Insight into farmhouse PDO cheese primary production environment to reconcile sanitary control and microbial ecosystems

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Socio-economic study of dairy farms in a semi-mountain PDO cheese area (St Flour, Cantal, France): Ways and strategies to improve production system robustness

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Abstract

In response to the decreasing number of dairy farms and associated workers, municipalities of the Saint-Flour area (Cantal, France) commissioned a study which aimed to better understand and describe the structures and strategies common to putatively robust dairy farms. Fifteen farms were selected and surveyed for their putative robustness. Four main successful strategies associated with improved robustness towards economic, social and environmental risks were highlighted: i) to prioritize forage autonomy through a maximization of grass use and parsimonious concentrate feeding and purchase, ii) to enhance milk paid in link with its intrinsic quality (increases of milk solids contents…) and/or through the milk delivery to dairy plants oriented to high value-added markets, and iii) to diversify the income sources with enhancement of the meat byproduct from the dairy herd and/or with the introduction of a suckling cow/ewe herd, or a farmhouse cheese plant, and iv) To reduce structural expenses by subcontracting tasks or by cooperative use of agricultural equipment and/or by very limited investments in equipment and building. Based on this assessment, a panel of proposals will be proposed to stakeholders and decision makers in order to promote those successful strategies via extension programs.

Keywords: Socio-economic study, systemic assessment, robustness, dairy farm, semi-mountain grassland area, Cantal

Introduction

In the semi-mountain Saint-Flour area (average altitude: 1 000 m) , the dominant agricultural activity is livestock grassland production systems and notably dairy farming in link with Protected Denomination of Origin (PDO) cheeses (Cantal, Bleu d'Auvergne, Saint Nectaire…) which promote associated touristic activities as well as patrimonial (customs and practices) and landscapes (biodiversity, grassland open area…) conservation. Therefore, it is necessary to maintain dairy farms to guarantee social, economic and environmental dynamics of the area. Nonetheless, recurring hazards have threatened dairy farm sustainability and associated farm jobs over the last 20 years. Thus, municipalities (merged on the name of "Saint-Flour Communauté") were concerned by reduction of dairy farms and commissioned a study to the "Ecole Nationale Supérieure d'Agronomie et des Industries Alimentaires" (ENSAIA, Nancy, France). The aim was to better understand the organization and functioning of the complex dairy sector of the area (diversities of farm and factory types) and to bring out drawbacks and strengths for farms robustness in order to present a panel of proposals to decision makers and stakeholders which could be applied via extension programs. Study was performed in two steps: at the sector scale and at the dairy production system scale. This paper reports the results of the second axis, which aims to understand the farming systems structure and functioning, and the characteristics improving their robustness.

Material and methods

Selection of dairy farm. Fifteen dairy farms were identified from a previous study examining the diversity of dairy farming systems in the Saint-Flour area (ENSAIA, 2015), and based on advice from local experts (INRA, IRSTEA and "Chambre d'Agriculture du Cantal"). The selection was oriented to be representative of the diversity of dairy farms systems of the area in terms of production scale, work organization and feeding systems, and to select farms putatively robust towards climate and economic constraints. Robustness is defined as the ability of the system to face hazards. To do so, the system can react through different types of adaptive processes in response to constraint as resistance, elasticity or plasticity (Blanc *et al.*, 2013).

Semi-directive survey. Farmers answered a survey during a 2 to 4-hour farm visit in February 2016 by five students. The semi-directive survey included questions on global organization of farming systems and on five specific topics: technical-economic management (from general accountancy data), work force management, land management, socio-economic environment, and planned future of the farm.

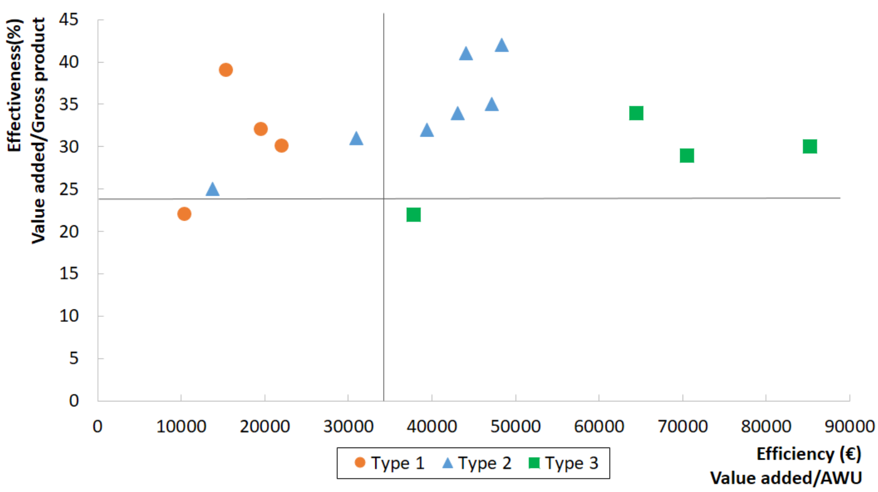
Data Analyses. Each farming system was firstly individually analysed and synthetically characterized regarding: i) land management paying attention on fields diversity and organization [cf. Bathfield *et al*. (2016) method], ii) workforce management paying attention on workload, paid and non-paid workers and work organization through talk from farmers, and iii) an annual economic situation paying attention on balance between receipts and costs and their origins (method of the "Institut de l'élevage" and "Chambre d'agriculture" for the "Réseau Inosys" farms). Three groups of farms were compared through these three topics: i) type 1: farms with less than 130 000 L of milk/annual worker unit (AWU, equivalent to the work of one full-time familial or salaried person), ii) type 2: farms from 130 000 to 250 000 L/AWU; iii) type 3: farms with more than 250 000 L/AWU, each group being supposed to work differently in terms of robustness and ways to improve it. Common assets, drawbacks and overall strategies in order to improve robustness were highlighted for each types based on this transversal analysis.

To validate experts selection, economic robustness was tested with two indicators: the work efficiency (value added divided by AWU) which is reached when it is higher than 34 000€ (limit to be able to earn incomes from the activity) and the effectiveness of the systems (value added divided by gross product) which is reached when the ratio is higher than 24%, as proposed by Velay (2016, Figure 1). Value added was used because it measures the wealth created by the farm without taking subsidies income, workforce, land and investments costs into account (Value added = animal, vegetal and other products – operating costs – external cost). Therefore, farms are evaluated independently of nature of land (owned or rented), nature of workers (head of the farm or employee)…

Results and discussion

As expected based on farm selection criteria, all surveyed farms can be classified as effective and potentially robust at the farmers lifetime scale, even if the incomes obtained by the system are quite modest in case of type 1.

Figure 1: Representation of the surveyed farms in function of the effectiveness of the system (limit at 24%) and the efficiency of labour force (limit at 34 000€) by type[1]



[1]*Type 1: farms with less than 130 000 L/Annual worker unit (AWU); type 2: from 130 000 to 250 000 L/AWU; type 3: more than 250 000 L/AWU*

Nonetheless, only nine farms are classified as work-efficient, a characteristic which is influenced by dairy production level (i.e., 5 of the 7 farms of type 2 and all the 4 farms of type 3 are efficient).

Basically, two main ways coexist to achieve robust economic performances: to raise and/or to stabilize inter-annually the gross product, and limit exposure to milk price volatility, and/or to reduce or stabilize both operating and structural costs.
Farmers followed different ways/strategies to improve [i) and ii)] or stabilize [iii)] the gross product:
i) **To enhance the milk value in link with its intrinsic** (milk solid contents, somatic cells and microbial counts) **or extrinsic qualities** by following specific production constraints linked to the milk delivery to dairy plants oriented on high value-added markets (organic milk, raw milk and/or non-fermented grass forages traditional cheese), or through the farmhouse cheese transformation. Almost all the type 1 farms and a part of types 2 and 3 farms followed this strategy raising the milk value (see milk price in Table 1).
ii) **To enhance the meat outcome from the dairy herd** (sales of non-reproductive calves and culled cows), linked with the breed choice and/or a fine reproduction management [e.g., artificial inseminations with sex-sorted semen in order to obtain dairy heifers from the expected reproductive cows, and with meat-breed semen for the rest of the non-reproductive cows (types 2 and 3)].

Tableau 1: Surveyed farms features by type (mean ± standard deviation)

	Type 1 < 130 000 L/AWU[a]	Type 2 from 130 000 to 250 000 L/AWU[a]	Type 3 > 250 000 L/AWU[a]
Number of farms	4	7	4
Structural features			
Milk production (L)	157 250 ± 41 031	295 000 ± 82 912	471 250 ± 150 686
Number of cows	35 ± 4	48 ± 12	69 ± 15
Number of workers (AWU[a])	2 ± 0,8	1,6 ± 0,5	1,3 ± 0,6
Total cultivated area (ha)	56 ± 10	92 ± 51	106 ± 39
Grass area[c] (%)	89 ± 9	94 ± 6	85 ± 14
Technical features			
Milk production by AWU[a] (L)	86 125 ± 30 931	194 786 ± 37 434	378 194 ± 89 578
Milk price (€/1000L)	383 ± 39	381 ± 55	366 ± 43
Meat byproduct[b] (€/1000L)	77 ± 29	68 ± 18	77 ± 23
Cows productivity (L/cow/year)	4 850 ± 1 034	6 200 ± 1 204	7 200 ± 1 249
Distributed concentrates (T/cow/yr)	0,7 ± 0,5	1,4 ± 0,3	1,7 ± 0,3
Economic features			
Operating costs (€/1000L)	129 ± 52	165 ± 29*	206 ± 34
Income[d] / AWU[a] (€)	11 640 ± 3923	28 403 ± 21 332	28 804 ± 6 774
Gross product (€)	108 084 ± 52 486	179 834 ± 54 467	281 747 ± 106 833
Value added (€)	33 199 ± 17 684	63 313 ± 25 535	84 654 ± 44 907
Effectiveness (%)	31 ± 7	34 ± 6	29 ± 5
Efficiency (€)	16 907 ± 5 092	40 071 ± 7 982	64 502 ± 19 823

*[a]AWU: Annual worker unit; [b]Surfaces covered by permanent or temporary grasslands; [c]Receipts from beef sold minus purchased (byproduct from dairy activity); [d]Gross operating profit minus structural costs, depreciation costs and financial costs; *n=5 because expenses could not be allocated between meat and dairy activities in two diversified farms*

iii) **To diversify the production with mixed systems** (introduction of a suckling cow or ewe herd which can optimise the use of available buildings/facilities and agricultural surfaces) **or with a farmhouse transformation and commercialization of milk**.

Conversely, strategies to reduce expenses are:
i1) **To promote feed self-sufficiency through maximization of grass use** (all types have more than 85% of the area covered by grass) **especially grazing** which allows balanced

nitrogen/energy diet and reduced grass harvest costs (most of type 1 lands) **and/or through raising the productivity by surface unit with an intensification of the forage areas** (type 2 and 3). Adaptations to increase grazing include the use of mobile milking equipment if grasslands are far from the barn (a farm of type 1, two of type 2 and one of type 3).

i2) **To promote feed self-sufficiency through limited feed purchases** (often linked with a limited cow productivity, type 1, Table 1) **and/or the introduction of crops production** to increase concentrate self-sufficiency (all types). A key factor is the coherence between the amount of distributed concentrate and the cow productivity.

ii) **To reduce structural expenses by subcontracting tasks or by cooperative use of agricultural equipment and/or by very limited investments in equipment and building.**

These results are in accordance with a previous study (Velay, 2016) summarizing year-2014-economic data of 1 673 farms of the Massif Central area. Nonetheless, man should remember than the 2014 year in Massif-Central was quite good for dairy production in regards to both milk price and climate. To really assess robustness, it would be interesting to follow farms over several years to see how they react and modulate their trajectories in face of constraints. This could highlight differences between farm strategies that are not obvious in an economically-profitable year.

Conclusions

Type 1 farms are based on a greater self-sufficiency from the input markets (feed, fertilizers) in order to reduce operating costs as much as possible. This low-input strategy brings them a certain robustness against input price fluctuations, even if it allows only limited income due to limited dairy cow productivity and then work-efficiency. Therefore, those farms are viable and robust at the generational scale, but seem hardly transmissible at the intergeneration scale because of the low income level. Conversely, type 3 farms showed comfortable incomes in 2014 but are more exposed to input price fluctuations. Building and equipment are also more modern than in type 1 due to a greater investment capacity. Nonetheless, farmers have a heavier workload, which is counterbalanced by overworking or by an essential non-paid labour force (family members). Type 2 farms show mixed strategies: they earn comfortable incomes while keeping a fair feed self-sufficiency. However most of these farms also restrain investments.

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