30.2ab	7.72	545.61bc
Bursa-1	1.19c	25.39b	8.83	479.24bc
$LSD_{\%5}$	1.00	24.731	öd	372.865

Çizelge 2 Bögürtlen çesitlerinin ortalama sürgün sayısı, salkım sayısı, salkımdaki tane sayısı ve sürgün basına düsen verim miktarı

	Tat	Aroma	Şekil	L	a	b
Gazda	5	3	Yuvarlak	16.60	7.18	2.27
Orkan	1	1	Konik	15.59	8.82	2.68
Ness	3	2	Yuvarlak	14.50	4.19	1.28
Jumbo	3	1	Yuvarlak	13.33	5.01	1.55
Chester	4	3	Yuvarlak	13.47	3.98	1.18
Black Satin	1	2	Konik	15.93	12.35	4.25
Bursa-1	3	3	Yuvarlak	15.95	9.75	3.10

Çizelge 3 Bögürtlen çesitlerinin tat, aroma, şekil özellikleri ve renk (L,a,b) değerleri

	Meyve eni (mm)	Meyve boyu (mm)	10 meyve ağırlığı (g)
Gazda	14.35d	15.46b	20.42c
Orkan	16.84cd	23.78a	43.93ab
Ness	19.47ab	21.09a	47.49a
Jumbo	18.96abc	21.26a	49.49a
Chester	20.01a	20.23a	42.90ab
Black Satin	17.18bc	19.41ab	37.38b
Bursa-1	18.03abc	19.90ab	38.76b
$LSD_{\%5}$	2.525	4.526	8.391

Çizelge 4 Bögürtlen çesitlerinin ortalama meyve eni ve boyu ve 10 meyve ağırlıkları

	SÇKM	Asitlik (%)	pH
Gazda	10.78a	1.16b	2.95
Orkan	8.02bc	1.92a	2.51
Ness	9.31abc	1.13b	2.91
Jumbo	8.32abc	1.27b	3.03
Chester	9.44ab	1.18b	2.89
Black Satin	7.14bc	1.55ab	2.83
Bursa-1	6.75c	1.91a	2.90
$LSD_{\%5}$	2.575	0.541	öd

Çizelge 5 Bögürtlen çesitlerinin ortalama SÇKM, asitlik, pH degerleri

ORGANİK MATERYAL UYGULAMALARININ KİL TEKSTÜRLÜ TOPRAĞIN HACİM AĞIRLIĞINDA MEYDANA GETİRDİĞİ DEĞİŞİMLER

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ÖZET

Bu çalışmada, farklı organik materyaller kil tekstürlü toprağa uygulanarak topağın hacim ağırlığına etkileri araştırılmıştır. Organik materyal olarak şeker pancarı küspesi (ŞPK), elma posası (EP) ve pamuk küspesi (PK) kuru ağırlık esasına göre (1000, 2000, 4000 kg/da) yaş olarak uygulanmıştır. Araştırma tesadüf parselleri deneme desenine göre 5 tekerrürlü olarak saksı denemeleri şeklinde sera koşullarında yürütülmüştür.

Araştırma iki farklı dönemden oluşmaktadır. Birinci dönem, ilk altı aylık inkübasyon süresini içermektedir. İkinci dönem ise diğer ikinci altı aylık inkübasyon süresi ile birlikte iki aylık fasulye bitkisinin yetiştirildiği dönemi kapsamaktadır. Araştırmada, ŞPK topağın hacim ağırlığında her iki dönemde de istatistiksel olarak önemli bir etki meydana getirmezken, EP birinci dönemde $p > 0.01$, ikinci

dönemde ise $p > 0.001$ düzeyinde istatistiksel olarak önemli etkide bulunmuştur. Pamuk küspesinin (PK) hacim ağırlığına etkisi birinci dönemde $p > 0.001$, ikinci dönemde ise $p > 0.01$ düzeyinde gerçekleşmiştir. Pamuk küspesi (PK) ve EP hacim ağırlığında azalma meydana getirmiş ancak hiçbir uygulama hacim ağırlığına etki bakımından dönemler arasında istatistiksel olarak önemli bir fark meydana getirmemiştir.

Anahtar Kelimeler: Elma posası, organik materyal, toprak fiziği

CHANGES IN SOIL BULK DENSITY BY ORGANIC MATERIALS APPLICATIONS IN CLAYEY TEXTURED SOIL

ABSTRACT

In this experiment, the effects of different organic materials application on bulk density of clayey textured soil were investigated. Organic materials, such as sugar beet pulp (SBP), apple pomace (AP) and cotton gin waste (CGW) was applied to soil as a fresh material, (dry weight basis 1000, 2000 and 4000 kg/da), and pot experiments were carried out according to the completely randomized design with 5 replicates in greenhouse conditions. This study is consisted of two different stages. The first stage which is consists of 6 months incubation period (1st sample period). Second stage which is consists of other 6 months plus 8 weeks bean (*Phaseolus vulgaris L.*) vegetation period (2nd sample period).In the experiment, while the effect of SBP on soil bulk density was not significant in both stages, the effect of AP on bulk density was significant $p > 0.01$ in first stage and $p > 0.001$ in second stage. The effect of CGW on soil bulk density was significant $p > 0.001$ in second stage and $p > 0.01$ second stage. In the effect of applications on soil bulk density, the effect of CGW and AP on soil bulk density was decreased but any applications have not significantly differences on soil bulk density in the between stages.

Key words: Apple pomace, organic material, soil physic

GİRİŞ

Yoğun tarımsal aktiviteler toprak organik madde düzeyindeki azalmaya ve toprakların yapısal olarak bozulmasına neden olmaktadır. Topraklardaki yapısal bozulmalar, yüzey akış miktarındaki artışla birlikte toprak kaybı ve çevresel kirlilik gibi birçok olumsuzluğun kaynağı olabilmektedir. Toprakların organik madde dengesi, sürdürülebilir tarımsal yönetimin en önemli bir göstergesidir [8]. Toprağın fiziksel özelliklerini düzeltme ve sürekliliğini sağlamada organik kökenli materyallerin kullanımı en fazla başvurulan yöntem olmaktadır [4].

Toprak organik madde içeriği ile hacim ağırlığı çok yakın bir ilişki içindedir. Kumlu toprakta yapılan bir çalışmada, organik madde içeriği yüksek olan parseldeki hacim ağırlığının, organik maddesi düşük olan parseldeki hacim ağırlığına göre daha düşük olduğu bildirmiştir [15]. Endüstriyel tarımsal katı atıklar toprak koşullarında malç, besin elementi ve organik madde kaynağı şeklinde kullanılabilir büyük bir potansiyele sahiptir. Tarımsal organik atıkların kullanılabilirlilikleri, bu materyallerin yapısal özelliklerinin bilinmesine bağlıdır. Ayrıca değişik organik atık maddelerin kombinasyonu ile dayanıklı fiziksel ve kimyasal karakteristiğe sahip yüksek besin değerinde kompost materyali meydana getirilebilmekte, böylece birçok bitkinin ve toprağın ihtiyaçları karşılanabilmektedir [12].

Şeker endüstrisi atıkları geniş niteliklere sahip işlenebilen endüstriyel organik atıklardır. Bu atıklardan olan şeker pancarı posası değerli bir besin elementi kaynağı ve toprak ıslah materyali olarak kullanılabilmektedir [2].

Kolombiya'da her yıl 1 milyon ton'dan daha fazla miktarda kahve atığı meydana gelmekte ve bu atıkların farklı yöntemlerle (kompostlaştırma) meydana getirilen değişik formları alternatif bir uygulama olarak organik gübre şeklinde kullanılmaktadır. Yapılan bir çalışmada da söz konusu kompostun toprağa uygulanması ile birçok toprak özelliğinde pozitif yönde gelişmelerin kaydedildiği bildirilmiştir [14].

Soya küspesi, pamuk küspesi ve ahır gübresinin yedi aylık bir inkübasyonu şeklinde yapılan bir çalışma sonrasında toprağın agregat oluşumu ve stabilitesinde önemli düzeyde artış meydana geldiği belirtilmiştir [18].

Mısır artıklarının fermantasyonu sonucu meydana gelen organik ürünün tarım topraklarına uygulanmasıyla toprakların organik madde kapsamlarının arttığı, bununla birlikte toprak strüktürünün geliştirilebileceği ve erozyon riskinin azaltılabileceği ifade edilmektedir [9].

Bu çalışmada, farklı özelliklere sahip organik materyaller kil tekstürlü toprağa uygulanarak toprağın hacim ağırlığında meydana getirdiği değişimlerin belirlenmesi amaçlanmıştır.

MATERYAL VE METOT

Materyal

Çalışmada toprak materyali olarak Büyük kuyu serisi olarak tanımlanan kil tekstürlü alüviyal toprakların 0–25 cm derinliğinden alınan örnekler kullanılmıştır. Araştırmada kullanılan toprak örneklerinin alındığı yerler Antalya ili sınırları içerisinde yer alan Aksu ilçesindeki Akdeniz Üniversitesi Ziraat Fakültesi Araştırma ve Uygulama arazisidir. Çalışmada organik materyal olarak şeker pancarı küspesi, elma posası ve pamuk küspesi kullanılmıştır.

Metot

Araştırma iki aşamadan oluşmaktadır. Birinci aşama, ilk altı aylık inkübasyon süresini, ikinci aşama ise ikinci altı aylık inkübasyon süresi ile birlikte fasulye bitkisinin (*Phaseolus vulgaris L.)* yetiştirildiği 8 haftalık yetiştiricilik periyodunu içermektedir.

Denemede toprak örnekleri hava kuru duruma getirilip 4 mm.lik elekten elendikten sonra her birinde 10 kg toprak olacak şekilde ve belirlenen miktarlardaki organik materyalle karıştırılarak saksılara konulmuştur. Organik materyal olarak kullanılan şeker pancarı küspesi, elma posası ve pamuk küspesi 250.000 kg/da toprak varsayımından yola çıkılarak Çizelge 1'de verilen fırın kuru ağırlık miktarlara eşit olacak biçimde yaş madde miktarı hesabı üzerinden 3 farklı doz ve 5 tekerrürlü olarak toprağa uygulanmıştır. Saksı denemeleri kil tekstürlü toprakta 3 organik materyal x 3 uygulama düzeyi x 5 tekerrür + 5 kontrol olmak üzere toplam 50 saksıdan oluşmaktadır.

Fasulye bitkisinin yetiştirilmesinde temel gübreleme olarak 8 kg N/da, 8 kg P_2O_5/da ve 8 kg K_2O/da olacak şekilde kompoze (15-15-15) gübre uygulanmıştır. Deneme saksılarına farklı bir alanda çimlendirilen eşit ve sağlıklı görünüme sahip üçer adet fasulye bitkisi aktarılmıştır. Yetiştirme süresince fasulye bitkisi için her saksıya 6 kg N/da (NH_4NO_3, %33), 4 kg P_2O_5/da (DAP, %46), 9 kg K_2O (K_2SO_4, %50), 1 kg MgO/da ($MgNO_3$, %16 MgO) ve 1.75 kg/da mikro element (Hortrilon, % 5 Fe, % 2.5 Mn, % 0.5 Zn, % 2.5 Cu) olacak şekilde çözelti halinde gübre uygulamaları yapılmıştır.

Denemenin I. aşaması olan ilk 6 ayın sonunda toprağın hacim ağırlığı değerlerinin belirlenmesi için I. dönem örneklemesi yapılmıştır. İkinci 6 aylık dönemden sonra gerçekleştirilen fasulye bitkisi dikiminden 8 hafta sonra uygulamaların hacim ağırlığına etkilerini belirlemek amacıyla 2. dönem toprak örnekleri alınmıştır.

Topraklarının nem düzeyleri, tarla kapasitelerinin % 50 sine düştüğünde sulamaya başlanması ve nem düzeyinin tarla kapasitesinin % 70 i oluncaya kadar suyun verilmesi şeklinde ayarlanmıştır.

Organik Materyaller	Dozlar	Kuru Ağırlık	Yaş Ağırlık
		Kg/da	Kg/da
Şeker Pancarı Küspesi (ŞPK)	$ŞPK_0$	0	0
	$ŞPK_1$	1000	5,830
	$ŞPK_2$	2000	11,660
	$ŞPK_3$	4000	23,320
Elma Posası (EP)	EP_0	0	0
	EP_1	1000	5,360
	EP_2	2000	10,720
	EP_3	4000	21,440
Pamuk Küspesi (PK)	PK_0	0	0
	PK_1	1000	1,070
	PK_2	2000	2,140
	PK_3	4000	4,280

Çizelge 1. Denemede kullanılan organik materyal dozları

Araştırmada, saksı denemeleri kurulmadan önce toprağın ve organik materyallerin genel durumunu belirlemek amacı ile toprak örneklerinde (Çizelge 2) ve kullanılan organik materyallerde çeşitli fiziksel ve kimyasal analizler yapılmıştır (Çizelge 3).

Toprak Analiz Yöntemleri

Toprak tekstürü pipet yöntemiyle yapılmıştır [3]. Toprak pH'sı ve elektriksel iletkenliği (EC) saturasyon çamurundan elde edilen ekstarkta belirlenmiştir [6]. Organik madde Modifiye Walkley-Black metoduna göre [5], toplam azot Modifiye Kjeldahl metoduna göre [10], alınabilir fosfor Olsen metoduna göre belirlenmiştir [13]. Değişebilir K, Ca, Mg ve Na toprakların 1 N Amonyum Asetat ile ekstraksiyonundaki süzüğün Atomik Absorpsiyon Spektrofotometre okumaları belirlenmiştir [17]. Alınabilir Fe, Zn, Mn ve Cu, DTPA ekstraksiyonu yolu ile elde edilen süzüklerde Atomik Absorpsiyon Spektrofotometresinde ölçülmüştür [10].

Organik materyal analiz yöntemleri

Materyalin organik madde içeriği kuru yakma metoduna göre [1]; organik karbon kuru yakma ile elde edilen organik madde değerlerinin 1.72 değerine bölünmesi ile elde edilmiştir [16]. Materyalin pH ve EC değerleri 1:5 oranında organik madde–su karışımında 1 saat süre ile çalkalandıktan sonra belirlenmiştir [1]. Materyalin % nem içeriği, materyal işletmeden alınır alınmaz 105 ^{0}C de 24 saat fırında kurutularak belirlenmiştir [10]. Toplam azot modifiye Kjeldahl metoduna göre [10]; fosfor içeriği nitrik-perklorik asit karışımı ile yaş yakma metodu sonucunda elde edilen süzükte fosfor vanadomolibdofosforik sarı renk metoduna göre belirlenmiştir [10]. Potasyum, kalsiyum, magnezyum, sodyum, demir, çinko, mangan ve bakır; organik materyallerin yaş yakma metodu ile elde edilen süzükteki K, Ca, Mg, Na, Fe, Zn, Mn ve Cu miktarları Atomik Absorpsiyon Spektrofotometresi ile belirlenmiştir [10].

pH (H_2O)	7.94
EC (dS/m)	0.16
$CaCO_3$ (%)	38.26
Kum	12.9
Silt	29.2
Kil	57.9
Tekstür	Kil
Tarla Kapasitesi (%)	27.17
Solma Noktası (%)	12.93
Yarayışlı Su (%)	14.24
Hacim Ağırlığı (kg/m^3)	1.45
KDK (me/100g)	25.74
Organik Madde (%)	1.29
Toplam N (%)	0.060
Alınabilir P (mg/kg)	6.97
Değişebilir K (me/100g)	0.290
Değişebilir Ca (me/100g)	24.74
Değişebilir Mg (me/100g)	4.17
Değişebilir Na (me/100g)	0.24
Alınabilir Fe (mg/kg)	10.84
Alınabilir Zn (mg/kg)	1.06
Alınabilir Mn (mg/kg)	6.45
Alınabilir Cu (mg/kg)	2.07

Çizelge 2. Deneme toprağının bazı fiziksel ve kimyasal özellikleri ile makro ve mikro besin elementi içeriği

İstatistiksel Analiz Yöntemleri

Yapılan araştırmada, uygulama konularının toprakların hacim ağırlığı üzerine etkisini istatistiksel olarak ifade edebilmek için hacim ağırlığına ait ortalama değerlere bilgisayar ortamında MINITAB ve MSTAT-C istatistik programları kullanılarak varyans analizi ve LSD (% 5) testi uygulanmıştır.

Analiz Edilen Parametreler	Şeker Pancarı Küspesi	Elma Posası	Pamuk Küspesi
Organik Madde (%)	96.95	98.05	81.22
Kül (%)	3.05	1.95	18.78
Nem (%)	483	436	7
Organik Karbon (%)	56.36	57.0	47.21
C:N	39.88	84.82	14.23
pH (H_2O)	3.98	3.84	5.96
EC (dS/m)	0.52	0.37	1.15
Toplam N (%)	1.413	0.672	3.317
P (%)	0.083	0.079	0.416
K (%)	0.364	0.696	1.371
Ca (%)	0.527	0.236	0.477
Mg (%)	0.323	0.065	0.298
Na (%)	0.119	0.035	0.033
Fe (mg/kg)	481.9	171.53	380.9
Zn (mg/kg)	14.2	10.4	40.8
Mn (mg/kg)	61.5	7.2	25.4
Cu (mg/kg)	8.3	10.7	10.1

Çizelge 3. Denemede kullanılan organik materyallere ait bazı analiz sonuçları

BULGULAR VE TARTIŞMA

Araştırmada, şeker pancarı küspesi (ŞPK) uygulamasının kil tekstürlü toprağın hacim ağırlığına etkisi her iki dönemde de istatistiksel olarak önemli olmamış, ayrıca dönemler arasında da istatistiksel olarak önemli bir fark meydana gelmemiştir (Çizelge 4).

Elma posasının (EP) kil tekstürlü toprağın hacim ağırlığına etkisi birinci ($p > 0.01$) ve ikinci dönemde ($p > 0.001$) istatistiksel olarak önemli olmuştur. EP her iki dönemde de toprağın hacim ağırlığında azalma meydana getirmiş, birinci dönemde en fazla azalma 1.29 g/cm^3, 1.36 kg/m^3 ve 1.39 kg/m^3 değerleri ile sırasıyla uygulamanın EP_3, EP_2 ve EP_1 seviyelerinde elde edilmiştir. İkinci dönemde en fazla azalma ise 1.25 kg/m^3 değerle EP_3 seviyesinde elde edilmiştir. EP hacim ağırlığına etki bakımından dönemler arasında istatistiksel olarak önemli bir fark meydana getirmemiştir (Çizelge 4).

Pamuk küspesinin (PK) kil tekstürlü toprağın hacim ağırlığına etkisi birinci ($p > 0.001$) ve ikinci ($p > 0.01$) dönemde istatistiksel olarak önemli olmuştur. PK her iki dönemde de toprağın hacim ağırlığını azaltıcı yönde etkide bulunmuştur. Hacim ağırlığındaki en fazla azalma birinci dönemde 1.29 kg/m^3 değeri ile uygulamanın PK_3 seviyesinde elde edilirken, ikinci dönemde 1.34 kg/m^3, 1.35 kg/m^3 ve 1.39 kg/m^3 değerleri ile sırasıyla uygulamanın PK_3, PK_2 ve PK_1 seviyelerinde elde edilmiştir. PK ile toprağın hacim ağırlığı değerlerinde dönemler arasında istatistiksel olarak önemli bir fark oluşmamıştır (Çizelge 4).

Çizelge 4. Uygulamaların kil tekstürlü toprağın hacim ağırlığına etkisi (kg/m^3)[1]

Uygulamalar	I. Dönem	II. Dönem
$ŞPK_0$	1.44	1.42
$ŞPK_1$	1.38	1.42
$ŞPK_2$	1.35	1.40
$ŞPK_3$	1.41	1.40
Ortalama	1.39	1.41
$LSD_{Uyg.}$ (%5)	öd	öd
$LSD_{Dön.}$ (%5)	öd	
EP_0	1.44**a**	1.42**a**
EP_1	1.39**ab**	1.45**a**
EP_2	1.36**ab**	1.41**a**
EP_3	1.29**b**	1.25**b**
Ortalama	1.37	1.38
$LSD_{Uyg.}$ (%5)	**	***
$LSD_{Dön.}$ (%5)	öd	
PK_0	1.44**a**	1.42**a**
PK_1	1.40**a**	1.39**ab**
PK_2	1.39**a**	1.35**b**
PK_3	1.29**b**	1.34**b**
Ortalama	1.38	1.37
$LSD_{Uyg.}$ (%5)	***	**
$LSD_{Dön.}$ (%5)	öd	

1. Değerler 5 tekerrür ortalamasıdır.

2. Aynı harfle gösterilmeyen değerler arasındaki farklar $p < 0.05$ düzeyinde önemlidir.

öd: Önemli değil **: $p < 0.01$ düzeyinde önemli ***: $p < 0.001$ düzeyinde önemli.

Uygulamaların kil tekstürlü toprağın hacim ağırlığına etkisinde, ŞPK dışındaki diğer uygulamalar hacim ağırlığı değerlerinde azalma meydana getirmiştir. Organik materyal uygulamalarıyla hacim ağırlığında elde edilen sonuçlar birçok literatürde belirtilen sonuçla paralellik sağlamaktadır. Nitekim endüstriyel organik atıkların toprak düzenleyicileri olarak tarımsal üretimde kullanılabileceği, bu atıkların topraklara uygulanması ile toprakların hacim ağırlığı değerlerinde azalma meydana geldiği bildirmiştir [7]. Yapılan bir çalışmada, bitkisel atıklardan elde edilen kompost, çiftlik gübresi ve kanalizasyon atığı 2.9, 9.2 ve 10.9 ton C/ha olmak üzere uygulayarak fiziksel toprak özellikleri üzerine etkileri araştırılmıştır. Çalışmada, toprağın fiziksel özelliklerindeki gelişimin yalnızca kompost uygulamasının yapıldığı alanlarda gözlendiği bildirilmiştir [11].

Sonuç olarak, söz konusu materyallerin tekstürel açıdan uç konumda bulunan deneme toprağının hacim ağırlığını azaltmada etkili olabileceği anlaşılmaktadır. Bunun yanı sıra materyallerin düzenli olarak kullanımıyla hacim ağırlığı üzerine etkilerinin daha yüksek olacağı ve bu sayede topraktaki yarayışlı su miktarında artış, suyun hareketi, toprağın havalanma kapasitesi, bitki kök dağılımı ve bitki kökünün birim alandaki yoğunluğu, sıcaklık dağılımı, mikroorganizma sayı ve aktivitesi gibi birçok olayın olumlu yönde etkilenebileceği öngörülmektedir.

TEŞEKKÜR

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SÜRDÜRÜLEBİLİR YAŞAM ALANLARI: EKO-KÖYLER

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ÖZET

Eko-köyler, birbiriyle, tüm canlılarla ve doğa ile uyum halinde yaşamaya çalışan, sade ve verimli bir yaşam sürdürmeyi isteyen insanların bir araya gelerek oluşturdukları, kendi kendine yetebilen kırsal veya kentsel bir yerleşim biçimidir. Yerleşim birimi olmasının ötesinde eko-köy, ekolojik, ekonomik ve sosyo-kültürel yönden sürdürülebilir bir yaşam için çaba harcayan insanların bir araya gelmesiyle oluşan bir topluluktur. Eko-köylerde, dayanışma prensibine dayalı sosyal ve kültürel çevre ile sade bir yaşam tarzı birleştirilmeye çalışılmaktadır. Bunu gerçekleştirmek için de ekolojik tasarım, ekolojik mimari, permakültür, yerel kaynakların etkin kullanımı ve yerel üretim, yenilenebilir enerji kullanımı, bilinçli toplum oluşturma uygulamaları gibi birçok yöntemden yararlanılmaktadır.

Bu bildiride, sürdürülebilirlik kavramından yola çıkarak çevre sorunlarına çözüm olması için geliştirilen insan merkezli ve doğa merkezli çözümlere yer verilmiştir. İnsan-doğa arasındaki mevcut ilişkinin sorgulanması ve sürdürülebilirlik sürecinde ortaya çıkan eko-köylerin felsefesine değinilmiş; ekolojik, sosyal, kültürel ve ruhsal boyutları anlatılmış ve Dünya'daki örneklere yer verilmiştir. Türkiye'de eko-köy konusundaki gelişmelere ve mevcut ekoköylere değinilerek geleneksel köylerin sürdürülebilir bir yerleşim olması için mevcut durumu ve potansiyelinin eko-köy olarak değerlendirilmesi için önerilere yer verilmiştir.

Anahtar kelimeler: Sürdürülebilir yaşam, ekolojik tasarım, ekolojik yerleşim, eko-köy, permakültür

GİRİŞ

Binlerce yıldır insanlar, doğa ile iç içe, doğaya ve birbirlerine karşı saygılı, sosyal dayanışma üzerine kurulu topluluklar halinde yaşamıştır. Ancak başta sanayileşme olmak üzere endüstrileşme, teknolojik gelişmeler ve kentleşme ile bu düzen değişmeye ve hatta yok olmaya başlamıştır. Bacon'la başlayan "doğaya egemen olma" tutkusu sanayi devrimi ile birlikte teknolojik gelişmelerle doğayı sömürme tutkusuna dönüşmüştür. 20. yüzyılın sonuna doğru dünya genelinde çevre sorunları hızla artmış; doğal alanları ve yaşam alanlarını tehdit etme boyutlarına ulaşmıştır. Çevre sorunlarının içinden çıkılmaz noktalara ulaşılması insanlığı yeni arayışlar içine itmiş ve bu arayışlar, 1970'li yıllardan itibaren hız kazanmıştır.

Yaşam alanlarını tehdit eden çevre sorunlarını çözmek için sürdürülebilirlik temel alınmış ve bu konuda pek çok kuram, ilke, model geliştirilmiş ve uygulanarak hayata geçirilmiştir. Doğayı esas alarak sürdürülebilir yaşamı hedefleyen eko-köyler de bunlardan birisi olup ekolojik, ekonomik, sosyal, kültürel ve ruhsal anlamda sürdürülebilir yerleşim modelleridir. Eko-köyler, sürdürülebilir bir yaşam tarzı yaratmak için çeşitli modeller oluşturarak 21.yüzyılda Dünya'ya zarar vermeden yaşamanın mümkün olduğunu göstermektedir.

SÜRDÜRÜLEBİLİRLİK

Sürdürülebilirlilik kavramının çıkış noktası kentsel, ekonomik, teknolojik, sanayi ve endüstri alanındaki gelişmelere paralel olarak ortaya çıkan çevre sorunlarının önlenmesi ve dünyanın geleceğe taşınmasıdır.

Sürdürülebilirlik kavramı ilk kez, Dünya Doğayı Koruma Birliği (IUCN) tarafından 1982 yılında kabul edilen **Dünya Doğa Şartı** belgesinde yer almıştır. Bu belgedeki açıklamaya göre insanların yararlandığı ekosistem, organizmalar, kara, deniz ve atmosfer kaynaklarının optimum sürdürülebilirliliğini başarabilecek biçimde yönetilmeleri gerektiği ancak bunun ekosistemlerin ve türlerin bütünlüğünü tehlikeye atmayacak biçimde yapılması öngörülmektedir. Sürdürülebilirliğin diğer yönü ise sosyal, ekonomik ve ekolojik hedeflerin dengelenmesi üzerinde odaklanmaktadır [1].

Tüm dünyada yaşanan olumsuz süreçte sürdürülebilirlik, her disiplinin kuramları, modelleri ve uygulama alanları içinde sıkça kullanılan bir kavram halini almıştır. Zamanla sürdürülebilirlik, toplumların gelecekte var olmalarını hedefleyen kilit bir kavram olma niteliği kazanmıştır. Özellikle ülkeler ekonomik, eğitim, sağlık, sosyal, kültürel, kentsel ve daha birçok konudaki gelişimini sürdürülebilir ilkeler temeline oturtmaya çalışmaktadır. Bu kapsamda planlama ve tasarımcılar, ekosistemin dengesini bozmadan, doğal kaynakları dengeli kullanmayı, ekolojik özellikleri koruyup geliştirmeyi hedefleyen sürdürülebilir planlama ve tasarım anlayışına yönelmiştir.

Sonuçta çevre sorunlarının çözümünde iki farklı yöneliş ortaya çıkmıştır. Bir tarafta mekanik evren anlayışı çerçevesinde şekillenen, **insan merkezli** ve mevcut düzen içerisinde bir takım reformları öngören, resmi organlar tarafından da desteklenen çözüm arayışları gerçekleştirilmiştir. Diğer tarafta ise post-pozitivist bir anlayış çerçevesinde gelişen, **doğa merkezli**, ekonomik, sosyal, kültürel ve ideolojik yapılarda köklü değişimleri öngören, daha çok radikal gruplar tarafından benimsenen çözümler karşımıza çıkmaktadır [2].

İNSAN MERKEZLİ ÇÖZÜMLER: SÜRDÜRÜLEBİLİR KALKINMA ve SÜRDÜRÜLEBİLİR KENTLEŞME…

Çevre sorunlarına çözüm arayışı somut olarak 1972 yılında yapılan **Birleşmiş Milletler İnsan ve Çevresi Konferansı (Stockholm Konferansı)** ile başlamıştır. 1976 yılında Vancouver'de düzenlenen ilk **Habitat Konferansı,** Stockholm Konferansı'nın bir ürünüdür. Habitat I'in amacı konut, barınma, alt yapı ve ulaşım gibi yerel çevre sorunlarını tartışmaktır.

Birleşmiş Milletler, Dünya Çevre ve Kalkınma Komisyonu tarafından 1987 yılında yayınlanan **Brundtland Raporu (Ortak Geleceğimiz)** ise bu sürecin kapsamlı ilk sonucudur. Stockholm Konferansı'nın temasını oluşturan **sürdürülebilir kalkınma** kavramı kullanılmış; bugünün gereksinimlerini, gelecek kuşakların kendi ihtiyaçlarını karşılama olanağından ödün vermeden karşılamak şeklinde açıklaması yapılmıştır [3].

Sürdürülebilir gelişme yaklaşımına göre, çevre ile ekonomi politikaları arasında bir eşgüdüm sağlanırsa, toplumsal yapıda da bir iyileşme ortaya çıkacaktır. Bu bağlamda sürdürülebilir gelişmenin ekonomik sürdürülebilirlik, sosyal sürdürülebilirlik ve çevresel sürdürülebilirlik olarak tanımlanabilecek üç boyutundan söz etmek mümkündür. Bu boyutlardan birincisi ekonomik sermayenin istikrarını, ikincisi katılım ve güçlü bir sivil toplumu, üçüncüsü ise insan gereksinimlerini karşılayan doğal kaynakların korunmasını sağlayan ve insan refahını yükseltmeyi içermektedir [1].

Brundtland Raporu'nun devamında 1992 yılında Rio de Janeiro'da toplanan **Dünya Zirvesi**'nde iki uluslar arası anlaşma ve iki bildiri ortaya çıkmıştır. Rio Konferansı'ndan 10 yıl sonra düzenlenmesi ve bu konferansla süreklilik içinde değerlendirilmesi nedeniyle Rio+10 şeklinde ifade edilen ve Johannesburg'ta gerçekleştirilen **Dünya Sürdürülebilir Kalkınma Zirvesi**'nde çevre ve ekonomiyi etkileyen tüm konularda yapılması gereken faaliyetleri tanımlayan bir eylem planı olan Gündem 21 yayınlanmıştır. Gündem 21, sürdürülebilir insan yerleşimleri, sürdürülebilir arazi yönetimi, sürdürülebilir tarım ve kırsal kalkınma, tatlı suların korunması ve yönetimi ile çöp katı atık ve kanalizasyon yönetimi gibi pek çok konu kent ve kentlileşme ile ilgilidir.

Sürdürülebilir kentleşme olgusunun ön plana çıktığı oluşumların başında 27 Mayıs 1994 tarihinde, Danimarka'nın Aalborg kentinde gerçekleştirilen **Avrupa Sürdürülebilir Kentler ve Kasabalar Konferansı** oluşturmaktadır. Konferansın sonunda **Sürdürülebilirliğe Doğru Avrupa Kentler ve Kasabalar Şartı** oluşturulmuştur. Aalborg Şartı, sürdürülebilirliği, yerel karar verme sürecinin tüm alanlarını kapsayan denge arayışlı, yerel ve yaratıcı bir süreç olarak tanımlamaktadır. Bununla birlikte Şart, doğanın taşıma kapasitesine uygun yaşam koşulları, sosyal adalet, ekonomik ve çevresel sürdürülebilirlik arayışlarında, sürdürülebilir gelişmenin, kentlere ve kasabalara önemli bir yol gösterici olduğunu işaret etmektedir. İnsanoğlunun yüzleştiği birçok çevresel sorun için kent yönetimlerine bir eko-sistem yaklaşımını benimsetmeyi amaçlayan bu şart doğrultusunda sürdürülebilirlik açısından kentsel politikalar geliştirilmiştir [1].

Sürdürülebilir kentleşme yaklaşımın temel olarak biçimlendirildiği bir diğer önemli organizasyon BM tarafından 1996 yılında İstanbul'da düzenlenen **Habitat II İnsan Yerleşimleri Konferansı (Kent Zirvesi)**'dır. Habitat II'nin temel amacı, herkese yeterli konut ve kentleşen dünyada sürdürülebilir yerleşmeyi gerçekleştirmektir. New York da 6-8 Eylül 2000'de toplanan **Birleşmiş Milletler Binyıl Zirvesi**'nde ise sürdürülebilir yaşam ve sürdürülebilir kalkınma temel konu olmuştur.

Sürdürülebilir kentleşme arayışlarının bir diğer ürünü ise **Avrupa Konseyi**'nin kentsel yaşam ve kentsel politikalarla ilgili olarak ortaya koyduğu **Avrupa Kentsel Şartı** ve **Avrupa Kentli Hakları Deklarasyonu**'dur. Bu deklarasyon kenti doğal ve sosyal yönleri ile bir bütün olarak ele alarak sürdürülebilir ve yaşanabilir kentlerin oluşturulması için yapılması gerekenleri ortaya koymaktadır. Bütün bu süreç ve belgelerden de açık bir şekilde görüldüğü gibi kentleşme, kentlerin sürdürülebilir ve yaşanabilir bir yer olması tüm dünyanın üzerinde yoğunlaştığı önemli konularından biridir [3].

Sürdürülebilir kentleşme yaklaşımı, kentsel gelişmenin etkilediği ve kentsel gelişmeyi etkileyen tüm çevresel (yapılı çevre/doğal çevre), sosyal, ekonomik unsurları birbiriyle ilişkili biçimde içermekte; ekonomik ve sosyal gelişimin çevre koruma ve iyileştirme amacı ile birleştirilmesini ön görmekte; gelişimin biçiminin katılımlı süreçlerle kararlaştırılmasını gerektirmektedir.

Bir yandan kentlerin sürdürülebilirliği üzerinde yeni modeller geliştirilip uygulanırken diğer yandan kırsal kalkınma yönünde de somut adımlar atılmaktadır. Kalkınmanın, kırsal alandan başladığı ilkesinden yola çıkarak kalkınma için kırsal alanların sürdürülebilir bir yaklaşımla düzenlenmesi hedeflenmiştir.

ÇEVRE MERKEZLİ ÇÖZÜMLER: ÇEVRE ETİĞİ ve DERİN EKOLOJİ…

Çevreci hareketlerin ortaya çıkış sürecini üç aşamalı bir yaklaşımla ele almak gerekmektedir: Birinci aşamayı bilimsel çevrecilik hareketi oluşturmaktadır. Bu dönemin en önemli ismi Biyolog olan ve 1876 yılında Ekoloji bilimini kuran Ernst Heackle'dır. Ekoloji bilimiyle birlikte doğal denge ve onun uzantısı olan doğal varlıkların korunması gereği de insanlığın gündeminde önemli bir yer tutmaya başlamıştır. İkinci aşamada çevreci hareketin 68 olaylarıyla birlikte toplumsal bir hareket olarak ortaya çıkışı yer almaktadır. Son aşamada ise 1979'larda başlayarak siyasal bir oluşuma dönüşen ve yeşiller hareketinin başını çektiği çevreci hareket bulunmaktadır [4].

Friend of earth (yeryüzü dostları), greenpeace (yeşil barış), ekotaj (çevresel sabotaj), eart first! (önce dünya!), yeşiller hareketi, çevre etiği, derin ekoloji, yaşama ve doğaya saygı etiği radikal ekolojik hareketler olarak nitelendirilmektedir. Bu ekolojik hareketler, ekolojik sorunlarla ilgili yaptıkları eylemler ve yayınları ile dünya çapında ekolojik duyarlılığın toplumun geniş kesimleri tarafından benimsenmesinde etkili olmaktadırlar. Bu kapsamda ekoköylerin oluşumunda etkili olan çevre etiği, derin ekoloji ile yaşama ve doğaya saygı etiğine değinilmiştir.

Çevre etiği, çevrenin tehlike içinde olduğu düşüncesiyle, doğa ile insan ilişkisi üzerine yapılan felsefi soruşturmadır. Tüm doğal varlıklar ve sistemlerin kendi başlarına bir değere sahip oldukları için ahlaki saygıyı hak ettikleri kabul edilmektedir. Çevre etiği, insanın doğayla ya da dış dünya ile nasıl ilişkide bulunması gerektiğini incelemektedir. Bir felsefe disiplini olarak çevre etiğinin söylemi, öncelikle yaşanan çevre sorunlarına kamuoyu dikkatini çekmektir. Bu boyutuyla çevre etiği, bir eylem etiği olup, uygulanan çevre politikalarının da takipçisidir. Çevre sorunlarına artan ilginin doğal bir sonucu olarak, çevre etiğinde de çözüm önerileri farklılık göstermektedir. Ancak, tüm bu farklılaşmalara rağmen, hepsinin ortak ilgisinin çevre sorunlarının en aza indirilmesi olduğunu belirtmek mümkündür [5].

Derin ekoloji, doğanın çeşitliliğine, hayranlık uyandırıcı uyumuna, hatta kutsallığına vurgu yaparak doğanın derinden duyulan bir "sorumluluk" duygusunun nesnesi olduğunu öncelikle kabul eder [6].

Norveçli felsefeci **Arne Næss**'in ileri sürdüğü derin ekoloji kavramının 8 temel ilkesi vardır:

1. Yeryüzündeki hem insanların hem de insan olmayan varlıkların iyi durumda olması ve gelişmesi kendi başına (özsel olarak) değerlidir. Bu değerler insan olmayan dünyanın, insanların amaçları için yararlı olup olmamalarından bağımsızdır.

2. Yaşam formlarının zenginliği ve çeşitliliği bu değerlerin gerçekleştirilmesine katkıda bulunur ve kendi başlarına birer değerdir. Basit, aşağı, ilkel denen bitki ve hayvan türleri daha üst bir yaşam biçimine katkıda bulundukları için değil kendi başlarına değerlidir.

3. İnsanların ihtiyaçların karşılamak dışında bu zenginliği ve çeşitliliği azaltmaya hiçbir hakları yoktur

4. İnsan olmayan dünyaya insan müdahalesi aşırıdır ve durum hızla kötüleşmektedir.

5. İnsan yaşamının ve kültürünün gelişmesi, insan nüfusunun önemli ölçüde azalmasıyla paraleldir. İnsan olmayan yaşamın gelişmesi böylesi bir azalmayı gerektirmektedir. Bu nedenle gelişmiş ülkeler nüfuslarını azaltmalıdır.

6. İnsan-doğa ilişkisi sadece bireysel ya da toplumsal bilinçlendirme olarak iyileştirilebilecek kadar basit bir ilişki değildir. İzlenen politikalar, hükümetlerin uygulamaları ve ideolojik kaygıların ön plana çıkması bu ilişkiye zarar vermektedir.

Dolayısıyla siyasal yönelimler ekonomik, teknolojik ve ideolojik yapılar düzleminde köklü bir değişim gerektirmektedir.

7. İdeolojik değişiklik, gittikçe yükselen yaşam standardını hedeflemek yerine öncelikle yaşamın niteliğine değerli kılma olgusundan ibarettir.

8. İfade edilen konulara katılanlar, bu zorunlu değişiklikler için çalışmaya doğrudan ya da dolaylı olarak yükümlüdürler [6].

Yaşama ve doğaya saygı etiği: Ekoloji, bütün dünyanın, insanın bedeninin bir parçası olduğunu ve insanın kendisine saygı gösterdiği gibi, ona da saygı göstermesi gerektiğini öğretmektedir. Bu nedenle, insanın kendisine, diğer insanlara ve doğaya bir amaç olarak bakması insanın sorumluluk bilincini geliştirir. İnsan ve doğa birer araç değil artık amaçtır. İnsan; geleceğe saygı ilkesiyle; yaşanabilir bir dünya, doğa ve insan için eylemde bulunmalıdır. Böylece doğaya saygı, insanın kendisine saygısıyla başlar. Kant'ın akıllı bir varlık olarak tanımladığı insan, doğaya saygı etiği görüşü kapsamında doğanın bir parçası olarak görülür. Bu yaklaşım, insan ve doğanın birlikteliğini temele alarak birlikte uyum içinde var olmanın yolarını arar. Doğaya saygı etiği kapsamında; İnsan, doğa ile birlikte var olduğuna göre doğa ile birlikte yaşamasını da öğrenmelidir [5].

Eko-köyler de bu bağlamda ortaya çıkmış bir kavramdır. Eko-köyler; kendi içlerinde uyum içinde yaşanırken, Dünya ve evrendeki canlı, cansız tüm oluşumlarla uyum içinde sürdürülebilir bir yaşam biçimi oluşturmaya öncülük eden insan topluluklarıdır. Yeni bir sosyal yapı olarak eko-köyler, bugünün ikilemi olan kentselleştirilmiş kırsal yaşamın çok ötesine geçmekte; 21. yüzyıldaki insan yerleşimlerinin planlanabilmesi, yeniden organize edilebilmesi ve geniş çaplı olarak uygulanabilecek yeni bir model yaratılmasını hedeflemektedir.

EKO-KÖYLER

Eko-köyler, yeni ve gelecek için ümit veren, belli bir amaç ile bir araya gelmiş, bilinçli topluluklardır. Yapılarında iki önemli özelliği barındırmaktadır. Birincisi, nitelikli yaşamın insanların birbirini desteklediği, sağlıklı küçük topluluklardan oluştuğudur. İkincisi ise insanlık için sürdürülebilir yaşama giden yolun geleneksel toplum yaşamının tekrar canlandırılmasından geçtiğidir.

Tüm dünyada yaşanan çevre sorunları ile birlikte dayanışma üzerine kurulu sosyal ve kültürel yapıların çökmesi eko-köylerin oluşmasında etkili olmuştur. İnsanların doğaya olan eğilimlerinin artması, farklı kültürleri ve yaşam biçimlerini öğrenme merakı, kalabalık, kirli, gürültülü ve yoğun tempolu kent ortamlarından uzaklaşma isteği köy yerleşimlerini gündeme getirmektedir. Parçalanmaya devam eden sosyo-kültürel yapıların geriye döndürülmesi ve çevresel anlamda yıkıcı girişimlere maruz kalmış olan Dünya'nın iyileştirilmesi ihtiyacı, ekoköylerin ve bir amaç etrafında bir araya gelmiş toplulukların oluşmasını motive etmiştir.

Günümüzde Dünya üzerinde eskiden kalma yerel yerleşimlerin kalmadığı yerlerde, ekoköyler bilinçli olarak kurulmaktadır. Hem kırsal hem de kentsel alanlarda, geleneksel yerleşimler ya da yeni kurulan bilinçli topluluklar olarak karşımıza çıkmaktadır [7].

Eko-köyler genellikle; yerel ekonomik kalkınma, işbirliğine dayalı sosyal ekonomiler, bir arada uyumla yaşayan topluluklar kurma, kültürel ve manevi-ruhsal çeşitliliği sağlama, katılımcı karar alma (karar süreçlerine dahil olma), barışçıl yollarla anlaşmazlıkların çözümü, toplum sağlığı, holistik 'tam insan' eğitimi, yerel ve organik gıda üretimi, permakültür tasarım yöntemlerinin uygulanması, ekolojik mimari, yenilenebilir enerji sistemleri, atık yönetimi konularından bazılarında ya da tümünde faaliyet göstermektedirler.

EKO-KÖYLERİN TEMEL FELSEFESİ

Eko-köyler, bir yaşam biçimi oluşturmakta ve eko-köy kavramı; evrendeki her şeyin, yaratılmış tüm birimlerin birbirleri ile etkileşim içinde olduğunu, insanın düşünce ve davranışlarıyla çevresine etkide bulunduğunu temel alan derin bir anlayış üzerine kurulmuştur. Bu felsefeye dayanarak eko-köyler sosyal, ekolojik, kültürel ve ruhsallık unsurları üzerine inşa edilmektedir. Her eko-köyün kendine özgü bir yönelimi, kendine özgü bir duyarlılığı ve kendine göre bir faaliyet alanı vardır. Buna göre bir eko-köyde bu unsurlar, tek tek ve ya birkaçı bir arada görülmektedir.

EKOLOJİK ODAKLI EKO-KÖYLER

Çevreyi daha az etkileyen ve genellikle Dünya'nın iyileştirilmesine önem veren parametreler esas alınmaktadır. Doğal peyzaj üzerinde çalışılarak ve sürdürülebilir tarım analizleri yapılarak geleceğin doğayla uyumlu köy modelini oluşturmaya önem verilmektedir. Evlerin yerleşimi, mimarisinde ekolojik prensipler dikkate alınmaktadır. Gıda üretim faaliyetleri, enerji üretimi, suyun kullanımı, atık yönetimi ve inşaat süreçleri de bu konular esas alınarak yapılmaktadır [8].

Ekolojik odaklı eko-köylerin büyük çoğunluğu permakültüre dayanmaktadır. Crystal Waters (Şekil 1) sürdürülebilir tarıma dayalı ekolojik köylere örnek gösterilebilir. Bu köy geniş çaplı olarak çevreyi koruma ve iyileştirme esas alınarak kurulmuştur. Kuzey Amerika'daki birçok köy projeleri de temel prensip olarak sürdürülebilir tarımı esas almıştır. Hertha gibi bazı ekoköyler ise sürdürülebilir tarım ilkeleri ile sosyal ve ruhsal unsurları bir araya getirmişlerdir.

Şekil 1 Crystal Waters sürdürülebilir tarıma dayalı eko-köy (Avustralya) [9]

Eko-köylerin ekolojik boyutu; esas olarak toprak, su, hava, rüzgar, bitkiler ve hayvanlar gibi insanların yaşadıkları Dünya ile bağlantıları üzerinde durmaktadır. Enerji korunumu ve atıkların geri dönüşümünden başlayıp, çevreye karşı daha duyarlı, daha az olumsuz etkisi olan bir yaşama biçimine, enerji sistemlerinin entegrasyonuna, su şartlarına, Dünya'nın onarımına, sürdürülebilir tarıma ve ekolojik binalara kadar uzanan bir vizyonu ortaya koymaktadır [8].

Eko-köylerde ekoloji;

- Mümkün olduğunca eko-köyün biyolojik alanları içerisinde organik gıdaların yetiştirilmesini,
- Doğal ve yerel malzemelerin kullanıldığı, yerel mimari geleneklerinin uygulandığı yaşam alanlarının yaratılmasını,
- Yenilenebilir entegre enerji sistemlerinin kullanılmasını,
- Ekolojik iş dünyası prensiplerini (yerel iş),
- Eko-köylerde kullanılan tüm ürünlerin yaşam döngülerine sosyal/ruhsal ve ekolojik bakış açısı ile yaklaşılarak değerlendirilmesini,
- Enerji ve atık yönetiminin uygulanması; su, hava ve toprağın temiz kalmasının sağlanmasını,
- Biyolojik çeşitliliğin korunması, teşvik edilmesi ve kırsal alanların korunmasını ifade etmektedir.

SOSYAL ODAKLI EKO-KÖYLER

Ortak kullanım alanlarını köyün merkezine yerleştirmiş konut kooperatifleridir. Yaşam alanları, birbirine yakın olarak ve bir cadde üzerinde ya da ortak kullanım alanlarının etrafında yerleştirilmektedir. Genellikle evler kümeler halinde konumlandırılmış ve her bir küme arasında daha fazla etkileşim ve sosyalleşme hedeflenmektedir. Evler genellikle bir veya iki katlıdır. Araçlar için eko-köyün girişinde ortak park yeri ayrılmaktadır. Sosyal odaklı eko-köyler genellikle diğer kavramları da içine alacak şekilde ama benzer prensipler üzerine inşa edilmektedirler [8].

Danimarka'daki Hertha (Şekil 2), Steiner felsefesinden esin almış, köyün tasarımı yetişkinlerin özürlü gençlerle bütünleşebileceği bir sosyal yapıda kurulmuştur. Tiyatro, toplantı salonları gibi sosyal alanlar ve evler gençlerin yaşadığı yurtların etrafına yerleştirilmiştir. Hertha'da bir biyodinamik çiftlik, bir fırın, bir gümüş atölyesi ve bir Steiner araştırma laboratuarı bulunmaktadır. Hertha, aynı zamanda Danimarka Ekoloji Derneği'nin de Liasion Ofisidir. Burası bir sosyal yapının köy üzerine olan etkisine ve yaşayanlarına gelir üretmek için oluşturulmuş oldukça iyi çalışan bir ekonomik kurguya örnek gösterilebilir.

Şekil 2 Hertha sosyal odaklı eko-köyü (Danimarka) [8]

Eko-köylerin sosyal boyutu; insanların birlikte daha fazla zaman geçirme arzusunu, bireylerin hem kişisel olarak hem de grubun bir parçası olarak gelişimlerini destekleyen bir ortam yaratılmasını kapsamaktadır. Genellikle eko-köyler insanların kişisel özgürlükleri ile başkalarına karşı sorumlulukları arasında bir denge oluşturmalarını teşvik eder. Özgür ve amaca yönelik oluşumları yaratabilmeyi, kendi ihtiyaçları ile olduğu kadar yaşadıkları toplumun ihtiyaçları ile de buluşabilmeyi öğrenmelerine imkan tanır. Eko-köyler herkesin kendini yetkilendirilmiş hissedebileceği kadar küçük bir ortamdır. Bu sayede toplumun sorumluluk sahibi bir üyesi olarak hareket etmek kendilerinin bütün içindeki konumlarını hatırlamalarını sağlar.

Eko-köylerde toplumun anlamı;

- İnsanların farkında olma (başkalarını fark etme) ve onlarla ilişki içinde olma,
- Ortak kaynakları paylaşmak ve karşılıklı yardımlaşma,
- Doğru kararlar almayı ve çatışmaları çözmeyi öğrenme,
- Ruhsal ve koruyucu sağlık uygulamalarına önem verme,
- Topluluğun tüm üyelerine anlamlı işler ve geçim imkanı sağlama,
- Çocuklar, yetişkinler ve uç grupların birlikte bir yaşam sürmesini sağlama,
- Ömür boyu sürecek bir eğitimin gelişimine yardımcı olma,
- Farklılıklara saygı göstererek birliği, bütünlüğü yüreklendirme,
- Kültürlerin ifade edilmesini teşvik etmektir.

KÜLTÜREL ODAKLI EKO-KÖYLER

Köyün merkezinde bir tiyatro, dans, müzik ya da mevsimsel kutlamaları gerçekleştirebilecekleri bir salon, sosyal, kültürel ve geleneksel aktivitelerin sürdürüldüğü, kutlamaların yapıldığı merkezi bir toplantı alanına yer verilmektedir. Ayrıca yetişkinlerin gençlere nasihatler verdiği, nesilden nesile devam eden hikayelerin anlatıldığı, kutlamaların yapıldığı bir ağaç, bir anıt ya da bir kutlama salonu da olabilir [8].

İtalya'daki Ithaca eko-köyü, ekolojik etkileri en aza indirgenmiş, güvenli, sağlıklı bir yaşam ortamı sağlamak; kültürel yönden tatmin edici, zengin bir sosyal yaşam tarzı sunan bir model olarak geliştirilmiştir. Ithaca eko-köyü, insanlara barınma, çalışma, ihtiyacı olan yiyecek üretimi, enerji, sosyal etkileşim ve rekreasyonel imkanlar sunmaktadır [10].

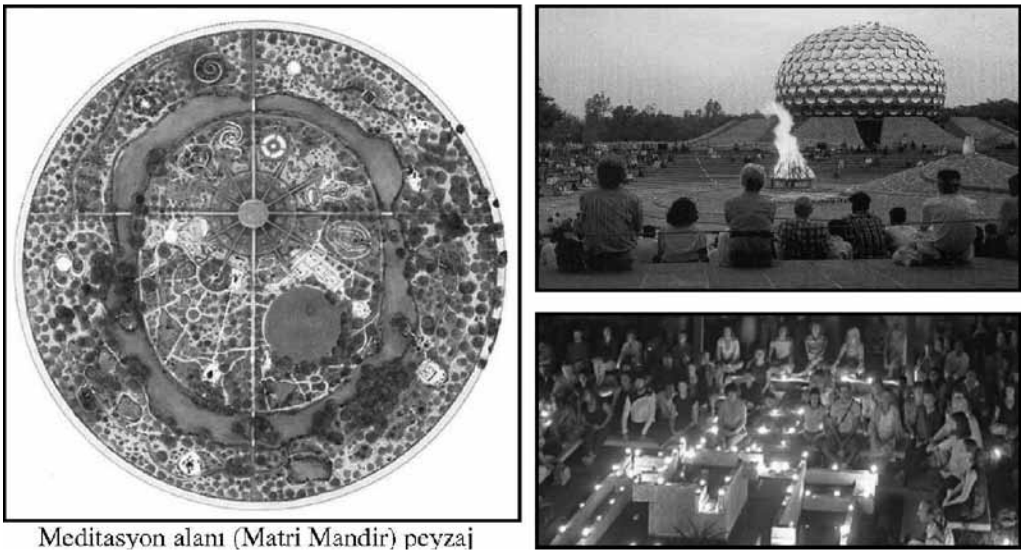
Şekil 3 Ithaca kültürel odaklı eko-köy (İtalya) [11]

Eko-köylerin kültürel boyutu; geleneksel kültürler üzerinde yoğunlaşmakta; yok olan ve ya yok olma tehlikesi ile karşı karşıya olan kültürlerin yeniden canlandırılması için çalışmalar gerçekleştirmektedir. Birçok eko-köyde geleneksel kültürlerin yeniden canlandırıldığı görülmektedir. Özellikle Kuzey yarımküresindeki eko-köyler geleneksel köy niteliğinde olup genellikle, seçtikleri ana unsurları esas alarak, eskiyi yeniden inşa etmek için uğraşmaktadırlar [8].

RUHANİ ODAKLI EKO-KÖYLER

Bu kapsamda tasarlanan birçok köyün kurulmasında Vastu Sastra (Hint mimarisi) gelenekleri, Feng Shui veya diğer benzer sistemler göz önünde bulundurulmaktadır.

Bu bağlamda Auroville'de köyün merkezinde, her bireyin rahatlıkla ulaşabileceği bir meditasyon salonu bulunmaktadır (Şekil 4). Yeraltı tapınağı olan Damanhur, üç enerji hattının birbirleri ile kesiştiği çok özel bir dağda yerleştirilmiş, böylece tüm dünya ile daha iyi bir iletişim içinde olacağı düşünülmüştür.



Meditasyon alanı (Matri Mandir) peyzaj tasarımı Auroville'de 2010 yılı kutlaması

Şekil 4 Auroville-Hindistan ruhsal odaklı eko-köyü [12]

Eko-köylerin ruhsal boyutu; dünya ile bütünleşme olgusu üzerinde durmaktadır. Doğanın döngülerini izleyerek, yerküreye ve üzerindeki tüm canlılara saygı duyarak, insanla doğanın ve evrenin bağlarının bilinçli olarak farkına varılması sağlanır. Bazı eko-köyler açıkça tanımlanmış bir ruhani yol seçerken çoğu da böyle bir ruhani yol benimsemezler. Bununla birlikte, doğal döngüleri anlamaya çalışmak, dünya üzerindeki yaşantılara saygı göstermek ve bu sayede insanlığın doğa ve evren ile bağlılığını anlatan yeni kültürel ifadeler yaratmak mümkün olabilir [8].

PERMAKÜLTÜR

İngilizce "**perma**nent" ve "agri**culture**" sözcüklerinin birleştirilmesiyle oluşturulmuş bir kavram olarak permakültür (permaculture), kültürün sürdürülebilir tarım temeli ve alan kullanım etiği olmaksızın kalıcı olmayacağını ortaya koyan bir yaklaşımdır. Sürdürülebilir insan yerleşimlerinin yaratılması için kullanılan alanın özellikleri, sosyal ve kültürel özellikler, enerji ve soyut bileşenler arasında ilişki kuran ve bunların bir yerleşim alanı içinde en iyi şekilde organizasyonunu sağlayan bir tasarım sistemidir [13].

Permakültürde doğal ekosistemler gibi çeşitliliğe sahip, dengeli ve dirençli, tarımsal olarak üretken ekosistemlerin bilinçli tasarımı ve bakımı gerçekleştirilmektedir. Gıda, enerji, barınma ve diğer ihtiyaçların giderilmesi için insanların ve yeryüzünün sürdürülebilir ve aynı zamanda uyumlu işbirliği gözetilmektedir.

Doğal üretim ve tarım yöntemlerine dayalı görünse de permakültür, bütüncül bir tasarım sistemidir. Sadece çevre dostu ürün yetiştirmekle sınırlanamayan bir yaklaşım olan permakültür, sürdürülebilir insan yerleşimlerinin nasıl gerçekleştirileceğini, doğal ekosistemlerin nasıl korunup genişletileceğini ve yaşam kalitesinin yeryüzünde tüm boyutlarıyla nasıl sağlanabileceğini ortaya koymaktadır [14].

KÜRESEL EKO-KÖYLER AĞI

Tüm dünyadaki mevcut eko-köyler, Küresel Eko-Köyler Ağı (Global Eco-village Network-GEN) çatısı altında toplanmış ve düzenli bir biçimde genişlemektedir. 1994 yılında kurulan Küresel Eko-Köyler Ağı, üç bölgesel büro ve bir topluluktan oluşmaktadır:

- **Oceania&Asia Inc. (GENOA):** Asya, Avustralya, Pasifik Adaları, Sri Lanka ve Filipinler,
- **The European Ecovillage Network (GEN-Europe):** Avrupa, Afrika and the Orta Doğu, İrlanda ve Senegal,
- **Eco-village Network of The Americas (ENA):** Kuzey, Merkez ve Güney Amerika, Meksika ve ABD'den oluşmaktadır.
- **The Next Generation of the Global Ecovillage Network (NextGEN):** Her yaştan gençler için gençler tarafından oluşturulmuş küresel bir topluluktur.

Küresel Eko-Köyler Ağı'nın rolü ağın küresel gündemini desteklemek, dünya çapında başlatılan faaliyetleri koordine etmek ve çalışmalara ivme kazandırmaktır. Konferanslar, gösteriler ve sosyal etkinliklere katılarak karar vericilere, planlamacılara ve profesyonellere eko-köy hareketini anlatır ve eko-köy tecrübelerini paylaşır [7].

TÜRKİYE'DE EKO-KÖYLER

Tüm Dünya'da olduğu gibi Türkiye'de de yaşanan sorunlar karşısında iki farklı yönde çözümler geliştirildiği ancak bu gelişmelerin eş zamanlı olmadığı görülmektedir. Bu süreçte kalkınma öncelikli çalışmalar devam ederken insan merkezli gelişim ve çözümler ön plandadır. Ancak zamanla çevre sorunlarının artması, kent yaşantısının yarattığı sorunlar (kalabalık, gürültü, kirlilik, güvenlik, sağlık) ve bu nedenle kentten uzaklaşma isteği, büyük kentlerde yaşayan insanların doğaya daha yakın, sağlıklı, huzurlu ve sade bir yaşam tarzı arayışı içine girmesine neden olmuştur. Böylece Türkiye'de eko-köyler, Dünya'da olduğu gibi, kentten uzaklaşma, doğa ile iç içe olma ihtiyacı doğrultusunda, alternatif bir yerleşim ve yaşam modeli yaratma çabasıyla ortaya çıkmıştır.

Gerçek anlamda Türkiye'de ekolojik yerleşim tartışmalarının başlangıcı; 1996 yılında İstanbul'da gerçekleştirilen Habitat II Kent Zirvesi'ne dayanmaktadır. Türkiye'de ilk eko-köy kurma girişimleri de bu paralelde gelişme göstermiştir. Bugüne gelindiğinde ise hem yeni yerleşimlerin ekolojik yaklaşımla planlama ve tasarımı hem de geleneksel yerleşimlerin sürdürülebilirliğinin sağlanması yönünde çalışmalar devam etmektedir [15].

Türkiye'de eko-köy kurma girişimlerinin arkasında, ekolojik yaşam tarzına odaklı sivil toplum kuruluşları ile gönüllü gruplar bulunmaktadır. Genel hedef, hem bireysel gelişim hem de ortak yaşama değer veren planlı bir toplumun yaşayacağı küçük ölçekli bir yerleşim birimi yaratmaktır. Dünya'daki çoğu eko-köyün tersine Türkiye'deki ilk girişimler mevcut bir yerleşimi alıp dönüştürmek yerine, yeni bir yapılı çevre oluşturma şeklinde gerçekleştirilmiştir [16].

Türkiye'de GEN-Europe üyesi olan 8 eko-köy (Şekil 5) bulunmaktadır. Bunlar eğitim ve tarımsal üretim amaçlı ve yeni kurulan bilinçli topluluklar olarak oluşturulmuş eko-köylerdir. Bu eko-köyler çoğunlukla kırsal ya da yarı-kırsal alanlarda, düşük yoğunluklu yerleşimler olarak planlanmıştır. Ekonomik olarak kendi kendine yetebilen bir döngü sistemine sahip olmaları hedeflenmiştir.
Ana gelir kaynakları ekolojik tarım, eğitim faaliyetleri ve ekoturizmdir. Ayrıca, bu eko-köylerde yerel kültüre ve yörenin geleneksel mimari özelliklerine saygı ön plana çıkmaktadır. Bu kapsamda yapılarda ahşap, taş, kerpiç ve saman balyası gibi yerel, doğal ve geri dönüşümlü malzemelerin kullanımı tercih edilmektedir.

Türkiye'deki ekoköyler:	
Güneş Köy	Ankara
ASSI	İstanbul
Buğday Evi	İstanbul
Dedetepe çiftliği	Çanakkale-Küçükkuyu
Đmeceevi	Çanakkale-Küçükkuyu
Hermes Projekt	Antalya-Kemer
GARP	Çanakkale-Babakale Koyu
Eko Foça	İzmir-Foça

Şekil 5 Türkiye'de GEN üyesi olan eko-köyler [8]

Bunların dışında GEN üyesi olmayan Hocamköy (Kırıkkale), Davutlar Kirazlı Köyü (İzmir) ve Turgutlar Köyü (İzmir) örnekleri de bulunmaktadır.

Hocamköy Anadolu Ekolojik Ortak Yaşam Hareketi'nin Hocamköy Eko-köy Projesi, Türkiye'de bilinen ilk kapsamlı deneysel eko-köy girişimi olarak nitelendirilmektedir. Yeni bir yaşam ve üretim modeli yaratmayı hedeflemiş bir grup üniversite öğrencisi tarafından Kırıkkale'nin Hasandede ilçesinde bozkır arazide gerçekleştirilmiştir. Projenin amacı, Anadolu'nun yüz yüze olduğu acil ekolojik sorunlara, yöre köylüleri ve çiftçileriyle beraber uygulanabilir çözümler bulmak ve daha iyi bir yaşam arayışıyla kentlere göç eden Anadolu köylüsüne kendi kendine yeten bir model sunabilmektir. Projenin 1997 ve 1998 yıllarındaki arazi çalışmalarında, toprağın permakültür yöntemleriyle iyileştirilmesi, tarım faaliyetleri ve kerpiç ev inşası gerçekleştirilmiştir. Proje 1998 yılında sonlanmış, ancak organizasyon modeli ve hedefleri sonraki eko-köy girişimlerine örnek olmuştur [16].

Davutlar Kirazlı Köyü ise Kirazlı Ekolojik Yaşam Derneği ile Kirazlı Köyü Sulama Kooperatifinin öncülüğünde başlayan, GEF-SGP'nin desteklediği "eko-köy" projesinin başarılı bir örneğidir. Köyde ekolojik tarımla yapılan çalışmalar sonucu üretilen ürünler, Kirazlı Eko-köy Yerel Ürünler Pazarı'nda satışa sunulmuştur. Pazarda sebze, meyve ve zeytinyağının yanı sıra köyün kadınları tarafından hazırlanmış geleneksel ev ürünleri de yer almıştır. Kirazlı Köyü'nde 50 yıldır Kiraz Festivali düzenlenirken 3 yıldan beri de ekolojik tarım yapıldığı için festival geleneksel hale getirilerek "Ekolojik Tarımda Geleneksel Kiraz Festivali" olarak düzenlenmeye devam edilmektedir [17].

Turgutlar Köyü (İzmir-Menemen), mevcut bir köyün dönüştürülmesi sonucunda ekolojik köy olduğu için Türkiye'de bir ilk olup bu yönüyle diğerlerinden farklıdır. Bir grup girişimci tarafından köyde doğal yaşamı sürdürmek, bir doğa okulu oluşturmak, evleri onarmak ve ekolojik tarım yapmak amacıyla 1970'ten sonra göç nedeniyle boşalan köyün eko-köy olarak yeniden yaşama geçirildiği bir projedir [18].

Türkiye'de planlama aşamasından öteye gidebilmiş çok az sayıda eko-köy girişimi bulunmaktadır. Bu durum; mevcut hayat tarzını geride bırakmaya istekli çok az insanın olması ve ekonomik nedenlere dayanmaktadır. Eko-köy girişimi başlangıç aşamasında belli bir ekonomik altyapıya sahip olmayı gerektirmektedir ancak bu faktör yaş sınırını yukarı çekerken gönüllü sayısını azaltm maktadır.

Diğer bir neden ise girişimlerin erken aşamalarında tartışmalara yol açan arazi sahiipliği konusudur. Birçok eko-köy üyesi, mutllak paylaşıma inandıkları için arazi sahipliğine karşı çıkmaktadır. Bu ise arazinin alınıp paylaşşımı sırasında etik ve felsefi açılardan fikir ayrıllıklarına sebep olmaktadır. Sonuç olarak, Türkiye'de eko-kööy kurma sürecinin herhangi bir yapılaşma sü ürecinden çok daha yavaş ilerlediği söylenebi ilir. Türkiye'deki bu örnekler, kooperatifleşmmenin eko-köy girişimlerinde başarı şansını arttırrdığını göstermektedir [16].

SONUÇ ve ÖNERİLER

Bu bildiride; esas vurgulanma ak istenen Türkiye'de var olan geleneksel yerleşimlerin dönüştürülmesi ve yüzyıllar bo oyunca oluşan bilgi ve birikim ile sürdürülebiilir yaşam ve yaşam alanlarının oluşturulabilecceğidir. Türkiye'nin sadece kırsal değil kkentsel alanlarda da geleneksel yerleşimlerin ekko-köy olarak dönüşümlerinin gerçekleştirilme esi için oldukça kapsamlı bir potansiyeli vardıır. Türkiye'de yerleşme olarak 81 il, 923 ilçe vve 35.000'den fazla köy bulunduğu dikkate alı ınarak mevcut durumu ve potansiyeli konusundaa bir değerlendirme yapacak olursak büyük bir aavantaja sahip olduğu söylenebilir (Şekil 6).

Şekil 6 Türkiye'nin eko-köy potansiyeli

Ekosistemlerin ve biyoçeşitliliğğin korunduğu, doğal koşulların uygun old duğu yerlerde yerleşimin kurulduğu, ekono omik etkinliklerin ağırlıklı olarak doğal kaynakların kullanılmasına dayandığı, yüz y yüze ilişkilerin daha yaygın olduğu, yaşam ta arzının büyük ölçüde gelenek ve görenekler re göre biçimlendiği geleneksel köylerin bbu özellikleri değerlendirilebilir. Bu bağlamda mevcut köylerin ekolojik bir yerleşime dönüştüürülmesi, ayrı bir çaba, strateji ve teknik ge erektirmektedir. Bu nedenle geleneksel yaşam mın hala var olmasının avantajını kullanıp ye erel halkla işbirliği yaparak her iki tarafın da dönüşümünü sağlamak mümkündür. Bu yön nde gerçekleşecek süreç bireysel, toplumsal, , ekolojik ve ekonomik anlamda strateji vee tekniklerin geliştirilmesini gerekli kılma aktadır. Bunu başarabilmek için;

Farkındalık yaratmak: Ekolojjik yaşam adına özellikle de köyde yaşayan yerel halkın mevcut değerlerinin (ekolojik, ek konomik, sosyal ve kültürel değerlerinin) farkına a varmaları ve sahip çıkmaları sağlanmalıdır.

Geçmiş birikimlerin gelecek için kaynak olarak değerlendirilmesi ve geliştirilmesi yönünde köylerin sürdürülebilir olması çok önemlidir. Bunun için köylerde yaşayan insanların mekansal anlamda olduğu kadar yöresel kültürleriyle nasıl yaşayacaklarını; yabancılaşmaya karşı nasıl direneceklerini; kimlikli ve sağlıklı bir gelecek için öz değerlerini nasıl koruyarak geliştireceklerini hedefleyen bir planlama ve tasarım yapılması gerekmektedir.

Bilinç düzeyini yükseltmek: Yerel halkın sahip olduğu tarihi, doğal, kültürel ve ekonomik kaynakların değeri ve önemi konusunda bilinç oluşturulmalıdır. Bunun için insanlara doğadaki yerlerini, kültürel kimliklerini, doğaya karşı sorumluluklarını anlamaları ve tüketim alışkanlıklarını değiştirmelerine yardım etmek ve ekosisteminin sürdürülmesine katkıda bulunmaları için neler yapılması gerektiği konularında bilgi verilmelidir. Bu amaçla modern yaşamın yok ettiği değerleri, özellikle gelenek ve görenekleri tekrar canlandırarak toplumun geri kazanımını sağlamak ve toplum ruhunun canlandırılması (sosyal sorumluluk ve bütünlüğün geliştirilmesini) için çeşitli etkinlikler gerçekleştirmelidir.

Eğitim olanakları sağlama: Sürdürülebilir gelişmenin temel taşlarından biri olarak yerleşimlerin daha yaşanabilir olması yani yaşam kalitesinin yükseltilmesi iyi yetişmiş, bilinçli toplumun ve bireylerin yaratılması ile mümkündür. Bunun için özellikle kadınlar, gençler ve çocukların eğitimine ve bilinçlenmesine önem verilmelidir. Bu amaçla daha gelişmiş bilgili, sorumlu ve daha ileri bir toplum oluşturmaya yönelik tekniklerin bir araya getirilmeli ve seminerler verilmelidir.

İletişim: İletişimin çok güçlü olduğu paylaşım, yardımlaşma ve dayanışma temelinde kurularak gelişmiş olan köylerin yeniden canlandırılması yok olmaya yüz tutan değerlerin yeniden kazanılmasına katkı sağlayacaktır. Bu amaçla sosyal ve kültürel etkinliklerin gerçekleştirildiği ortak kullanım alanlarının özellikle dış mekan kullanım alanlarının (köy meydanı, hasat meydanı, cami avluları, kahvehaneler, çeşme başı toplanma mekanları) fiziksel planlarda yer alması kaçınılmazdır. Toplumsal karmaşa, kopukluk ve çözülmeye neden olan iletişimsizlik sorununun sadece fiziksel planlarla çözülmesi beklenemez. Ancak mevcut koşulların iyileştirilmesi, mekan kalitesinin arttırılması, insanlar arası etkileşim ve paylaşımın arttırılması sağlanabilir.

Bir yerleşimi yaşanabilir kılan öğeler, o yerleşimi paylaşan bireylerin sosyal, kültürel ve ekonomik düzey ve beklentileri ile ilgili olduğu kadar, ekolojik özelliklerle de doğrudan ilişkilidir. O halde bir yerde yaşamı sürdürülebilir kılan, bireyleri hayatta tutmaya yarayan beslenme olanaklarını ve çevresel koşullar karşısında güvenliğini sağlayacak, sosyo-kültürel gelişime imkan sunacak ortamların oluşması kaçınılmazdır.

Permakültür tasarımı ve uygulamaya geçirilmesi: Özellikle Türkiye'de yaşanan son gelişmeler nedeniyle tarımla birlikte yok olan değerler ve yaşam kültürünün sürdürülebilirliğinin sağlanması için insanları, hayvanları ve doğal yaşamı eşzamanlı destekleyerek sağlıklı ve üretken yaşam alanları yaratmak amacıyla permakültür yaygınlaştırılmalıdır.

Bunların yanı sıra dönüştürülecek köy, içinde bulunduğu bölge ile birlikte değerlendirilmeli, idari sınırları içinde yer aldığı kent ve çevresini destekleyecek bir şekilde gelişmesi sağlanmalıdır.

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ORTA KARADENİZ KOŞULLARINDA ORGANİK NOHUT YETİŞTİRİCİLİĞİ İÇİN EN UYGUN ÇEŞİDİN BELİRLENMESİ

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ÖZET

Bu çalışma ile Orta Karadeniz koşullarında tescilli nohut çeşitlerinin organik ve geleneksel nohut yetiştiriciliğine göre performansları tespit edilmiş, organik ile geleneksel nohut yetiştiriciliği için bu bölgede en uygun çeşitler belirlenmiştir. Organik esaslara göre planlanan çeşit verim denemesinin iki yıllık birleştirilmiş analizlerine göre organik esaslara göre planlanan denemenin ortalama verimi(107.78 kg/da) ile geleneksel esaslara göre planlanan deneme sonuçlarının ortalama verimleri (112.72 kg/da) birbirlerine yakın değerler göstermişlerdir. Ancak yıllara göre incelendiğinde ise bu farklılık artmıştır. Bunun nedeni 2005 yılında antraknoza nedeniyle organik parsellerdeki verimler düşmüştür. Her iki çalışmada da en fazla verimi Çağatay çeşidi vermiştir. Bu nedenle bu bölgede gerek organik yetiştiricilikte gerekse geleneksel yetiştiricilikte çeşit olarak Çağatay çeşidi tavsiye edilebilir. Ancak özellikle organik yetiştiricilikte antraknoza karşı korunma tedbirleri üzerinde çalışılması gerekmektedir.

Anahtar Kelimeler : Nohut, organik yetiştiricilik, geleneksel yetiştiricilik

ABSTRACT

Determination of the Most Suitable Cultivar for Organic Chick-Pea Growing under the

Middle Black Sea Region Conditions of Turkey

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Performances of registered chick pea cultivars and the most suitable cultivars were determined for organic and conventional growing conditions in the Black Sea region in this study.

According to two year composed analyzes, average yield (1077.8 kg/ha) of the experiment planned in accordance with organic base and average yield (1127.2 kg/ha) of the experiment planned in accordance with conventional base was similar to each other. But if the evaluation was realized on the basement of years, this difference was much more. The reason of this difference was that yields in the organic plots decreased because of the Anthracnose disease in the year 2005. Maximum yields were obtained from Çağatay cultivar in both experiments. Because of this reason Çağatay cultivar is advisable for both organic and conventional growing in the region. But sanitation measures and control methods against Anthracnose disease in especially organic cultivation should be studied.

Key Words: Chick Pea, Organic cultivation, Conventional cultivation

GİRİŞ

Dünya nüfusunun hızlı artışı tarımsal üretim artışı zorunluluğunu da beraberinde getirmiştir. Tarımsal üretim artışı için kimyevi gübre ve ilaç kullanımı, üretimi belli bir noktaya kadar arttırmış, ancak çevreye olumsuz etkide bulunmuştur. Ayrıca kimyasal ilaç ve gübreler tarım ürünlerinde kalıntı bıraktıkları gibi yer altı sularına karışarak insan sağlığını tehdit etmeye başlamıştır. Bu olumsuzluklar karşısında özellikle gelir seviyesi yüksek gelişmiş ülkeler başta olmak üzere, bir çok ülkede üretici ve tüketiciler örgütlenerek doğal dengeyi bozmadan, çevreyi kirletmeden, insanlarda ve diğer canlılarda toksit etki yapmayan temiz ürünler üretmeye ve tüketmeye başlamışlardır. Bu amaçları gerçekleştiren üretim sistemine 'Ekolojik Tarım' adı verilmektedir (Aksoy ve Altındişli, 1999). Ekolojik tarım gelecek kuşaklardan ödünç aldığımız ekolojinin ve insan sağlığının korunması için sunulan bir seçenektir.

1990'lardan itibaren ekolojik tarım Avrupa'da hızlı bir gelişim göstermiştir. 1998 yılında AT ve EFTA (Europen Free Trade Association) ülkelerinde 85.337 tarım işletmesi, 2 milyon hektar alanda ekolojik tarım yapmaktadır. Tarım alanlarının % 1,4'ü, tarım işletmelerinin % 1,1'i ekolojik tarıma geçmiştir. ABD'de 1995 yılında 2,8 milyar USD olan ekolojik gıda pazarı %26 artarak 1996'da 3,5 milyar USD'na ulaşmıştır (Aksoy, 1999). Dünyada hızlı artış gösteren organik tarımın, Ülkemizde de hak ettiği payı alabilmesi için araştırmalara hız verilmesi gerekmektedir. Çünkü ülkemiz ekolojik tarımın uygulanabilmesi konusunda bir çok ülkeye göre bir çok avantaja sahiptir(Delen, 1999). Yani ülkemizde çok farklı koşullar, biyolojik zenginlik ve bu koşullara adapte olmuş ürünler ekolojik tarım açısından avantaj olarak görülmektedir. Diğer bir avantaj ise bazı bölgelerde sentetik girdi tüketimi kullanımı çok düşük düzeyde olmasıdır. Ancak başarı için tekniklerin bilinmesini bilgi birikimini gerektirmektedir. Organik tarımda ekolojik koşulların ve ürünün interaksiyonu, başarıyı etkilediğinden ileriye dönük ihtiyaç duyulacak konularda araştırmaların bir an önce yürütülmesi gerekmektedir (Aksoy ve Altındişli, 1999).

Bölgemizde de ekolojik tarım konusunda yapılan bu çalışma ile nohut bitkisinin ekolojik ve geleneksel tarımda verimleri belirlenmiş ve sistemler için ayrı ayrı çeşit tavsiyesinde bulunulmuştur.

MATERYAL ve METOD

Deneme 2003-2004 yılları arasında Samsun/Ladik'te yürütülmüştür. Bu bölgede, uzun yıllar iklim verilerine göre Nisan – Haziran aylarında 76,2 ile 59,4 mm aralığında yağış ve 8,9 ile 15,6 C^0'lik sıcaklığa, Temmuz – Eylül arasında 27,5 ile 29,1 mm'lik yağış ve 17,7 ile 10,7 C^0 sıcaklığa sahip olduğu belirlenmiştir (Anonim, 1999).

Deneme alanının toprak yapısı killi –tınlı, hafif kireçli ve organik maddece fakirdir (Anonim,2003). Nohudun toprak isteği yönünden son derece kanaatkâr, kirece ve tuzluluğa toleranslı olması ve genel olarak hafif kireçli – kumlu, kumlu – tınlı toprakları sevmesi (Akçin, 1988) nedeniyle, seçilen deneme alanı nohut tarımı için uygundur. Ayrıca organik tarımda tek yıllık ürünlerde 2 yıllık geçiş süreci uygulanması nedeni ile; 2002 yılında boş bırakılan arazide 2003 ve 2004 yıllarında deneme kurulmuştur. Çalışmada iki parsel kullanılmış, birinci yıl bir parsele deneme kurulmuş, diğerine ise buğday ekilmiş, ikinci yılda ise buğday olan parsele deneme kurulmuş, deneme olan parsele ise buğday ekilmiştir.

Deneme Nisan ayında sıra arası 35 cm 4 sıra parsel boyu 4 m olacak şekilde 3 tekerrürlü olarak tesadüf blokları deneme desenine göre kurulmuş olup, denemede antraknoza karşı toleranslı olan farklı Enstitülerin 12 adet tescilli çeşidi kullanılmıştır (Onoğur, 1998). Denemede bakım işleri Akçin (1988)' e göre, Organik denemede yapılan işlemler ise organik tarım ile ilgili yönetmeliğe (Anonim, 2002) uygun olarak yapılmıştır. Denemede bitki boyu (cm), 100 tane ağırlığı (g), su alma indeksi (%), Hidrasyon Kapasitesi, Elek ortalaması, 9 nolu elek yüzdesi ve verim (kg/da) ölçme değerleri alınmıştır. Elde edilen bu veriler MSTAT-C paket programı ile analiz edilmiştir.

BULGULAR VE TARTIŞMA

a- Bitki Boyu (cm)

Bitki boyu bakımından organik denemede, çizelge 1'de görüldüğü gibi iki yıllık birleştirilmiş analiz sonuçlarına göre çeşitler arasında herhangi bir farklılık tespit edilemezken, 2003 yılı sonuçlarına göre P<0.05 düzeyin bir farklılık görülmüştür. Buna göre en uzun bitki boyu 51.3 cm ile Uzunlu 99'da, en kısa bitki boyu 35.7 cm ile Küsmen 99'da tespit edilmiştir.

Geleneksel yetiştiricilikte iki yılın birleştirilmiş analiz sonuçlarına göre çeşitler arasında farklılıklar (P<0.01 düzeyinde) tespit edilmiştir. Geleneksel yetiştiricilikte en yüksek bitki boyu (54.90 cm) Uzunlu 99 çeşidinde, en kısa bitki boyu ise geleneksel tarımda Damla 89 ve Gülümser' (41.6 cm ve 42.0 cm) de tespit edilmiş olup, Özçelik ve ark.(2001)'nın Amasya/GökhöyükTe yaptıkları çalışmada da en kısa bitki boyu Damla 89'da belirlenmiştir. Bu çalışmada bitki boyunun daha yüksek olması lokasyonun daha çok yağış almasından kaynaklanmış olabilir.

b- 100 Tane Ağırlığı (g)

Organik denemede 100 tane ağırlığı bakımından yapılan iki yıllık birleştirilmiş analiz sonuçlarına göre çeşitler arasında farklılık önemli (P<0.05) bulunmuş olup, en yüksek 100 tane ağırlığı Sarı 98'de, en düşük Damla 89 (37.6 g) ve Er 99 (38.6 g) 'da belirlenmiştir. Yıllara göre incelendiğinde çeşitler arasındaki farklılık çalışmanın ilk yılında P<0.01, çalışmanın ikinci yılında P<0.05 düzeyinde önemli bulunmuştur. Çalışmanın ilk yılında Sarı 98 çeşidi (61.2 g), ikinci yılında Çağatay 37.2 g ile en yüksek 100 tane ağırlıklarını vermişlerdir. Geleneksel denemede 100 tane ağırlığı bakımından çeşitler arasında önemli farklılık görülmüş olup, en yüksek 100 tane ağırlığı Çağatay çeşidinde 45.1 g olarak belirlenmiştir. Çalışmanın her iki yılındada çeşitler arasında farklılık (P<0.01 düzeyinde) tespit edilmiş olup, ilk yılında Sarı 98 çeşidi (51.1 g), ikinci yılında Çağatay (39.8 g) çeşitleri en yüksek 100 tane ağırlıklarını vermişlerdir.

Çizelge 1. Nohut çeşitlerine ait verim ve verimi etkileyen bitki boyu ve 100 tane ağırlığı ölçüm değerleri

Çeşitler	Organik									Geleneksel								
	Bitki Boyu			100 Tane Ağırlığı			Verim			Bitki Boyu			100 Tane Ağırlığı			Verim		
	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort
ÇAĞATAY	38.7 bc	44.6	41.6	51.2 bd	37.2 a	44.2 ab	164.6 a	129.4 a	147.0 a	43.7 b	53.3 ab	47.0 bd	42.5 c	39.8 a	41.1 ad	134.0 a	203.0 a	153.6 a
MENEMEN 92	39.5 bc	44.7	42.2	44.2 cd	30.0 d	40.0 b	124.4 cd	99.7 cd	125.4 ab	40.5 bd	51.3 ab	44.7 ce	42.0 c	34.4 bd	38,2 bd	101.1 bc	141.3 bc	115.5 ad
GÜLÜMSER	39.5 bc	51.0	45.2	47.1 bd	36.6 bd	41.8 ab	141.5 bc	105.1 ab	123.3 ab	40.8 bd	53.3 ab	42.0 e	50.5 a	35.5 bd	38.8 ad	104.1 bc	159.4 ab	109.9 ad
GÖKÇE	37.7 bc	45.0	43.8	48.4 bd	34.6 ac	41.7 ab	96.9 e	69.8 ef	111.9 ab	42.6 bc	52.0 ab	44.2 de	49.4 b	30.1 e	40.7 ad	70.4 d	89.5 c	129.4 ad
CANITEZ 87	39.4 bc	50.0	42.2	46.9 bd	35.0 ac	40.7 ab	152.7 ab	127.0 ab	111.3 ab	40.5 bd	53.7 ab	47.2 bd	42.0 c	34.0 cd	39.1 ad	114.2 ab	170.0 ab	135.6 ac
ER 99	39.5 bc	51.7	42.1	47.2 bd	31.7 ac	38.6 b	120.7 cd	86.4 ce	110.2 ab	35.7 d	46.6 b	43.8 de	41.0 cd	34.6 bd	37.4 bd	80.7 cd	121.3 bc	81.2 cd
SARI 98	41.9 bc	45.0	42.4	61.2 a	35.9 ab	49.0 a	150.6 ab	126.4 ab	104.0 ab	39.6 bd	56.0 ab	45.8 be	51.0 a	35.0 bd	43.7 a	106.6 b	160.1 ab	113.1 ad
İZMİR 92	43.8 b	48.3	44.0	54.4 ab	35.2 ac	43.8 ab	121.6 cd	95.7 cd	100.3 ab	35.2 d	48.3 b	49.8 b	45.9 bc	36.6 b	38.7 ad	99.4 bc	139.2 bc	147.1 ab
DAMLA 89	37.8 bc	47.7	44.7	43.6 d	34.1 ac	37.6 b	113.3 de	85.6 ce	99.8 ab	49.2 a	52.0 ab	41.6 e	45.9 bc	36.4 bc	35.5 cd	80.5 cd	119.7 bc	97.2 bd
CEVDET-BEY	39.3 bc	44.3	43.8	53.9 ab	33.3 bd	44.5 ab	99.1 e	79.3 df	97.4 ab	36.6 d	49.0 b	48.9 bc	36.5 d	27.6 f	42.3 ac	73.1 d	116.8 bc	84.3 cd
UZUNLU 99	51.3 a	48.0	49.6	55.1 ab	35.0 ac	45.0 ab	98.4 e	70.3 ef	84.3 ab	35.6 d	55.3 ab	54.9 a	44.7 bc	35.2 bd	39.5 ad	73.0 d	98.2 c	80.8 d
KÜSMEN 99	35.7 c	43.0	41.7	53.0 ac	33.1 d	43.5 ab	71.5 f	57.4 f	78.5 b	37.6 cd	60.6 a	44.4 de	43.5 c	33.1 d	38.9 ad	68.4 d	81.2 c	104.9 ad
VAR. AT(%)	10.45	11.42	8.67	9.31	6.05	8.07	9.34	14.47	13.63	7.76	7.75	3.88	6.39	6.98	7.43	14.60	13.44	15.01
ÖNEMLİLİK	*	ÖD	ÖD	**	*	*	**	**	**	**	*	**	**	**	**	*	**	**

*Aynı harfle gösterilen ortalamalar arasında fark yoktur.

Organik ve Geleneksel denemelerde çalışmanın ikinci yılında organik nohutun 100 tane ağırlığının çok düşük olmasının nedeni hastalıktan kaynaklanmaktadır. Bu durum organik denemede daha yoğun olarak görüldü. Bu nedenle 100 tane ağırlığı önemli oranda düşmüştür. Geleneksel nohutta antraknoz mücadelesi yapılması nedeni ile 100 tane ağırlıklarında ki azalma organik denemesine göre daha az olmuştur. Özellikle 2003 yılında organik nohutta 100 tane ağırlığının yüksek olması Antraknoz hastalığının görülmemesi ve iklim şartlarının uygun olmasından kaynaklanmaktadır. Sarı 98 çeşidi iri taneli fakat antraknoz hastalığına hassas olduğu için ikinci yıl 100 tane ağırlığında belirgin düşüşler görülmüştür. Çalışmanın ikinci yılında en yüksek 100 tane ağırlığını veren Çağatay çeşidi antraknoza daha toleranslı olduğu görülmüştür.

c- Verim (kg/da)

Çizelge 1'de görüldüğü gibi 2003 yılında organik nohutun verimi gelenekselden daha yüksek çıkmış, bu durum 2004 yılında da tersi olmuştur. Uygulamaların verime etkisi istatistiki olarak birinci yıl önemli (P<0.05), ikinci yıl ise çok önemli (P<0.01) çıkmıştır. Yıl birleştirme sonucunda da farklılık çok önemli (P<0.01) çıkmış, verim organik nohutta 147 kg/da çıkmasına rağmen geleneksel nohutta 153.6 kg/da olarak gerçekleşmiştir. Özellikle 2004 yılında organik nohutta antraknozdan kaynaklanan önemli bir verim düşüşü meydana gelmiştir. Antraknoza karşı alınması gereken bütün kültürel tedbirler alınmasına rağmen hastalık epidemi oluşturmuştur. Geleneksel parsel ilaçlı mücadele yapıldığı için zarar görmeden hastalığı atlatırken, organik tarımda antraknoza karşı kullanılabilecek bir ilaç olmaması sebebiyle hastalık ortaya çıkmış ve çok büyük oranda zarar vermiş, verimi de düşürmüştür. Ekolojik tarımın verim kaybına neden olmadığını bildiren Akgüngör (1996) ile çalışmamızdan elde edilen sonuçlar uyuşmamaktadır.

Ayrıca hem organik denemede ve hemde geleneksel parselde Çağatay çeşidi her iki yılda da en yüksek verimi vermiştir.

e-Hidrasyon Kapasitesi (%)

Çizelge 2 incelendiğinde, çalışmanın yapıldığı her iki yılda da Hidrasyon Kapasitesi üzerine çeşitlerin etkisi istatistiki olarak önemli çıkmıştır. Birleştirme sonrasında da çeşitlerin etkisi istatistiki olarak önemli bulunmuştur. Birleştirme sonuçlarına baktığımızda organik nohutun Hidrasyon Kapasitesi az da olsa geleneksel nohuttan yüksek çıkmıştır. Bu durum, organik ürünlerde protein ve kuru madde içeriğinin, geleneksel ürünlerden daha yüksek olduğunu bildiren Ertem (1993) ile aynı doğrultudadır. Ayrıca her iki uygulamada da yılların birleştirilmiş analizine göre en yüksek hidrasyon kapasitesini Sarı 98'in sağladığı belirlenirken, yıllara göre incelendiğinde birinci her iki uygulamada Sarı 98, ikinci yıl ise organik denemesinde Küsmen 99 ve Geleneksel denemesinde ise Damla 89 en yüksek hidrasyon kapasitesini sağlamıştır.

d- Su Alma İndeksi (%)

Uygulamaların su alma indeksi üzerine etkileri istatistiki olarak, çalışmanın yapıldığı tüm yıllarda da çok önemli (P<0.01) çıkmıştır (Çizelge 2'de). Geleneksel nohutun su alma indeksi, çalışmanın her iki yılında ve birleştirme sonrasında organik nohuttan daha yüksek bulunmuştur. Bu durum özellikle nohut üretiminde döllenme sonrası geleneksel parsellerin hastalık kontrolünün ve beslenme düzeninin iyi olmasından kaynaklandığı sanılmaktadır. Yılların birleştirilmiş analizine göre Organik denemede Çağatay ve Damla 89, Geleneksel denemede ise Cevdetbey en yüksek su alma indeksini sağlamıştır. Ayrıca Çağatay çeşidi her iki denemede su alma indexi yönünden çok az bir değişim göstermiştir.

e- Elek Ortalaması

Çizelge 2'de de görüldüğü gibi 100 tane ağırlığının doğrudan etkilediği elek ortalaması yönünden iki denemede de yılların birleştirilmiş analizine göre çeşitler arasında önemli farklılıklar (P<0.01 düzeyinde) çıkmıştır. Bu farklılığa göre Çağatay çeşidi organik (8.45) ve Geleneksel (8.31) denemelerde en yüksek elek oranını vermiştir. Bu sonuç özellikle 2003 yılının organik değerlerinin yüksek olmasından kaynaklanmaktadır. 2004 yılında meydana gelen antraknoz hastalığı nedeniyle organik Nohut değerleri düşük bulunmuştur. Ayrıca Sarı 98 çeşidi çalışmanın birinci yılında istatistiki olarak Çağatay ile aynı sınıfta yer alarak yüksek elek ortalaması sağlasa da çalışmanın ikinci yılında iki uygulamada da antraknoz nedeniyle bu ortalama düşmüştür.

Çizelge 2. Nohut Çeşitlerine ait Teknolojik özellikler ölçüm değerleri

Çeşitler	Organik												Geleneksel											
	Hidrasyon Kapasitesi			Su Alma İndexi			Elek Yüzdesi			9 Nolu Elek Oranı			Hidrasyon Kapasitesi			Su Alma İndexi			Elek Yüzdesi			9 Nolu Elek Oranı		
	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort	2003	2004	Ort
ÇAĞATAY	0.47 ad	0.43 ab	0.45 b	0.93 ab	0.99 a	0.96 a	8.91 a	7.99 a	8.45 a	84.8 ab	21.9 a	53.3 a	0.40 ab	0.44 b	0.42 bc	0.96 ab	0.95 ac	0.96 bc	8.42 ab	8.09	8.31 a	49.3 cd	28.4 a	48.4 ab
MENEMEN 92	0.41 ce	0.39 cd	0.40 de	0.94 a	0.86 cd	0.90 ac	8.51 c	7.05 c	8.05 ac	55.8 ef	3.1 d	34.7 ab	0.41 ab	0.42 bc	0.39 de	0.94 ab	0.98 a	0.95 bc	8.49 a	7.75	7.79 ab	55.7 bc	22.6 cd	26.3 ab
GÜLÜMSER	0.43 be	0.39 cd	0.41 ce	0.92 ab	0.91 cd	0.92 ac	8.36 c	7.68 bc	8.02 bc	49.4 f	17.7 bc	33.5 ab	0.41 ab	0.43 bc	0.40 cd	0.94 ab	0.97 ab	0.96 bc	8.54 a	7.81	7.95 ab	68.4 bc	24.7 bc	27.2 ab
GÖKÇE	0.43 be	0.43 bc	0.42 cd	0.90 ab	0.94 bc	0.92 ac	8.74 ab	7.44 bc	8.14 ac	76.9 bc	18.1 ab	45.5 ab	0.38 b	0.34 e	0.44 b	0.77 b	0.85 e	0.81 d	8.66 ab	7.26	8.18 ab	70.2 b	7.9 f	42.9 ab
CANITEZ 87	0.43 be	0.41 bc	0.43 c	0.91 ab	0.87 cd	0.89 b	8.51 c	7.55 bc	7.97 c	56.8 ef	14.1 bc	37.4 ab	0.40 ab	0.41 bc	0.41 c	0.95 ab	0.93 bc	0.94 bd	8.39 ab	7.79	8.14 ab	47.3 cd	22.3 cd	39.0 ab
ER 99	0.43 be	0.38 cd	0.41 ce	0.91 ab	0.94 bc	0.93 ab	8.70 ac	7.62 bc	7.87 c	73.3 bd	8.7 c	38.2 ab	0.41 ab	0.40 bd	0.36 f	1.00 ab	0.91 cd	0.95 bc	8.18 b	7.62	7.95 ab	32.6 de	17.8 de	39.0 ab
SARI 98	0.54 a	0.40 bc	0.49 a	0.88 ab	0.99 a	0.94 ab	8.91 a	7.59 bc	8.40 ab	91.3 a	13.6 bc	56.0 a	0.51 a	0.42 bc	0.50 a	0.94 ab	0.95 ac	0.95 bc	8.47 a	7.89	8.24 ab	88.1 a	25.4 bc	58.4 a
İZMİR 92	0.38 e	0.44 ab	0.37 f	0.74 b	0.95 ab	0.83 d	8.65 ac	7.53 bc	7.99 bc	67.5 ce	10.9 bc	39.8 ab	0.45 ab	0.40 bd	0.41 c	0.98 ab	1.00 a	0.98 b	8.55 ab	7.72	8.15 ab	61.2 bc	21.9 cd	37.3 ab
DAMLA 89	0.40 de	0.44 ab	0.39 e	0.93 ab	0.98 a	0.95 a	8.72 ac	7.45 bc	8.17 ac	45.9 f	11.2 bc	27.3 b	0.46 ab	0.49 a	0.41 cd	1.01 ab	0.95 ac	0.97 b	8.55 ab	8.01	7.60 b	63.1 bc	28.7 ab	18.5 ab
CEVDETBEY	0.50 ac	0.36 d	0.47 b	0.93 ab	0.78 e	0.86 c	8.71 ac	7.34 bc	8.12 ac	73.7 bd	12.2 bc	42.3 ab	0.42 ab	0.38 de	0.37 ef	1.18 a	0.94 bc	1.06 a	7.58 b	7.19	8.17 ab	19.3 e	5.4 f	45.9 ab
UZUNLU 99	0.51 ab	0.42 bc	0.47 b	0.93 ab	0.94 bc	0.93 ab	8.78 ab	7.51 bc	8.14 ac	79.6 b	14.6 bc	47.1 ab	0.38 b	0.37 de	0.44 b	0.85 b	0.80 f	0.83 ce	8.65 ab	7.69	7.94 ab	70.2 b	21.6 cd	37.1 ab
KÜSMEN 99	0.51 ab	0.45 a	0.47 ab	0.96 a	0.91 cd	0.94 ab	8.58 ac	7.89 a	8.01 bc	62.1 de	20.8 a	36.6 ab	0.43 ab	0.43 bc	0.43 bc	0.99 ab	0.96 ab	0.98 b	8.44 ab	7.34	8.09 ab	52.3 b	11.2 ef	37.4 ab
VAR. AT(%)	10.52	8.81	11.68	10.85	7.93	2.59	2.20	11.64	2.09	9.40	17.45	13.56	14.90	12.66	13.50	15.88	11.64	5.82	3.08	7.81	3.56	17.27	16.52	14.09
ÖNEMLİLİK	**	*	**	**	**	**	**	*	**	**	*	**	*	**	**	*	**	**	**	Ö.D.	**	*	**	**

*Aynı harfle gösterilen ortalamalar arasında fark yoktur.

f- 9 Nolu Elek Ortalaması

Çalışmanın yapıldığı yıllardaki elek ortalamaları Çizelge 18'de görülmektedir. Çeşitlerin nolu elek yüzdesi üzerine etkisi, çalışmanın her iki yılında da istatistiki olarak önemli ($P<0.05$), iki yılın birleştirilmesi sonucunda da çok önemli ($P<0.01$) farklılık bulunmuştur. 100 tane ağırlığı fazla olan geleneksel parselin elek ortalaması da buna paralel olarak yüksektir. Birleştirme sonucuna göre organik nohutta elek ortalaması Çağatay çeşidinde % 53.3 iken geleneksel nohutta % 48.4 olarak bulunmuştur. Bu sonuç özellikle 2003 yılının organik değerlerinin yüksek olmasından kaynaklanmaktadır. 2004 yılında meydana gelen antraknoz hastalığı nedeniyle organik Nohut değerleri düşük bulunmuştur.

SONUÇ

1. 2004 yılında ilkbahar döneminde düşen uzun süreli yağışlar ve havanın kapalı olması, hem hastalık şiddetini artırmış ve hem de döllenme sorunu yaşanmasına neden olmuştur.

2. Sarı 98 çeşidi 2003 yılında çok yüksek, 2004 yılında ise antraknoz hastalığı nedeniyle oldukça düşük değerler vermiştir. Ayrıca Cevdetbey çeşidi, vejetasyon süresinin uzun olmasından dolayı geç olgunlaşmayla beraber pas hastalığına maruz kalmaktadır. Bütün bu nedenlerden dolayı organik tarımda bölge için önerilecek çeşitler mutlaka antraknoz hastalığına yüksek toleranslı çeşitlerden seçilmelidir.

3. Çeşitlerin her iki yılda farklı reaksiyon göstermesi, Organik tarımda çeşitlerin çok iyi seçilmesi gerekliliğini ortaya koymaktadır.

4. Organik tarımda tüketici istekleri ikinci plana kalmaktadır. Bu nedenle tane iriliği göz ardı edilebilir.

5. Organik nohut tarımı için uygun alan bulunulursa başarı şansı oldukça yüksektir.

6. Ele alınan çeşitlerden Çağatay çeşidi her iki yılda da yüksek verim vererek stabil bir çeşit olduğunu göstermiştir. Ayrıca sahip olduğu diğer tane ve kalite özelliklerinden dolayı bölge çiftçisine tarımı için önerilmektedir.

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KARADENİZ BÖLGESİNDE ORGANİK ÇİLEK YETİŞTİRİCİLİĞİ

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ÖZET

Bu çalışma, 2004-2005 yıllarında Karadeniz Tarımsal Araştırma Enstitüsü'ne ait deneme alanında, organik çilek yetiştiriciliğinin uygulanabilirliğinin araştırılması amacıyla yürütülmüştür. Denemede yaz dikim sistemi ile Camarosa, Sweet Charlie, Kabarla, Strawberry Festival ve Redlans Hope çilek çeşitleri kullanılarak organik ve geleneksel sistemlerde fenolojik gözlemler ile verim ve bazı kalite kriterleri bakımından karşılaştırmalar yapılmıştır. İlk çiçeklenme ve ilk hasat tarihleri genellikle çeşitlere de bağlı olarak organik sistemde geleneksel sisteme göre daha geç olmuştur. Bitki başına verim değerleri geleneksel sistemde daha yüksek olmuştur. Meyve ağırlıkları ve SÇKM açısından sistemler arasında farklılık olmamıştır. Halbuki meyvenin asitliği Sweet Charlie, Camarosa ve Redlans hope çeşitlerinde geleneksel sistemde organik sisteme göre yüksek bulunmuştur. Verim, kalite kriterleri sonuçlarına bakıldığında, Camarosa ve Kabarla çilek çeşitleri ile bölgede organik çilek yetiştiriciliği uygulanabilir nitelikte bulunmuştur.

Anahtar kelimeler: Çilek, Organik Tarım, Karadeniz Bölgesi

ORGANIC STRAWBERRY GROWING IN THE BLACK-SEA REGION OF TURKEY

ABSTRACT

The study was carried out at the research field of Black Sea Agricultural Research Institute in 2004-2005. The aim of the study was to investigate the applicability of organic strawberry growing. In the study 5 strawberry cultivars including Camarosa, Sweet Charlie, Kabarla, Strawberry Festival and Redlans Hope were planted at summer planting system in conventional and organic farming systems. These cultivars were compared by using two growing systems according to their phenologic observation, yield and some quality criteria. The flowering date and first harvest date was earlier in conventional system when compared to organic system. Yield was higher in conventional system. There were no statistical differences between conventional and organic system in fruit weight and total soluble solid of fruit. Whereas fruit acidity of Sweet Charlie, Camarosa ve Redlans hope cultivars were higher in conventional system than those of organic system. According to the yield and quality Camarosa and Kabarla cultivars were suitable for organic growing system in the region.

Key words: Strawberry, Organic Agriculture, Black-Sea Region

GİRİŞ

Birim alandan en çok gelir getiren bahçe ürünlerinden biri çilektir. Çilek değişik iklim ve toprak koşullarına kolay uyabilmesi nedeniyle dünya üzerinde çok geniş bir yetişme alanına sahiptir. Çilek diğer ürünlerin sınırlı yetiştirilebildiği yamaç ve dar arazilerde de rahatlıkla yetiştirilebilmektedir. Böylece hem arazi iyi değerlendirilebilmekte hem de uygun ekolojilerde kaliteli ve bol ürün vermektedir.

Dünya'nın bir çok yerinde ıslah edilmiş verimli ve kaliteli çeşitler ile üretimi yapılan çilek, ülkemizde de son yıllarda gittikçe artan bir önem kazanmaktadır. Gerek sanayi için elverişli olması, gerekse taze olarak tüketilebilen bir meyve türü oluşunun yanı sıra ilkbaharda hemen hiçbir meyvenin bulunmadığı bir zamanda olgunlaşması nedeniyle tüketici tarafından fazla talep görmektedir (**Ağaoğlu, 1986**). Bu sebeple birim alandan en çok gelir getiren bahçe ürünlerinden biri de çilektir.

Tarım sektörü artan dünya nüfusunun beslenme ihtiyaçlarını karşılamak için birim alandan verimi artırmaya çalışırken, çoğunlukla kontrolsüzce kullanılan kimyasal girdiler çevreyi kirletmektedir. Organik tarım ise, ekolojik sistemde yanlış uygulamalar sonucu kaybolan doğal dengeyi yeniden kurmaya yönelik, insana ve çevreye dost üretim sistemlerini içermektedir (**Altındişli ve İlter, 1999**). Çevreyi ve insan sağlığını tehdit eden olumsuz gelişmeler sonucunda başta gelişmiş ülkeler olmak üzere, bir çok ülkede bilinçli tüketiciler doğal dengeyi bozmayan, insanlarda ve diğer canlılarda toksik etki yapmayan ürünleri talep etmeye ve tüketmeye yönelmişlerdir. Dünya'da gelişmekte olan tüketici bilincine bağlı olarak organik yetiştirilen meyvelere olan talep de giderek artmaktadır. Bu proje ile, talebi ve pazar payı hızla artan organik ürünlerden biri olan çilekte, organik ve geleneksel yetiştiricilik sistemlerinde karşılaştırmalı olarak fenolojik ve pomolojik incelemeler yapılmıştır.

MATERYAL VE METOT

Araştırma, 2004-2005 yıllarında Karadeniz Tarımsal Araştırma Enstitüsü'ne ait Çınarlık deneme alanında yürütülmüştür. Organik parseller organik tarım yönetmeliğine uygun olarak belirlenen alanda, geleneksel parseller ise normal tarım yapılan bir alanda planlanmıştır **(Anonim 2001).** Denemede organik ve geleneksel parseller ayrı ayrı oluşturulmuş ve parseller arasında organik yetiştiricilik için gerekli izolasyon mesafesi (10 m) bırakılmıştır.

Araştırmada bitkilerin dikimi yapılmadan önce, her iki deneme alanına 4 ton/da hesabıyla ahır gübresi verilmiştir.

Organik parsellerde ahır gübresi uygulandıktan sonra 2002 yılı Kasım ayında yeşil gübreleme amacıyla fiğ ekimi yapılmış ve çiçeklenme döneminde sürülerek toprağa karıştırılmıştır **(Okur, 1999; Çakmak ve Ertem, 1999)**. Fidelerin dikileceği seddeler hazırlanırken 15 kg /da hesabıyla, geleneksel parsellerde TSP ile, organik parsellerde ise odun külü ile fosfor gübrelemesi yapılmıştır. Geleneksel parsellerde azot (15 kg/da) ve potasyum (20 kg/da), bitkiler dikildikten sonra damla sulama sistemiyle, organik parsellerde ise dikimden önce yeşil gübreleme yapılarak ve kül verilerek uygulanmıştır. Gübrelemeler sırasında, ahır gübresi, kül ve toprak tahlil sonuçları dikkate alınmıştır **(Çizelge 1.,2.).** Toprak tahlil sonuçları dikkate alınarak, araştırma yeri dikime hazırlanırken ahır gübresi ve fosforlu gübre ile, bitkiler dikildikten sonra da damla sulama sistemiyle azot ve potasyum gübrelemesi yapılmıştır.

Çizelge 1. Ahır Gübresi ve Kül Analiz Sonuçları

Örnek	Örnek İçerikleri				
	% Nem	% N	% P	% K	1/5 extract EC dS/m
Ahır Gübresi	39.09	0.84	0.17	0.30	2.94
Kül	-	0.03	1.65	7.72	-

Çizelge 2. Denemeden önce ve sonra toprağın fiziksel ve kimyasal analizleri

Denemeden önce	Toprak tekstürü	Toplam Tuz %	pH	$CaCO_3$ %	P_2O_5 kg/da	K_2O kg/da	Organik Madde
Organik	Killi	0.11	7.65	6.55	6.20	100	4.07
Geleneksel	Killi	0.07	7.85	5.85	5.30	108	3.58
Denemeden sonra							
Organik	Killi	0.05	7.80	6.44	11.7	82	3.73
Geleneksel	Killi	0.07	7.80	6.52	8.8	61	4.17

Fidelerin dikimi, 20 cm yüksekliğinde, 35 cm ark genişliği olan ve 65 cm eninde **(Konarlı, 1986)** hazırlanan yastıklara, her parselde 20 bitki olacak şekilde 30x32 cm mesafede çift sıralı olarak 18 Temmuz 2003'de yapılmıştır (**Karaduva ve Kurnaz, 1992**). Dikimi takip eden sonbaharda siyah plastik malç ile malçlama yapılmıştır.

Araştırmada Kabarla, Strawberry Festival (S. Festival), Camarosa, Redlans Hope, Sweet Charlie çilek çeşitleri kullanılmıştır. Deneme, tesadüf blokları deneme desenine göre 4 tekerrürlü olarak kurulmuştur.

Çeşitlerin ilk çiçeklenme, ilk ve son hasat tarihleri kaydedilmiştir. Meyve ağırlığı, suda çözünebilir kuru madde miktarı (SÇKM) ve titre edilebilir asitlik değerleri her parselden alınan meyveler ile belirlenmiştir. Denemede hastalık ve zararlılarla ilgili gözlemler de yapılmıştır. İstatistiki analizlerde SAS ve JMP programları kullanılmıştır.

BULGULAR VE TARTIŞMA

1. Fenolojik Gözlemler

Çizelge 3.'de organik, **Çizelge 4.**'de geleneksel sistemde denemeye alınan çeşitlere ait yıllara göre fenolojik gözlemler verilmiştir. İlk çiçeklenme tarihleri 2004 yılında organik parsellerde 30 Mart 5 Nisan tarihleri arasında gerçekleşirken, geleneksel parsellerde 2-5 güne varan erkencilikle 27-30 Mart tarihleri arasında olmuştur. 2005 yılında ilk çiçeklenme tarihleri organik parsellerde 06-10 Nisan, geleneksel parsellerde 05-07 Nisan tarihleri arasında, 2006 yılında ise organik parsellerde 04-07 Nisan, geleneksel parsellerde 01-03 Nisan tarihleri arasında olmuştur. İlk hasat tarihleri 2004 yılında organik parsellerde 12-17 Mayıs, geleneksel parsellerde ise 05-10 Mayıs, 2005 yılında organik parsellerde 14-21 Mayıs, geleneksel parsellerde 12-18 Mayıs, 2006 yılında organik parsellerde 13-22 Mayıs, geleneksel parsellerde 08-18 Mayıs olarak belirlenmiştir. Son hasat tarihleri 2004 yılında organik parsellerde çeşitlere göre 25 Haziran-09 Temmuz, geleneksel parsellerde 29 Haziran- 15 Temmuz tarihleri arasında, 2005 yılında organik parsellerde 20-30 Haziran, geleneksel parsellerde 30 Haziran tarihleri arasında gerçekleşmiştir.

İlk çiçeklenme ve ilk hasat tarihleri genellikle çeşitlere de bağlı olarak geleneksel sistemde daha erken olmuştur. Bu organik sistemdeki saman maçla karşılık geleneksel sistemde kullanılan plastik maçlın erkenciliğe etkisinden kaynaklanmış olabilir **(Singh ve ark, 2005; 2007**). **Çizelge 3.** ve **4.**'de ilk ve son hasat tarihlerine bakıldığında her iki sistemde de yıllara göre bitkilerin yaşlanma sebebi ile hasat sürelerinin kısaldığı görülmektedir. Hasat süresi, özellikle 2004 yılında sistemler arasında da farklı olmuştur.

Çizelge 3. Organik Sistemde Çeşitlerin İlk Çiçeklenme, İlk ve Son Hasat Tarihleri

Çeşitler	İlk Çiçeklenme		İlk Hasat		Son Hasat	
	2004	2005	2004	2005	2004	2005
Kabarla	05.4	08.4	15.5	20.5	02.7	30.6
S. Festival	30.3	10.4	10.5	18.5	02.7	30.6
Sweet Charlie	01.4	06.4	08.5	14.5	02.7	30.6
Camarosa	01.4	06.4	12.5	16.5	25.6	30.6
Redlans Hope	02.4	08.4	17.5	21.5	09.7	20.6

Çizelge 4. Geleneksel Sistemde Çeşitlerin İlk Çiçeklenme, İlk ve Son Hasat Tarihleri

Çeşitler	İlk Çiçeklenme		İlk Hasat		Son Hasat	
	2004	2005	2004	2005	2004	2005
Kabarla	30.3	06.4	10.5	16.5	15.7	30.6
S.Festival	28.3	07.4	08.5	14.5	02.7	30.6
Sweet Charlie	27.3	06.4	05.5	12.5	29.6	30.6
Camarosa	27.3	05.4	08.5	14.5	02.7	30.6
Redlans Hope	28.3	06.4	10.5	18.5	15.7	30.6

2. Pomolojik Değerlendirmeler

Sistemlere ve çeşitlere göre meyve ağırlıkları, SÇKM, titre edilebilir asitlik oranları **Çizelge 5., 6. ve 7.'**de verilmiştir. İstatistiki analizler her yıl için ayrı ayrı yapılmıştır. 2004 ve 2005 yılı toplam verimleri ile SÇKM, asitlik ve meyve ağırlıkları ortalamaları istatistiki olarak değerlendirilmiştir.

Meyve ağırlıkları her iki sistemde 2004 ve 2005 yılları ortalamaları alınarak istatistiki olarak t testi ile karşılaştırılmış ve farkın önemli olmadığı belirlenmiştir **(Çizelge 5.).**

Çizelge 5. Yıllara Göre Ortalama Meyve Ağırlıkları (g)

Çeşitler	2004		2005		Ortalama		Fark (%)
	Org.**	Gel.**	Org.*	Gel.**	Org.**	Gel.**	
Kabarla	12.43b	11.68ab	7.45b	6.85ab	8.24b	9.27ab	-12 ÖD
S. Festival	9.79c	10.25bc	7.70b	6.42ab	7.62c	8.33bc	-9 ÖD
Sweet Charlie	8.75c	9.06c	9.75a	5.80b	7.14c	7.43c	-4 ÖD
Camarosa	11.8b	12.39a	8.15b	7.50a	9.46b	9.95a	-5 ÖD
Redlans Hope	14.22a	12.70a	8.70ab	7.47a	10.45a	10.09a	+3 ÖD
C.V (%)	8.71	10.79	10.25	13.60	6.98	7.84	

Aynı harf ile gösterilen ortalamalar arasındaki fark önemsizdir (*P< 0.05; **P< 0.01)

- Organik sistemde geleneksele göre düşük değerleri, + ise yüksek değerleri ifade etmektedir.

SÇKM bakımından yıllara göre ve ortalama değerlere göre istatistiki analizler yapılmıştır. Ortalama değerlere bakıldığında organik sistemde Sweet Charlie çeşidi, geleneksel sistemde Sweet Charlie, Strawberry Festival ve Camarosa çeşitleri ilk grupta yer almıştır. Sistemlerdeki çeşitlerin ortalama değerleri t testi ile mukayese edilmiş ve fark önemli çıkmamıştır (**Çizelge 6**).

Çizelge 6. Yıllara Göre ve Ortalama SÇKM Oranları (%)

Çeşitler	2004		2005		ortalama		Fark (%)
	Org.**	Gel.**	Org.**	Gel.**	Org.**	Gel.**	
Kabarla	5.77c	6.12b	5.25b	7.30b	6.61c	6.71c	-2 ÖD
S. Festival	7.5a	7.85a	5.45b	8.8ab	7.6b	7.92ab	-4 ÖD
Sweet Charlie	7.35a	7.90a	5.52b	8.75a	8.55a	8.32a	+1 ÖD
Camarosa	6.85ab	7.47a	7.12a	7.65ab	7.5b	7.56abc	-1 ÖD
Redlans Hope	6.40bc	7.35a	6.67a	7.05b	7.55b	7.20bc	+1 ÖD
C.V (%)	8.02	7.92	10.36	10.13	5.45	7.0	

Aynı harf ile gösterilen ortalamalar arasındaki fark önemsizdir (*P< 0.05; **P< 0.01)

- Organik sistemde geleneksele göre düşük değerleri, + ise yüksek değerleri ifade etmektedir.

Meyvelerin titre edilebilir asitlik değerleri istatistiki olarak incelenmiştir. Ortalama değerlere göre organik sistemde Strawberry Festival, Redlans Hope, Kabarla çeşitleri ilk grupta yer almıştır. Geleneksel sistemde çeşitler arasındaki fark önemli çıkmamıştır. Sistemlerdeki çeşitler t testi ile karşılaştırılmışlar farklı sistemlerdeki Sweet Charlie, Camarosa ve Redlans Hope çeşitleri arasındaki fark önemli çıkmıştır (**Çizelge 7.)**

Çizelge 7. Yıllara Göre ve Ortalama Asitlik Oranları (gr/100ml)

Çeşitler	2004		2005		ortalama		Fark (%)
	Org.*	Gel.	Org.**	Gel.**	Org.**	Gel.	
Kabarla	0.29ab	0.34	0.28bc	0.28b	0.28ab	0.31	-10 ÖD
S. Festival	0.30a	0.34	0.30a	0.33ab	0.30a	0.34	-12 ÖD
Sweet Charlie	0.26b	0.34	0.25c	0.38a	0.26c	0.36	-28 **
Camarosa	0.27ab	0.36	0.28ab	0.37a	0.28bc	0.37	-24 **
Redlans Hope	0.29ab	0.41	0.27bc	0.38a	0.29ab	0.40	-27 **
C.V (%)	7.63		5.13	11.42	4.55		

Aynı harf ile gösterilen ortalamalar arasındaki fark önemsizdir (*P< 0.05; **P< 0.01)

- Organik sistemde geleneksele göre düşük değerleri, + ise yüksek değerleri ifade etmektedir.

3. Verim Değerleri

Elde edilen bitki başına verim bulgularının, her iki sistem için ayrı ayrı ve karşılaştırmalı olarak yıllara, aylara ve iki yıllık toplam verim değerlerine göre istatistiki analizleri yapılmıştır (**Çizelge 8., 9.**).

Analiz sonuçlarına göre 2004 yılında her iki sistemde de Kabarla çeşidi istatistiki olarak ilk sırada yer almış, t testi ile bu çeşidin sistemler arasındaki farkı önemli ve %21 oranında bulunmuştur. 2005 yılında organik sistemde Camarosa ve Sweet Charlie çeşitleri ilk grupta yer alırken geleneksel sistemde çeşitler arasındaki fark istatistiki olarak önemli olmamıştır (**Çizelge 8.**).

Çizelge 8. Bitki Başına Yıllara Göre Verim Değerleri (g)

Çeşitler	2004		Fark (%)	2005		Fark (%)
	Org.**	Gel.**		Org.**	Gel.	
Kabarla	403.99 a	501.41 a	21 **	157.57 b	251.54	37 ÖD
S. Festival	253.62 b	260.99 c	3 ÖD	147.19 b	295.38	50 **
Sweet Charlie	159.82 c	260.63 c	39 **	268.83 a	341.94	22 ÖD
Camarosa	299.31 b	373.95 b	20 *	270.35 a	344.96	22 ÖD
Redlans Hope	136.32 c	186.62 d	17ÖD	135.67 b	202.74	33 ÖD
C.V (%)	16.14	11.21		24.96		

Aynı harf ile gösterilen ortalamalar arasındaki fark önemsizdir (*P< 0.05; **P< 0.01)

Bitki başına 2004 ve 2005 yılı toplam verimleri hesaplanmıştır. Her sistemde çeşitler istatistiki olarak değerlendirilmiştir. Buna göre iki yıllık toplam verimde her iki sistemde de Camarosa ve Kabarla çeşitleri ilk grupta yer almıştır. **Furaro ve ark. (2000)** İtalya'da, **Pahla ve ark. (2002)** Portekiz'de ve **İslam ve ark. (2003)** Ordu'da yaptıkları çalışmalarda Camarosa çeşidinin yüksek verimli çeşit olduğunu bildirmişlerdir. Yürütülen bu araştırmada da benzer bulgular elde edilmiştir.

Her iki sistemdeki çeşitler t testi ile karşılaştırılmışlardır. Sistemler arasındaki fark, tüm çeşitlerde de istatistiki olarak önemli bulunmuş ve %21 (Camarosa) ile %29 (Sweet Charlie) arasında değişmiştir (**Çizelge 9**). Bu bulgular **Gliessman ve ark. (1996)**'in çilekte organik ve geleneksel sistemler arasında ilk yıl %39, ikinci yıl %30, üçüncü yıl %28 olarak elde ettiği sonuçlar ile benzer hatta daha iyi olduğunu göstermiştir.

Çizelge 9. 2004 ve 2005 Yılı Bitki Başına Toplam Verimler ve Sistemler Arasındaki Farklar

Çeşitler	Organik**	Geleneksel**	Fark (%)
Kabarla	561.56 a	752.95 a	25**
S. Festival	400.82 b	556.37 c	28**
Sweet Charlie	428.64 b	602.58 bc	29**
Camarosa	569.65 a	718.91 ab	21*
Redlans Hope	271.99 c	389.36 d	28*
C.V (%)	14.60	14.67	

Aynı harf ile gösterilen ortalamalar arasındaki fark önemsizdir (*P< 0.05; **P< 0.01)

4. Hastalık Ve Zararlılar

Deneme süresi boyunca çileğin en önemli zararlılarından birisi olan kırmızı örümcekler (*Tetranychus* spp.) ve en önemli hastalığı olan kurşuni küf hastalığı (*Botrytis cinerea* pers) ile ilgili gözlemler alınmıştır. Yabancı otlarla mekanik olarak mücadele yapılmıştır. Hastalık ve zararlılarla mücadelede her iki sitemde de herhangi bir kimyasal preparat kullanılmamıştır.

Deneme süresince yapılan gözlemler sonucunda organik ve geleneksel çilek parsellerinde kırmızı örümcek populasyonu ekonomik zarar eşiğinin (15 adet/ yaprak) altında kalmıştır. Bu nedenle herhangi bir uygulama yapılmamıştır. Deneme alanlarından alınan örneklerde yapılan incelemelerde bazı predatörlere rastlanılmıştır. Kırmızı örümcek populasyonunun düşük kalmasının nedeninin predatörlerin faaliyetlerinden dolayı olabileceği düşünülmektedir. Bu konuda daha detaylı çalışmaların yapılarak konunun aydınlatılması gerekmektedir.

Denemenin ilk yılında 9 gün boyunca süren aralıklı yağmur nedeni ile organik ve geleneksel parsellerde yoğun olarak kurşuni küf hastalığı ortaya çıkmıştır. Hastalığa karşı 2004 yılında geleneksel ve organik yetiştiricilikte kullanılabilecek ruhsatlı bir preperat bulunmadığından dolayı her iki sistemde de ilaçlama yapılmamıştır. Sadece kültürel önlem olarak hastalıklı bitki artıklarının temizliği gerçekleştirilmiş ve sonrasında hastalığın azaldığı görülmüştür. Denemenin 2. yılında kurşuni küf hastalığına çok az rastlanılmıştır.

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GÖLBAŞI ÖZEL ÇEVRE KORUMA BÖLGESİ'NDE TARIMSAL SÜRDÜRÜLEBİLİRLİK İÇİN ALAN KULLANIM ALTERNATİFLERİNİN AHP (ANALİTİK HİYERARŞİ PROSES) TEKNİĞİ İLE BELİRLENMESİ ve DEĞERLENDİRİLMESİ

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ÖZET

Sulak alanlar binlerce yılda oluşmuş yeryüzünün en hassas aynı zamanda da en karmaşık ilişkilerine sahip ekosistemleridir. Sulak alanlar su geçişini yavaşlatarak sularla taşınan besin ve sedimanların birikmesini sağlar. Bu nedenle deltalar ve taşkın alanları en verimli tarım arazileridir. Biyolojik çeşitlilik açısından oldukça zengin bir yapıya sahip olan sulak alanlar, verimli toprak yapıları ve su varlığı nedeniyle çevrelerinde tarımsal faaliyetlerin yaygın bir şekilde görüldüğü alanlardır.

Sulak alanlar gibi hassas ekosistemlerde, mevcut durumu korumak ve sürdürülebilirliği sağlamak ekosistem ilişkilerini ve insan kullanımlarını düzenlemek gerekmektedir. Doğanın insanoğluna sunmuş olduğu kaynakların tahrip olmaması ve sonraki nesillere aktarılabilmesi için, bu alanlarda gerçekleştirilecek faaliyetlere yönelik plan kararlarının bilimsel, akılcı ve uygulanabilir olması gerekir. Bu bağlamda; hassas ekosistemlerde sürdürülebilir bir planlamanın sağlanması, alanın sahip olduğu tüm doğal, kültürel ve ekonomik değerlerin analiz, değerlendirme ve sentez sürecine bağlıdır.

Ölçülebilir ve sayılabilir değerlerin yanı sıra ölçülemeyen, sayılamayan değer ve kaynaklara da sahip ekosistemlerde planlama sürecinde; kantitatif tekniklerin kullanımı daha akılcı sonuçlar ve değerlendirmeler için gereklidir. Bu nedenle kantitatif değerlendirme tekniklerinden biri olan AHP tekniği hassas ekosistemleri de barındıran mekanlarda sürdürülebilir alan kullanım planlaması ve alternatif değerlendirmede önemli bir araçtır.

Bu çalışmada, Gölbaşı Özel Çevre Koruma Bölgesi'nin (ÖÇKB) ekolojik, kültürel ve sosyal değerleri araştırılmış, alanda var olan nitelikli tarım arazilerinin mevcut durumları değerlendirilmiş, alanın sahip olduğu değerlerden yola çıkarak sürdürülebilir tarım için alan kulanım alternatifleri belirlenmiş ve AHP (Analitik Hiyerarşi- Analitik Sıralanım Süreci) ile analiz edilerek alanın tarımsal faaliyetlere uygunluğu değerlendirilerek alan için en uygun kullanım alternatifi seçilmeye çalışılmış, alana yönelik öneriler getirilmiştir.

Anahtar Kelimeler: Fuzzy Set Tekniği, Sürdürülebilir Tarım, Alan Kullanım Planlaması, Gölbaşı ÖÇKB.

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GİRİŞ

Yenilenebilir ve yenilenemeyen kaynakların rasyonel kullanımı ve ekonomi ve ekoloji arasındaki dengenin kurulması; yaşam kalitesinin artırılması ve küresel düzeyde sürdürülebilir bir geleceğin elde edilmesi için esastır. Tarım alanlarının korunmasını hedefleyen alan kullanım planlaması ve yönetimi sürdürülebilir kalkınmanın sağlanmasında etkili araçlardır. Bir alan için alan kullanım tiplerinin uygunluğunun belirlenmesi ve öncelikli kullanım tipinin seçilmesi ise alan kullanım planlamasının önemli bir aşamasıdır [2].

Kırsal alanların en önemli bileşenlerinden olan tarım alanları ve meraların ise farklı alan kullanım tiplerinin baskısı altında olması ve çoğu zamanda bu baskılara yenik düşmesi; tarımsal alanların önemli bileşenleri olan yenilenemeyen doğal kaynakların tahribine ve yok olmasına da neden olmaktadır. Bu zararlanma; tarımsal ve çevresel sürdürülebilirliğin önündeki en önemli engeldir. Uygulanabilirliği ve yaptırım gücü yüksek yasal –yönetsel çerçeve ile desteklenen akılcı planlamalar ile tarımsal sürdürülebilirlik sağlandığı gibi kırsal kalkınma kapsamında da önemli adımlar atılmış olur.

Tarım alanlarının, mera alanlarının yasal düzenlemelerle koruma altına alınması, bu kaynakların daha rasyonel değerlendirilmesini ve gelecek için bu kaynakların sürdürülmelerini sağlayacaktır. Yeterli tarımsal ve çevresel politikalarla; ve kırsal planlama çalışmaları ile;

- Doğal kaynakların ve ekosistemin korunması,
- Tarımsal alanların korunması ve geliştirilmesi,
- Tarımsal üretimin ve bu ürünlerin pazarlanma olanaklarının artırılması,
- Hem tarımsal alanlarda hem de bağlantılı diğer alanlarda yeni iş imkanları,
- Tarımsal alanlarda elde edilen ekonomik gelirin yöre ve ülke ekonomisine katkısının artması sağlanabilir [1].

Yukarıda sözü edilen yaklaşım ve öngörülerin örneklenmesi amacıyla; farklı alan kullanım tiplerinin bir arada, etkileşim ve çatışma içinde olduğu; ekolojik, tarımsal ve rekreasyonel özellikleri ile ön plana çıkan, Gölbaşı Özel Çevre Koruma Bölgesini de içine alan Gölbaşı İlçesi çalışma alanı olarak seçilmiştir.

Gölbaşı, Ankara İli sınırları içinde yaklaşık 20 km. güneyde Konya karayolu üzerinde yer alan ve nüfusu 40.803 olan bir ilçe merkezidir. Mogan Gölü ve Eymir Gölü ile bunları besleyen akarsu kaynaklarını da içine alan havza 22.10.1990 tarih ve 90/1117 sayılı Bakanlar Kurulu Kararı ile Özel Çevre Koruma Bölgesi (ÖÇKB)olarak ilan edilmiştir [4] .

Mogan ve Eymir Gölleri Ankara yakınlarında bulunan sınırlı sayıda sulak alanlardan en büyük ve en önemli olanlarıdır. Mogan Gölü'nü besleyen derelerin, göle ulaştığı düşük eğimli alanlar; gölün güneyindeki yaklaşık 750 hektarlık bataklık ve ıslak çayırlık alanlarla, Mogan-Eymir bağlantısını sağlayan alanda, hidrojeolojik, hidrolojik, klimatik ve biyolojik açıdan çok büyük önem arz eden "sulak-bataklık alan"lar gelişmiştir. Bu alanlar; göller için yeraltı suyu depolama ve kurak mevsimlerde göle su sağlama, fırtınadan korunma ve sel etkisini yumuşatma, sediment kontrolü, suyun fiziksel kimyasal kirleticilerinin tutulması, yerel iklim şartlarının düzenlenmesi gibi işlevlere sahiptir. Ayrıca bölgedeki "sulak-bataklık alanlar", sayısız bitki ve hayvan türünün yaşayabilmesi için, bağımlı olduğu suyu ve birincil üretimi sağlayan, canlı tür ve çeşitliliğinin beşiğidir. Bu nedenle, birçok canlı türünün yaşamını devam ettirebilmesi için stratejik öneme sahiptirler [7].

Göller bölgesini içine alan havza verimli I. ve II. sınıf tarım arazilerine sahiptir. Genelde nadaslı kuru tarım yapılan bölgede, vadi tabanlarında yer yer sebze üretimine ve sık olmamak üzere meyve bahçelerine rastlanmaktadır. İlçenin 145500 ha olan toplam yüzölçümünün % 42.96'lık kısmı (64500 ha) tarım alanıdır. Bu alanlarının % 54.3 'ünde hububat, % 2.7'sinde yem bitkisi, yemeklik baklagil, çeşitli meyve ve sebzeler, endüstri bitkileri ve yağlık tohumlar yetiştirilmektedir. Tarım alanlarının % 40'ı nadasa bırakılmakta, % 3.1'i ise tarıma elverişli olduğu halde kullanılmamaktadır [5]. Ancak, ikinci konut ağırlıklı yerleşim alanlarının, rekreasyonel ve turistik tesislerin ve diğer arazi kullanımlarının gelişmesi sonucu, bu alanlar yavaş yavaş yok olmaktadır. Tarım alanlarının hızla farklı kullanımlara dönüşmesine karşın besi hayvancılığı önemini korumaktadır. Bununla birlikte; yöredeki otlak sayısındaki azalış hayvan sayısını da olumsuz etkilemiştir.

Öte yandan; Ankara Metropolitan Kentinin periferisinde yer alan bölge; sahip olduğu doğal ve ekolojik özelliklerinin yanı sıra suya dayalı rekreasyonel açıdan da önemli bir kaynağa sahip olduğundan; rekreatif faaliyetler ve ikinci konut alanlarının da baskısı altındadır.

Tarım alanları ve meraların giderek azaldığı, ikinci konut alanlarının arttığı ve buna bağlı olarak sahip olduğu özgün tarımsal peyzaj karakterinin hızla kaybolduğu bu alanda; kırsal kalkınma kapsamında öncelikle tarımsal ve çevresel sürdürülebilirliğin sağlanması için tarım öncelikli alan kullanım tiplerinin gündeme gelmesi ve değerlendirilmesi zorunludur.

MATERYAL ve YÖNTEM

Tarımsal alan kullanım tiplerinin öncelikli alan kullanım tipi olarak seçiminde birçok faktör göz önünde bulundurulmaktadır. Bu faktörlerden bazıları nitel, bazıları ise nicel faktörlerdir. Çok kriterli kantitatif karar verme teknikleri nicel ve nitel verilerin birarada değerlendirilmesine imkan sağlayan değerlendirme yöntemleridir [2].

Çok kriterli karmaşık problemlerin analizi için bir sıralanım (hiyerarşi) oluşturulmasına dayanan Analitik Hiyerarşi Proses (AHP) , ilk olarak 1970'li yıllarda Thomas L. Saaty tarafından ortaya konulmuştur [8]. Geliştirildiğinden bu yana ekonomi, planlama, enerji politikaları, kaynak tahsisleri, sağlık, anlaşmazlık çözümü, proje seçimi, pazarlama, bilgisayar teknolojisi, bütçe tahsisi, muhasebe, eğitim, sosyoloji, mimarlık ve daha birçok alanlardaki çeşitli karar problemlerine uygulanmıştır [9]. Bunun yanında karmaşık çevresel karar analizlerinde kullanımı da farklı şekillerde örneklenmiş bulunmaktadır [6].

AHP tekniği, alan kullanım planlamasında, bir alana ilişkin belirlenen niteliklerin ikili olarak karşılaştırılmasından elde edilen öncelik değerlerine dayalı bir ölçüm teorisidir. Bu teknik en uygun alan kullanım alternatifinin seçilmesinde, hem kantitatif (objektif, nicel) ve hem de kalitatif (sübjektif, nitel) faktörlerin dikkate alınmasına imkan vermektedir. Karmaşık karar problemlerinin analizinde gösterdiği basitlik, esneklik, kullanım kolaylığı ve rahat yorumlanması gibi özellikleri ile çok çeşitli karar problemlerinde bu tekniğin geniş bir kullanım alanına sahip olduğu görülmektedir. AHP bu haliyle mevcut en popüler çok kriterli karar verme metodolojilerinden birisi olarak dikkati çekmektedir [9].

AHP'nin; ayrıştırma, karşılaştırmalı değerlendirme ve önceliklerin sentezi olmak üzere üç ilkesi vardır. Tekniğin esası; bir elemanın içinde bulunduğu set ya da gruba dahil olma ya da üyelik derecesinin belirlenmesine dayanır. İkili karşılaştırmaya esas oluşturacak şekilde değerlendirme faktörlerinin birbirleriyle karşılaştırılması, değerlendirme faktörlerine göre ise alternatiflerin birbirleriyle karşılaştırılması amacıyla; puanlama yoluyla matrislerin oluşturulması ve her matrisin öz vektörlerinin hesaplanması, matrisi oluşturan elemanların üyelik derecelerinin belirlenmesi ve fuzzy set tekniği kapsamında sentezlenmesi AHP tekniğinin temel aşamalarıdır [3].

Bir set içindeki elemanın üyelik derecesinin ölçülmesi için Saaty tarafından önerilen yöntem; bir ıskala kullanımı vasıtasıyla setin her elemanının birbirleriyle karşılaştırılmasına dayalı bir karşılıklı (resiprocal) matrisin oluşturulmasıyla başlar. Iskaladaki değerler 1 ile 9 arasında değişmektedir. İki elemanın karşılaştırılması sırasında birinin diğeri üzerine etkisi ya da önemi ile ilgili olarak değerlendirme yapacak analistlere ya da uzman grubuna gereksinim. Matrisin tamamlanmasını takiben her matrisin maksimum özdeğeri hesaplanır ve bundan yararlanarak uyumluluk indeksi (Consistency Index - CI) ve uyumluluk oranı (Consistency Ratio – CR) hesaplanır. Uyumluluk oranının maksimum %20 olması beklenir. Bu örneklemde uyumluluk oranı % 15 olarak alınmıştır.

Örneklem kapsamında; alanın doğal-ekolojik, kültürel ve sosyoekonomik özellikleri, yerel halkın ve Ankara metropolitan kent halkının istek ve beklentileri de dikkate alınarak, alanın mevcut tarımsal durumunun iyileştirilmesi, var olan kaynakların korunması ve sürdürülebilirliğinin sağlanması hedeflenerek 3 alan kullanım alternatifi geliştirilmiştir. Bunlar; **Alternatif A** (*Mera Öncelikli Alan Kullanımı*), **Alternatif B** (*Tarla Tarımı Öncelikli Alan Kullanımı*) ve **Alternatif C** (*Tarımsal Rekreasyon Öncelikli Alan Kullanımı*) dir.

Önceliklerin belirlenmesi amacıyla oluşturulan sette; değerlendirme faktörleri 3 grupta toplanmış ve bu faktörlerin o gruba dahil kriterlerin bir set dahilinde göreceli önemleri ve bunların etkileri değerlendirilmiştir (Şekil1.).

Alanın kullanım alternatiflerini etkileyen faktörler ve alt kriterleri aşağıda belirtilmiştir.

- **Doğal Faktörler**

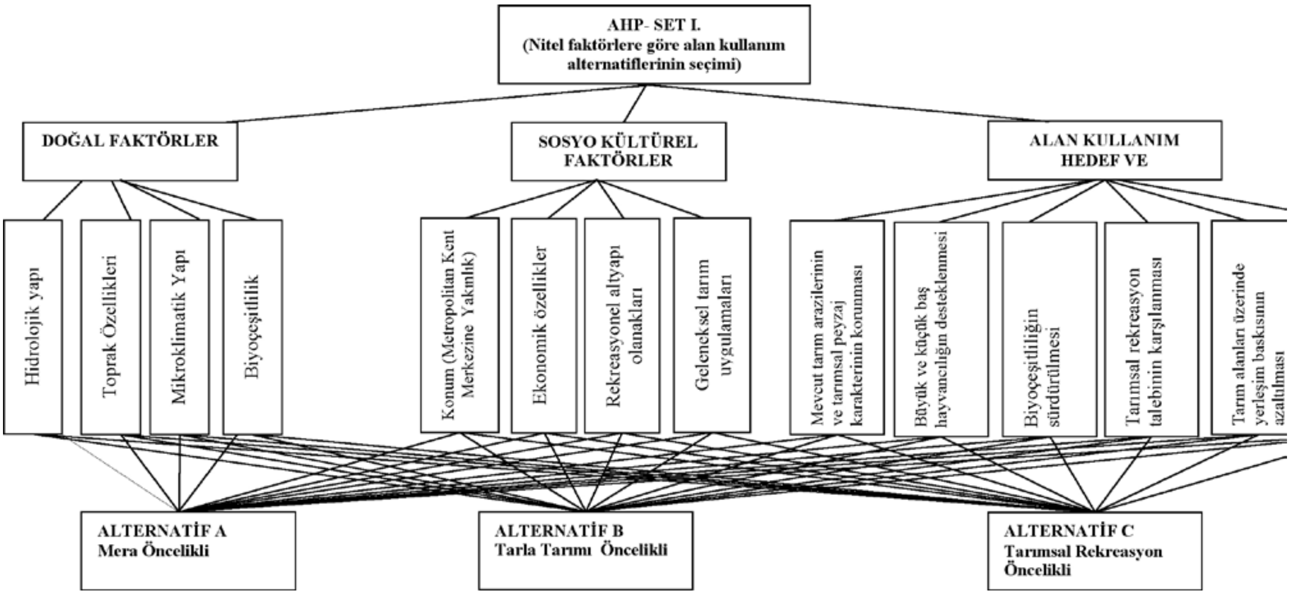
1. Hidrolojik yapı (Su varlığı)
2. Toprak özellikleri
3. Mikroklimatik yapı
4. Biyoçeşitlilik

- **Sosyo-Kültürel Faktörler**

1. Konum (Metropolitan Kent Merkezine Yakınlık)
2. Ekonomik özellikler
3. Rekreasyonel altyapı olanakları
4. Geleneksel tarım uygulamaları

- **Alan Kullanım Hedef Ve Politikalarına İlişkin Faktörler**

1. Mevcut tarım arazilerinin ve tarımsal peyzaj karakterinin korunması
2. Büyük ve küçük baş hayvancılığın desteklenmesi
3. Biyoçeşitliliğin sürdürülmesi
4. Tarımsal rekreasyon talebinin karşılanması
5. Tarım alanları üzerinde yerleşim baskısının azaltılması
6. Afet yönetimi (tarımı olumsuz etkileyebilecek afetler; taşkın, erozyon gibi)



Şekil 1. Alan kullanım alternatiflerinin seçimi için oluşturulmuş set

GENEL DEĞERLENDİRME

Değerlendirme faktörleri ve alternatifler için karşılıklı ikili değerlendirme ilkesi kapsamında matrislerin hazırlanmasında ve puanlamalarda örneklem alan hakkında detaylı bilgi sahibi olan ve planlama konusunda uzman öğretim elemanlarından oluşuna bir ekipten yararlanmış ve puanlamalarda uzlaşma sağlanmıştır. Elde edilen değerler ve değerlendirmeler özetle aşağıda verilmiştir.

Alan kullanımını etkileyen tüm faktörlerin birbirleriyle karşılaştırılmasında; en büyük değere sahip olan "doğal faktörler" 0.5812'lik bir üyelik derecesi ile en etkili faktör olmuştur.

Doğal faktörlerin birbirleriyle karşılaştırılmasında; biyoçeşitlilik, 0.4831'lik derece ile en etkili kriter olarak değerlendirilmiştir. Tüm doğal faktörlerin bir arada değerlendirilmesiyle **Alternatif C- Tarımsal Rekreasyon Öncelikli Alan Kullanımı** (0.3739 üyelik derecesi) ön plana çıkmıştır

Sosyo kültürel faktörlerde ise; Rekreasyonel alt yapı olanakları (0.4926 üyelik derecesi) en etkili kriter olarak belirlenmiştir. Tüm sosyo-kültürel faktörlerin bir arada değerlendirilmesiyle yine **Alternatif C- Tarımsal Rekreasyon Öncelikli Alan Kullanımı** (0.6606) en uygun alternatif olarak belirlenmiştir.

Alan kullanım hedef ve politikalarına ilişkin faktörlerde; biyoçeşitliliğin sürdürülmesi (0.3433) en etkili kriter, tüm hedef ve politikalara ilişkin faktörlerin bir arada değerlendirilmesinde ise 0.3735'lik üyelik derecesi ile **Alternatif B** (*Tarla Tarımı Öncelikli Alan Kullanımı*) ön plana çıkmıştır.

Tüm değerlendirme faktörlerinin bir arada değerlendirildiği etkileşim ve hesaplamalarda ise **Alternatif C- Tarımsal Rekreasyon Öncelikli Alan Kullanımı (0.38449)** en uygun alternatif olarak ortaya çıkmıştır.

Tüm Nitel Faktörler		Doğal Faktörler		Sosyo-Kültürel Faktörler		Alan Kullanım Hedef ve Politikaları		Alternatifler
0.1090		0.3639		0.1089		0.3137		0.24494 (ALTERNATİF A)
0.3098	X	0.2652	X	0.2305	X	0.3735	=	0.21556 (ALTERNATİF B)
0.5812		0.3709		0.6606		0.3129		0.38449 (ALTERNATİF C)

Çizelge 1. Tüm nitel faktörlerin üyelik dereceleri ve alternatiflere göre değerleri

SONUÇ ve TARTIŞMA:

Planlama çalışmalarında kantitatif tekniklerin kullanımı, karar vermeyi kolaylaştırırken, alan kullanım kararlarına farklı boyutlardan yaklaşmayı da sağlamaktadır. Bu çalışmada; Çok kriterli karar verme yöntemlerinden AHP'nin kullanımı planlamayı etkileyecek kriterlerin bir hiyerarşi içinde gruplandırırılarak bir set içinde değerlendirilmesine olanak sağlamıştır. Matrislerin değerlendirilmesi sürecinde uyumluluk oranının ≤0.15 alınması değerlendirmeleri tatmin edici düzeyde tutmuştur.

Örneklemde ; seçilen alternatifler ve değerlendirme kriterlerine bağlı olarak Gölbaşı Özel Çevre Koruma Bölgesi ve yakın çevresinde en uygun alternatif **Tarımsal Rekreasyon Öncelikli Alan Kullanımı** olarak belirlenmiştir. Bu kullanım tipinin ön plana çıkmasındaki temel neden; tarım ve rekreasyon gibi birden fazla kullanımı içeren çok fonksiyonlu bir kullanım tipi olması nedeniyle; planlama hedef ve politikalarının önemli bir kısmını karşılamasıdır.

Alternatif C'nin en belirgin farkının ortaya çıktığı değerlendirme grubu; sosyokültürel faktörlerdir. Her üç alternatifin de planlama hedef ve politikalarını karşılama konusunda çok belirgin farkın olmamasına rağmen, sosyokültürel faktörler söz konusu olduğunda tarımsal rekreasyon öncelikli kullanımın ayırt edici bir farkla ön plana çıkması; örneklem alanının metropolitan alan yakın çevresinde yer almasının ve kent halkı rekreasyon alanı gereksiniminin önemli bir göstergesidir. Doğal faktörler söz konusu olduğunda ise; Tarımsal rekreasyon öncelikli kullanım tipinin, mera öncelikli alan kullanım tipi ile çok yakın üyelik derecelerine sahip olması ise; tarımsal ve doğal peyzaj karakterinin mera alanlarında daha belirgin olduğu ve bu bağlamda alanın sahip olduğu doğal ve ekolojik kaynak değerlerinin korunmasında her iki kullanım tipinin de etkili olabileceği şeklinde yorumlanabilir.

Yapılan bu çalışma göstermiştir ki; AHP, alan kullanım tiplerinin önceliklerinin belirlenmesinde uygulanabilirliği söz konusu olan bir değerlendirme tekniğidir. Bu tür yöntemler; planlama çalışmalarında plancının bilgi birikimi, deneyimi ve sezgilerini kantitatif olarak ifade etmesine yardımcı olmaktadır ve koruma – kullanım dengesini gözeten daha akılcı planların ortaya çıkmasına destek vermektedir.

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ORGANİK VE KONVANSİYONEL OLARAK YETİŞTİRİLEN BAZI ELMA ÇEŞİTLERİNİN MİNERAL MADDE İÇERİKLERİNİN BELİRLENMESİ

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ÖZET

Bu çalışma, Isparta/Türkiye' de, organik ve konvansiyonel olarak yetiştirilen M9 bodur elma anacı üzerine aşılı üç elma çeşidinin yaprak ve meyvelerinde mineral madde içeriklerinin (N, P, K, Ca, Mg, Mn, Fe, Cu ve Zn) belirlenmesi amacıyla yürütülmüştür. Yaprak örnekleri Temmuz ayında, meyve örnekleri ise hasat zamanında alınmıştır. Çalışmada, yaprak ve meyve örneklerinde organik yetiştiricilikte konvansiyonel yetiştiriciliğe göre N, Cu, Mn ve Zn içerikleri düşük seviyede belirlenirken, konvansiyonel yetiştiricilikte ise organik yetiştiriciliğe göre K, Ca Mg ve Fe içerikleri düşük olarak saptanmıştır. Yapılan istatistik analizde besin elementi alımı açısından organik ve konvansiyonel yetiştiricilik arasında P için istatistik olarak önemli bir fark elde edilmezken, P dışındaki tüm elementlerde ortalamalar arasındaki farklar istatistik olarak önemli bulunmuştur.

Anahtar Kelimeler: Elma (*Malus communis* L.), besin elementi alımı, organik ve konvansiyonel yetiştiricilik

DETERMINATION OF THE MINERAL NUTRIENT CONTENTS OF ORGANICALLY AND CONVENTIONALLY GROWN SOME APPLE (*M. COMMUNIS*) CULTIVARS

ABSTRACT

This study was carried out in three apple cultivars grafted on the M9 dwarf rootstock grown in organic and conventional production systems in Isparta province of Turkey to determine mineral nutrient contents (N, P, K, Ca, Mg, Mn, Fe, Cu and Zn) of leaves and fruits. Leaf samples were taken in July and fruit samples were taken at harvest. The organic production system resulted in lower concentrations of N, Cu, Mn and Zn contents of leaves than conventional production system, while the conventional production system resulted in lower concentrations of K, Ca, Mg, and Fe than those of organic production system. The results also showed that while there were no significant differences in P contents between organic and conventional production systems, significant differences were found for other elements.

Key words: Apple (Malus communis L.), nutrient up-take, organic and conventional growing

GİRİŞ

Yılın her mevsiminde taze veya işlenmiş olarak her yaştan insan tarafından kolaylıkla tüketilebilmesi nedeniyle elma dünyada en fazla üretilen meyvelerden biridir.. Elma vitamin, antioksidant, mineral madde vb. bakımından oldukça zengin olup, insan beslenmesi ve sağlığı açısından önemli bir yere sahiptir. Nitekim yapılan son araştırmalar, her gün elma tüketilmesinin kanser ve kalp hastalıklarına karşı korunmaya yardım ettiğini göstermektedir (Küçükyumuk 2007, Mordoğan ve Ergün 2001). Son yıllarda konvansiyonel yetiştiricilikte yoğun bir şekilde kimyasal ilaç ve gübre kullanılması; kalıntı riski, toprağın fiziksel yağısının bozulması, organik madde ve canlılığın yitirilmesi ve besin maddesi dengesinin bozulması, tuzlulaşma ve çoraklaşma gibi çevre sorunlarını beraberinde getirmiştir (Aksoy 1999). Özellikle meyvede kalıntı sorunu tüketiciler tarafından sorgulanır hale gelmiştir. Böylelikle çevreye ve insan sağlığına verilen önemin artmasıyla birlikte, güvenli gıda talebinde bulunan tüketiciler organik ürünleri tercih etmeye başlamıştır (Amarante ve ark. 2008). Buna paralel olarak organik elma üretiminde de artışlar olmuştur. Bu bahçelerde optimum verim ve kalitede organik elma üretimi için gerekli kültürel tedbirlerin alınması son derece önemlidir. Bitkisel üretimde verimlilik ve kalite bitkideki besin elementi konsantrasyonuyla yakından ilişkilidir (Erdal 2005). Türkiye toplam elma üretiminin yaklaşık %25'ini karşılayan Isparta'da organik elma bahçeleri kurulmaya başlanmıştır. Bu çalışmada Isparta/Türkiye ekolojisinde organik ve konvansiyonel yetiştiriciliği yapılan M9 bodur anacına aşılı bazı elma çeşitlerinin meyve yapraklarında bazı besin elementi içeriklerinin belirlenmesi amaçlanmıştır.

MATERYAL VE YÖNTEM

Araştırma Isparta/Türkiye'de yürütülmüş olup, bitkisel materyal olarak organik ve konvansiyonel olarak yetiştirilmiş 5 yaşındaki elma ağaçları kullanılmıştır. Topaz, Rubinola ve Rajka elma çeşitlerine ait ağaçlar 3x1m aralıkla dikilmiş olup, M9 anacı üzerine aşılıdır. Deneme 3 tekerrürlü olarak tesadüf parselleri deneme desenine göre kurulmuş ve her tekerrürde 10 ağaç yer almıştır. Araştırmada toprak örnekleri 0-30 cm derinlikten alınmış olup, tekstür ile N, P, K, Ca, Mg, Mn, Fe, Cu, Zn analizleri yapılmıştır (Grewelling ve Peech 1960; Boyoucos 1951; Jackson 1962; Hızalan va Ünal 1966, Bremner 1965, Pratt 1965; Olsen ve ark. 1954, Lindsay ve Norvell 1978).

Çizelge1. Konvansiyonel elma bahçesinde topraktaki besin elementleri

Özellik	Organik	Konvansiyonel
Kum (%)	42,16	24,16
Silt (%)	23,208	29,208
Kil (%)	34,632	46,632
pH	7,88	7,77
Kireç (%)	6,435	8,579
Organik madde (%)	3,282	3,142
N (%)	0,368	0,487
P (ppm)	84	189,6
K (ppm)	261,8	334,7
Ca (ppm)	3418	4312
Mg (ppm)	396,4	789
Na (ppm)	27,31	22,22
Fe (ppm)	2,74	11,1
Cu (ppm)	8,365	9,619
Mn (ppm)	1,835	5,045
Zn (ppm)	4,803	1,125

Araştırmada konvansiyonel ve organik olarak yetiştirilen bahçelerde uygulanan gübreleme programı aşağıda verilmiştir.

Çizelge 2. Organik bahçe gübre uygulamaları;

Gübre adı	Miktar
Çiftlik gübresi	2 ton/ha
"Biofarm" organik gübre (2 uygulama) (Organik madde %65, N:%3.5 P2O:%3 K2O:%3)	2 kg/ağaç
"Maxgrow" organik iz element gübresi (2 uygulama) (B: %0,6 Cu: %1 Fe: %5 Mn: %3.5 Mo: %0.3 Zn: %2,4)	1 kg/ha

Çizelge 3. Konvansiyonel bahçe gübre uygulamaları;

Gübre adı	Miktar
Amonyum nitrat (%33)	15 kg/da
Monoamonyumfosfat-MAP	6 kg/da
Potasyum Nitrat	14 kg/da
İz element gübresi	2 kg/ha

Araştırmada meyve ve yaprak örneklerinde N, P, K, Ca, Mg, Mn, Fe, Cu ve Zn analizleri yapılmıştır. Temmuz ayında alınan (Bergmann 1992) yaprak örnekleri saf su ile yıkandıktan sonra kurutulmuş, öğütüldükten sonra analiz edilmiştir. Hasat zamanında alınan meyve örnekleri yıkandıktan sonra parçalara ayrılarak, kurutulduktan sonra öğütülmüştür. Meyve ve yapraklarda besin elementi analizleri Kacar (1972)'a göre yapılmıştır.

Araştırmada elde edilen veriler, üzerinde durulan özellikler bakımından faktöriyel düzende varyans analizi tekniğiyle analiz edilmiştir. Grup ortalamaları arasındaki farkın belirlenmesinde Tukey testi kullanılmıştır.

BULGULAR VE TARTIŞMA

Meyve ve yaprak örneklerinde N miktarları Çizelge 4'te verilmiştir. Meyvelerdeki N bakımından ortalamalar arasındaki farklar istatistik olarak önemli değildir. Bununla birlikte, meyvelerde N içeriği konvansiyonel yetiştiricilikte (% 0,265) organik yetiştiriciliğe (% 0,239) göre daha yüksek saptanmıştır. Mordoğan ve Ergün (2001), Golden Delicious ve Starking Delicious çeşitlerine ait meyvelerin % 0,14-0,33 N içerdiğini bildirmiştir. Bulgularımız bu değerlerle uyumludur. Yapraktaki N içeriği bakımından çeşitler arasındaki fark istatistik olarak önemli bulunmuştur. Rubinola çeşidi diğer çeşitlerden daha yüksek N (%2,35) değeri göstermiştir. Erdal (2005), Isparta bölgesinde elmada yaptığı çalışmada, yapraktaki N değerlerinin %2.30 ile %2-80 arasında değiştiğini bildirmiştir. Amarante ve ark. (2008), organik ve konvensiyonel olarak yetiştirilen farklı elma çeşitlerinin yapraklardaki N miktarlarını organik yetiştiricilikte %1.91 ile %2.59 arasında; konvensiyonel yetiştiricilikte ise %2.61 ile %2.99 arasında değiştiğini saptamışlardır. Nagy ve Holb (2006), organik elma yetiştiriciliğinde farklı çeşitlerde yaptıkları çalışmada, en düşük N içeriğini Eylül ayında Remo çeşidinde %1.91, en yüksek N içeriğini ise Nisan ayında Egri Piros çeşidinde %3.91 olarak bildirmişlerdir. Çalışmamızda hem konvansiyonel hem de organik yetiştiricilikte elde edilen N değerlerinin literatürde bildirilen N değerler ile uyumlu olduğu görülmektedir. Ancak çalışmada elde edilen % N değerlerinin elma için normal kabul edildiği bildirilen değerlerden (%2.20-2.80) düşük çıktığı görülmektedir (Yılmaz 2004). Bunun nedeni olarak her iki yetiştiricilikte de toprakların N içeriklerinin düşük olması ve N elementinin yapraklardan sürgün ve meyvelere taşınmış olabileceği şeklinde söylenebilir (Karlıdağ ve Güleryüz 2008).

Meyve ve yaprak örneklerinde P miktarları Çizelge 4'te verilmiştir. Meyve ve yaprak örnekleri için P değerleri arasındaki farklar istatistik olarak önemli değildir. Erdal (2005), Isparta bölgesinde elmada yaptığı çalışmada, yapraktaki % P içeriklerinin %0.13-%0.21 arasında değiştiğini bildirmiştir. Nagy ve Holb (2006), organik elma yetiştiriciliğinde farklı çeşitlerde yaptıkları çalışmada, en düşük P içeriğini Eylül ayında Red Elstar çeşidinde %0.15, en yüksek P içeriğini ise Nisan ayında Remo çeşidinde %0.45 olarak bildirmişlerdir. Çalışmamızda her iki yetiştiricilikte elde edilen P değerlerinin önceki çalışmalarda elde edilen P değerlerine yakın çıktığı saptanmıştır. Ayrıca çalışmada elde edilen % P değerlerinin elma için normal kabul edildiği bildirilen değerler (% 0.18-0.30) arasında kaldığı görülmektedir (Yılmaz 2004). Mordoğan ve Ergün (2001), elma yapraklarındaki P miktarını %0,11-0,23 olarak bildirmektedir. Aynı araştırıcılar meyvelerde P miktarını 292-960 ppm olarak bildirmişlerdir. Araştırmamızda elde ettiğimiz değerler bu miktarların biraz üzerindedir. Bu durumun Mg ile P arasındaki sinerjik etkiden kaynaklanmış olabileceği düşünülmektedir.

Meyve ve yaprak örneklerinde K miktarları Çizelge 4'te verilmiştir. Meyve ve yaprak örnekleri için uygulama x çeşit interaksiyonu istatistik olarak önemli çıkmıştır. Organik bahçeden alınan meyve örneklerinde en yüksek K değerini Rajka (% 0,754) çeşidi gösterirken Rubinola (%0,632) çeşidi bunu takip etmiş, Topaz (% 0,590) çeşidi son sırada yer almıştır. Mordoğan ve Ergün (2001), meyvelerde ortalama 5000-10000 ppm K tespit etmiştir. Araştırmamızda elde ettiğimiz değerler bu sınırlar içerisindedir. Ancak Amarante ve ark. (2008), organik yetiştiricilikte meyvelerde % 0,107-0,115 ve konvansiyonel yetiştiricilikte ise % 0,132-0,146 K bulunduğunu bildirmektedir. Bulgularımız bu oranların üzerindedir. Bu duruma deneme arazilerindeki toprağın K miktarının yüksek olmasının yol açtığı düşünülmektedir. Yaprak örneklerine bakıldığında organik bahçeden alınan örneklerde en yüksek değeri Rajka çeşidi göstermiş (%1,462), bunu topaz çeşidi takip etmiştir (%1,200). Konvansiyonel bahçeden alınan yaprak örneklerinde en yüksek K içeriği yine Rajka çeşidinde tespit edilmiştir (%1,341). Rubinola çeşidi son sırada yer almıştır (%1,078). Konvansiyonel olarak yetiştirilen Rajka yapraklarında organiğe göre daha yüksek K saptanmıştır (%1,341). Nagy ve Holb (2006), organik elma yetiştiriciliğinde farklı çeşitlerde yaptıkları çalışmada, en düşük K içeriğini Temmuz ayında Reka çeşidinde %0.89, en yüksek K içeriğini ise Mayıs ayında Egri Piros çeşidinde %1.94 olarak bildirmişlerdir. Erdal (2005), Isparta bölgesinde elmada yaptığı çalışmada, yapraktaki % K içeriklerinin %1.72-%3.01 arasında değiştiğini bildirmiştir. Amarante ve ark. (2008), organik ve konvensiyonel olarak yetiştirilen farklı elma çeşitlerinde yaptıkları çalışmada, yapraklardaki K miktarlarını organik yetiştiricilikte %1.04 ile %1.38 arasında, konvensiyonel yetiştiricilikte ise %1.32 ile %1.46 arasında değiştiğini saptamışlardır. Çalışmada elde edilen % K değerlerinin elma için normal kabul edildiği bildirilen değerler (%1.10-1.60) arasında kaldığı görülmektedir (Yılmaz 2004).

Meyve ve yaprak örneklerinde Ca miktarları Çizelge 4'te verilmiştir. Meyve örnekleri için için çeşitler arasındaki fark istatistik olarak önemlidir. Yaprak örnekleri için uygulama x çeşit interaksiyonu istatistik olarak önemlidir. Organik olarak yetiştirilen bahçeden alınan yaprak örneklerinde en yüksek Ca içeriği Topaz çeşidinde tespit edilmiş olup, en düşük Rajka'da saptanmıştır. Konvansiyonel yetiştiricilikte ise yapraklarda en yüksek Ca Rajka çeşidinde saptanmıştır. Organik yetiştiricilikte konvansiyonel yetiştiriciliğe göre Ca miktarı daha yüksek olmuştur. Araştırmamızda yaprak örneklerinde saptadığımız Ca değerleri elma için verilen referans değerler (1,3-2,0 ppm) arasında yer almakla birlikte, organik bahçeden alınan Rubinola (0,952 ppm) ve konvansiyonel bahçeden alınan Topaz (0,460 ppm) yapraklarında bu referans değerlerinin altında Ca tespit edilmiştir. Amarante ve ark. (2008), organik yetiştiricilikte yapraklardaki Ca miktarını %1,17-1,26 konvansiyonel yetiştiricilikte ise % 1,15-1,43 arasında olduğunu bildirmektedir. Mordoğan ve Ergün (2001)'e göre Starking Delicious ve Golden elicious çeşitlerinde yapraklardaki % Ca miktarı %0,9-1,9 arasında değişmektedir. Bulgularımız bu değerlerle uyumludur. Bununla birlikte, Erdal (2005), Isparta bölgesinde elma yapraklarında Ca miktarının %0,76-1,19 arasında olduğunu bildirmektedir. Araştırmamızda elde ettiğimiz % Ca içeriklerinin bu değerlerin üzerinde olduğu görülmektedir. Araştırmamızda meyve örneklerinde organik yetiştiricilikte çeşitler arasında istatistik olarak fark olmamakla beraber ortalama %0,122 Ca tespit edilmiştir. Konvansiyonel yetiştiricilikte ise çeşitler arasındaki fark istatistik olarak önemlidir. En yüksek Ca Rubinola (%0,148) çeşidinden elde edilirken en düşük Rajka (%0,097) çeşidinde saptanmıştır. Amarante ve ark. (2008), organik meyvelerdeki Ca miktarını 50,9-61,0 ppm ve konvansiyonel meyvelerde ise 49,9-57,8 ppm olarak bildirmektedir. Mordoğan ve Ergün (2001), meyvelerdeki Ca miktarını 100-500 ppm olarak bildirmişlerdir. Araştırmamızda elde ettiğimiz bulgular bu değerlerin üzerindedir. Bu durumun P ile Ca arasındaki antagonistik etkiden kaynaklanmış olabileceği düşünülmektedir.

Meyve ve yaprak örneklerinde Mg miktarları Çizelge 4'te verilmiştir. Meyve örnekleri için ortalamalar arasındaki farklar istatistik olarak önemli değildir. Yaprak örnekleri için uygulamaxçeşit interaksiyonu istatistik olarak önemlidir. Yapraklardaki Mg miktarı bakımından organik yetiştiricilikte en yüksek değer Topaz (%0,320) çeşidinde elde edilmiştir. En düşük değeri Rajka (%0,231) göstermiştir. Konvansiyonel yetiştiricilikte ise en yüksek değeri Rubinola (%0,277) çeşidi vermiştir. Topaz çeşidi yapraklarında organik yetiştiricilikte konvansiyonele göre daha yüksek Mg tespit edilirken diğer çeşitlerde organik yetiştiricilik daha yüksek Mg içermiştir. Amarante ve ark. (2008), organik yetiştiricilikte yapraklardaki Mg miktarını %2,2-4,0; konvansiyonel yetiştiricilikte ise % 2,8-3,3 olarak bildirmektedir. Araştırmamızda elde ettiğimiz değerler bu miktarlardan daha düşüktür. Bununla birlikte Erdal (2005), Isparta bölgesinde yapraklardaki Mg miktarını %0,33-0,44 olarak saptamıştır. Bulgularımız bu değerlere yakındır. Yapraklardaki Mg miktarının düşük olmasının nedeni, potasyumca zengin olan deneme arazilerinin Mg alımını zorlaştırdığı şeklinde söylenebilir. Araştırmamızda meyve örneklerinde Mg miktarı %0,30-0,42 arasında değişmiştir. Mordoğan ve Ergün (2001), meyvelerdeki Mg miktarını 174-853 ppm olarak bildirmektedir. Araştırmamızda elde ettiğimiz bulgular bu değerlerle uyumludur.

Meyve ve yaprak örneklerinde Fe miktarları Çizelge 4'te verilmiştir. Meyve örnekleri için çeşitler arasındaki fark istatistik olarak önemlidir. Yaprak örnekleri için uygulama x çeşit interaksiyonu istatistik olarak önemlidir. Meyve örneklerinde en yüksek Fe Rubinola (29,730 ppm) çeşidinde saptanmıştır. Rajka (22,135 ppm) çeşidi son sırada yer almıştır. Mordoğan ve Ergün (2001), elma meyvelerinde Fe miktarını 7-72 ppm olarak bildirmektedir. Bulgularımız bu değerler arasında yer almakla beraber, Fe alımına antagonistik etki yapan elementlerin (P, Mn, Zn) etkisi nedeniyle meyvelerdeki Fe miktarlarının biraz düşük kaldığı söylenebilir. Yaprak örneklerinde konvansiyonel yetiştiricilikte en yüksek Fe Topaz (83,69 ppm) çeşidinde en düşük Fe ise Rubinola (59,160 ppm) çeşidinde saptanmıştır. Rubinola ve Rajka çeşitlerinde organik bahçelerden alınan yaprak örnekleri konvansiyonele göre daha yüksek Fe içermiştir. Mordoğan ve Ergün (2001), yaprak örneklerinde demir miktarını 26-470 ppm olarak bildirmektedir. Bulgularımız bu değerlerin arasında yer almaktadır. Ancak yapraklardaki N miktarıyla kıyaslandığında Fe miktarı olması gerekenden biraz yüksek gibi gözükse de bu durum N miktarının gerekenden az olmasından kaynaklanmaktadır.

Meyve ve yaprak örneklerinde Cu miktarları Çizelge 2'de verilmiştir. Meyve örnekleri için uygulama x çeşit interaksiyonu istatistik olarak önemlidir. Meyve örneklerinde konvansiyonel yetiştiricilikte en yüksek Cu miktarı Rubinola (5,427 ppm) çeşidinde saptanırken, Topaz (3,280 ppm) çeşidi son sırada yer almıştır. Rubinola çeşidinde organik bahçeden alınan meyveler konvansiyonele göre daha yüksek Cu içermiştir. Yaprak örneklerinde uygulamalar arasındaki fark istatistik olarak önemlidir. Konvansiyonel yetiştiricilikte (6,333 ppm) yapraklardaki Cu miktarı organik (4,750 ppm) yetiştiriciliğe göre daha yüksek tespit edilmiştir. Yaprak örneklerinde normal kabul edilen Cu miktarı 5-12 ppm'dir (Yılmaz 2004). Araştırmamızda konvansiyonel yetiştiricilikte elde edilen değerler normal kabul edilebilir miktardadır. Organik yetiştiricilik ise normal sınırların altında değer göstermiştir. Mordoğan ve Ergün (2001), yapraklardaki Cu miktarını 8-48 ppm olarak bildirmekte ve bu değerleri normal kabul etmektedir. Bu durumda araştırmamızda konvansiyonel yetiştiricilikte elde edilen Cu miktarı da düşük gözükmektedir. Bu durumu deneme arazisinin besin elementi kompozisyonunun düzensiz olmasına ve iyon-antagonismasına bağlamak mümkündür (Nagy ve Holb 2006).

Meyve ve yaprak örneklerinde Mn miktarları Çizelge 4'te verilmiştir. Yaprak ve meyve örnekleri için uygulamaxçeşit interaksiyonu istatistik olarak önemlidir. Organik bahçeden alınan meyve örneklerinde Rubinola (2,258 ppm) çeşidi en yüksek Mn içeriğine sahip olmuş, Rajka (0,850) çeşidi son sırada yer almıştır. Konvansiyonel yetiştiricilikte ise Rajka (2,550 ppm) çeşidi en yüksek Mn içeriğine sahiptir. Rajka çeşidinde konvansiyonel yetiştiricilikte (2,550 ppm) organik yetiştiriciliğe (0,850 ppm) göre daha yüksek Mn miktarı saptanmıştır. Mordoğan ve Ergün (2001), meyvelerdeki Mn miktarlarını 0,1-12,4 ppm olarak bildirmiştir. Bu değerler elde ettiğimiz miktarlarla uyumludur. Organik bahçeden alınan yaprak örneklerinde Rubinola (40,450 ppm) en yüksek Mn içeriğine sahip olurken, Topaz (24,630 ppm) en düşük değeri göstermiştir. Konvansiyonel yetiştiricilikte de yine Rubinola (42,180 ppm) çeşidi Mn miktarı açısından ilk sıradadır. Üç çeşitte de konvansiyonel yetiştiricilikte organiğe göre daha yüksek Mn saptanmıştır. Erdal (2005), Isparta' nın farklı bölgelerinden aldığı elma yapraklarında Mn miktarını ortalama 29-68,3 ppm olarak bildirmiştir. Yılmaz (2004) yaprak örneklerinde 35-100 ppm Mn miktarını normal sınırlar olarak kabul etmektedir. Mordoğan ve Ergün (2001), elma yapraklarında 19-112 ppm arasında Mn saptamıştır. Araştırmamızda elde ettiğimiz bulgular literatürde bildirilen sınırlar içerisindedir. Konvansiyonel yetiştiricilikte organik yetiştiriciliğe göre daha yüksek Mn elde edilmesinin sebebi, konvansiyonel bahçedeki toprak örneklerinde K içeriğinin organik yetiştiriciliğe göre yüksek olması ve bunun Mn alımına sinerjik etki yapması olarak düşünülmektedir.

Meyve ve yaprak örneklerinde Zn miktarları Çizelge 4'te verilmiştir. Meyve ve yaprak örnekleri için uygulamaxçeşit interaksiyonu istatistik olarak önemlidir. Meyve örneklerinde konvansiyonel yetiştiricilikte Topaz (1,584 ppm) çeşidi en yüksek Zn içeriğine sahip olmuştur. Rubinola (0,604 ppm) çeşidi son sıradadır. Rubinola çeşidinin meyvelerinde Zn miktarı organik yetiştiricilikte konvansiyonel yetiştiriciliğe göre daha yüksektir. Diğer çeşitlerde ise konvansiyonel yetiştiricilik daha yüksek değerler göstermiştir. Mordoğan ve Ergün (2001), meyve örneklerinde Zn miktarını 1,4-5,9 ppm olarak bildirmiştir. Özellikle organik bahçe topraklarında yeterli Zn bulunmasına rağmen, meyvelerde Zn miktarının düşük kalması besin elementi kompozisyonunun düzensiz olmasına ve iyon-antagonisması etkisiyle olabileceği düşünülmektedir (Nagy ve Holb 2006). Yaprak örneklerinde organik yetiştiricilikte en yüksek Zn içeriği Topaz (8,836 ppm) çeşidinde saptanırken, en düşük. Rubinola (4,913 ppm) çeşidinde belirlenmiştir. Konvansiyonel yetiştiricilikte ise en yüksek Zn içeriği Rajka (10,250 ppm) çeşidinde, en düşük Topaz (8,018 ppm) çeşidinde saptanmıştır. Topaz çeşidinde organik yetiştiricilikte yapraklardaki Zn miktarı konvansiyonel yetiştiriciliğe göre daha yüksek olurken, diğer iki çeşitte konvansiyonel yetiştiricilik daha yüksek Zn içermiştir. Mordoğan ve Ergün (2001), yaprak örneklerinde Zn miktarını 5-112 ppm olarak bildirmiştir. Bulgularımız bu değerlerle uyum halindedir. Bununla birlikte, Erdal (2005)'a göre Isparta'nın değişik bölgelerinde elma yapraklarında Zn miktarı 8,8-24,7 ppm arasında değişmektedir. Jones ve ark. (1991), elma yapraklarında yeterli kabul edilen Zn değerlerini 20-100 ppm olarak bildirirken, Yılmaz (2004) normal kabul edilen Zn miktarını 15-50 ppm olarak bildirmiştir. Küçükyumuk (2007), Isparta ekolojik koşullarında farklı elma çeşitlerinde yapraklardaki Zn miktarını 23-25 ppm olarak bildirmiştir. Araştırmamızda elde ettiğimiz değerlerin literatürde bildirilen sınır değerlerden düşük olduğu görülmektedir. Bu duruma deneme arazisinde toprakta bulunan besin elementi kompozisyonunun düzensiz olmasından kaynaklanan antoganistik etkileşimin neden olduğu söylenebilir.

Çizelge 4. Yaprak ve meyvelerde besin elementleri

Besin Elementleri	Çeşit	Meyve			Yaprak		
		Organik	Konvansiyonel	Ortalama	Organik	Konvansiyonel	Ortalama
N (%)	1	0,168	0,235	0,202	1,238	2,240	1,739 b**
	2	0,330	0,280	0,305	1,809	2,352	2,080 a
	3	0,218	0,280	0,249	1,557	2,083	1,820 b
	Ortalama	0,239	0,265	0,252	1,534 B*	2,225 A	1,880
P (%)	1	0,050	0,046	0,048	0,261	0,205	0,233
	2	0,060	0,060	0,060	0,147	0,166	0,157
	3	0,077	0,050	0,064	0,365	0,188	0,277
	Ortalama	0,062	0,052	0,057	0,258	0,186	0,222
K (%)	1	0,590 b* A**	0,513 b* B	0,552	1,200 b* B*	1,327 a* A	1,264
	2	0,632 b B	0,638 a A	0,635	1,137 b A	1,019 b B	1,078
	3	0,754 a A	0,670 a B	0,712	1,462 a A	1,220 a B	1,341
	Ortalama	0,659	0,607	0,633	1,266	1,189	1,228
Ca (ppm)	1	0,110	0,095	0,103 b	1,487 a* A**	0,460 c* B	0,974
	2	0,143	0,153	0,148 a	0,952 b B	1,525 a A	1,239
	3	0,113	0,080	0,097 b	1,391 a B	1,437 b A	1,414
	Ortalama	0,122	0,109	0,116	1,277	1,141	1,209
Mg (ppm)	1	0,030	0,034	0,032	0,320 a* A**	0,212 b* B	0,266
	2	0,042	0,037	0,040	0,241 b B	0,277 a A	0,259
	3	0,033	0,030	0,032	0,231 b B	0,227 b A	0,229
	Ortalama	0,035	0,034	0,034	0,264	0,239	0,251
Fe (ppm)	1	26,230	21,370	23,800 b**	86,890 A*	83,690 a B	85,290
	2	28,860	30,600	29,730 a	93,950 A	59,160 b B	76,555
	3	22,490	21,780	22,135 b	96,010 A	67,740 b B	81,875
	Ortalama	25,860	24,583	25,222	92,283	70,197	81,240
Cu (ppm)	1	3,280	5,447 a**	4,364	4,786	6,076	5,431
	2	5,427 A*	2,888 b B	4,158	4,751	6,263	5,507
	3	3,313	3,080 b	3,197	4,714	6,659	5,687
	Ortalama	4,007	3,805	3,906	4,750 B*	6,333 A	5,542

Mn (ppm)	1	2,240 a**	1,453 b**	1,847	24,630 b* B**	30,670 b* A	27,650
	2	2,258 a	1,956 b	2,107	40,450 a B	42,180 a A	41,315
	3	0,850 b B*	2,550 a A	1,700	26,100 b B	30,820 b A	28,460
	Ortalama	1,783	1,986	1,885	30,393	34,557	32,475
Zn (ppm)	1	1,070 B*	1,584 a* A	1,327	8,836 a* A*	8,018 c* B	8,427
	2	0,868 A	0,604 b B	0,736	4,913 b B	9,735 b A	7,324
	3	1,004 B	1,280 c A	1,142	8,798 a B	10,250 a A	9,524
	Ortalama	0,981	1,156	1,068	7,516	9,334	8,425

*Ortalamalar arasındaki fark istatistik olarak önemlidir (p<0,01)

** Ortalamalar arasındaki fark istatistik olarak önemlidir (p<0,05)

Küçük harfler çeşitler arasında, büyük harfler uygulamalar arasındaki farkı göstermektedir.

SONUÇ

Organik ve konvansiyonel elma bahçelerine ait toprak örnekleri besin elementi analizleri sonuçlarından da anlaşılacağı gibi N elementinin topraktaki miktarı yeterli değildir (Loue 1968). Diğer elementler açısından her iki bahçede de besin elementi miktarları yeterli düzeydedir (Lindsay ve Norvell 1978, Hızalan ve Ünal 1966, Schlicting ve Blume 1966, Lindsay ve Norvell 1969). Ancak besin elementlerinin topraktaki oranları bazı elementler için birbirlerine antagonistik etki yapacak şekilde bozuktur. Bunun elma ağaçlarının besin elementi alımını etkilediği düşünülmektedir. Aynı ortam ve şartlarda yetişseler dahi bitkiler topraktaki besin elementlerinden farklı düzeylerde yararlanmaktadır (Kacar 1995, Marschner 1996). Bu durum verim değerlerine yansımaktadır. Organik olarak yetiştirilen Topaz (7004 kg/da), Rubinola (8512 kg/da) ve Rajka (9443 kg/da) elma çeşitlerinden konvansiyonel (sırasıyla; 10108 kg/da, 13134 kg/da,13530 kg/da) yetiştiriciliğe göre daha az ürün alınmıştır. Organik olarak yetiştirilen çeşitlerin yapraklarında azot hariç makro besin elementi alımı daha iyi olmuştur. Fe dışındaki mikro elementlerde ise konvansiyonel bahçe daha iyi durumdadır. Bu sonuçlara göre hem organik hem de konvansiyonel yetiştiricilikte gübreleme programı hazırlanırken yaprak analizleri dikkate alınmalı, topraktaki besin elementi komposizyonu iyi ayarlanmalıdır.

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DOĞU KARADENİZ BÖLGESİ'NİN EKOTURİZM AÇISINDAN DEĞERLENDİRİLMESİ

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ÖZET

Doğal, sosyo-kültürel ve tarihi değerleri açısından zengin yerleşmeleri olan Türkiye, çevre kaynakları ve turizm potansiyeli açısından uluslararası düzeyde öneme sahiptir. Özellikle 1950'lerden sonra yaşanan endüstrileşme, kentlerin gelişme ve büyüme süreçlerinin hızı ve buna bağlı olarak gelişen çarpık yapılaşma gibi sorunlar altyapı, ulaşım, görsel kirlilik ve çevre kirliliği gibi sorunları da beraberinde getirmiş; böylece kaynaklar hızla tüketilme sürecine girmiştir. Bu kapsamda doğal, kültürel ve tarihi kaynakların plansızca tüketilmesi ve fiziksel çevre üzerinde onarımı güç tahribatların meydan gelmesi gibi nedenlerle sürdürülebilirlik kavramı her alanda olduğu gibi turizmde de büyük önem kazanmıştır. Böylece, kaynakların sürdürülebilir kullanımını amaçlayan, çevreyi koruyan, yerel halkın refahını geliştiren ve geleneksel sosyo-kültürel yaşamla entegre olmuş bir turizm türü olan ekoturizm, sürdürülebilirlik tartışmaları ile birlikte gündeme gelmiştir.

Bu bildiride; Anadolu'nun özgün kimliğini büyük ölçüde koruyan, coğrafi konumu, kırsal peyzaj özellikleri, yayla kültürü, özgün geleneksel yapılanma kültürü ve özelliklerinin yanı sıra farklı ekosistemleri bir arada barındırması açısından Dünya'nın ekolojik anlamda en zengin ve korunması gereken alanlarından biri olması nedeni ile ekoturizm açısından önemli bir potansiyele sahip olan Doğu Karadeniz Bölgesi değerlendirilmiştir. Araştırma kapsamında; Artvin, Bayburt, Giresun, Gümüşhane, Ordu, Rize ve Trabzon gibi kentsel yerleşim yerleri ile doğal değerlere sahip yakın çevreleri doğal, kültürel ve tarihi değerleri ile irdelenmiş, doğa yürüyüşü, yaban hayatı ve kuş gözlemciliği, yamaç paraşütü gibi birçok ekoturizm aktivitesine olanak sağlayan ve ekoturizme örnek olabilecek alanlar saptanarak elde edilen veriler peyzaj mimarlığı açısından değerlendirilmiş, kaynakların sürdürülebilir kullanımı ve gelecek nesillere aktarımı kapsamında öneriler geliştirilerek sorunlar, olanaklar genel planlama yaklaşımları ve peyzaj mimarlığı kapsamında tartışılmıştır.

Anahtar Kelimeler: Sürdürülebilirlik, ekoturizm, koruma, peyzaj mimarlığı

GİRİŞ

Özellikle 20. yüzyılın ikinci yarısından itibaren Dünya ekonomisinde en hızlı gelişen ve genişleyen sektörlerden biri haline gelen turizm, ulusal ve uluslararası düzeyde ülkelerin ekonomik, sosyal ve kültürel kalkınma süreçlerine yardımcı olan önemli bir sektördür. Turizm faaliyetlerinin ülkelerin sahip olduğu özgün değerleri kullanma imkanı vermelerinin yanı sıra, istihdam sağlama, ülke ölçeğinde gelir dağılımının eşitlenmesine ve kırsal alanların kalkınmasına katkıları söz konusu olmaktadır. Ancak bilinçsiz ve plansız yapılan turizm yatırımları çevre değerlerinin bozulmasına ve yerel kültürün zarar görmesine neden olmaktadır. Bu nedenle turizmde gelişmenin sürdürülebilir olması ve bugün ile gelecek nesillerin yaşam kalitelerinin artırılması hedeflenmelidir.

Gerek turizm eylemleri gerek diğer etmenler ile Dünya kaynaklarının kirlenerek yok olma tehlikesi ile karşı karşıya kalması doğal sınırlar konusundaki çevre bilincini arttırmıştır. Bunun turizm sektörüne yansıması; doğal çevre bilinci yüksek, kültürel çevre verilerine daha fazla önem veren, konfor beklentisi öncelikli olmayan, farklılık arayışı içinde olan yeni bir turist tipi ve buna cevap verebilecek turizm türü şeklinde olmuştur. Bugün Dünya ülkeleri çevresel kaynaklara daha saygılı, çevreyi kullanırken sürdürebilirliğini sağlamayı amaçlayan turizm türlerini (sürdürülebilir turizm, çevreci turizm, ekoturizm gibi) ve bunlar ile ilgili yapılanma biçim ve niteliğini tartışarak, planlamalarını bu doğrultuda gerçekleştirmektedirler [5].

EKOTURİZM KAVRAMI VE ÇEVRE

Özellikle 1970'lerde ivme kazanmaya başlayan ve 1980'lerde hızlanan çevre koruma hareketleri ve turizmin ortaya çıkardığı olumsuz sonuçların artması ile birlikte yeni çözümler de üretilmeye başlanmış, ekoturizm 1970'lerde ve 1980'lerde çevre hareketinin içinde gelişim göstermiştir. Ekoturizm kavramının kökeni kesin olarak bilinmemektedir, fakat Hetzer bu kavramı ilk kullananlardan biri olarak kabul edilmektedir. Hetzer ekoturizmi 4 temel ilke ile;

- Çevresel etkilerin en aza indirilmesi,
- Ev sahibinin kültürüne saygı duyulması,
- Yerel topluma faydaların en üst düzeyde tutulması,
- Turist memnuniyetinin üst düzeye çıkarılması şeklinde tanımlamaktadır [4].

Kitle turizmine bir tepki ve alternatif olarak gelişme gösteren ekoturizm kavramı, kırsal ve kültürel turizmin unsurlarını içermekte ve hassas doğal ve kültürel alanlarda geliştirilebilecek en uygun turizm türü olarak ifade edilmektedir. Kontrolsüz gelişen kitlesel turizm hareketinin çevre ve toplum üzerindeki tahribatları karşısında ekoturizm, sürdürülebilir gelişmenin sağlanmasında önemli bir araç olarak görülmektedir. Ekoturizm, sürdürülebilir turizmin bir alt bileşenini oluşturmaktadır. Bazen sürdürülebilir turizm ile eş anlamlı olarak kullanılmakla birlikte, ekoturizm sürdürülebilir turizm şekillerinden biridir [2]. Dünya Turizm Örgütü (WTO-World Tourism Organisation)'ne göre sürdürülebilir turizm; "ev sahibi toplumların yaşam kalitesini geliştiren, misafirler için yüksek kaliteli deneyim sağlayan ve her ikisinin de bağlı oldukları çevrenin kalitesini sürdüren ve koruyan bir turizm biçimidir". Sürdürülebilir turizm kalkınması bu hedefi, seyahat edilecek yerlerde yerel doğal, kültürel ve yapı kaynaklarını koruyan bir ekonomik gelişmenin teşviki yoluyla aramaktadır [6]. Kaynakların sürdürülebilir bir şekilde kullanımını ön palana çıkaran ve yerel halk ile çevreye karşı sorumlu bir turizm türü olan ekoturizmin temelinde sürdürülebilirlik bulunmaktadır.

Uluslararası Ekoturizm Derneği (TIES-The International Ecotourism Society)'nin tanımına göre ekoturizm; "çevreyi koruyan ve yerel halkın refahını geliştiren, doğal alanlara yapılan sorumlu seyahattir". Ekoturizm aktivitesine katılanların;

- Etkileri en aza indirmek,
- Çevresel ve kültürel bilinç ve saygı oluşturmak,
- Hem ziyaretçiler hem de yerel halk için olumlu deneyimler sağlamak,
- Koruma için doğrudan ekonomik yarar sağlamak,
- Yerel halka ekonomik yarar ve yetkilendirme sağlamak,
- Ev sahibi ülkelerin politik, çevresel ve sosyal şartlarına olan duyarlılığı artırmak gibi ekoturizm ilkelerini yerine getirmeleri gerekmektedir [14].

Uluslararası Doğa Koruma Birliği (IUCN-International Union for Conservation of Nature) ise ekoturizmi; "geçmiş ve gelecekteki kültürel özelliklerin her birine eşlik ederek düşük ziyaretçi etkisi ile korumayı geliştiren, yerel halkın aktif sosyo-ekonomik katılımına olanak tanıyan, doğadan zevk almak ve doğanın değerini anlamak amacıyla doğal alanda yapılan çevresel açıdan sorumlu seyahat" olarak tanımlamaktadır. Bugün doğal alanlarda yapılan çoğu turizm türü ekoturizm olmadığı gibi sürdürülebilir de değildir. Ekoturizm koruma, eğitim, ziyaretçi sorumluluğu ve aktif halk katılımı özelliği ile doğa turizminden ayrılmaktadır. Ekoturizm daha özelde değerlendirildiğinde;

- Çevreye duyarlı, düşük etkili ziyaretçi davranışına sahip olmak,
- Yerel kültürlerin ve bioçeşitliliğin değerini anlayıp onlara karşı duyarlı olmak,
- Yerel korumacı girişimleri desteklemek,
- Yerel halka sürdürülebilir fayda sağlamak,
- Karar verme mekanizmalarına yerel katılımı sağlamak,
- Hem ziyaretçi hem de yerel halk için eğitim bileşenleri oluşturmak gibi niteliklere sahip olduğu görülmektedir [13].

Sürdürülebilir turizm hedeflerini benimseyen, kar amacı taşımayan bir il kuruluşu olan Saskatchewan Ekoturizm Topluluğu, ekoturizmi; "eğitim, takdir etmek ve yabani bitki ve hayvanlar ile kültürel özelliklere sahip olan doğadan zevk almak amacıyla, nispeten bozulmamış ve kirletilmemiş doğal alanlara yapılan saygılı ve çevreye karşı sorumlu seyahat" olarak tanımlamıştır. Ekoturistler işgücü (yol inşası, kuşların sayımı) veya ekonomik girdi (yerel mal satın alma, koruma fonlarına katkı sağlama) sağlama yolu ile ziyaret ettikleri alana katkıda bulunma eğiliminde olmaktadırlar. Çünkü ekoturizm, turizmin diğer türlerine göre daha fazla öğrenme ve deneyime dayalıdır ve topluluklar kendi varlıklarını vitrine çıkarmak için daha çok fırsata sahiptirler. Bu sık sık hem ziyaret edilen toplumlarda hem de genelde, turistlerin takdir ve koruma sorunlarına bağlılığını daha da güçlendirme niteliği taşımaktadır [9].

Ekoturizm, genellikle küçük grupların katılımı ile ve yerel halkın işlettiği küçük ölçekli tesislerde ya da geleneksel yapı stoğu kullanılarak gerçekleştirilen bir aktivite olup yerel kaynakların kullanımını hedef almaktadır. Ekoturizm, amacına uygun gerçekleştirildiği koşulda, hassas ekosistemlerin korunması ve bu bölgelerde ve çevresinde yaşayan nüfusun sosyo-ekonomik gelişimi için kaynak yaratabilen bir araç olabilmektedir. Önemli ekoturizm potansiyeli olan dağlık ve ormanlık bölgelerdeki köylerde yaşayan halkın gelir düzeyi göz önüne alındığında, ekoturizmin yerel anlamda ekonomik girdi sağlayacak bir eylem olduğu açıktır. Doğal kaynakların sürdürülebilirliğinin güvence altına alınması, yöre halkının ekonomik kalkınmasına destek olunması ve sosyo-kültürel değerlerin korunması olarak değerlendirilen ekoturizm; ekolojik sistemin korunması yönünde sorumluluk taşıyan doğa temelli bir turizm aktivitesidir.

Ekoturizm ile ilgili olarak evrensel bir tanım olmamasına rağmen genel özellikleri;

- Turistlerin temel motivasyonunun; doğal alanlarda yaygın olan geleneksel kültürlerin yanında, doğayı gözlemlemek ve doğanın değerini bilmek olduğu tüm doğa temelli turizm çeşitleridir,
- Eğitim ve yorumlama özellikleri içermektedir,
- Genellikle yerel işletme sahipleri tarafından küçük gruplar için düzenlenmiştir,
- Doğal ve sosyo-kültürel çevre üzerindeki olumsuz etkileri azaltmaktadır,
- Doğal alanların korunmasını;
  - ev sahibi toplumlar, kuruluşlar ve koruma amacıyla doğal alanları yöneten yetkililer için ekonomik faydalar yaratması,
  - yerel halk için alternatif istihdam ve gelir olanakları sağlaması,
  - hem yerel halk hem de turistler arasında, doğal ve kültürel varlıkların korunmasına yönelik bilincin artırılmasını sağlaması açısından desteklemektedir şeklinde özetlenebilmektedir [17].

Korunan ve çevresel açıdan yönetilen alanlardaki ekoturizmin özellikleri ise;

- Ekoturizmin pozitif çevre ahlakını ve katılımcılarına çevreye duyarlı bilinçli davranışları teşvik etmesi,
- Ekoturizmin doğal kaynakları tahrip etmemesi ya da doğal çevre sürecine müdahale etmemesi,
- Ekoturizmin dışsal değerlerden çok içsel değerlere yoğunlaşması; olanakların ve hizmetlerin asla kendi içlerinde cazip hale gelmemesi,
- Ekoturizmin felsefede eş merkezcilikten daha ziyade canlı merkezci olması; ekoturistin çevrenin kendi koşullarını kabul etmesi, çev-

renin kendi rahatlığı için değiştirilmesini beklememesi,
- Ekoturizmin yaban hayatı ve doğal çevreye fayda sağlaması gerekliliği; çevre ve ekolojik fonksiyonların turizm tarafından rahatsız edilmeden korunması,
- Ekoturizmin doğal çevre ile ilgili ilk elden tecrübe kazandırması,
- Ekoturizmin fiziksel başarı veya macera arayışından çok eğitim ve/veya hayranlık kriterleri ile ölçülen bir memnuniyet beklentisine sahip olması,
- Ekoturizmin yüksek bilgi ve tecrübeye dayanan boyutunun olması olarak değerlendirilmektedir [16].

WTO'ya göre ekoturizmin amacı;
- Turizmin doğal ve geleneksel çevreye verdiği tahribatın en alt düzeye indirilmesi,
- Turistlere ve yerel halka doğanın ve geleneksel sosyo-kültürel çevrenin korunmasına yönelik eğitim verilmesi,
- Turizmin yerel halkın ihtiyaçlarını karşılayan, yerel yönetim ve halkla işbirliği içinde gelişen sorumlu bir ticaret olarak özendirilmesinin sağlanması,
- Koruma kapsamındaki (doğal ve sosyo-kültürel) alanların yönetimi için kaynak ayrılması,
- Turizmin negatif etkisinin en alt düzeye indirilmesi amacıyla sosyo-kültürel ve doğal çevreye yönelik uzun vadeli takip ve değerlendirme programlarının desteklenmesi,
- Turizmin yerel halkın geçimine katkıda bulunmasını sağlayacak şekilde geliştirilmesi,
- Turizmin yörenin sosyal ve çevresel kapasitesini artıracak şekilde geliştirilmesi,
- Çevreyle uyumlu, doğal ve geleneksel sosyo-kültürel yaşamla iç içe geçen, yöresel bitki örtüsünü ve yaban hayatını koruyan turizmin altyapı yatırımlarının gerçekleştirilmesidir. Hedefleri ise;
- Doğal ve kültürel mirasın korunma statüsünün geliştirilmesi,
- Bakanlık tarafından da yürütülen turizm çeşitlendirme politikasının ana hedeflerinden birisi olan kırsal alanlarda ve korunmuş alanlar yakınında bulunan yerel toplumların yaşam düzeyinin geliştirilmesi,
- Doğa, yerel kültürler ve onların çeşitliliği hakkında daha iyi bilgi ve saygının oluşturulmasıdır [8].

Ekoturizmin iki önemli kriteri bulunmaktadır. Bunlardan ilki "doğal çevrenin korunarak sürdürülebilirliğin sağlanması" ilkesine sıkı sıkıya uyulması ve gerektiğinde uzman rehber kullanılmasıdır. Ekoturizmin ikinci önemli kriteri ise "yerel kültürlere saygı ve yerel halkın ekoturizmden fayda sağlamasıdır". Ekoturizm bölgelerinde yaşayan topluluklar genellikle otantik niteliğe sahip yerel kültür özelliklerini korudukları için, bölgeye turizm kanalı ile katkı sağlanırken, ahlaki, dini ve geleneksel değerlere saygı gösterilmesi, yerel yeme-içme eğlenme gibi geleneklere uyumlu davranılarak manevi kültür unsurlarının bozulmamasına dikkat edilmesi gerekmektedir. Diğer önemli bir unsur, ekoturizmden bölge yerel halkının katkı sağlaması için uluslararası büyük tur operatörleri yerine bölgede bulunan küçük acentelere başvurulması ve bu tur acentelerinin de tur gereksinimlerini bölgeden sağlamalarının yerel gelişim açısından gerekliliğidir [10].

Ekoturizm faaliyetleri, son yirmi yılda Dünya çapında hızlı bir şekilde genişlemiştir ve gelecekte daha da ileri bir düzeyde büyüme beklenmektedir. 2002 yılı Birleşmiş Milletler Sürdürülebilir Kalkınma Komisyonu tarafından "Uluslararası Ekoturizm Yılı" olarak ilan edilmiş ve bu konuyla ilgili olarak WTO görevlendirilmiştir. WTO ve Birleşmiş Milletler Çevre Programı (UNEP-United Nations Environment Programme), ekoturizm yılı boyunca uluslararası düzeyde üstlenilmesi gereken bazı faaliyetlerin hazırlanması ve düzenlenmesinde iş birliği yapmışlardır.

Dünya ölçeğinde keşif amaçlı olarak yapılan ekoturizm, son yıllarda Türkiye'de de sık sık gündeme gelmekte, ancak genelde yayla turizmi bağlamında değerlendirilmektedir. Oysa bir bütün olarak ele alınması gereken ekoturizm, sosyal ve kültürel faaliyetleri de içine alan, birçok aktiviteyi kapsayan bir etkinliktir. T.C. Kültür ve Turizm Bakanlığı ekoturizmi; yayla turizmi, ornitoloji (kuş gözleme) turizmi, foto safari, akarsu sporları (rafting-kano), çiftlik turizmi, botanik (bitki inceleme) turizmi, kamp/karavan turizmi, mağara turizmi, dağ turizmi, doğa yürüyüşü, bisiklet turları, atlı doğa yürüyüşü gibi alternatif turizm olanakları kapsamında değerlendirmektedir. Doğa temelli turizme artan ilginin temel nedeni bu alanların sahip olduğu ekonomik ve ekolojik potansiyeldir

DOĞU KARADENİZ BÖLGESİ VE EKOTURİZM

Ekoturizm etkinlikleri için oldukça ilgi çekici bir ülke konumunda olan Türkiye, zengin tarihi ve kültürel mirasının yanı sıra iklimsel çeşitliliği nedeni ile uluslararası düzeyde önem taşıyan bir biyoçeşitliliğe sahip olup, Akdeniz'deki en önemli turizm ülkelerinden biridir.

Tüm Avrupa'da 500 kuş türü bulunmasına karşılık, Türkiye'de 420 civarında kuş türü tespit edilmiştir. Ayrıca Avrupa'da tespit edilen yaklaşık 12.000 bitki türünden yaklaşık 9.000'i Türkiye'de bulunmaktadır. Türkiye, gerek dağları, ormanları, yaylaları, kıyıları, gölleri, akarsuları gibi doğal varlıkları; gerek flora ve faunası ve gerekse mağaraları ve kanyonları gibi ilginç jeolojik oluşumları açısından uluslararası düzeyde bir zenginliğe sahiptir ve bu zenginlikler Türkiye'yi ekoturizm için oldukça ilgi çekici bir ülke konumuna getirmektedir [8]. Alternatif turizm olanakları açısından Türkiye'nin önemli bölgelerinden biri olan Karadeniz Bölgesi ise gerek coğrafi konumu ve yeryüzü şekilleri gerekse doğal, kültürel ve tarihi değerleri ile ekoturizm için büyük önem taşımaktadır. Kuzeyinde, Sakarya'nın doğusundan Gürcistan'a kadar Karadeniz'e paralel olarak uzanan Karadeniz Bölgesi; Gürcistan, D. Anadolu, İç Anadolu ve Marmara Bölgeleri ile ve adını aldığı deniz ile komşu olup Batı Karadeniz, Orta Karadeniz ve Doğu Karadeniz olmak üzere üç bölümden oluşmakta (Şekil 3.1) ve Doğu Karadeniz Bölgesi **Artvin**, **Bayburt**, **Giresun**, **Gümüşhane**, **Ordu**, **Rize** ve **Trabzon** illerini kapsamaktadır.

Şekil 1. Karadeniz Bölgesi [1]

Araştırma alanını oluşturan Doğu Karadeniz Bölgesi; 36°41'25"ve 42°42'35" doğu meridyenleri ile 39°50'23" ve 41°31'28"kuzey paralelleri arasında bulunmaktadır. Yüzölçümü, 35.174 km^2 olup Türkiye yüzölçümünün % 4,48'ini oluşturmaktadır. Bölgede rakım, deniz seviyesinden başlayıp, 3.932 m.'ye (Kaçkar Dağı) kadar yükselmektedir [12].

Doğu Karadeniz Bölgesi; Ordu İli'nin doğusundaki Melet Çayı'ndan Gürcistan sınırına kadar uzanan, Karadeniz Bölgesi'nin en dağlık ve yükseltisinin en fazla olduğu (4.000 m.) bölümüdür. Topografik yapısı ve meteorolojik özellikleri nedeni ile sel ve heyelan olaylarının sıkça yaşandığı bir coğrafyada yer almaktadır. Kıyıları fazla girintili-çıkıntılı değildir. Dağlarının kıyıya paralel olması tarım alanlarını sınırlandırmıştır. Kırsal nüfusun ve dağınık yerleşmenin en fazla olduğu bölümdür. Türkiye ve Karadeniz Bölgesi'nin en fazla yağış alan bölümü olup, yıllık ortalama yağış miktarı 1500 mm. (m^2'ye 1500 kg.), en yağışlı ili 2400 mm. ile Rize'dir. Dağlar kıyı kesimin nemli havasının iç kısımlara geçmesini engeller ve bölgenin kıyısı ile iç kesimleri arasında önemli iklim farklılıkları görülmektedir. Kıyılardan iç kesimlere doğru gidildikçe hem yağış oranı azalmakta, hem de karasallık nedeniyle sıcaklıklar düşmektedir. Bölgenin yağış dağılımında hakim rüzgar yönü ile yamaçların konumu ve yükseltisi en önemli etkenlerdir [15].

Karadeniz sahil kuşağının 500 m.'ye kadar olan kesimlerinde çay başta olmak üzere, mısır, patates, tütün, fındık ile bazı sebze ve meyveler yetiştirilmektedir. Çay ekim alanları, Rize'den başlayıp Doğu Karadeniz sahil şeridi boyunca doğuya doğru devam etmektedir ve Çoruh Vadisi aracılığı ile Borçka'ya kadar uzanmaktadır. Buralarda 600 m. yüksekliğe kadar olan yamaçlar boyunca yer yer çay bahçelerine rastlanmaktadır. Türkiye'nin en önemli ihraç ürünlerinden biri olan fındık ise Ordu, Giresun ve Trabzon kıyı kuşağında yetiştirilmektedir. Fındık bahçeleri, Karadeniz sahillerinden başlayarak yamaçlar boyunca 500-600 m. yüksekliğe kadar devam etmektedir. Sahilden 1000 m.'ye kadar olan kuşakta Karadeniz Bölgesi'ne özgü özgün kimlik taşıyan dağınık yerleşmeler bulunmaktadır [3].

Doğu Karadeniz Bölgesi'nin topografyası içerisinde dağlar, yaylalar, akarsular, yer altı su kaynakları ve göller önemli bir yer tutmaktadır. Bölge dağları batıdan doğuya doğru Canik Dağları, Giresun Dağları ve Doğu Karadeniz Dağları'ndan oluşmaktadır. Canik Dağlarının doğu uzantısı Ordu İli'nin güney sınırlarını teşkil etmekte olup, Giresun Dağları; Çadır Dağı, Karadağ, Hasan Dağı, Çakıl Dağı ve Karagöl Dağı'ndan oluşmaktadır. Doğu Karadeniz Dağları ise Alacadağ, Kalkanlı (Zigana), Büyükdağ, Soğanlı Dağı, Haldizen Dağı, Kırklar Dağı, Kaçkar Dağı, Alacadağ ve Çomak Dağı gibi yükseltilerden oluşmaktadır. Bu dağlar hem Kuzey Anadolu'nun hem de Türkiye'nin en yüksek dağlarını oluşturmaktadır. Bazı zirveler 3.000 m.'nin üzerine kadar yükselmektedir. Doğu Karadeniz Bölgesi'nin en önemli vadileri; Çoruh Vadisi ve Kelkit Vadisi, en önemli ovaları; Kelkit Ovası ve Şiran Ovası, ve en önemli yaylaları; Sultanmurat Yaylası, Kuşmer Yaylası, Kadırga Yaylası, Sisdağı Yaylası, Çambaşı Yaylası, Perşembe Yaylası, Keyfalan Yaylası, Argın Yaylası, Kümbet Yaylası, Bektaş Yaylası, Anzer Yaylası, Elevit Yaylası, Bilbilan Yaylası, Uzungöl Yaylası ve Ayder Yaylası'dır (Şekil 3.2). Su potansiyeli açısından Türkiye geneline oranla oldukça zengin kaynaklara sahip olan bölgede Çoruh, Harşit, Melet ve Kelkit gibi önemli akarsular bulunmaktadır. Doğu Karadeniz Bölgesi genelinde büyük göllere rastlanmayıp, daha çok dağların tepelerinde oluşan küçük buzul gölleri ile heyelan sonucunda oluşan göllere rastlanmaktadır. Bölgenin önemli gölleri, heyelan sonucu oluşan Sera Gölü ve Solaklı Çayı'nın getirdiği alüvyonlarla vadi ağzının tıkanması sonucu oluşan Uzungöl, Kaçkar ve Karagöl krater gölleri, Aygır Gölü, Balıklı Göl, Büyükdeniz Gölü, Göleteği Gölü, Salıncak Gölü, Önacar Gölleri, Sefkar Gölleri, Kapılı Gölü, Suluk Gölü, Ambar Gölü, Çakır Göl, Deringöl, Dipsizgöl, Gaga Gölü, Karagöl, Ulugöl ve Sağrak Gölü'dür. Ayrıca farklı büyüklüklerde buzul gölleri de bulunmaktadır

Şekil 2. Doğu Karadeniz Bölgesi, yaylaları (Orijinal, 2009)

Doğu Karadeniz Bölgesi kıyı şeridi, dağların kıyıya paralel uzanışına ve eğimin fazla oluşuna bağlı olarak falezlerin en çok görüldüğü yerdir. Kıyı şeridi Samsun-Ordu İl'i sınırından başlayıp, Gürcistan sınırına kadar uzanmaktadır. Doğu Karadeniz Bölgesi sahilden 3376 m. yükseltiye kadar değişen yükselti farklılığı, dağların denize paralel uzanması, kuzey sınırı Karadeniz'in oluşturması, çok sayıdaki dereleri, irili-ufaklı gölleri, toprak ve iklim özellikleri nedeniyle çeşitli ekolojik birimleri bünyesinde barındırdığından zengin bir flora ve vejetasyona sahiptir. Bu zengin vejetasyonun her biri; dar bir yayılış bölgesine sahip, özel ekolojik koşullarda yetişebilen, yetiştiği yöreye özgü olup, yöre dışında başka yerlerde yetişmeyen bitkiler olarak tanımlanan birçok endemik bitkiye ev sahipliği yapmaktadır. Bu biyolojik zenginlikleri nedeniyle biyogenetik rezerv alanları olarak değerlendirilmeleri, doğal kaynakların korunması ve biyolojik çeşitliliğin devamı için büyük önem taşımaktadır. Bölge ormanların florası çeşitli ağaç, ağaççıklar ile otsu ve odunsu diri örtüden oluşmaktadır. Ormanlarda bulunan bitki türleri; ladin, kayın, kızılağaç, göknar, sarıçam, kestane, meşe, gürgen, akasya, akçaağaç ve şimşirdir. Ayrıca orman alt tabakasında bulunan ve geniş alanlarda yayılış gösteren ormangülü önemli flora zenginliğidir. Bunun dışında böğürtlen, taflan, karayemiş, ayıüzümü, kuşburnu, ahududu, eğrelti otu ve çeşitli çayır ve mera otları flora çeşitliliği içindedir. Tarımsal ürünlerde çay ve fındık bölge ile özdeşleşmiş ürünler olup, bunların yanında tarla, sebze ve meyve ürün gruplarından birçok ürün çeşitinin de yetiştiriciliği yapılmaktadır. Çay ve fındık bölgenin sahil illerinde üretilirken tahıl üretimi iç kesimdeki il ve ilçelerde yoğunluk kazanmaktadır [12].

Doğu Karadeniz Bölgesi'nde sahil kesiminden sonra aniden yükselen tepeler ve tarımsal üretime elverişli olmayan alanlardan sonra devam eden topografik yapı, hayvancılığın ön plana çıkmasına neden olmuştur. Yörede yaylalar gerek hayvanların doğal çevrede rahatlıkla beslenebilmeleri, gerekse bu yükseltilerde özellikle yaz aylarında gözlenen iklimsel nitelikler, insanların yaz mevsiminde yaylalara yönelmesine neden olmaktadır.

Doğu Karadeniz Bölgesi sahil yöresinin yüksek kesimleri, doğal ortamlar ve buna bağlı olarak ekonomik faaliyetler açısından iki alt yöreye ayrılabilmektedir. 1000-2000 m. arasındaki kuşakta yerleşmeler seyrekleşmektedir. Vadi eteklerinde kurulmuş dağınık köyler, özellikle eğimli yamaçlarda birkaç evden oluşan yerleşmeler bulunmaktadır. 2000-22000m. yükseklikten sonra yaylalar kuşağında artık ormanlar görülmemektedir. Yaylalarda çoğunlukla ahşap malzemeden yapılmış yayla evlerinden oluşan yerleşim dokuları bulunmaktadır. Karadeniz yayla kuşağı, Karadeniz Bölgesi'nin doğal ve kültürel özelliklerini tanıtan, turizm açısından önemi olan bir ekoturizm alanıdır. Artvin-Yusufeli arasındaki Çoruh Vadisi'nde ise Karadeniz kıyı kuşağının aksine dere kenarlarına kurulmuş olan toplu köy tipleri yer almakta ve yer yer pirinç yetiştirilmektedir. Kelkit Vadisi boyunca ise kırmızı ve sarı renklerde kendini belli eden ve üzerinde son derece seyrek bitki örtüsü barındıran tuzlu evaporit çökeller görülmektedir. Bu alanın elverişli yerlerinde tahıl (buğday, arpa) yetiştirilmekte ve organik tarım yapılmaktadır (Şekil 3.3) [3].

Karadeniz kıyıları çok çeşitli bitki örtüsü ile bunların oluşturduğu doğal peyzaj özelliklerine sahiptir. Yüksek dağların doruklarında krater gölleri, yaylaları, mağaraları, fauna ve flora zenginliği, tarihi kilise, kale, çeşme, cami, ve kemer köprüleri, geleneksel mimarisi ve festivalleri ile çeşitli turizm değerlerini içinde barındıran otantik bir turizm potansiyeline sahiptir. Yaylacılık faaliyetleri, sarp dağları ile dağcılık, zirve tırmanışı, kaya ve buzul tırmanışı, yamaç paraşütü, doğa yürüyüşü, dağ bisikleti vb. gibi faaliyetler, nehirleri ile kano, rafting ve sahip olduğu tarihi ve kültürel değerleri ile tarihi eser ziyaretleri, özellikle son yıllarda gelişen ekoturizm faaliyetleridir. Ayrıca; belgesel yapımı, kampçılık, dağcılık ve çevre eğitim kampları, doğa fotoğrafçılığı, yaban hayatı gözlemleri, kuş gözlemciliği gibi turizm aktivitelerinin yanı sıra gastronomik turizm, agro turizm gibi çok sayıda turizm türüne de olanak sağlayan özgün değerlere sahip bir yöredir.

Şekil 3. Doğu Karadeniz Bölgesi, genel görünüm (Orijinal, 2009)

Doğu Karadeniz Bölgesi, 20 adet "turizm merkezi" olmak üzere, 200'den fazla sayıda yaylaya sahiptir. Yaylalar 1500 m. yükseklikten başlayarak yükselen çok zengin doğal peyzaj özellikleri taşıyan ve doğal arberatum niteliğindeki alanlardır. Bölgenin doğusundaki Kaçkar Yaylası ve Turizm Merkezi'nden, batıdaki Çambaşı Yaylası ve Turizm Merkezi'ne kadar olan alanda günübirlik rekreasyonun yanı sıra doğa yürüyüşü, tırmanma, foto safari, bilimsel doğa araştırmaları ve av turizmi ile Ayder'de olduğu gibi termal turizme olanak sağlayan alanlar da bulunmaktadır [7].

T.C. Kültür ve Turizm Bakanlığı tarafından ilan edilen Yayla Turizm Merkezleri kapsamında; Giresun Bektaş Yaylası T.M., Trabzon Akçaabat Karadağ T.M., Trabzon Tonya Armutlu Gümüşhane Kürtün Erikbeli, Artvin Kaçkar T.M., Artvin Kafkasör T.M., Giresun Kümbet Yaylası T.M., Giresun Yavuzkemal Yaylası T.M., Gümüşhane Zigana T.M., Ordu Çambaşı Yaylası T.M., Ordu Akkuş Argın Yaylası T.M., Ordu Aybastı Perşembe Yaylası T.M., Rize Anzer T.M., Trabzon Maçka Şolma T.M., Trabzon Araklı Pazarcık Yaylası T.M., Bayburt Kop Dağı T.M., Rize Çamlıhemşin Ayder Kaplıcası T.M., Ordu Mesudiye Keyfalan Yaylası T.M., Ordu Mesudiye Yeşilce Topçam Yaylası T.M., Trabzon Araklı Yeşilyurt Yılantaş Yaylası yer almaktadır [11].

SONUÇ VE ÖNERİLER

İkizdere İlçesi'nin Anzer Yaylası ile Çamlıhemşin İlçesi'nin Pokut Yaylası yamaç paraşütü yapılabilecek doğal yapıya sahiptir. Rize'nin birçok yaylasında bu potansiyel mevcut olmasına rağmen, en uygun yer Ballıköy (Anzer) Yaylası'dır. Yörede yamaç paraşütü için uygun bir diğer alan da Çamlıhemşin-Pokut-Hazindağ hattıdır. Artvin İl'i Kaçkar Dağları, Bilbilan Yaylası ve Sahara Yaylası ile Bayburt İl'i Çoruh Vadisi ve Kop Dağı ise atlı doğa yürüyüşü yapılabilecek alanlardır. Dağcılık, zirve tırmanışı, kış sporları gibi turizm aktivitelerine olanak sağlayan, Rize ve Hopa arasında yer alan, yıl boyunca gözlenebilen keskin buzulları, gölleri, yoğun yeşil dokuya sahip ormanları, su kaynakları, flora ve fauna çeşitliliği ve doğal peyzaj değerleri (Kaçkar Sıradağları, Altıparmak Tepesi, Kavran Tepesi, Verçenik Tepesi) ile Doğu Karadeniz Bölgesi'nin bu alt yöreleri ekoturizme kaynak oluşturmaktadır. Yanı sıra Bayburt Ovası'nın etrafında yörenin doğu kesimindeki dağlık alanlar ve ovanın kuzeyinde ve güneyinde bulunan yüksek sıradağlar da benzer amaçlarla kullanılabilecek alanlardır. Giresun'a 60 km. uzaklıkta olan Karagöl Dağları; Dereli İlçesinin güneybatısında, Giresun, Ordu ve Sivas illerinin birleşme noktasına yakın ve Giresun'un en yüksek ikinci dağı konumundadır. Doğa yürüyüşü için son derece elverişli olan bölgede çok çeşitli parkurlar bulunmaktadır. Ayrıca Anastos Yaylasının Arda Mevkii ile Bektaş Yaylası Yürücek Tepesi gibi bölgeler de dağ turizmi için elverişlidir. Giresun İli Görele İlçesinin sahile 40 km. uzaklıktaki en büyük dağı olan Aladağ'ın en yüksek tepesi Alimeydan (Sis) Dağı'dır. Ağaç yetiştirme sınırı üzerinde çayırlar ve kır çiçekleri ile kaplı, çok geniş bir alana yayılmış küçük yaylalar topluluğundan meydana gelmiştir. Trabzon ve Giresun illeri sınır bölgesinde yer alan bu yörede yaz aylarında bile kar bulunabilmektedir. Oldukça engebeli bir arazi üzerinde yer alan Gümüşhane'nin kuzeyini Zigana Dağları ile Trabzon Dağları'nın güney kısımları oluşturmaktadır. Kuzey yönünde ise il Karadeniz Dağları ve Soğanlı Dağları ile çevrelenmektedir. Bunlardan başka farklı yükseltilerde değişen önemli tepeler ve dağlar da kentin topografik yapısını belirlemektedir. Doğu Karadeniz Dağları dahilinde olan Gavur Dağı ise Pleistosen Buzullaşmasına uğraması ile Türkiye için ender rastlanan önemli alanlardan biri olma özelliğini taşımaktadır. Ayrıca Artvin şehir merkezine 17 km. uzaklıkta bulunan Atabarı Kayak Merkezi de kış sporları için uygundur. Dünyanın en heyecanlı doğa sporlarından biri olarak gösterilen heliski, yakın zamana kadar İsviçre'nin Alplerinde, Himalayalar'da ve Kanada dağlarında yapılırken 2004 yılında Türkiye'de ilk defa Kaçkar Dağları'nda yapılmıştır. Rize İl'inin Çamlıhemşin İlçesi'ne bağlı Ayder Yaylası'nda konaklayan kayakçılar, özel eğitimli yabancı pilotların kontrolündeki helikopterle Kaçkar Dağları'nın sarp tepelerine çıkarılmakta ve zirvelerden dağların eteklerine doğru serbest stilde iniş gerçekleştirmektedirler. Kano, rafting, nehir kayağı ve olta balıkçılığı gibi turizm faaliyetlerine olanak sağlayan alanların başında; Mescit Dağları'ndan doğarak Gürcistan sınırları içerisinde Karadeniz'e dökülen Çoruh Nehri gelmektedir. Bayburt'tan başlayıp İspir ve Yusufeli'ni takip ederek Artvin'e kadar uzanan nehirde bugün 4 farklı etapta rafting yapılmaktadır. Farklı zorluk derecelerinde gerçekleştirilen rafting aktivitelerine olanak tanıması nedeniyle profesyonel sporcuların tercih ettiği bir alan olup, 1993 yılında 4. Dünya Akarsu Şampiyonası Çoruh Nehri'nde yapılmıştır. Rize İl'i Ardeşen İlçesi'ne yaklaşık 2 km. uzaklıkta bulunan Fırtına Deresi de akarsu turizmi (kano-rafting) açısından uygundur. Fırtına Deresi, debisi en yüksek ve hızla akan bir akarsu olma özelliği nedeni ile sporcular tarafından tercih edilmektedir. Fırtına Deresi dışında yörede rafting yapılan diğer akarsular ise, Taşlıdere ve İkizdere (İyidere)'dir. Bu akarsularda ulusal rafting gösterileri ve 2004 yılı ulusal rafting şampiyonası gerçekleştirilmiştir. Ayrıca Artvin İl'i genelinde yer alan akarsu ve göllerden özellikle Barhal Çayı'nda, Hatila Deresi'nde, Arhavi Ortacalar Deresi'nde, Borçka Camili - Maçahel Deresi'nde ve Karagöl olarak adlandırılan göllerde sportif olta balıkçılığı yapılmaktadır (Şekil 4.1).

Şekil 4. Doğu Karadeniz Bölgesi, alternatif turizm alanları (Orijinal, 2009)

Zengin flora ve faunaya sahip Çoruh Nehri Vadisi, aynı zamanda kuşların göç yolu üzerinde bulunmaktadır. Nehrin çevresindeki bazı kayalıklarda nesli tükenmekte olan kızıl akbaba türü koloniler halinde yaşamaktadır. Hopa, Murgul, Borçka ve Artvin'in yüksek tepeleri, göçmen kuşlarının geçit yolları üzerinde bulunması nedeniyle kuş gözlemciliği gibi olanaklar sunmaktadır. Ayrıca kırsal kesimler zengin flora ve faunası ile kelebekler için habitat oluşturmaktadır. Doğu Karadeniz Dağları'nda ise önemli kuş alanları bulunmakta ve bu alanlar Türkiye'de Avrasya yüksek dağlık (alpin) biyomunu temsil etmesi nedeniyle önemli kuş alanları statüsü kazanan tek alandır. Ordu İl'i Perşembe İlçesi'nin en önemli tarihi değerlerinden biri olan Hoynat Adası ise, martı ve karabatak kuşlarının yaşadığı önemli yerlerden biri olup tepeli karabatakların Türkiye'de yuva yaptığı tek yer olma özelliğine de sahiptir. Kaçkar Dağları çok çeşitli kuş ve kelebek türü için habitat olma özelliğine sahiptir. Ziyaretçiler, özellikle dağ horozunu yaşam alanında gözlemlemek için Rize'ye gelmektedir. Ayrıca çok sayıda yırtıcı kuş, yaz aylarında, doğudan Rize'ye gelerek güneye, daha sonra ise, aynı güzergahı kullanarak Kafkas Dağları'na göç etmektedir. Bu göç yolu, yırtıcı kuşların Türkiye'de kullandıkları önemli göç yolarından biridir ve kuş gözlemciliği için eşsiz bir parkurdur. Karadeniz'in tek adası olan Giresun Adası ise kıyıdan bir mil açıkta yer almaktadır. Adada çok sayıda doğal otsu ve odunsu bitki türleri bulunmaktadır. Karadeniz'de karabatak ve martıların doğal olarak ürediği ada aynı zamanda göçmen kuşların uğrak ve dinlenme yeridir. Mitolojik çağlara ait birçok kalıntıların bulunduğu ada aynı zamanda ikinci derece sit alanıdır.

Artvin İl'i sahil şeridinde bulunan plajlarda, orman içi dinlenme yerlerinde, milli parklarda kamp ve karavan turizmi için uygun yerler mevcut olup bunların başında; Kemalpaşa Plajı ve çevresi, Kafkasör Orman İçi Dinlenme Yeri, Borçka Karagöl, Şavşat Karagöl, Hatila Vadisi, Sahara, Yusufeli Kaçkar Turizm Merkezi ve Yusufeli Çevreli Köyü Rafting Kamp Merkezi yer almaktadır. Ayrıca Yusufeli İlçesi Çevreli Köyü'nde rafting kamp alanı da bulunmaktadır. Ordu İl'i Gölköy İlçe merkezine 17 km. uzaklıkta bulunan Ulugöl kamp yapmaya uygun bir krater gölüdür. Rize yaylaları ise, temiz hava ve güzel manzaraları nedeni ile kampçıların sıklıkla tercih ettikleri yerlerdir. Kaçkar Dağları Milli Parkı'nda kamp ve karavan turizmi için önemli olanaklar bulunmaktadır. Ayrıca Bayburt İl'i Kop Dağı Kayak Merkezi de kamp ve karavan turizmi için uygundur.

Eşsiz doğal güzellikleri ile Artvin, jeep safari aktiviteleri için uygun alan ve parkurlara sahiptir. Rize İli'nin güneyinde yer alan ve dağ yolları ile birbirine bağlanan yaylalar ise macera turizmi için uygun ortamlardır. Yerli ve yabancı ziyaretçiler, rehber eşliğinde Trabzon ya da Bayburt illeri üzerinden jeeplerle gelip, Anzer Vadisi yoluyla İkizdere'ye buradan Çağrankaya Yaylası yolunu kullanarak Çamlıhemşin'e, son olarak ise Ayder Yaylası ve Kavron Yaylası'na ulaşabilmektedirler.

Çok sayıda mağara bulunan Doğu Karadeniz Bölgesi'nin turizm açısından en önemli mağarası Gümüşhane İli'nde bulunan Karaca Mağarası'dır. İl'de ayrıca Akçakale Mağarası, Arılı Mağarası, İkisu Mağarası, Ardıçlı Mağarası, Üçbacalı Mağara, ve Altındaş Mağarası bulunmaktadır. Bunların dışında Bayburt İli'nde Çimağıl Mağarası ile Helva Köyü Buz Mağarası ve Trabzon İli'nde ise Çalköy Mağarası yer almaktadır.

Rize İli'nde Bakanlar Kurulu kararı ile turizm merkezi olarak ilan edilen yerler arasında; Çamlıhemşin - Ayder Kültür Turizm Koruma ve Gelişim Bölgesi, İkizdere - Anzer Kültür Turizm Koruma ve Gelişim Bölgesi, Çayeli - Kuspa Turizm Merkezi ve İkizdere – Ovit Dağı Kış Turizm Merkezi yer almaktadır ve bu merkezler tarihi, doğal ve sosyo-kültürel turizm değerlerine sahip olup çevre duyarlı alternatif turizm aktivitelerine olanak sağlayacak alanlar olarak değerlendirilmelidir.

Doğu Karadeniz Bölgesi'nde özellikle ekoturizm açısından önem taşıyan korunan alanlar kapsamında ise; Artvin İli'nde Hatıla Vadisi Milli Parkı, Karagöl-Sahara Milli Parkı, Borçka-Karagöl Tabiat Parkı, Çamburnu Tabiatı Koruma Alanı, Camili-Efeler Tabiatı Koruma Alanı, Camili-Gorgit Tabiatı Koruma Alanı, Kamilet Doğu Kayını Tabiat Anıtı, Melodere Doğu Ladini Tabiat Anıtı, Gümüşhane İli'nde Artabel Gölleri Tabiat Parkı, Örümcek Ormanı Tabiatı Koruma Alanı, Kirani Evliya Ardıcı Tabiat Anıtı, Ali Ağanın Kavağı Tabiat Anıtı, Örümcek Ormanı Ladini Tabiat Anıtı, Örümcek Ormanı Göknarı Tabiat Anıtı ile Rize İli'nde Kaçkar Dağları Milli Parkı, Trabzon İli'nde ise Altındere Vadisi Milli Parkı ve Uzungöl Tabiat Parkı bulunmaktadır. Doğu Karadeniz Bölgesi'nin sahip olduğu bu özgün değerlerin korunması, geliştirilmesi ve sürdürülebilirliliklerinin sağlanarak gelecek nesillere aktarılması amacıyla ulusal ve uluslararası düzeyde bazı çalışmalar yapılmaktadır.

Doğu Karadeniz Bölgesi'nin planlı olarak kalkınması ve gelişiminin sağlanmasında önemli bir işlevi olan T.C. Doğu Karadeniz İlleri Hizmet ve Kalkınma Birliği; Doğu Karadeniz DOKAP Bölgesi'nde kirlenmeye yol açan unsurları önleyici önlemler almak, tarihi ve doğal çevreyi, su kaynaklarını, orman varlığını korumak ve geliştirmek, haberleşme, ulaşım, eğitim ve iskan, turizm ve kültür şartlarını iyileştirici her türlü genel ve özel projeler yaptırmak uygulamak ve uygulatmak amacıyla, Bakanlar Kurulu'nun 15.12.2006 tarih ve 2006/11457 sayılı kararı ile kurulmuştur. Birliğin amacı; bölgede kamu, özel ve sivil toplum kuruluşları arasındaki işbirliğini geliştirmek, çevre kaynaklarının etkin kullanımını sağlamak ve ulusal kalkınma planı ve programlarda öngörülen ilke ve politikalar ile uyumlu olarak, uluslararası kurumlarla işbirliği yaparak bölgesel gelişmeyi hızlandırmak, sürdürülebilirliğini sağlamak ve bölge içi gelişmişlik farklarını azaltmaktır.

Doğu Karadeniz, doğa koruma açısından Dünya'nın en önemli bölgelerinden biri olan Kafkasya'da yer almaktadır. Karadeniz ile Hazar Denizi arasında yer alan ve Azerbaycan, Ermenistan, Gürcistan topraklarının tamamı ile Rusya, İran ve Türkiye topraklarının bir bölümünü içeren Kafkasya Ekolojik Bölgesi biyolojik çeşitlilik açısından dünyanın en zengin yerlerinden biri olarak kabul edilmektedir. Dünya Doğal Yaşamı Koruma Vakfı (WWF - World Wildlife Fund), Tiflis'te yerleşik Kafkasya Program Ofisi aracılığı ile, bölgenin sahip olduğu biyolojik çeşitliliğin korunması için bölge ülkelerinden ilgi gruplarının temsilcileri ve ulusal uzmanların katılımı ile eylem odaklı, kapsamlı bir Ekolojik Bölge Koruma Planının (EBKP) hazırlanmasına yardımcı olmaktadır. Kritik Ekosistemler Ortaklık Fonu (CEPF) Destek Programı'nın Türkiye'deki koordinasyonu WWF-Türkiye tarafından yürütülmüştür. Kafkasya Ekolojik Bölgesi'nde Doğa Koruma İttifakının Güçlendirilmesi Programı çerçevesinde Türkiye'de CEPF tarafından desteklenen ve sivil toplum kuruluşları tarafından yürütülen altı proje tamamlanmıştır. Bu projeler; çocukların turizm eğitimi, doğal koruma alanlarının değerlendirilmesi, biyolojik çeşitliliğin sürdürülebilirliği, dağ ve orman ekosistemlerinin korunması ve havza yönetimine ilişkin projeler olup yörenin kalkınması ve sürdürülebilirliğinin sağlanmasına yönelik çalışmalardır.

Çevresel Destek Sistemleri Projesi ise; Avrupa Komisyonu'nun 7. Çerçeve Programı'nca desteklenen bir uluslararası araştırma projesi olup amacı, biyoçeşitlilik ve onunla ilişkili yerel düzeydeki çevresel verileri planlama ve alan kullanım kararlarına entegre etmektir. Biyolojik çeşitlilik ve ekosistem hizmetlerinin devamını sağlamak ve onu geri kazanmak için yerel halkı bu tür verileri derlemeye teşvik etmek de proje kapsamındadır. AB üye ülkelerden 14 bilim ve araştırma kuruluşu ile WWF-Türkiye ortaklığında yürütülen projenin Türkiye'deki pilot alanı Fırtına Vadisi'dir. Türkiye'de bulunan 26 su havzasından biri olan Doğu Karadeniz Havzası; Melet, Pazar, Harşit çayları ile İkizdere, Fırtına gibi Karadeniz'e akan akarsuları ve alt havzalarını içermektedir. Bitki, kuş, memeli, sürüngen türleri ile Fırtına Havzası, Türkiye'nin önemli bitki ve kuş alanları arasında yer almaktadır. Aynı zamanda, Türkiye ormanlarının 9 "sıcak nokta"sından biridir. Taş ve kum ocakları, hidroelektrik santraller, plansız altyapı çalışmaları, kontrolsüz turizm, yasadışı avlanma, sel ve toprak kayması gibi nedenlerle alan zarar görmektedir. Bu nedenle koruma-kullanım dengesini gözeten, bütüncül, katılımcı, yenilikçi bir planlama ve uygulama yaklaşımının geliştirilmesi gerekmektedir.

2004 yılında başlamış olan "Karadeniz Kirlilik İzleme Projesi" ise; İğneada'dan Hopa'ya kadar Karadeniz kıyı şeridi boyunca 69 noktada yürütülen izleme çalışmalarını devam etmektedir. 21 Nisan 1992 tarihinde Bükreş'te imzalanan ve 15 Ocak 1994 tarihli Resmi Gazete'de yayımlanarak yürürlüğe giren "Karadeniz'in Kirliliğe Karşı Korunması Sözleşmesi"nin amacı; Karadeniz'in kirliliğe karşı korunması için, kıyısı olan ülkeler arasındaki işbirliğini geliştirmektir. Taraf olan ülkeler Bulgaristan, Gürcistan, Romanya, Rusya Federasyonu, Türkiye ve Ukrayna'dır. Ayrıca T.C. Kültür ve Turizm Bakanlığı tarafından "Türkiye Turizm Stratejisi 2023" kapsamında "alternatif turizm türlerinden öncelikli olarak sağlık turizmi ve termal turizm, kış turizmi, golf turizmi, deniz turizmi, **ekoturizm** ve yayla turizmi, kongre ve fuar turizminin geliştirilmesi" strateji olarak belirlenmiş, ekoturizm açısından 2023 yılı hedefleri ise; ekoturizm ve yayla turizminin geliştirilmesi, ana tur güzergahlarının belirlenmesi, ara ve alt istasyon noktalarının saptanması, kamu, özel sektör ve sivil toplum kuruluşları işbirliği ile agroturizm, macera turizmi, mağara turizmi, spor turizmi faaliyetlerinin gerçekleştirilmesi ve bu doğrultuda turizm planlama çalışmalarının yöndendirilmesi olarak belirlenmiştir.

İyi planlanmış bir ekoturizm strateji ile gerçekleştirilen ve amacına uygun biçimde yapılan ekoturizm, ülkelerin özellikle hassas ekosistemlerinin korunması ve sürdürülebilirliklerinin sağlanmasında önemli bir etkendir. Ekoturizmin amacı bir alanın doğal ve kültürel özelliklerinin korunurken, aynı zamanda yerel topluluklar için sosyo-ekonomik faydaların da sağlanmasıdır. Ancak bugün daha fazla kar elde etmek amacı ile doğayı tahrip eden, zarar veren yatırımlar gerçekleştirilmektedir. Ekoturizm adı altında yapılan, ancak ekoturizm anlayışına uygun olmayan bu faaliyetler doğal ekosistemi tehdit eden boyutlara ulaşmıştır. Bu nedenle ekoturizm amacıyla kurulan tesislerin ve bu tesislerde gerçekleştirilen aktivitelerin sosyal, ekonomik, kültürel ve ekolojik çevre üzerindeki etkilerinin düzenli olarak izlenmesi ve değerlendirilmesi gerekmektedir. Ekonomik, çevresel ve sosyal faydaları en üst düzeye çıkaran, olumsuz etkileri en aza indiren bir düzenleme ve planlama yaklaşımının benimsenmesi gerekmektedir. Ekoturizm planlaması; ülkesel, bölgesel, yerel, ekolojik ve biyolojik envanterlerin hazırlanması, biyotop haritalarının oluşturulması, hassas alanların tespiti ve bunlara bağlı arazi kullanım kararlarının oluşturulmasından sonra, planlamaya halkın ve sivil toplum örgütlerinin de katılımı sağlanarak, yerel halkın eğitimi ve çevre koruma bilincinin geliştirilmesi ile mümkün olabilecek geniş tabanlı ve uzun vadeli bir turizm hareketidir.

Doğa temelli turizm talebini etkileyen en önemli unsurlardan biri çevre bilincinin artmasıdır. Çevre konusundaki bilincin geliştirilmesi, turistin ve ekoturizm eyleminde yer alacak tüm aktörlerin eğitimi, ekoturizm için vazgeçilemez bir ön koşuldur. Çünkü turistlerin bilgilendirilme yoluyla bilinçlerinin arttırılması, ekoturizmin uygulanabilirliğini arttırıcı bir faktör olacaktır. Bu nedenle ekoturizmde ziyaretçilere bölgenin eko-sistemi, yerel kültürler ve sürdürülebilirlik konularında yapılan bilgilendirmeler büyük önem taşımaktadır. Yerel halkın bölgelerinde gelişen ekoturizmin yol açacağı etkiler konusunda önceden bilgilendirilip bu konuda eğitilmeleri ve ekoturizmden en fazla etkilenecek kesim olan yerel halkın bölgelerinde turizm gelişimini kabul etmeleri gerekmektedir. Ekoturizm ve çevre bilincinin geliştirilmesi amacıyla, okul öncesi eğitimden başlayarak tüm eğitim programlarında ekoturizm ve çevreyle ilgili konulara ağırlık verilmesi gerekmektedir. Ayrıca yaygın eğitime yönelik olarak radyo ve televizyon programlarında da ekoturizm ve çevrenin önemi ile çevre bilincinin geliştirilmesine yönelik programlara yer verilmelidir.

Ekoturizmin doğal ve kültürel mirasın korunması ve kırsal kalkınmadaki rolü göz önünde bulundurularak ekoturizm uygulamaları için ulusal strateji ve özel programlar hazırlanmalı, ekoturizmin sürdürebilirliğinin sağlanması için gereken planlama, yönetim ve izleme etkinliklerine ilişkin yöntemler saptanmalıdır. Çünkü bilinçsiz ve plansız yapılan turizm yatırımları çevre değerlerinin bozulmasına ve yerel kültürün zarar görmesine neden olmaktadır. Bu olumsuzlukları önlemek için yörelerin ekoturizm potansiyellerinin doğru bir şekilde saptanması ve doğayla bütünlük sağlayan, çevreyle barışık yatırımların gerçekleştirilmesi gerekmektedir. Turizmin temel potansiyelini oluşturan bu değerlerin sürdürülebilirliğinin sağlanabilmesi için ilgili disiplinler tarafından alanın turizm açısından kapsamlı bir envanterinin çıkarılması ve turizm yörelerinde yapılacak planlama çalışmalarının her aşamasına yerel halkın katılımının sağlanması gerekmektedir. Turist, yerel halk, ilgili kurum ve kuruluşlar ile sivil toplum örgütlerinin (meslek örgütleri, vakıflar, dernekler, vb.) birlikte çalışması turizmde sürdürülebilirliğin sağlanması açısından büyük önem taşımaktadır.

Amaç ve ilkelerine uygun gerçekleştirildiği takdirde, doğal, kültürel ve tarihi değerleri koruyan ve yerel halkın sosyo-ekonomik gelişimi için kaynak yaratabilen ekoturizmin önemi büyüktür. Ancak, özellikle korunan alanlarda oluşan aşırı yoğunluk, ekosistemlerin büyük zarar görmesine neden olmaktadır. Bu nedenle çevrenin korunması ve sürdürülebilir turizmin temel prensiplerinden biri olan taşıma kapasitesi dikkate alınmalı ve kaynakların sürdürülebilir kullanımını tehlikeye atacak taşıma kapasitelerini aşan kullanımlara izin verilmemelidir. Aksi takdirde sahip olduğu kaynak değerleri nedeni ile koruma altına alınmış olan alanlar ekonomik katkı sağlanması uğruna büyük zararlara uğrayacaktır ki, özellikle gelişmekte olan ülkelerde bunun belirgin örnekleri izlenmektedir. Ziyaretçi aktiviteleri nedeniyle vejetasyon, toprak, su ve yaban hayatı etkilenmekte, toprak üzerine basılması ve araçlar nedeniyle çevre vejetasyon zarar görmekte ve dolayısı ile alanın özgün niteliği değişebilmektedir.

Özellikle yanlış arazi kullanımı ve sürdürülebilir olmayan uygulamalar nedeniyle Doğu Karadeniz Bölgesi'ndeki doğal, tarihi ve sosyo-kültürel değerler zarar görmekte ve bu doğal kaynaklar plansızca kullanılarak yok edilmektedir. Bölge için en önemli sorunlardan biri ekoturizm adı altında yapılan ve sürdürülebilir olmayan plansız ve kontrolsüz gelişen turizm ile buna bağlı olarak gelişen altyapı ve çarpık yapılaşmadır. Özellikle yörede bulunan yaylaların turizme açılması, turizm talebinin ve dolayısı ile geleneksel mimari anlayışından uzak konut sayısının artmasına neden olmuştur. Bu tür alanlarda doğal yapıların korunması, yapılacak her türlü yapılaşmanın geleneksel yapı tekniğini dikkate alan bütüncül bir planlama yaklaşımı ile değerlendirilmesi gerekmektedir. Ayrıca Anadolu geleneksel kültürünün korunması ve geliştirilerek değerlendirilmesi amacıyla özgün değerlere sahip olan yörede pansiyonculuk geliştirilmeli, bunun için yeterli mali ve teknik destek sağlanmalı ve yerel halk bu konuda bilgilendirilmelidir. Yeni yapılacak turistik yapıların planlama çalışmaları öncesinde ise anket vb. yöntemlerle yerel halkın görüşleri alınmalı, katılım ve desteği sağlanmalıdır.

Yayla kültürü, tarihi eserleri, doğal ve kültürel peyzaj özellikleri, zengin biyoçeşitlilik, flora ve faunası ile alternatif turizm olanakları açısından önemli turizm çekim potansiyeline sahip olan Doğu Karadeniz Bölgesi'nin yöresel değerlerinin korunması, çeşitli tanıtımlar, festivaller ve konferanslar ile yöre özellik ve değerlerinin daha tanımlı hale getirilmesi, yöre halkının sahip olduğu değerlerin korunması konusunda eğitilmesi, yerel idare ve ilgili kuruluşlar ile işbirliği içerisinde altyapı ve üst yapı olanaklarının daha iyi duruma getirilmesi gerekmektedir. Ayrıca ekoturizm aktivitesinin gerçekleştirildiği alanlarda ziyaretçilerin bilgilendirilmesi amacıyla ekosistem tanıtıcı (bitki ve hayvan türleri vb.) bilgilendirme levhaları uygun noktalarda konumlandırılmalı ve çevre kaynaklarının korunma ve kullanımında gerekli duyarlılık ve bilinç oluşturulmalıdır.

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ORGANİK ÇAY ÜRETİMİNİN GELİŞTİRİLMESİ İÇİN BİYOLOJİK GÜBRE OLARAK KULLANILABİLECEK BİTKİ GELİŞMESİNİ TEŞVİK EDİCİ BAKTERİ ARAŞTIRMASI*

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ÖZET

Organik tarım, ürün artışını sağlamak için kullanılan yoğun sentetik kimyasalların toprak kalitesine olan olumsuz etkisini azaltabilmek ve sürdürülebilirliği sağlamak için önemli bir araçtır ve bu yüzden organik tarımda ve özellikle çay yetiştiriciliğinde, biyogübre olarak biyoajanların kullanımı önemli bir konudur. Mikroorganizmalar, bitkilerin besin elementi dönüşümlerini gerçekleştirmede ve ihtiyaçlarını olabildiğince gidermede tarımda önemlidirler. Bu yüzden sürdürülebilir tarımda bu organizmaların biyogübre olarak kullanımları önceliklidir. Spesifik rhizobakterilerin eldesini ve geliştirilmesini amaçlayan bu çalışma, çay yetiştirilen topraklardan biyogübre olarak kullanılabilecek potansiyele sahip bakterileri izole etmeye yöneliktir. Bu araştırma, Rize ve Trabzon illerindeki çay rizosferinden biyogübre olarak kullanılabilecek PGPR lerin izolasyonu, teşhisi amacıyla ve bu bakterilerin çayda, bitki gelişimi ile azot fiksasyonu ve fosfat çözme kabiliyetini değerlendirmek amaçlarına yönelik olarak yürütülmüştür. Çalışmada, N fiske eden bakterileri izole etmek için, N içermeyen Malate-sucrose ortamı kullanılmıştır Bakteri izolatlrının Fosfat çözme aktivitesi NBRIP-BPB ile belirlenmiştir. İzolatlar, MIDI ve BIOLOG sistemleri kullanılarak hücrelerindeki yağ asit metil esterleri (FAMEs) nalizleri ile tanımlanmışlardır. Seçilen 25 izolat, saksılarda ve tarla koşullarında doğal ekolojik şartlar altında verim ve gelişimi artırma potansiyelleri yönünden test edilmişlerdir. Denemede N ve NP gübreleri içeren 4 farklı uygulama ile birlikte kontrol uygulaması da birlikte test edilmiştir. Hayrat ve Fener-3 çay klonlarında; *Bacillus simplex* 6/4, *Bacillus subtilis* 52/1, *Alcaligenes faecalis* 47/11, *Staphylococcus simulans* 36/1, *Brevibacillus choshinensis* 2/5, *Brevibacillus centrosporus* 66/4, *Pantoea agglomerans* 5/8 and *Paenibacillus validus* 22/1 izolatları, bütün bitkilerde hem gelişimi hem de yaprak verimini artırmıştır. Bu çalışmada test edilen bakteriyel izolatların, sürdürülebilir ve organik çay yetiştiriciliğinde kullanılabilme potansiyeline sahip oluğu belirlenmiştir.

Anahtar Kelimeler: Bitki gelişimini teşvik edici rizobakteri, izolasyon, azot fiksasyonu, fosfat çözme, çay, *Camellia sinensis*

**** Bu çalışma TUBİTAK 107 O 360 nolu Proje ile desteklenmiştir.***

RESEARCH OF PLANT GROWTH PROMOTING RHIZOBACTERIA AS BIOFERTILIZERS TO ENHANCE ORGANIC TEA PRODUCTION*

ABSTRACT

Organic farming is becoming a major tool for sustaining the soil quality degraded by intensive use of synthetic chemicals for increasing crop production and therefore, use of bioagents as biofertilizers is an integral part of organic farming especially in tea cultivation. Microorganisms are important in agriculture in order to promote the circulation of plant nutrients and reduce the need for chemical fertilizers as much as possible. Therefore, use as biofertilizers for sustainable agriculture is important. The research aims to develop an improved understanding of specific rhizobacteria, will isolate from tea rhizosphere soils and identify and study larger scale demonstrations, with a good potential as plant growth promoting “biofertilisers”. This study was conducted to isolate and identify plant growth promoting bacteria (PGPR) as biofertilizers from the rhizosphere of tea (*Camellia sinensis* L.) grown in Rize and Trabzon Province and to evaluate their potential use for nitrogen fixation, phosphate solubilization and improving plant growth of tea. A nitrogen-free solid malate-sucrose medium was used to isolate N_2-fixing bacteria. Phosphate solubilization activity of the bacterial isolates was detected on NBRIP-BPB. The isolates were identified based on whole-cell fatty acid methyl ester (FAMEs) analysis using the MIDI system and BIOLOG assays. The selected 25 strains were tested for their growth and yield increasing potential under natural soil conditions by conducting pot and field experiments. The experiment also included applications of three different mineral nitrogen dozes (N) and NP-fertilizer as well as a control treatment without inoculation and fertilizer application. In particular, newly N_2-fixing and P-solobilizing bacterial strain *Bacillus simplex* 6/4, *Bacillus subtilis* 52/1, *Alcaligenes faecalis* 47/11, *Staphylococcus simulans* 36/1, *Brevibacillus choshinensis* 2/5, *Brevibacillus centrosporus* 66/4, *Pantoea agglomerans* 5/8 and *Paenibacillus validus* 22/1 strains stimulated overall plant growth and leaf yield of Hayrat and Fener 3 tea clones. The bacterial strain tested in this study has a potential

to be used as a bio-fertilizer in sustainable and organic tea production.

Keywords : Plant growth promoting rhizobacteria, isolation, nitrogen fixation, phosphate solubilization, tea, *Camellia sinensis*

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GİRİŞ

İnsanoğlunun ekosistemlere yaptığı aşırı baskılar ve sömürüler, sonunda insanlığın temel ekolojik sorunlarını ortaya çıkarmıştır. Bunlar yalnız insanların değil, bütün canlıların yaşam koşullarını sınırlandırmış, yaşam dünyalarının geleceğini tehlikeye atmıştır. Bu tehlikenin boyutları toprak, su ve hava gibi doğal yaşam kaynaklarının eksikliğinin duyulmaya başlamasıyla belirgin hale gelmiştir [8]. Tüm dünyada, bitkisel üretimde ve zararlıların kontrolünde aşırı düzeyde ve gelişigüzel kimyasal ve pestisit kullanımı, toprak sağlığının bozulmasına ve çevre kirliliğine sebep olmaktadır. Bu durum tarımsal üretimde sürdürülebilirliğin bozulmasına ve gerekli olan sağlıklı ve kaliteli gıdanın temininde problemlere yol açmaktadır [3], [29], [6] . Kimyasal gübrelerin kullanımı şüphesiz, tarımsal üretimde önemli verim artışlarına sebep olmuştur. Fakat bitkisel üretimde kullanılması gereken kimyasal gübrenin en yüksek düzeyine ulaşılmış olması, bunun üzerindeki miktarlarda artık verim artışının sağlanamayacak olması da önemli bir problemdir. Kısacası kimyasal gübrelerin kullanımı ile tarımdaki hızlı üretim artışında önemli azalmalar gözlenmekte, artık bitkisel üretimde sürdürülebilirlik için alternatif uygulamalar ön plana çıkmaktadır [29]. Bitki gelişiminde temel elementlerden olan N ve P, devamlı olarak kimyasal yollarla toprağa ilave edildikçe, günümüzde artan çevresel problemlere önemli katkılar yapmaktadır. Özellikle Azotlu gübrelerin çevre üzerine olan olumsuz etkilerini (su kaynaklarının nitrit ve nitratlarca kirlenmesi gibi) günümüzde daha belirgin olarak görmekteyiz. Son yıllarda çevreye olan olumsuz etkileri ve üretim maliyetlerindeki artış nedeniyle, alternatif gübre materyalleri ile ilgili çalışmalarda artış vardır. Bu alternatif uygulamalardan birisi de bitki büyüme ve gelişimini teşvik edici bakterilerin (PGPR) bitkisel üretimde kullanılmalarıdır. Biyolojik azot fikseri ve fosfat çözücü *Rhizobium, Azotobacter, Bacillus, Azospirillum Pseudomonas, Enterobacter, Klebsiella* ve *Staphylococcus* gibi bakterilerin biyolojik gübre olarak kullanımı, fasülye [36] [31, şekerpancarı [34], [4], [5], [35], buğday [2], [16], [37], [13], [28], [9], [30], domates, biber ve hıyarda [17], [23], [14], [22], [15], gibi tek yıllık bitkilerin yanısıra dut [32], kayısı [11], ahududu [24], kiraz [12], elma [1] , [19], [27], [18], ve çayda [10] gelişim, verim ve unsurlarını olumlu etkilediği belirlenmiştir. Bu çalışmalarda kullanılan izolatların, farklı çevre koşullarına adaptasyonlarının iyi olması, bitkisel üretimdeki etkinlikleri ve kullanılabilirliklerini de artırmaktadır. Bu nedenle çok farklı ekolojik koşullara adaptasyon yeteneği yüksek, gelişim, verim ve verimle ilgili unsurlara olumlu katkılar sağlayabilen biyolojik gübre olarak kullanılabilecek bakterilerin izole edilmesi en önemli başlangıç noktasını oluşturmaktadır. Bu araştırma, Türkiye'de 1. derecede çay yetiştiriciliği yapılan asidik toprakların taranması ve bakterilerin izole edilerek karakterizasyonu amaçlarına yönelik olarak yürütülmektedir. Çalışma sonucunda organik çay yetiştiriciliğinde ihtiyaç duyulan besin elementlerinin tamamının ya da bir kısmının bu mikroorganizmalarla temin edilmesi amaçlanmaktadır.

MATERYAL VE YÖNTEM

Bakterilerin İzolasyonu ve Tanısı

Bakteri izolasyonu, Rize ve Trabzon yöresinde 54 farklı agroklimatik lokasyonda çay rizosfer topraklarından alınan 214 toprak örneğinde gerçekleştirilmiştir. Araştırma alanı çoğunluğu Rize olmak üzere Doğu Karadeniz bölgesini kapsamaktadır (40°50' ve 41°20' N; 38°49' ve 41°28' E). Toprak örneklerinin pH değeri 3.8 ile 6.1 (ortalama 5.3) arasında değişim göstermiştir. Bitki rizosferinden alınan toprak laboratuarda 10 g toprak steril koşullarda 100 ml su içine erlene alınarak, çalkalanmış (30 da 150 rpm), 1 ml örnek 9 ml steril su ile karıştırılmış, dilüsyondan 0.1 ml (10^5) besin ortamına alınarak, 28 ^oC'de 7 gün inkübasyona bırakılmış, bakteriler saflaştırılmış ve izolatlar MIDI Sistem metotlarına göre FAMEs analizi ve BIOLOG sistemine göre tanılanmıştır. Bakteriler yaklaşık 50 mg canlı hücre TSBA ortamında yetiştirilip hasat edilmiş, 1 ml 1.2M NaOH, %50 metanol ilavesiyle 5 tüp 100^oC'de 30 dakika inkübe edilmiştir. Hızlı soğutmadan sonra 1.25 ml %50 MTBE hekzan ekstraktı Pastör pipetle alınıp, 3 ml 0.3 M NaOH ile yıkanmış, FAMEs ekstraktı gaz kromotoğrafisinde (HP6890, Hewlett Packard, Palo Alto, CA) silika kapillar kolon ile %5 phenylmethyl silikon kullanılarak ayrılmış, parametreler bilgisayar programı ile otomatik olarak belirlenmiştir. Pik tanısı kalibrasyon standartlarına göre yapılmış (Microbial ID 1200-A), her bir bakteriye ait FAME profil TSBA 40 ve MIS datalarına göre saptanmıştır.

Fosfor Çözme ve Azot Fiksasyon Kapasitesinin Belirlenmesi

Bakterilerin fosfat çözücülük aktivitesinin belirlenmesinde NBIRP-BPB sıvı besiyeri kullanılmıştır. Nutrient agarda 24 saat geliştirilen bakterilerden öze ile 1 lup alınarak önce 1 mI steril su içeren eppendorf tüpler içinde vortex yardımıyla süspanse edilmiş ve bu süspansiyondan 190 µI alınarak sıvı besi yerine pipetlenmiştir. Besiyerindeki renk değişimi 15 gün boyunca gözlemlenmiş ve renk açılması baz alınarak streinler pozitif, negatif, kuvvetli pozitif ve zayıf pozitif olarak değerlendirilmiştir. NBIRP-BPB besiyerinin pH değeri 7'ye ayarlanmış olup g/L cinsinden içeriği: 20 g glukoz, 10 g $Ca_3(PO_4)_2$, 5 g $MgCI_2$ $6H_2O$, 0.25 g $MgSO_4$ $7H_2O$, 0.2 g KCl, 0.1 g $(NH_4)_2SO_4$, ve 0.025 g BPB oluşmaktadır. Nutrient agarda 24 saat geliştirilen bakteriler azotsuz sükroz ortamına ekilerek bir hafta boyunca gelişimleri gözlemlenmiş, gelişim gücüne göre pozitif, negatif, kuvvetli pozitif ve zayıf pozitif olarak bakterilerin azot fiksasyon özellikleri değerlendirilmiştir. Azotsuz sükroz vasatının pH değeri 7,2' ye ayarlanmış olup g/L cinsinden içeriği; 10 g sukroz, 5 g L-malik asit, 0,2 g $MgSO_4$ H_2O, 0,01 g $FeCl_3$, 0,1g, NaCl, 0,02 g $CaCl_2$ $2H_2O$, 0,1g K_2HPO_4, 0,4 g KH_2PO_4, 0,002 g Na_2MoO_4 H_2O ve 18 g agardan oluşmaktadır.

DENEMELERİN YÜRÜTÜLMESİ

Sera, Tarla ve Laboratuar Denemeleri ile İnokulasyon Teknikleri

MIS benzerlik indeksi (MIS similarity index) değerleri ve ön değerlendirmelere göre izole edilen bakterilerden, bitki gelişimini teşvik edici özellikler göstermesi beklenen ve öncelikle test edilmesi planlanan bakteri izolatları ile tarla ön denemeleri kurulmuştur. Saksı içinde kurulan denemelerde Hayrat (tek yapraklı köklenmiş çay çelikleri) ve Fener-3 (dört yapraklı çay fidanı) çay klonları kullanılmıştır. Deneme öncesinde, saksılar steril edilmiş, fidanlar gelişme bakımından tamamen üniform olarak titizlikle seçilerek, mümkün olduğunca fidanların aynı boy ve çapta olanları işaretlenmiş ve uygulamalar bu fidanlara tesadüfi olarak dağıtılmıştır. Birinci deneme tek yapraklı, 2. deneme 4 yapraklı (köklenme sonrası 6 aylık), olarak kökleri bakteri süspansiyonu içinde (60 dakika) bekletilmiş ve inokulum kök bölgesine uygulanmıştır.

Deneme I

Bu deneme, Hayrat çay klonunun tek yapraklı köklendirilmiş çelikleriyle saksılarda kurulmuş, 130 günlük (19-20/5/2008-18/9/2008) deneme süreci sonunda fidanlar kesilmeden sadece bitki yüksekliği, gövde çapı ve yaprak sayısı değerlendirilmiştir (Tablo 1). İnokulasyon, köklenmiş tek yapraklı çeliklerin bütünüyle bakteri süspansiyonu içine daldırılması şeklinde gerçekleştirilmiştir. Bu deneme 25 farklı bakteri izolatı, kontrol (gübre ve bakteri uygulanmamış) ve 4 farklı gübre uygulamasına (a: 48 kg/da kompoze gübre (25-8-5), b: 48 kg/da amonyum nitrat (%33), c: 24 kg/da amonyum nitrat, d:12 kg/da amonyum nitrat) kıyaslamalı olarak 4 tekerrürlü ve her bir tekerrürde 3 fidan olacak şekilde kurulmuştur.

Deneme II

İkinci deneme, Fener 3 klonunun dört yapraklı üniform gelişim göstermiş fidanlarıyla saksılarda kurulmuş, 130 günlük (20/5/2008-18/9/2008) deneme sürecinde oluşan dal ve yapraklar eşit yükseklikten kesilerek hasat edilmiş ve gelişim parametreleri değerlendirilmiştir. Bu denemede 25 farklı bakteri izolatı, kontrol (gübre ve bakteri uygulanmamış) ve 4 farklı gübre uygulamasına (a: 48 kg/da kompoze 25-8-5 gübresi, b: 48 kg/da amonyum nitrat %33, c: 24 kg/da amonyum nitrat, d:12 kg/da amonyum nitrat) kıyaslamalı olarak, 3 tekerrürlü ve her bir tekerrürde 3 fidan olacak şekilde kurulmuştur (Tablo 2). İnokulasyon, fidanların kök aksamı bakteri süspansiyonu içine daldırılarak gerçekleştirilmiştir. Bitki yüksekliği, fidan gövde ve sürgün çapı kalınlığı, deneme sürecinde oluşan yaprak sayısı, toplam dal+yaprak ağırlığı, yaş ve kuru yaprak ağırlığı gibi parametreler değerlendirilmiştir.

BULGULAR

Hayrat tipi Türk çay klonunda, fidan yüksekliği bakımından kontrol ve gübre uygulamaları arasında önemli bir farklılık ortaya çıkmazken, *Bacillus simplex* 6/4, *Staphylococcus simulans* 36/1, *Brevibacillus choshinensis* 2/5 ve *Brevibacillus centrosporus* 66/4 bakteri aşılamaları gübre ve kontrole kıyasla fidan yüksekliğini artırmış, diğer bakterilerle mineral gübre ve kontrol arasında önemli bir farklılık görülmemiştir (Tablo 1). Gövde çapı *Brevibacillus choshinensis* 2/5 ve *Brevibacillus centrosporus* 66/4 aşılamasıyla önemli düzeyde artarken, diğer uygulamalar arasında istatistiki bakımdan önemli bir farklılık görülmemiştir. Yaprak sayısı *Brevibacillus choshinensis* 2/5 ve *Staphylococcus simulans* 36/1 aşılamalarıyla kontrole kıyasla önemli düzeyde artarken, diğer uygulamalar arasında önemli bir farklılık ortaya çıkmamıştır. Bakterilerin büyük çoğunluğu özellikle kontrol, ½ ve ¼ azot dozu uygulamalarına kıyasla fidan yüksekliği, çap ve yaprak sayısı değerlerinde artışa neden olmuş ancak araştırmanın ilk yılında bu artışlar istatistiki bakımdan önemli bulunmamıştır. Fener 3 tipi Türk Çay klonunda, aşılanan bakteri ve gübre uygulamalarına bağlı olarak değişmekle birlikte değerlendirilen parametreler bakteri ve gübre uygulamalarıyla artmıştır. Kontrole kıyasla 22 bakteri toplam dal+yaprak ağırlığı ve yaş yaprak ağırlığını, 8 bakteri ise kuru yaprak ağırlığını önemli ölçüde artırmıştır. Toplam 6 izolat dal + yaprak ağırlığını, 7 izolat yaş yaprak ağırlığını ve 4 izolat ise kuru yaprak ağırlığını kompoze (48 kg/da) ve amonyum nitrat (48 kg/da) gübresi uygulamalarıyla aynı miktarda artırmıştır. Bakteriler arasında *Bacillus subtilis* 52/1, *Alcaligenes faecalis* 47/11, *Pantoea agglomerans* 5/8 ve *Paenibacillus validus* 22/1 en etkin izolatlar olmuştur. Özellikle *Bacillus subtilis* 52/1 izolatının Fener 3 klonunda test edilen tüm parametrelerde ve bakterilerin çoğunluğunun yaş çay yaprağı ağırlığında ve toplam dal+ yaprak ağırlığında kontrole kıyasla önemli artış sağlaması önemli bir sonuç olarak ortaya çıkmıştır.

TARTIŞMA

Bu araştırmada test edilen bakterilerin izole edildiği toprakların pH değerleri 3,8 ile 5,4 arasında değişmiştir. İzole edilen azot fikseri ve fosfat çözücü bakterilerin, düşük toprak pH düzeylerine adapte olmaları dolayısıyla asidik koşullarda yetiştirilen çay benzeri türlerde uygun olabileceği söylenebilir. Bazı araştırmalarda asidik topraklarda aktif olabilecek bazı izolatlar geliştirilmiş [25], [26], ancak bu araştırmanın yürütüldüğü bölge ve çay topraklarında benzer çalışmanın olmaması, ortaya konulan orijinal asite tolerans bakterilerin özellikle çay topraklarında ve çay bitkisinde biyolojik gübre formülasyonlarında kullanılabileceğini göstermesi bakımından önemlidir. Bakteri uygulamaları verimin yaprak ağırlığı ile değerlendirildiği çay bitkisinde özellikle dal+yaprak ve yaş yaprak ağırlığında önemli artışlar meydana getirmiştir. Bakteriyel etkinliğin seçilen bakteri türü, çay tipi ve ele alınan bitkisel parametrelere göre değiştiği deneme sonuçlarına göre; uygulamaların beklenenden daha etkin olduğu, test edilen izolatların organik ve sürdürülebilir tarımda kullanılabileceği ve gübre uygulamalarını azaltma bakımından önemli bir potansiyele sahip olabileceği söylenebilir. Bitki gelişmesini teşvik edici bakteriler çay klonlarında gelişmeyi teşvik etmekte ancak bakteriyel etkinlik izolatlara bağlı olarak değişmektedir. Bitki gelişimini teşvik edici bakteri etkileri kompleks bir süreç olup, bakteri tür ve sayısı, bitki-bakteri kombinasyonu, bitki genotipi, gelişme dönemi, hasat tarihi, bitkisel parametreler, toprak tipi, toprak organik madde miktarı ve çevresel koşullara bağlı olarak değişmektedir [35], [7] . Bakteri izolatlarının belli bitki türlerinde etkin olduğu [21], etkinliğin bitki türlerine bağlı olduğu [20] vurgulanmıştır. N_2-fiksasyon ve fosfat çözücü bakteri aşılamasının sağladığı gelişme ve verim artışı dikkate alındığında; mikrobiyal gübrelemenin, yüksek maliyet ve kirliliğe neden olan mineral gübrelemeye alternatif olabileceği söylenebilir. Özellikle fazla azot gereksinimi olan çay bitkisinde mikrobiyolojik gübreleme ile uygun sonuçlar alınabilir. Bu sonuçlar özellikle iyileştirilmiş tarım uygulamalarında test edilen izolatlarla kullanılacak azot gübrelerinin azaltılabilmesi bakımından önemli olabilecektir. Bakteri aşılamalarının uzun dönemde mineral gübrelere göre toprak ve çevreye olumlu etkileri dikkate alınarak benzer araştırmaların yürütülmesi gerekmektedir. Özellikle azot gübrelemesinin bedeli ve çevreye olumsuz etkisi dikkate alındığında, bu araştırmada test edilen bakterilerin tek başına veya birlikte inokulasyonunun sürdürülebilir çevre dostu tarımsal üretim için asidik çay topraklarında kullanılabilecektir. Bakteriyel etkinliğin seçilen bakteri, çay tipi ve ele alınan bitkisel parametrelere göre değiştiği deneme sonuçlarına göre, *Staphylococcus simulans* 36/1, *Brevibacillus choshinensis* 2/5, *Brevibacillus centrosporus* 66/4 ve *Bacillus simplex* 6/4 izolatlarının Hayrat, *Bacillus subtilis* 52/1, *Pantoea agglomerans* 5/8, *Alcaligenes faecalis* 47/11, *Brevibacillus centrosporus*66/4, *Paenibacillus validus* 22/1 ve *Bacillus simplex* 6/4 izolatlarının ise Fener 3 çay klonunda mineral gübre ve kontrole kıyasla ele alınan parametrelerde (özellikle dal+yaprak ve yaş yaprak ağırlığında) istatistikî bakımdan önemli artışlar meydana getirmiştir. Denemeye alınan her iki çay klonu birlikte değerlendirildiğinde çay yetiştiriciliğinde, bakteri uygulamalarının etkin olduğu, test edilen bakteri izolatlarının organik, sürdürülebilir ve iyileştirilmiş tarımda kullanılabileceği ve gübre uygulamalarını azaltma bakımından önemli bir potansiyele sahip olabileceği söylenebilir.

Uygulama	**Bitki yüksekliği (cm)**	**Gövde çapı (cm)**	**Yaprak sayısı (adet/fidan)**
Kontrol (gübre ve bakteri uygulanmamış)	19,0 c	2,16 c-e	7,3 b-d
Gübre Komp. (25-8-5) 48 kg/da	20,3 c	2,30 c-e	9,0 a-d
Gübre AN (%33) 48 kg/da	21,8 bc	2,27 c-e	9,5 a-c
Gübre AN (%33) 24 kg/da	18,5 c	2,31 c-e	8,8 a-d
Gübre AN (%33) 12 kg/da	15,8 c	1,94 e	7,8 a-d
Bacillus simplex 6/4	27,3 ab	2,83 a-c	10,3 a-b
Brevibacillus choshinensis 2/5	29,0 ab	3,31 a	10,5 a
Paenibacillus validus 22/1	16,5 c	2,37 c-e	6,8 cd
Staphylococcus simulans 36/1	28,8 a	2,64 b-d	10,5 a
Brevibacillus centrosporus 66/4	27,0 ab	3,03 ab	10,3 ab
Paenibacillus polymyxa 66/6	19,5 c	2,65 b-d	7,5 a-d
Pseudomonas putida 35/4	19,3 c	2,32 c-e	7,8 a-d
Burkholderia cepacia 65/6	21,3 bc	2,08 d-e	7,8 a-d
Bacillus subtilis 52/1	18,8 c	2,12 d-e	7,8 a-d
Pseudomonas fluorescens 48/1	19,3 c	2,21 c-e	6,8 cd
Rhodococcus erythropolis 4/8	17,0 c	1,89 e	8,3a-d
Pantoea agglomerans 5/8	18,8 c	2,49 b-e	8,0 a-d
Bacillus cereus GC subgroup A 27/6	17,0 c	2,25 c-e	7,0 cd
Bacillus pumilus 35/6	16,0 c	2,20 c-e	6,5 cd
Chryseobacterium indologenes 21/5	19,5 c	2,31 c-e	8,3 a-d
Bacillus megaterium 42/4	15,5 c	2,29 c-e	7,5 a-d
Brevibacterium liquefaciens 28/5	16,5 c	1,93 e	7,3 b-d
Bacillus sphaericus 57/3	15,0 c	2,07 d-e	6,3 d
Pseudomonas savastanoi fraxinus 27/3	19,5 c	2,36 c-e	9,0 a-d
Pseudomonas sp. 30/5	14,3 c	2,05 d-e	6,8 cd
Alcaligenes faecalis 47/11	16,3 c	2,10 d-e	7,3 b-d
Stenotrophomonas acidaminiphila 4/7	19,0 c	2,05 d-e	8,3 a-d
Stenotrophomonas maltophilia 60/5	16,3 c	1,99 d-e	7,0 cd
Paenibacillus polymyxa 24/3	15,3 c	2,36 d-e	7,3 b-d
Rhodococcus rhodochrous 66/9	15,3 c	1,90 e	7,0 cd

Tablo 1. Bakteri ve Kimyasal Gübre Uygulamalarının Hayrat Tipi Çay Fidanlarında Gelişmeye Etkisi (Tek yapraklı köklendirilmiş

çeliklere bakteri aşılanmış)

*Aynı harfle gösterilen ortalamalar arasındaki farklar kendi grubunda önemli ($p< 0.05$) değildir; **deneme her tekerrürde 3 fidan olacak şekilde 4 tekerrürlü olarak kurulmuş, hasat edilmeden ölçüm yapılmıştır.

Uygulama	Bitki yüksek-liği (cm)	Çap kalınlığı (cm)		Yaprak sayısı (adet/ fidan)	Toplam dal+yaprak ağırlığı (g/ fidan)	Yaprak ağırlığı (g/fidan)	
		I çap Gövde	II çap sürgün			Yaş ağırlık	Kuru ağırlık
Kontrol	56,0 b-f	4,99 b-d	3,60 bc	14,3 cd	6,46 n	4,68 m	2,62 g-j
Gübre Komp. (25-8-5) 48 kg/da	60,0 a-f	5,94 ab	4,35 a-c	14,6 cd	12,89 b-e	8,97 b-g	3,56 a-f
Gübre AN (%33) 48 kg/da	57,0 b-f	5,06 b-d	4,46 a-c	17,3 a-d	13,44 a-d	9,48 a-e	3,76 a-d
Gübre AN (%33) 24 kg/da	49,3 f	4,88 b-d	3,99 a-c	13,7 c	9,73 g-l	7,47 f-l	3,37 b-h
Gübre AN (%33) 12 kg/da	49,0 f	4,71 b-d	3,71 bc	13,0 c	8,18 k-n	5,74 l-m	3,10 c-j
Bacillus simplex 6/4	59,7 b-f	4,86 b-d	4,31 a-c	17,3 a-d	13,29 a-d	9,60 a-d	3,39 b-h
Brevibacillus choshinensis 2/5	52,3 c-f	4,52 cd	3,46 c	13,7 c	9,42 i-l	6,54 j-l	2,93 d-j
Paenibacillus validus 22/1	63,7 a-f	5,59 a-d	4,22 a-c	14,7 b-d	15,48 a	10,78ab	3,87 a-c
*Staphylococcus simulans*36/1	61,7 a-f	5,10 b-d	3,99 a-c	15,3 a-d	9,86 g-l	7,42 e-l	2,85 e-j
*Brevibacillus centrosporus*66/4	60,3 a-f	5,28 a-d	4,14 a-c	14,0 c	14,29 a-c	10,27a-c	3,44 b-g
Paenibacillus polymyxa 66/6	55,0 c-f	4,61 b-d	3,52 c	14,0 c	12,06 d-g	9,05 a-f	3,01 d-j
Pseudomonas putida 35/4	58,3 b-f	4,95 b-d	4,01 a-c	15,3 a-d	11,0 e-i	8,72 c-h	3,28 b-i
Burkholderia cepacia 65/6	69,0 a-c	5,63 a-d	4,26 a-c	19,3 a-c	11,61 d-i	8,40 c-j	2,90 e-j
Bacillus subtilis 52/1	76,7 a	6,49 a	4,94 a	19,7 ab	14,99 ab	10,27a-c	4,32 a
Pseudomonas fluorescens 48/1	67,7 a-d	5,01 b-d	4,14 a-c	17,7 a-d	10,28 f-k	7,08 g-l	2,54 h-j
*Rhodococcus erythropolis*4/8	58,3 b-f	5,01 b-d	3,68 bc	16,3 a-d	9,89 g-l	7,48 f-l	2,52 h-j
Pantoea agglomerans 5/8	67,0 a-e	5,65 a-d	4,70 ab	16,7 a-d	15,31 a	10,86 a	3,68 a-e
Bacillus cereus 27/6	60,7 a-f	5,06 b-d	4,15 a-b	15,7 a-d	10,85 e-j	8,12 d-k	2,69 g-j
Bacillus pumilus 35/6	60,7 a-f	4,88 b-d	3,83 a-c	17,0 a-d	10,85 e-j	7,17 f-l	2,55 h-j
Chryseob. indologenes 21/5	61,3 a-f	4,95 b-d	3,75 bc	16,3 a-d	11,23 d-i	8,33 d-j	2,40 j
Bacillus megaterium 42/4	56,3 b-f	5,33 a-d	4,01 a-c	16,0 a-d	12,56 c-f	9,93 c-g	3,04 c-j
*Brevibact. liquefaciens*28/5	52,0 c-f	5,26 a-d	4,13 a-c	16,0 a-d	8,67 j-m	6,20k-m	2,72 f-j
Bacillus sphaericus 57/3	49,7 ef	5,11 b-d	3,91 a-c	13,3 c	9,64 h-l	6,87 h-l	2,64 g-j
Ps. savastanoi fraxinus 27/3	54,3 c-f	4,77 b-d	3,52 c	15,0 b-d	6,71 mn	6,24k-m	2,43 i-j
Pseudomonas sp.30/5	51,3 d-f	4,87 b-d	3,99 a-c	15,0 b-d	9,45 i-l	6,59 j-l	2,47 i-j
Alcaligenes faecalis 47/11	72,3 ab	5,86 a-c	4,68 ab	20,3 a	11,63 d-i	8,62 c-i	4,00 ab
Stenotroph. acidaminiphila 4/7	50,0 ef	4,36 d	3,71 bc	14,7 b-d	10,23 g-k	6,76 i-l	2,81 f-j
Stenotroph. maltophilia 60/5	56,0 b-f	5,12 b-d	3,84 a-c	15,7 a-d	11,83 d-h	7,61 e-l	2,58 g-j
Paenibacillus polymyxa 24/3	49,7 ef	4,82 b-d	3,48 c	15,3 a-d	7,77 l-n	6,48 j-l	2,53 h-j
Rhodococcus rhodochrous 66/9	61,0 a-f	5,36 a-d	4,04 a-c	18,0 a-d	11,62 d-i	7,78 d-k	2,94 d-j

Tablo 2. Bakteri ve Kimyasal Gübre Uygulamalarının Fener 3 Tipi Çay Fidanlarında Gelişmeye Etkisi (20/5/2008 tarihinde 4 yapraklı dönemde bakteri aşılanmış, dal ve yapraklar 18/9/2008 tarihinde hasat edilmiş).

*Aynı harfle gösterilen ortalamalar arasındaki farklar kendi grubunda önemli ($p< 0.05$) değildir, **deneme her tekerrürde 3 fidan olacak şekilde 3 tekerrürlü olarak kurulmuş, deneme sürecinde oluşan dal ve yapraklar eşit yükseklikten kesilerek hasat edilmiş ve değerlendirilmiştir.

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KURAK İKLİM BÖLGELERİNDE ORGANİK TARIM VE GELECEĞİ: KONYA İLİ ÖRNEĞİ

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ÖZET

Konya ilindeki kuru tarım alanlarında organik olarak yetiştirilen nohut, mercimek ve haşhaş'ta toplam 48 organik işletmeye karşılık, ilgili ürünün organik yetiştirildiği köylerde, organik işletmeler ile aynı ekim alanına sahip 48 geleneksel işletmeden anketle toplanan verilerin analizi yapılmıştır. İki üretici grubun sosyo-ekonomik özellikleri açısından farklılıkları incelenmiş olup, organik işletmelerde işletmecinin daha eğitimli, işletme büyüklüğünün ve işletme sermayesi gereksiniminin daha fazla olduğu saptanmıştır.

Nohut, mercimek ve haşhaş üretiminde organik üretici grubunda verim, geleneksel üretici grubuna göre daha düşük tespit edilmiştir. Ancak yapılan karlılık analizleri sonucu üç üretim faaliyetinde de organik işletmelerin daha karlı olduğu saptanmıştır.

Anahtar Kelimeler: *Organik Tarım, Konya, Nohut, Mercimek, Haşhaş, Kuru Tarım*

GİRİŞ

İnsan hayatının vazgeçilmez aktivitesi beslenmedir. Beslenme materyallerinin tarımsal ürünlerden oluşması, tarımın insanlar için vazgeçilmez olduğunu açıklamaktadır. Bu gerçek insanın hayatını sürdürebildiği her yerde tarımsal faaliyetin var olduğunu ortaya koymaktadır. Tarımsal faaliyet ve dolayısı ile tarımsal üretim çok geniş bir yelpazeye sahiptir. İşletmelerde uygulanacak tarımsal faaliyetler, bölgenin coğrafyasına, ekonomik ve kültürel yapısına göre farklılıklar göstermektedir. Tarımsal faaliyet üzerinde değişen ekonomik ve ekolojik faktörlerin etkili olduğu söylenebilir. Bu değişmeler karşısında tarımsal üretimde de yeni arayışlar söz konusu olmaktadır.

Tarımsal üretim, ülkelerin ekonomik gelişmişlikleri ve insan refahının gelişmesi sonucu artan ve değişen talep özellikleri doğrultusunda değişmiştir. Bunların başında maliyeti düşürmek için mekanizasyon kullanımı ve verimliliği artırmak için kimyasal girdi kullanımı gelmektedir. Ancak verimliliği artırma çalışmaları çerçevesinde kullanılan kimyasal girdilerin sağlığı tehdit edecek boyutta olması, tüketici tercihinin tekrar değişmesine neden olmuştur. Bu çerçevede gıda güvenilirliğini artıran organik tarım sistemi tarımsal üretim kapsamında geliştirilmiştir.

Organik tarım, farklı ekolojik bölgelerde ve üretim faaliyetlerinde uygulanabilmektedir. Ayrıca ekstansif tarımın yaygın olarak yapıldığı kurak iklim özelliklerine sahip bölgelerde daha rasyonel olduğu düşünülmektedir. Bu bölgelerde yoğun girdi kullanılmamasından dolayı verimin nispeten düşük olması, organik tarıma geçiş sürecini hızlandıran bir olgudur. Bununla birlikte, Türkiye'de organik tarımın üretici açısından bilinç düzeyi en fazla tartışılan konulardan biridir. Çünkü Türkiye'de organik tarımın yaygınlaşmasında, genelde kimyasal girdi kullanımının az veya hiç olmadığı işletmeleri tespit eden organik tarım ürünleri ticareti yapan firmaların çabaları etken bir rol oynamaktadır. Dolayısıyla, Türkiye'deki üretici, organik tarım felsefesini tam olarak kavrayabilmiş değildir. Bu açıdan bu bildiride, Konya İli örneğinde organik üretimin ekonomik ve sosyolojik etkileri araştırılmıştır. Bu bağlamda, organik tarım yapan üreticilerin organik tarımı tercih nedenleri, organik tarım ile geleneksel tarım yapan işletmelerin sosyo-ekonomik açıdan farklılıkları, organik olarak üretilen aynı üründe fiyat avantajı sağlayıp sağlamadığı incelenmiştir.

Çalışma, Konya iline bağlı Akşehir ve Yunak ilçelerinde yürütülmüştür. Kuru tarım bölgelerinde yetiştiriciliği yapılan nohut, mercimek ve haşhaşın organik üretiminin bu ilçelerde yapılması, bu ilçelerin çalışma kapsamı olarak seçilmesinde belirleyici faktördür. Konya ili İç Anadolu Bölgesi'nde olup, tarım potansiyeli çok yüksektir. Konya ilinde sulabilir arazilerin oranı % 19'dur. Başta ilin kuzey bölgeleri olmak üzere yıllık yağış miktarı 400 mm'nin altında olup, yaygın olarak kuru tarım yapılmaktadır[1]. Bu bölgede yaygın olarak yetiştiriciliği yapılan ürünler buğday, arpa, nohut, mercimek, kimyon, vs.'dir. Bu ürünlerin kar marjları düşük olmakla birlikte bölgenin sosyo-ekonomik gelişmişliği diğer bölgelere göre geri kalmıştır. Bu nedenle gelir seviyesi düşük olan bu bölgelerde organik nohut, mercimek ve haşhaşın gelir artırıcı bir faktör olabilirliği araştırılmıştır.

MATERYAL VE YÖNTEM

Konya İline bağlı Akşehir ve Yunak ilçelerinde kuru tarım yapan işletmeler içinde, organik ve geleneksel olmak üzere iki grup seçilmiştir. Nohut, mercimek ve haşhaşı kuru koşullarda organik olarak yetiştirenlerin listesi, Tarım ve Köyişleri Bakanlığı'nın ilgili biriminden alınmıştır. Söz konusu listelerde her ürün farklı üreticiler tarafından yetiştirilmektedir. Diğer bir deyişle, nohut, mercimek ve haşhaşı organik olarak yetiştirenler farklı köylerde bulunmaktadır. Bu nedenle, her ürün için organik üretimde tam sayım uygulanmış olup, organik nohut üreten toplam 22 işletme, organik mercimek üreten toplam 14 işletme ve organik haşhaş üreten 12 işletme tespit edilmiş ve anket uygulanmıştır. Anket uygulanacak geleneksel işletmelerin seçiminde ise her ürünün organik olarak yetiştirildiği köylerde, organik yetiştiricilik yapan ile söz konusu üründe aynı ekim alanına sahip olanlar aynı sayıda dikkate alınmıştır. Buradan 48 adet organik işletmeye karşılık, 48 adet de geleneksel işletmeden veri toplanmıştır.

Anket ile tarım işletmelerinden 2008-2009 üretim yılına ilişkin olarak toplanan fiziki ve mali veriler kullanılarak, bütçe yaklaşımından hareketle ürünlere göre fiziki girdi kullanım düzeyleri ve birim ürün maliyetleri ortaya konulmuştur. Üretim faaliyeti ile ilgili ortalama fiziki ve mali değerler, örnek işletmelerde kullanılan toplam girdi miktarları, ürünlerin toplam ekim alanına bölünerek birim alana ortalama olarak saptanmıştır.

Tarım işletmelerinin genel yapısal özelliklerinin değerlendirilmesinde; işletmelerin arazi varlığı ve kullanım durumu, üreticilerin yaşı, eğitimi, işletmelerdeki nüfus ve işgücü varlığı vb. göstergeler incelenmiştir. İşletme arazisi varlığının tespitinde ise, incelenen üretim döneminde mülk, kira ve ortakçılıkla tutulan arazi miktarlarının toplamından, kira ve ortağa verilen arazi miktarı çıkarılmıştır.

İşletmelerde fiziki girdi kullanımı ile ilgili olarak işgücü ve traktör çekigücü, işletmelerde fiilen çeşitli işlemlerin yapılmasında kullanılan miktarları göstermektedir. Üretim faaliyetlerinin çeşitli aşamalarında kullanılan işgücü; cinsiyet, yaş ve çalışma süreleri dikkate alınarak saptanmış ve ürünlerin yetiştirme dönemlerine göre işgücü gereksinimleri ortaya konulmuştur. Maliyet çizelgelerinde, üretim faaliyetlerinde işgücü kullanımı saat olarak verilmiştir. Üretim maliyetinde yer alan işçilik masrafları ise, araştırma yörelerinde geçerli olan işgücü ücretleri esas alınarak saptanmıştır.

İşletmelerde girdi kullanımının analizinde fiilen kullanılan kimyasal gübre, çiftlik gübresi, ilaç, tohum, akaryakıt ve yağ miktarları ile bunlar için ödenen bedeller (çiftlik avlusu fiyatları veya pazar fiyatı + satın alma ve taşıma) esas alınmıştır[2]. Bu kapsamda kimyasal gübre ve tarım ilaçlarının fiyatlarından sübvansiyonlar ve üreticiye yapılan iade bedelleri çıkarılarak, bu girdilerin işletmelere olan maliyetleri esas alınmıştır. Maliyet çizelgelerinde tarım ilaçlarının etkili madde toplamı olarak birim alana kullanım miktarları verilmiştir[3]. Benzer biçimde kimyasal gübre kullanım miktarları da bitki besin maddeleri toplamı olarak ilgili çizelgelerde gösterilmiştir[4].

Araştırmada üretim faaliyetlerinde kullanıldığı tespit edilen aile işgücü ücret karşılıkları, yörelerde geçerli ortalama işgücü ücret düzeyleri esas alınarak hesaplanmıştır. Genel idare giderleri, masraflar toplamının % 3'ü alınarak hesaplanmıştır. Döner sermaye faizi değişen bir masraf olup, üretim faaliyetine yatırılan sermayenin fırsat maliyetini temsil etmektedir. Bu amaçla incelenen üretim dönemi için T.C. Ziraat Bankası'nın bitkisel üretim kredi faiz oranlarının (% 13,13) yarısı, üretim masraflarının üretim dönemine yayılmış olduğu ve tarımsal üretimde sermayenin bağlı kaldığı süre dikkate alınarak kullanılmıştır[2].

Üretimde sabit masraflardan biri olan arazi kirası, kira ile tutulan araziler için fiilen ödenen kira bedeli ve mülk arazide ise alternatif kira bedeli olarak hesaba katılmıştır[5]. İncelenen tarım işletmelerinde tam işletme analizi yapılmadığından, ortak kullanıma konu olan bina ve alet-makinelerin amortisman, faiz, tamir ve bakim masrafları, üretim maliyetinin hesabında dikkate alınmamıştır. Tarım işletmelerinde ürünlerin satış fiyatları ve brüt üretim değerlerinin hesaplanmasında çiftçi eline geçen net satış fiyatları dikkate alınmıştır. Organik tarım yapan çiftçilere ödenen destekler, brüt üretim değerinin hesabında dikkate alınmamıştır. 2009 yılı için organik tarım yapanlara verilecek destek miktarı 20 TL/da olarak belirlenmiştir. Yapılan karlılık analizlerinde organik üretime sağlanan desteğin dikkate alınmamasında, söz konusu desteklerin yıldan yıla değiştiği ve süreklilik arz edip-etmeyeceği konusunda net bir bilginin yer almaması yatmaktadır. Ancak karlılık amalizine ilişkin yorumlarda söz konusu destekler de dikkate alınmıştır.

Üretim faaliyetlerinde birim ürün maliyetlerinin belirlenmesinde, basit ve bileşik maliyet hesaplama yöntemi kullanılmıştır. Basit maliyet hesaplama yönteminde, birim alana yapılan toplam üretim masrafları birim alan verimine bölünmüştür. Bileşik maliyet hesaplama yönteminde ise, birim alana yapılan toplam üretim masraflarından yan ürün geliri çıkarılarak bulunan fark, ana ürün miktarına bölünerek birim ürün maliyeti bulunmuştur. Yan ürün geliri, nohut ve mercimekte saman, haşhaşta ise kapsüldür. Organik tarımın üretici refahına olan katkılarının analizi için, kısmi bütçe analizi veya üretim faaliyet dalı analizi yapılmıştır[6]. Üretim faaliyet dalı analizinde; incelenen üretim faaliyetinin üretim masrafları toplamı, brüt üretim değerinden çıkarılarak üretim dalının net karı ve üretim faaliyetinin değişen masrafları, brüt üretim değerinden çıkarılarak üretim dalının brüt karı hesaplanmıştır[2]. Pratik ve kolay olması ve genellikle bu amaçla yapılan araştırmalarda tercih edilmesi nedeni ile çalışmada, üretim dalının analizinin yapılması tercih edilmiştir. Diğer yandan incelenen işletmelerden bazıları bir bütün olarak organik tarıma geçmiş olmalarına karşın, bazıları işletme bünyesinde aynı veya farklı ürünlerde geleneksel ve organik tarımı birlikte yapmaktadırlar. Bu koşullarda organik ve geleneksel tarımın ekonomikliğinin rasyonel olarak karşılaştırılabilmesi ve işletmeler arasında homojenliğin sağlanabilmesi yönünden de üretim faaliyeti (kısmi bütçe) analizinin yapılması gerekli görülmüştür. Üretim maliyetinin analizinde açık ve örtülü maliyet unsurlarının tamamı dikkate alındığından, organik ve geleneksel tarımda belirlenen birim alana düşen net karlar, iktisadi karı göstermektedir.

Ayrıca çalışmada ki-kare ve t testi kullanılarak organik üretimin tercih edilmesinde işletmelerin nüfus, işletme genişliği, işletmecinin yaşı ve eğitiminin ilişkisi araştırılmıştır[7].

BULGULAR VE TARTIŞMA

İncelenen işletmelerin sosyo-ekonomik özellikleri

Çalışmada anket uygulanan üretici gruplarında işletmecinin yaşı, eğitim düzeyi, ailedeki birey sayısı, işletme arazisi genişliği, gelir düzeyi ve işletme sermayesi gereksinimi vb. konular açısından karşılaştırmalar yapılmıştır.

İşletmecilerin yaş durumu, organik tarımı benimseme açısından çeşitli çalışmalarda etkili bir faktör olarak ele alınmıştır. Bunun nedenleri arasında organik tarımın yeni bir üretim yöntemi olması ve yeni bir tekniği uygulama davranışı ile yaş arasındaki ilişkinin olumlu olacağı yatmaktadır. Bu konuda Türkiye'de yapılan araştırma sonuçları da farklılık göstermektedir. Manisa İlinde yürütülen bir çalışmada işletme sahiplerinin yaşı ile organik tarımı tercih etme arasında yapılan ki-kare testinde anlamlı bir sonuç bulunamamıştır[8]. Diğer taraftan, zeytin üreticileri üzerine yapılan bir başka çalışmada ise organik zeytin üreticilerinin konvansiyonel zeytin yetiştirenlere göre daha genç oldukları vurgulanmıştır[9]. Kuru incir üreticileri üzerine yapılan bir çalışmada da benzer sonuçlar bulunmuştur[10]. Diğer taraftan, bazı araştırmalarda ise organik ve geleneksel işletme gruplarında yaş ortalamalarının birbirine çok yakın olduğu tespit edilmiştir [11-18].

Bu araştırmada ise organik tarım yapan işletme sahiplerinin yaş ortalaması 45,9 ve geleneksel tarım yapan işletmecilerin ise 46,3 olarak hesaplanmıştır. Yapılan ki-kare testinde iki üretici grubun yaşları arasında bir farklılık olmadığı tespit edilmiştir (X^2=0,91; p=0,999).

Yaş Grupları	**Organik İşletmeler**		**Geleneksel İşletmeler**	
	Sayı	Oran (%)	Sayı	Oran (%)
<30	4	8,33	5	10,42
31-40	11	22,92	13	27,08
41-50	16	33,33	15	31,25
51-60	12	25,00	11	22,92
>61	5	10,42	4	8,33
Toplam	**48**	**100,00**	**48**	**100,00**

Tablo 1. Organik ve Geleneksel Tarım İşletme Sahiplerinin Yaşa Göre Dağılımı

Eğitim düzeyi de hiç kuşkusuz yeni bir üretim tekniğini uygulama konusunda etkin bir faktör olarak ele alınmaktadır. Diğer taraftan, eğitim düzeyi her alanda olduğu gibi kırsal alanda da kişilerin sosyo-ekonomik durumunu ortaya koymada önemli göstergelerden biri olup, kişilerin davranışları üzerinde etkili olmaktadır.

Araştırma sonuçlarına göre organik tarım yapan işletme sahiplerinin eğitim düzeyinin geleneksel tarım yapanlara göre nispeten yüksek olduğu Tablo 2'den de görülebilmektedir. Organik grupta gerek yüksekokul/üniversite mezunu ve gerekse ortaöğretim mezunu olanların oranı çok daha fazladır. Nitekim iki üretici grubun eğitim düzeyleri arasındaki farklılık yapılan ki-kare testi sonucu önemli çıkmıştır (X^2=21,77; p=0,001).

Bu değişkene ilişkin yapılan diğer çalışmaların bir kısmında eğitim düzeyi önemli bir faktör olarak bulunmazken[8,10] bazılarında ise iki üretici grubun eğitim düzeyleri arasındaki fark önemli bulunmuştur[9,14]. Yabancı literatürde de, eğitim düzeyi organik tarımı benimsemede etkili bir faktör olarak tespit edilmiştir[19-21].

Eğitim düzeyi	**Organik İşletmeler**		**Geleneksel İşletmeler**	
	Sayı	Oran (%)	Sayı	Oran (%)
Okur-yazar	1	2,09	2	4,17
İlköğretim mezunu	10	20,83	25	52,08
Ortaöğretim mezunu	27	56,25	15	31,25
Y.okul/Üniversite mezunu	10	20,83	6	12,50
Toplam	**48**	**100,0**	**48**	**100,0**

Tablo 2. Organik ve Geleneksel Tarım İşletme Sahiplerinin Eğitim Düzeyine Göre Dağılımı

İncelenen işletme gruplarında işgücü varlığı açısından bir farklılık olup olmadığı da test edilmiştir. Organik tarım, geleneksel (konvansiyonel) tarıma oranla daha fazla işgücü talep eden bir üretim tekniği olarak bilinir. Bu durum, organik tarımı seçenlerin genelde daha fazla işgücü varlığına sahip işletmeler olması sonucunu doğurabilmektedir. Nitekim Olhan (1997), Manisa'da yürüttüğü çalışmasında ailedeki birey sayısının organik tarım işletmelerinde daha fazla olduğunu tespit etmiştir.

Bu çalışmada ise işletme başına ortalama birey sayısı organik tarım yapan işletmelerde 5,63 kişi ve geleneksel tarım işletmelerde ise 5,67 kişi olarak hesaplanmıştır. Tablo 3'de ailedeki birey sayısı açısından gruplar itibariyle bir farklılık görülmediği, her grupta birbirine yakın oranlarda birey bulunduğu tespit edilmiştir. Diğer bir deyişle, ailedeki birey sayısı açısından bir farklılık söz konusu değildir. Yapılan ki-kare ve t testlerinde de bu durum tespit edilmiştir. Çalışmada hedef grubun kuru tarım alanlarında organik ve geleneksel olarak üretim yapan işletmeler olduğundan, ilgili üretim faaliyetlerinin organik ve geleneksel olarak üretiminde gerekli işgücü miktarlarının birbirinden farklı olmadığı da belirlenmiştir.

Ailedeki Birey Sayısı (Kişi)	**Organik İşletmeler**		**Geleneksel İşletmeler**	
	Sayı	Oran (%)	Sayı	Oran (%)
1-3	11	22,92	10	20,83
4-6	24	50,00	22	45,83
7-10	10	20,83	15	31,25
>10	3	6,25	1	2,08
Toplam	**48**	**100,00**	**48**	**100,00**

***Tablo 3*.** Organik ve Geleneksel Tarım Yapan İşletmelerin Nüfus Varlıklarına Göre Dağılımı

İşletme büyüklüğü açısından bir değerlendirme yapıldığında, organik işletmelerde işletme başına ortalama işletme arazisi genişliği 141,44 da ile geleneksel işletmelere oranla (107,35 da) daha yüksek olarak tespit edilmiştir. Üretici gruplarında işletme arazisinin farklı büyüklükler itibariyle dağılımı Tablo 4'de verilmiştir. Organik işletmelerin genelde daha geniş arazi gruplarında daha fazla pay aldığı dikkati çekmektedir. Nitekim yapılan ki-kare testi sonucunda organik işletmelerin geleneksel işletmelerden farklı olduğu sonucu ortaya çıkmıştır (X^2=23,69; p=0,001).

İşletme büyüklüğü ile organik tarım yapma arasında bir ilişki bulunduğuna ilişkin yurt dışında ve Türkiye'de yapılmış çok sayıda araştırma bulunmaktadır. Bunlardan bazıları organik işletmelerin büyüklüğünün geleneksel işletmelere oranla daha büyük olduğu şeklinde sonuçlanırken[22,23,8,14], bazılarında ise organik işletmelerin geleneksel işletmelere oranla daha küçük işletme büyüklüğüne sahip oldukları şeklinde çıkmıştır[19,24-26,9].

İşletme Arazisi (Da)	Organik İşletmeler		Geleneksel İşletmeler	
	Sayı	Oran (%)	Sayı	Oran (%)
1-50	2	4,17	8	16,67
51-100	23	47,92	29	60,41
101-250	16	33,33	9	18,75
251-+	7	14,58	2	4,17
Toplam	**48**	**100,00**	**48**	**100,00**

Tablo 4. Organik ve Geleneksel Tarım Yapan İşletmelerin İşletme Arazisine Göre Dağılımı

Organik tarım yapanların, geleneksel tarım yapanlara göre farklılıkları ortaya konulurken, dikkate alınan değişkenlerden biri de gelir düzeyidir. Bu konuda Türkiye'de yapılmış araştırma sonuçları da farklılık gösterebilmektedir. Olhan (1997), sulu tarım koşullarında yürüttüğü çalışmasında deneklerin beyanlarına göre yaptığı değerlendirmesinde organik tarım yapanların geleneksel tarım yapanlara oranla daha yüksek gelir gruplarında olduğunu belirlemiştir. Ancak bu değerlendirmenin, çiftçiye yaşadığı köydeki aileler içinde hangi gelir grubunda yer aldığının sorulmasıyla alınan yanıtlara göre olduğu unutulmamalıdır. Benzer değerlendirme ve sonuçlar, Köksal (2009) tarafından da bulunmuştur.

Bu çalışmada, işletmecilerin işletme arazisi genişliği, ürün deseni, üretim miktarları, satış fiyatları, işletme masrafları ve tarım dışı gelir vb. faktörler açısından nispeten objektif bir değerlendirme yapılmıştır. İşletmelerdeki gelir düzeyinin, organik tarım yapanlarla geleneksel tarım yapanlar arasında bir farklılık olup, olmadığı da incelenmiştir. Gelir değişkeni olarak işletmelerin tarım ve tarım dışı faaliyetlerinden elde ettikleri toplam (aile) gelir dikkate alınmıştır. Bu yıllık gelir düzeylerinin 12'ye bölünmesi ile aya düşen gelirleri tespit edilmiş olup, aylık geliri 1000 TL'den az olanlar düşük gelir grubu, 1001 TL-2500 TL arasında olanlar orta gelir grubu ve 2500 TL'den fazla olanlar ise yüksek gelir grubu olarak nitelendirilmiştir. Bu skalaya göre işletmelerin gelir açısından dağılımı Tablo 5'de görüldüğü gibidir. Üretici gruplarının gelir düzeyi açısından farklı olmadığı yapılan ki-kare testi ile saptanmıştır (X^2=0,43; p=0,995).

Gelir düzeyi	Organik İşletmeler		Geleneksel İşletmeler	
	Sayı	Oran (%)	Sayı	Oran (%)
Düşük gelir grubu	24	50,00	25	52,08
Orta gelir grubu	17	35,42	15	31,25
Yüksek gelir grubu	7	14,58	8	16,67
Toplam	**48**	**100,0**	**48**	**100,0**

Tablo 5. Organik ve Geleneksel Tarım İşletmelerinin Toplam Gelire Göre Dağılımı

İncelenen üretim faaliyetlerinde girdi kullanımı

Organik tarımda ve özellikle de kuru tarım alanlarında yetiştirilen ürünlerin organik üretiminde üretim masraflarının genelde geleneksel üretime oranla daha düşük olduğu bilinmektedir. Diğer bir deyişle, kimyasal girdileri kullanmamaktan dolayı organik işletmeler daha düşük masraf ile yetiştiricilik yapabilmektedir. Bu durum, araştırma alanında da gözlenmiştir. Sonuçta, işletmelerin yetersiz işletme sermayesine karşılık belli ölçülerde üretim yapabilmesi organik tarım ile mümkün olabilmektedir. Buradan, işletmelerdeki üretim faaliyetleri için gereksinim duyulan işletme sermayesi gereksinimi de, organik tarımı tercih etmede etkili unsurlardan biri olabilmektedir. Türkiye'de bu konuda yapılan çalışmalarda dikkate alınmamış olmasına karşın, araştırma alanının kuru tarım bölgesi olması, zaten geleneksel işletmelerde de çok yoğun kimyasal kullanımının söz konusu olmaması, *işletme sermayesi gereksinimi* faktörünün değerlendirmeye alınmasını zorunlu kılmıştır. İşletme sermayesi gereksiniminin tespitinde, işletmelerde yürütülen üretim faaliyetlerinde sarfedilen toplam üretim masrafları dikkate alınmıştır. Organik ve geleneksel işletmelerde nohut, mercimek ve haşhaş dışında yetiştirilen diğer ürünler buğday, arpa ve fiğdir. Her işletmenin ürün deseni, her ürün için üretim masrafları sırasıyla sorgulanmış ve toplam üretim masrafları tespit edilmiştir.

İki üretici grubun üretim masraflarının farklı olup, olmadığının tespitinde birim alana düşen üretim masrafı değerlendirmeye alınmıştır. Birim alana düşen üretim masraflarının iki üretici grubunda farklı olup, olmadığı t testi ile ortaya konulmuştur. Organik işletmeler ile geleneksel işletmelerin, dekara üretim masrafları açısından % 1 hata ile birbirinden farklı olduğu saptanmıştır. Nitekim organik işletmelerde birim alana üretim masrafları 134,69 TL/da iken, geleneksel işletmelerde 152,72 TL/da olarak tespit edilmiştir. Diğer bir deyişle, organik işletmeler işletme sermayesi gereksinimi daha fazla olan işletmelerdir.

İncelenen üretim faaliyetlerinde üreticilerin dekara fiziki girdi kullanımları Tablo 6'da gösterilmektedir. İşgücü kullanımı açısından üretici grupları arasında çok büyük bir farklılık söz konusu değildir. Nohut üretiminde organik işletmeler dekara 22,58 saat işgücü kullanırken, geleneksel işletmeler aynı üründe 22,30 saat işgücü kullanmaktadır. Mercimek üretiminde bu rakamlar sırasıyla 14,14 saat/da ve 14,53 saat/da şeklindedir. Haşhaş üretiminde de, mercimek üretimine benzer bir durum söz konusu olup, üretici gruplarının işgücü sarfiyatları birbirine çok yakındır (85,75 saat/da ve 85,84 saat/da).

Üç üretim faaliyetinde de geleneksel işletmelerin organik işletmelere oranla daha fazla çekigücü kullandıkları saptanmıştır. Geleneksel işletmelerde çekigücü kullanımının nispeten fazla çıkmasında, organik grupta yapılmayan gübreleme ve ilaçlama işlemlerine harcanan çekigücü sarfiyatları etkendir. Ancak bu farklılık, istatistiki açıdan önemli bulunmamıştır.

Geleneksel işletmelerde üç üretim faaliyetinde de kimyasal gübre kullanılmaktadır. Ancak işletmelerde kimyasal gübre kullanım oranları ürünler itibari ile farklılık göstermektedir. Nohut ve mercimekte sadece fosforlu taban gübresi (tohum ile birlikte) kullanımı söz konusudur. Nohutta kimyasal gübre kullananların oranı % 95,4 ve mercimekte ise % 85,7 olarak tespit edilmiştir. Haşhaş üretiminde ise taban gübresi yanında azotlu üst gübreleme de yapılmaktadır. Haşhaşta geleneksel işletmelerin tamamı kimyasal gübre kullanmaktadır.

Organik işletmeler nohut üretiminde çiftlik gübresi kullanmamaktadır. Organik işletmelerin mercimek ve haşhaşta çiftlik gübresi kullanma oranları ise sırasıyla % 31,8 ve % 33,3 olarak saptanmıştır.

Girdiler	**Nohut**		**Mercimek**		**Haşhaş**	
	Organik	*Geleneksel*	*Organik*	*Geleneksel*	*Organik*	*Geleneksel*
İşgücü (h/da)	22,58	22,30	14,14	14,53	85,75	85,84
Çekigücü (h/da)	1,19	1,25	1,33	1,49	1,36	1,42
Kimyasal gübre (kg/da)+	-	4,73	-	6,84	-	24,52
N	-	1,75	-	2,53	-	12,14
P	-	2,98	-	4,31	-	12,38
K	-	-	-	-	-	-
Pestisit (kg/da) ++	-	0,05	-	0,02	-	-
Çiftlik gübresi (kg/da) +++	-	-	507,56	-	1.127,58	-
Tohum (kg/da)	13,08	14,69	8,08	8,00	0,99	0,98

Tablo 6. İncelenen Üretim Faaliyetlerinde Üretici Grupları İtibariyle Fiziki Girdi Kullanımı

+ Değerler bitki besin maddesi cinsinden olup, nohut üretiminde kimyasal gübre kullananların oranı % 95,4, mercimekte % 85,7 ve haşhaşta ise % 100'dür.

++ Değerler etkili madde cinsinden olup, nohut üretiminde pestisit kullananların oranı % 31,8 ve mercimekte ise % 57,4'dür.

+++Çiftlik gübresi kullanma oranı; organik mercimek üretenlerde % 31,4 ve organik haşhaşta ise % 33,3'tür.

Geleneksel olarak haşhaş üretiminde tarım ilacı kullanımı söz konusu değildir. Nohut ve mercimekte ise tarım ilacı kullananların oranı % 31,8 ve % 57,4'dür. Dekara kullanılan tohum miktarı açısından üretim sistemleri arasında nohut dışında bir farklılık olmadığı söylenebilir. Nohutta ise geleneksel işletmelerin daha fazla miktarda tohum kullandıkları tespit edilmiştir.

Buradan özellikle nohut üretiminde organik işletmelerin sadece işgücü, çekigücü ve tohum kullanarak ekstansif bir üretim yaptıkları ortaya çıkmaktadır. Organik mercimek üretiminin ise organik nohut üretiminden farkı organik işletmelerin % 31,8 oranında çiftlik gübresi kullanmış olmalarıdır.

İncelenen işletmelerde ve üretim faaliyetlerinde değişen masraf unsurlarının dağılımı Tablo 7'de verilmiştir. Organik işletmelerde değişen masraflar içinde işgücü masrafları geleneksel işletmelere oranla daha yüksek bir orandadır. Bunda, geleneksel işletmelerin değişen masrafları içinde kimyasal gübre ve pestisit masraflarının belli oranlarda pay alması etkendir. Geleneksel nohut üretiminde kimyasal gübre ve pestisit masraflarının payı % 9,1'i bulurken, geleneksel haşhaş üretiminde % 14,3 ve geleneksel mercimek üretiminde % 16,9'a çıkmaktadır. Diğer bir deyişle, organik işletmeler yaptıkları üretim faaliyetlerinde en az bu oranlarda girdi tasarrufu sağlamaktadırlar.

Değişen Masraflar	Nohut		Mercimek		Haşhaş	
	Organik	*Geleneksel*	*Organik*	*Geleneksel*	*Organik*	*Geleneksel*
İşgücü masrafları	51,6	46,4	35,4	32,1	76,1	69,2
Çekigücü masrafı	25,2	21,8	28,3	28,8	9,7	9,0
Kimyasal gübre masrafı	-	8,0	-	11,7	-	14,3
Tarım ilacı masrafı	-	1,1	-	5,2	-	-
Çiftlik gübresi masrafı	-	-	11,6	-	6,6	-
Tohum masrafı	17,0	16,5	18,5	16,0	1,4	1,3
Değişen masrafların faizi	6,2	6,2	6,2	6,2	6,2	6,2
Sertifikasyon masrafları [+]	-		-		-	
Toplam	100,0	100,0	100,0	100,0	100,0	100,0

Tablo 7. İncelenen Üretim Faaliyetlerinde Üretici Grupları İtibariyle Değişen Masrafların Dağılımı(%)

[+] Üreticiler sertifikasyon masraflarına katılmadıkları için dikkate alınmamıştır.

İncelenen üretim faaliyetlerinde işletmelerin ekonomik performansları

Nohut üretiminde ortalama verim organik işletmelerde geleneksel işletmelere oranla % 9 daha düşüktür. Nohutta üretici grupları arasındaki verim farkı istatistiki açıdan önemli bulunmuştur (Tablo 8). Üreticiler ürettikleri organik nohudu, geleneksel nohuda oranla sadece % 3 daha yüksek bir fiyattan satabilmektedirler. Bu açıdan bakıldığında, daha düşük verime karşılık sadece % 3'lük bir fiyat farkının yeterli olmayabileceği düşünülebilir. Ancak organik işletmelerde üretim masraflarının geleneksel işletmelere oranla daha düşük olması, bu durumu telafi edebilmektedir. Nitekim organik nohutta üretim masrafları, geleneksele oranla % 8 daha düşüktür. Organik işletmeler ile geleneksel işletmelerin değişen ve üretim masrafları arasındaki farklılık istatistiki açıdan önemli bulunmuştur. İşletme gruplarında birim maliyet 1,12 TL/kg ile aynı düzeydedir.

Organik nohut üretiminde 1 dekardan elde edilen net kar 60,57 TL. olup, bu değer geleneksel nohut üretiminde 58,70 TL ile % 3 oranında daha düşüktür. İncelenen üretim yılında organik tarım yapan işletmeler dekara 20 TL devlet desteği alacaklardır. Bu destek dikkate alındığında organik nohut üreten işletmelerin dekara net karı (47,81 TL/da), geleneksel işletmelere (25,61 TL/da) oranla 22,2 TL/da daha fazla olacaktır. Birim ürüne düşen net kar açısından organik işletmeler daha iyi durumdadır. Aynı şekilde kullanılan işgücü saatine düşen net kar da organik işletmelerde yüksek çıkmıştır. Diğer bir deyişle, organik işletmeler işgücünü geleneksel işletmelere oranla daha iyi değerlendirebilmektedir.

	Organik üreticiler		Geleneksel üreticiler		Organik/ Gelenekselx100
	Ortalama	S.sapma	Ortalama	S.sapma	
Nohut Verimi (kg/da)	103,39 [a]	± 5,74	113,03 [b]	± 7,37	91
Ürün Satış Fiyatı (TL/kg)	1,39 [a]	± 0,04	1,35 [a]	± 0,01	103
Yan Ürün Geliri (TL/da)	8,93 [a]	± 2,36	8,84 [a]	± 3,49	101
Brüt Üretim Değeri (TL/da)	152,64 [a]	± 7,47	161,43 [b]	± 11,25	95
Değişen Masraflar (TL/da)	92,07 [a]	± 5,26	102,73 [b]	± 8,78	90
Üretim Masrafları (TL/da)	124,83 [a]	± 5,41	135,82 [b]	± 9,03	92
Birim Maliyet (TL/kg)	1,12 [a]	± 0,04	1,12 [a]	± 0,02	100
Brüt Kar (TL/da)	60,57 [a]	± 4,86	58,70 [a]	± 3,99	103
Net Kar (TL/da)	27,81 [a]	± 4,85	25,61 [a]	± 3,88	109
Birim ürüne düşen net kar (TL/kg)	0.27 [a]	± 0,04	0.23 [b]	± 0,02	117
İşgücü saatine düşen net kar (TL/h)	1.23 [a]	± 0,24	1,15 [a]	± 0,19	107

*Tablo 8.*Nohut Üretiminde Üretici Gruplarının Ekonomik Performansları

[b] Organik ve geleneksel üretici gruplarının ortalama değerleri arasındaki fark istatistiki açıdan önemlidir ($p<0.01$).

Organik işletmelerde mercimek verimi 87,54 kg/da ile geleneksel işletmelere oranla % 11 daha düşük olarak saptanmıştır (Tablo 9). Satış fiyatı açısından ise % 5'lik bir fiyat farkı söz konusudur. Mercimek üretiminde organik işletmeler, geleneksel işletmelere oranla % 3 daha yüksek brüt kar ve % 7 daha yüksek bir net kar elde etmektedirler. Organik işletmeler daha düşük bir verime karşılık nispeten yüksek bir fiyat ve nispeten daha düşük üretim masrafları ile geleneksel işletmelere oranla daha iyi bir performans sergileyebilmektedir. Yine de elde edilen sonuçlar açısından her iki işletme grubunda da çok büyük bir farklılık olmadığı söylenebilir. Nitekim söz konusu üretici gruplarında brüt kar ve net karların istatistiki açıdan farklı olmadığı saptanmıştır. Ancak nispeten düşük verim nedeniyle birim ürüne düşen net kar organik işletmelerde daha yüksektir. Devlet desteği dikkate alındığında, organik işletmelerde dekara net kar geleneksele oranla % 64 daha fazla olmaktadır.

	Organik üreticiler			Geleneksel üreticiler			Organik/Geleneksel x100
	Ortalama		S.sapma	Ortalama		S.sapma	
Mercimek (yeşil) Verimi (kg/da)	87,54 [a]	±	7,21	98,37 [b]	±	5,57	89
Ürün Satış Fiyatı (TL/kg)	1,59 [a]	±	0,02	1,51 [a]	±	0,01	105
Yan Ürün Geliri (TL/da)	27,66 [a]	±	3,34	28,80 [a]	±	7,35	96
Brüt Üretim Değeri (TL/da)	166,85 [a]	±	11,20	177,34 [a]	±	7,58	94
Değişen Masraflar (TL/da)	87,40 [a]	±	14,25	99,87 [b]	±	4,38	88
Üretim Masrafları (TL/da)	130,03 [a]	±	13,86	142,86 [a]	±	4,51	91
Birim Maliyet (TL/kg)	1,17 [a]	±	0,07	1,16 [a]	±	0,16	101
Brüt Kar (TL/da)	79,45 [a]	±	3,61	77,47 [a]	±	6,95	103
Net Kar (TL/da)	36,82 [a]	±	3,93	34,48 [a]	±	6,98	107
Birim ürüne düşen net kar (TL/kg)	0.42 [a]	±	0,07	0.35 [b]	±	0,06	120
İşgücü saatine düşen net kar (TL/h)	2,60 [a]	±	0,30	2,37 [b]	±	0,49	110

Tablo 9. Mercimek Üretiminde Üretici Gruplarının Ekonomik Performansları

[b] Organik ve geleneksel üretici gruplarının ortalama değerleri arasındaki fark istatistiki açıdan önemlidir ($p<0.01$).

Üretici gruplarının haşhaş üretimindeki ekonomik performansları Tablo 10'da verilmiştir. Organik üretimde haşhaş tohumu verimi 93,13 kg/da ile geleneksel işletmeler ortalamasından % 2 daha düşük bulunmuştur. Ancak ürün satış fiyatı organik işletmelerdeki verim düşüklüğünü telafi edebilecek düzeydedir. Organik haşhaş tohumu, geleneksel ürüne oranla % 9 daha yüksek fiyattan satılmaktadır. İncelenen üç ürün içinde en iyi fiyat avantajının haşhaşta olmasının temel nedeni, bu ürünün izne tabi oluşu ve sınırlı miktarda yetiştiriliyor olmasıdır. Bu durum, organik haşhaş tohumu talep eden firmaların, geleneksel üretime oranla daha yüksek fiyat vermelerini gerektirmektedir. Nohut ve mercimekte ise firmalar işletmelere daha düşük fiyat teklif ederek ürünlerini satın alabilmektedir. Bu ürünlerde organik ürün arzının, talepten fazla olması sonucu fiyat farkı düşük düzeylerde kalmaktadır. Organik haşhaş üretiminde masraflar, geleneksel ürüne oranla % 9 daha düşüktür. Bu durum, gerek nispeten yüksek satış fiyat ve gerekse düşük üretim masrafları neticesinde organik haşhaş üretiminde dekara net karın geleneksele oranla % 38 daha fazla olması ile sonuçlanmaktadır. İki üretici grup arasında brüt kar, net kar, üretim masrafları, birim maliyet, birim ürüne ve işgücü saati başına düşen net karlar açısından farklılık olduğu belirlenmiştir. Söz konusu organik işletmelerin aldıkları devlet desteği de dikkate alındığında (20 TL/da), net kar geleneksel haşhaş işletmelerinin net kar düzeyine göre % 51 daha fazla olmaktadır.

	Organik üreticiler			Geleneksel üreticiler			Organik/Geleneksel x100
	Ortalama		S.sapma	Ortalama		S.sapma	
Haşhaş Tohumu Verimi (kg/da)	93,13 [a]	±	10,29	94,83 [a]	±	7,90	98
Ürün Satış Fiyatı (TL/kg)	4,81 [a]	±	0,04	4,43 [b]	±	0,05	109
Yan Ürün Geliri (TL/da)	175,10 [a]	±	16,04	183,44 [a]	±	24,49	95
Brüt Üretim Değeri (TL/da)	623,06 [a]	±	61,08	603,54 [a]	±	52,00	103
Değişen Masraflar (TL/da)	343,87 [a]	±	21,80	382,49 [b]	±	29,57	90
Üretim Masrafları (TL/da)	409,18 [a]	±	22,42	448,97 [b]	±	30,40	91
Birim Maliyet (TL/kg)	2,51 [a]	±	0,29	2,80 [b]	±	0,26	90
Brüt Kar (TL/da)	279,19 [a]	±	49,27	221,05 [b]	±	34,96	126
Net Kar (TL/da)	213,88 [a]	±	49,04	154,57 [b]	±	34,73	138
Birim ürüne düşen net kar (TL/kg)	2,30 [a]	±	0.31	1,63 [b]	±	0.24	141
İşgücü saatine düşen net kar (TL/h)	2,49 [a]	±	0.65	1,80 [b]	±	0.40	138

*Tablo 10.*Haşhaş (tohum) Üretiminde Üretici Gruplarının Ekonomik Performansları

[b] Organik ve geleneksel üretici gruplarının ortalama değerleri arasındaki fark istatistiki açıdan önemlidir ($p<0.01$).

İşletmelerin Organik Tarımı Tercih Nedenleri

Bir çok Avrupa ülkesi ve ABD'ninde organik tarımın gelişimine çiftçiler öncü olmasına karşın, Türkiye'de organik tarım, Avrupa'ya organik ürün pazarlayan firmaların çalışmaları ile başlamıştır. Diğer bir deyişle, AB ve ABD'nde organik tarım tabandan tavana yayılan bir hareket iken, Türkiye'de tam tersi bir oluşum söz konusudur. Bu durumda, Türkiye'de üreticilerin organik tarımı tercih nedenlerinde etkili olan faktörlerin öncelik sırasının, gelişmiş ülkelerdeki tespitlerden farklı olması beklenebilir.

İncelenen işletmelerde kuru tarım alanlarında organik tarım yapan işletmelerin organik tarımı neden tercih ettikleri belirlenmeye çalışılmıştır. Üreticilere yöneltilen soru da, organik tarımı tercih nedenleri arasında ekonomik, sosyal, sağlık, çevre koruma ve yeniliklere açık olma faktörleri açısından hangilerinin etkili olduğunun sıralanması istenmiştir. Ekonomik faktörler olarak; yüksek satış fiyatı, alım garantisi, firmaların girdi ve avans vermesi kastedilirken, sosyal faktörler arasında halihazır yaşam biçimi olması, iş memnuniyeti ve üretim faaliyetleri konusunda sağlanan teknik bilgi yer almaktadır.

Organik tarım tercih nedenleri arasında ekonomik faktörler ilk sırada yer almaktadır. Diğer bir deyişle, organik tarımı tercih eden işletmeler organik olarak ürettikleri ürüne alacakları yüksek fiyat, alım garantisi ve firmaların girdi ve avans desteğini daha fazla önemsedikleri ortaya çıkmaktadır. Şu ana kadar Türkiye'de organik tarım ile ilgili çalışmaların çoğunda ekonomik faktörlerin en önemli nedenler arasında olduğu tespit edilmiştir. Bu faktörleri işletmenin hali hazır üretim ve yaşam biçimi olması ve yapılan işin memnuniyeti gibi sosyal faktörler izlerken, çevre koruma faktörünün üçüncü sırada yer aldığı söylenebilir. Sağlık faktörü ile yeniliklere açık olma faktörü ise daha az öncelikli nedenler arasındadır.

Tercih Nedeni		Hiç Etkili Değil	Az Etkili	Orta Derecede Etkili	Etkili	Çok Etkili	Toplam
Ekonomik faktörler	Sayı	1	2	8	11	26	48
	Oran	2,08	4,17	16,67	22,92	**54,17**	100,00
Sosyal faktörler	Sayı	4	14	11	10	9	48
	Oran	8,33	29,17	**22,92**	20,83	18,75	100,00
Çevre koruma faktörü	Sayı	11	13	10	8	6	48
	Oran	22,92	**27,08**	20,83	16,67	12,50	100,00
Sağlık faktörü	Sayı	16	11	8	10	3	48
	Oran	**33,33**	22,92	16,67	20,83	6,25	100,00
Yeniliklere açık olma	Sayı	16	8	11	9	4	48
	Oran	**33,33**	16,67	22,92	18,75	8,33	100,00
Toplam	Sayı	48	48	48	48	48	48

Tablo 11. Organik Tarım Yapan İşletmelerin Organik Tarımı Tercih Nedenleri

Organik işletmelerin organik tarımı tercih nedenlerinin genelde ekonomik faktörlere dayalı olması, işletme arazisi daha fazla ve işletme sermayesi gereksinimi daha çok olan işletmeler olması farklılıklarını da destekler durumdadır. ***Sonuçta, daha fazla işletme arazisine sahip ancak nispeten az miktarda işletme sermayesi bulunan işletmelerin gelirini artırabilmek amacıyla geleneksel üretime oranla daha yüksek satış fiyatı avantajı veren organik üretimi tercih ettikleri görülmektedir***. Bu tercihte, işletmecilerin eğitim düzeylerinin nispeten yüksek olduğu da unutulmamalıdır.

SONUÇ VE ÖNERİLER

Kuru tarım alanlarında incelenen ürünlerde organik üretimin, geleneksel üretime oranla daha avantajlı olduğu tespit edilmiştir. Organik işletmeler söz konusu ürünlerde gerek masraf, gerekse karlılık açısından geleneksel işletmelere oranla daha iyi bir performans sergilemektedirler. Kuru tarım alanlarında münavebeye girecek ürün sayısı da sınırlıdır. Bu açıdan organik tarım, işletmelerin gelirlerini artırmaya hizmet edecek bir üretim sistemi olarak karşımıza çıkmaktadır. Diğer taraftan, gelişmiş ülkelerin tarımı ile kıyaslandığında Türkiye gibi tarımda kimyasal girdi kullanımı düşük olan ülkelerde doğal olarak organik tarıma uygun bir zemin hazırlanmış olmaktadır.

Kuru tarım alanlarında organik tarımın bu avantajını sürdürebilmesi, üreticilerin ürünü pazarlayan firmaların inisiyatifindeki sertifikasyon işlevinden kurtulması gerekmektedir. Bunun için üretici örgütlenmesi kaçınılmazdır. Devletin organik tarıma yönelik desteklerinin ise üretici örgütlenmesi şartına bağlanması, sertifikasyon masraflarının üretici örgütleri tarafından karşılanabilir düzeye getirilmesi, tüketici ile üretici arasındaki fiyat farkının bir kısmının üreticide kalmasını sağlayacaktır.

Türkiye' de hızla gelişen organik tarımın sağlıklı gelişebilmesi ve sürekli olabilmesi için; organik tarımın desteklenmesi ve teşvik edilmesi ve **üreticilerin bilinçlendirilmesi** gerekir. Diğer taraftan, yapılan üretimin kontrol edilmesi ve uluslararası standartlara uygun olması sağlanmalıdır. Bölgesel ürün ve iklim farklılıkları dikkate alınmalı ve buna göre yönlendirme sağlanmalıdır.

Türkiye'de üreticiler organik ürünü daha yüksek fiyata satabilecekleri ürün olarak görmektedirler. Oysa organik ürün üreticisi, **organik tarım felsefesine** inanmalı ve bunu bir yaşam biçimi olarak kabul etmelidir. Ayrıca üretici, organik tarım ile toprağının verimliliğini sürekli kıldığının, çevreyi koruduğunun, insan sağlığı için sağlıklı ürünler ürettiğinin bilincinde olmalıdır. Organik tarım üretim teknikleri ile ilgili araştırma çalışmaları (kompost hazırlama, hastalık ve zararlılarla alternatif mücadele metotları vb.) teşvik edilmelidir. Bu çalışmalara ilave olarak, üretici sorunları, tüketici eğilimleri ve isteklerinin belirlenmesi gibi konularda proje formatlı çalışmalar teşvik edilmelidir.

Dünya'da organik tarımsal üretim artmakta olmasına rağmen mevcut talebi karşılayamamakta olup, bu durum gelişmekte olan ülkeler için önemli bir fırsat olarak görülmelidir. Türkiye, sahip olduğu ekolojik özellikler itibariyle organik tarımsal üretim açısından önemli mukayeseli üstünlüklere sahip bulunmaktadır. Türkiye'nin dünya pazarından almakta olduğu %0,2'lik pay oldukça azdır. Ülkemiz bir taraftan dünya ticaretindeki payını artırma yönünde çaba göstermesi gerekirken, bir taraftan da yok denecek kadar az olan kendi iç tüketimini artırma yoluna gitmelidir. Dünyada da benzer sorunlar yaşanmakta, organik üretim ve tüketim potansiyelini artırmak için çok sayıda çalışma yapılmaktadır.

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