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## CONTRIBUTION OF INTENSIVE RABBIT BREEDING TO SUSTAINABLE DEVELOPMENT. A SEMI-QUANTITATIVE ANALYSIS OF THE PRODUCTION IN FRANCE

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**ABSTRACT:** This work was aimed at evaluating the contribution of intensive rabbit breeding to sustainable development using a semi-quantitative method. Nine sustainability indicators were defined for the environmental (energy use, antibiotic use, and biodiversity), economic (profit, specialisation rate, and transmissibility) and social scales of sustainable development. A score (-1, 0 or +1) was given for each indicator using data from French rabbit farms (12,000 farms for economic results and 100 farms for social and environmental data). Scores were added within each scale to obtain a final score. It was revealed from the data analysis that intensive rabbit breeding had some negative contributions to sustainable development, due to the high cost of indirect energy, high use of antibiotics, low biodiversity and little respect for animal welfare, in particular in the scale of environmental sustainability (total score: -2). But it also had positive contributions to sustainable development, particularly in the economic and social scales (total score: +1 each). Indeed, the mean profit, life and working conditions were good and the rabbit meat is of good quality. Therefore, the challenge for rabbit production will be to manage the lawful development and to face the market trends while preserving the maximum of its advantages.

**Key Words:** Rabbit breeding, sustainable development, sustainability indicators, antibiotics, economic viability, living conditions.

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## INTRODUCTION

For several decades, rabbit production in developed countries (mainly in Europe) has been intensified being the number of animals per breeding unit, productivity of reproducing females and feed conversion ratio greatly improved (Lebas, 2007). Intensification was mainly due to the development of cycling systems, coupled with artificial insemination that improved the efficiency of the working time in breeding, genetic selection on prolificacy and a better knowledge of the nutritional needs of the animals.

In parallel, the concept of sustainable development emerged in 1987 in the report of the World Commission on the environment and development. It was defined by Brundtland (1989) as a “*development which satisfies the needs of the present generation without compromising the chance for future generations to satisfy theirs*”. Indeed, several studies have demonstrated that human activity in general, and agriculture in particular, could be harmful to our environment. Especially, the harmful effects on the environment of

the intensive agriculture practised in the developed countries is now well documented: degradation and/or pollution of water (nitrate content), soils (pesticides, humus content organic matter) and the air; heavy use of fossil energy both directly (agricultural machinery, transport of raw materials and products, etc.) and indirectly (fertilisation, veterinary care, etc.) resulting in high greenhouse gas emissions and contributing to global warming; loss of genetic and ecological biodiversity; presence of residues (pesticides, antibiotics) in food, frequently use of antibiotics in livestock rearing and possible risk of increased resistance to antibiotics, spatial inequalities with over-intensification in certain districts where pollution is severe and desertification in others where nature is no longer cared for; impoverishment of landscape and of the relationship with nature (Bonny, 1994; Steinfeld *et al.*, 2006).

Consequently, the European Union set the development of more sustainable agriculture as an objective. In France, the Law of Agricultural Guidance (LOA) passed in July 1999 redefined missions for agriculture to guide it towards objectives of sustainability: quality production, land development, maintenance of landscape, protection of natural resources, and contribution to rural employment (French Law, 1999). These missions were reinforced during the Environment Round Table (Pitte, 2007).

The objective of this paper was to assess the contribution of intensive rabbit breeding to sustainable development by using data from French farms. In agriculture, several tools are available to evaluate the environmental impacts of agricultural activities (SOLAGRO, 2002). However, sustainable development refers to several components belonging to environment, economic and social scales. Therefore, it is necessary to evaluate simultaneously these three components of sustainability, which required a multi-criteria approach. The IDEA method (Indicateurs de Durabilité des Exploitations Agricoles: indicators of sustainability for farms; Vilain, 2003) responds to this objective but it evaluates the sustainability of the farm (vegetable and animal production) not of the breeding unit itself. Therefore, to address this assessment, we selected 9 indicators of the IDEA method, which are relevant for the breeding units.

## METHOD AND DATA

### Sustainability indicators

According to Gras *et al.* (1989), an indicator is a variable which provides information on other variables which are more difficult to access. It should be easy to understand and relate to initial objectives. The IDEA method contains 41 indicators (Vilain, 2003). However, several of them (for example, 11 of the 19 indicators on the environment scale) concern the management of fields and/or plant production (crop diversity, rotation, fertilisation, zones with ecological regulations, field sizes, etc.). These indicators are not relevant for the evaluation of breeding. In the present work, we selected 9 relevant indicators, which are related to environment (energy use, antibiotic use and biodiversity), economy (profit, specialisation rate and transmissibility) and social issues (living and working conditions, animal welfare and product quality).

*Energy use.* Energy use has become a pressing issue today due to the exhaustion of the non-renewable energy sources and climate warming. In farming, one can distinguish between direct energy use (electricity, fuel, gas) for the farm building and indirect energy use (feed). Data concerning direct energy use are scarce for rabbit breeding. However, energy use is still increasing for controlling the breeding environment (temperature, ventilation, and lighting) and mechanisation (automatic feeding and washing). But, the main energy use is indirect in the form of animal diet. Indeed, energy is necessary for production and transportation of feed. And today, the feed (and raw material) itself could be used to produce energy in form of biofuel. In the present paper, we used the feed conversion as an indicator for indirect energy use. A low feed conversion (<3) will be related to good energy use efficiency (score +1), a high feed conversion (>4) was related to poor energy use efficiency (score -1).

*Antibiotic use.* An ecologically healthy agriculture system or industry should try to limit the use of pesticides and veterinary products which constitute a threat to human health and ecosystems. In livestock rearing, it is mainly the consumption of antibiotics for therapeutic use which is targeted these days, since their use as growth promoters has been banned in the European Union since 1st Jan 2006.

*Biodiversity.* Diversity concerns both genetic diversity and functional diversity. The diversity activates the synergies and natural regulation processes in agricultural ecosystems. In farming, it could be assessed by the number of breeds or strains.

*Profit.* This indicator gives the possibility for the farmer to earn a living from his work. The agricultural income could be calculated as - farm net profit / family manpower units - and be compared to references. For example, in France, SMIC (Salaire Minimum Interprofessionnel Garanti: guaranteed minimum wage) is the monthly wage of reference.

*Specialisation rate.* In the IDEA method, it is estimated by the ratio profit of the main production to total profit and the ratio of selling by the main purchaser to total selling. An inadequately specialised farm has several products (both of animals and/or vegetables) as well as several purchasers. A low degree of specialisation reduces the sensitivity to climatic, sanitary or financial uncertainty. For example, if a farmer produces only rabbit meat, the farmer does not have any income if all the animals die (colibacillosis). The breeding can then disappear. On the other hand, if he also produces several other productions (wheat, pigs...), the income of these productions can make it possible the farmer to reconstitute the rabbit herd.

*Transmissibility.* Transmissibility is an element in the analysis of the long-term continuity of the farm. In fact, the sustainability of agricultural systems depends on their capacity to endure from one generation to another. In the IDEA method, it is estimated as the ratio of Farm Capital/UTH (Unit of Human Worker). Indeed, in the case of succession, if too much capital is needed to buy and run the farm, it may result in its abandonment.

*Living and working conditions.* Even if economically viable and ecologically healthy, an agricultural system which damages the quality of life of the producer is not sustainable. This is a subjective indicator which is related to mechanisation and painfulness of work, geographical location of the farm and its possible insulation, possibility to have free weekends and holidays.

*Animal welfare.* The respect of the animal's well-being is a present societal request because the public wants management to be respectful of the animal. Therefore, in recent years, increasing importance has been assigned to the analysis of the rabbits' welfare. In Europe, the economically more efficient battery cage system is generally poorly appreciated by consumers. The main problems in the cage housing systems are the limitation of locomotion and the barren environment. Additionally, the respect of Farm Animal Welfare Council propositions imposes the animals having free access to food and water.

*Quality of products.* Consumers are concerned about the hedonistic and sensorial quality of the meat they eat, but also in its nutritional value and hygienic quality. A certain quality of foods is officially recognised by labelling (AOC: Appellation d'Origine Contrôlée, name of controlled origin, red label, CCP: Certification of Conformity Product etc.), partial or complete traceability and organic production. Associated with a specification, these labels help to defend a certain production method which is generally distinct from standardised production methods.

## **Data**

For the analysis, we used mainly the data of Azard (2006), which relates to the characterisation of the French rabbit systems of production. The analysis was carried out based on data from: i) the technico-economic management data of 12,000 French rabbit stock breeders (which represents 85% of the rabbit

females in organised production); ii) results from the network “Cunimieux”. It was created in 1997 and includes a hundred farms located in all the French territory. Each year, stock breeders answer questions concerning their practices (feeding programs, management of effluents, antibiotic use, organisation of work); iii) an investigation carried out in 2005 by the French Technical Poultry Institute (ITAVI) of 680 French rabbit stockbreeders, and iv) the annual inquiry carried out by the National Federation of Rabbit Stockbreeders (FENALAP; 30 producer groups answered in 2004 of the 31 adherent groups).

All the data came from farms where rabbits were reared in cages under indoor husbandry conditions. In all cases, animals were fed pelleted diets produced by the animal feed industry. The great majority of females were fertilised using artificial insemination in a cycling system. There was neither organic farming nor grazing systems. Consequently, data came from farms which were classified as intensive rabbit breeding.

### **Assessment of sustainability**

We did not analyse data from individual farms but instead attempted to assess the sustainability of the practices and situations commonly encountered in intensive rabbit breeding as described by Azard (2006). A score (−1, 0, +1) was given for each of the 9 sustainability indicators described previously: “+1” means a positive contribution to sustainable development and was attributed when the targets for the indicator (see chapter method section 1) were reached (in absolute or compared with other species); “−1” means a negative contribution to sustainable development and was attributed when the targets for the indicator were not reached; “0” was an intermediate situation when targets i) were not fully reached, ii) were reached on a minority of farms, or iii) were reached for some targets but not for others.

We assumed equal importance of each indicator in the final assessment of durability. The scores obtained for each indicator were added within the 3 scales of sustainability (environment, economy, social). Then, the total of each of the three scales could be between −3 and +3. The final numerical value for the sustainability of the farm is the lowest of the 3 sustainability scales as proposed by Vilain (2003). The addition of the scores within a given scale implies that, within this scale, favourable practices can compensate for harmful ones. On the other hand, the three scales were deliberately not added to one another, applying the rule of limiting factors which applies to the dynamics of ecosystems (Zahm *et al.*, 2005) and respecting the principle of sustainable agriculture. Indeed, very high economic viability can never compensate for poor environmental performance, just as a non-polluting system is not sustainable unless it is profitable.

## **RESULTS AND DISCUSSION**

The scores obtained for each indicator were reported in Table 1.

### **Environmental sustainability**

*Energy use.* The feed conversion rate was 3.5 per rabbit (Azard and Lebas, 2006). It is higher than for chickens (1.9; Gallot and Magdelaine, 2007) or pigs (2.6; Massabie *et al.*, 2006), but lower than for ducks and geese (4.2; Azard, 2007). Therefore, the score was 0 for this indicator.

*Antibiotic use.* In 2003, French rabbit farms used 77.3 t of active antibiotic ingredients (Moulin and Roux, 2003). This situation is explained by the difficulty in controlling digestive troubles in young growing rabbits, notably because of the epizootic enterocolite of the rabbit. In the herd of reproductive females, it is mainly chronic respiratory problems (pasteurellosis) which require antibiotic prescriptions. Disease control is and will remain one of the major problems in the rabbit industry, being required an effort on the search of alternatives to antibiotic use (Falcão-e-Cunha *et al.*, 2007). The score was −1.

**Table 1:** Scores of intensive rabbit production in France for the 9 sustainability indicators.

Sustainability indicator	Score for the indicator <sup>1</sup>	Total for the scale
Environment		-2
Energy use	0	
Antibiotics use	-1	
Biodiversity	-1	
Economy		1
Profit	1	
Specialization rate	0	
Transmissibility	0	
Social		1
Living and working conditions	1	
Animal welfare	-1	
Quality of products	1	

<sup>1</sup> Score could be -1, 0 or +1 (see chapter method section 1).

*Biodiversity.* The number of breeds used in French rabbit farms has fallen over recent decades. This is due to the development of genetic selection and the prevalence of selected strains. In France, more than 90% of rabbits were acquired from 4 French private breeding companies. They all sell strains originating from the New Zealand breed. Purebreds are found almost exclusively on family farms. The score was -1.

### **Economic sustainability**

*Profit.* Numerous factors such as committed fixed costs and biotechnical choices affect the profitability of a breeding unit. To draw general conclusions for a unit calls for prudence. Nevertheless, Azard (2006) showed that rabbit production can provide between 1 and 1.5 times the minimal monthly wage in France (SMIC) per month over 12 months for a unit with more than 400 females managed with artificial insemination. This figure is cited by breeders as an encouragement to setting up a unit. The score was +1.

*Economic specialisation rate.* On 60% of farms, the rabbit unit is one unit within a farm producing other products, plant or animal, which is a positive situation. But in the great majority of cases the buyer is a single individual (Azard, 2006), which is considered to be not sustainable. The final score was 0.

*Transmissibility.* Rabbit breeding requires a high level of management. Much progress has been made in recent years on controlling the breeding environment (buildings, temperature, ventilation, etc.) and on husbandry (automatic feeding, cages, etc.). These practices improve the level of performance of the unit and its consistency. However, they come at a cost which results in an increase in the farm capital and/or the cost of the installation. Moreover, this increase is made much greater by the increase in the size of the units (+46% between 1995 and 2004; Azard, 2006) made possible by the development of the batch rearing system. Thus, 32% of farmers questioned considered the high investment cost to be a deterrent for an installation (Azard, 2006). Consequently, the increase in working capital and/or installation costs is not a sustainable trend. However, one should emphasise that the building cost of a rabbit production unit is far below that of a farm with a lot of land, due to the high price of farmland. The score for the indicator was 0.

### **Social sustainability**

*Living and working conditions.* The development of the batch rearing technique associated with artificial insemination has allowed a major improvement in the efficiency of the workload, with the ability to plan

this better in advance. This criterion is often put forward by numerous breeders as being beneficial (Azard, 2006). The manipulation of animals becomes easier. This advantage certainly explains the fact that one woman is alone responsible for the rabbit unit on 42% of farms (Azard, 2006), which is far more than the 23% of women among the total professional farms (Agreste, 2005). Lastly, except in the case of disease problems, there is very little night or weekend work apart from minimal supervision. The score was +1.

*Animal welfare.* Intensive rabbit breeding consists of an indoor battery cage husbandry system. Future laws could impose higher cages (platform cages) or enrichment of cages (hay, gnawing sticks...) to improve animal well-being. In addition, feed restriction was mostly developed to reduce the frequency of digestive troubles in growing rabbits (Azard, 2006). However, one can consider that it is not suitable for animal welfare. But one could remark that such a practice can reduce antibiotic use. The score was -1.

*Quality of products.* In France, rabbits are mainly reared in intensive conditions. In fact, unlike poultry in which Red Label products have developed due to poor quality of standard products, rabbit meat from conventional farms is considered of good quality by consumers. Moreover, it does not suffer from any major defect. Rabbit meat also has nutritional interest because it is rich in selenium and is a source of omega-3 fatty acids (Gigaud and Combes, 2008).

Nearly a third of farms produce rabbit under CCP (Certification of Conformity Product), 1% under Red Label and 14% under other specifications (Azard, 2006). It is interesting to note that this aspect is changing rapidly as nearly half of the units created since 2000 are aimed at certified production. The score for the indicator was +1.

### **Global contribution of intensive rabbit breeding to sustainable development**

The addition of the scores obtained for each indicator within each scale is reported in table 1. Our results showed that intensive rabbit production exhibits a positive contribution to sustainable development on economical and social scales (total score: +1 for each scale). Indeed, the production was of quality and profitable while the investment was limited. It allowed acceptable living and working conditions. However, intensive rabbit breeding had a negative contribution to sustainable development in the environmental scale (total score: -2) due to a high use of indirect energy and antibiotics and reduced biodiversity. The final score was +1, for both economic and social scales, while the maximum score was +3. Therefore, further progress can be made regarding sustainable development, for example in animal welfare, specialisation rate, biodiversity or antibiotics use.

## **CONCLUSIONS**

In France, intensive rabbit breeding showed some negative contributions to sustainable development such as the frequent antibiotic prescriptions, weak biodiversity and an improvable of animal welfare. But it also shows several positive contributions to sustainable development, especially concerning economic and social issues. Indeed, it offers meat of good sensorial and nutritional qualities, while being profitable and allowing a good quality of life and work for the stockbreeders. Thus, the challenge will be to manage the lawful development and to face the market trends while preserving the maximum of its advantages. This is the first work that attempts to assess the contribution of intensive rabbit breeding to sustainable development using a semi-quantitative method. In future, it would be useful to develop an evaluation tool of sustainability adapted to indoor breeding units and permitting a more complete assessment (soil and water protection, direct energy use, etc...). A quantitative analysis of sustainability of rabbit breeding could therefore be possible.

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