How to analyse technical adaptability of dairy farms involved in quality cheese production? Case study of non-pasteurized cheese production with Protected Geographical Indication label in the Pyrenean Mountains

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Abstract

In less favoured regions milk production is traditionally combined with cheese production to enhance the value of the products. In the Pyrenees producers wish to make a non-pasteurized cheese with a Protected Geographical Indication (PGI) label: "tomme des Pyrénées au lait cru". The specifications define a three month grazing period and a quarter of the forage to be given as hay during the no-grazing period. We established for 423 farms how closely the feeding management conformed to the specifications. The greatest number of farms are characterised by two types of feeding management. To conform to the specifications the forage systems of these farms should be changed. We show the value of looking at the farm system operational processes to suggest different ways of modifying management. After interviewing 12 farmers, we identified 3 methods of livestock production management and five methods of grass area management. To understand the farmer's capacity for change we analysed the convergence between livestock production management and grass use practices and as a result, described five management types. This analysis permitted us to propose different forms of technical advice to help farmers to meet the PGI label requirements. If we exclude one type, which is too far from the specifications, it is possible to propose four forms of advice that can be used for the different types of management.

I. Introduction

1. Context

Faced with changes in the CAP, there is uncertainty as to how dairy systems should evolve. In less-favoured, e.g. mountainous, regions, milk production is traditionally combined with cheese production (Brunschwig, 2000). To improve farm incomes in these regions, the dairy farms must enhance the value of the products and to the recognition of a quality cheese (Chatellier & Delattre, 2003). Generally certain criteria explain traditional production patterns. To develop relationships between milk production and quality cheese production many quality policies could be introduced, the most important being the European PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication) quality labels (Sylvander, 1994). These policies are generally essential to the local development (Barjolle et al., 1998; Barham, 2003). Producers make specifications to guarantee livestock farming and cheese processing practices. These guarantees can concern flavour, smell and appearance characteristics, food safety, and relationships with the "terroir" and brand image of the product. In the important case of mountainous regions, the first stake is to specify more clearly the milk and cheese production for labelled products. This situation is very interesting for us researchers, because it raises the question of changing the farming system.

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2. From making specifications to changing feeding practices

In the specifications, milk production is generally defined by the feeding pattern which can be more or less precisely defined. For some products with Protected Geographical Indication (PGI), feeding only needs to conform with agricultural regulations (e.g. a ban on feeding animal proteins and hormones). This is the case for the PGI "Tomme des Pyrénées", a French cheese descended from an ancient cheese-making tradition but now a standardised product made by south-western dairy firms. Also this cheese is made with the milk produced by the largest and most modern and intensive farms, many using maize silage to feed the dairy cows. But traditional cheese production continues on the cheese-making farms and small firms. Today this production made with raw milk cannot be protected by the PGI label. So the producers of the supply chain wish to make a new PGI label "tomme des Pyrénées au lait cru" to protect these products. New specifications will state that cows are to be fed with hay during winter and with 3 months of pasture in spring and will limit this production to farms in the Piedmont plain and mountainous areas. But in this region, grass silage or maize silage use is very developed. So farmers who wish to produce in accordance with specifications will have to change their feeding patterns. We are interested in studying the feasibility of these modifications in the different types of farming system.

3. Creating research and development groups and the birth of a research project.

To study forage system evolution in the Pyrenees, workgroups have been formed with farmers, farming advisers and researchers. The main objective of these workgroups is to suggest a coaching method for changing dairy farming systems. We used our competence to model the dairy system management rules and tools within these workgroups and for training farmers on the changes needed in their forage systems.

In this workshop, we describe (i) a study of feeding systems for the region's farms and their conformity with specifications (ii) a running model for a few dairy farms with an analysis of links between the forage system and herd management which is important to explain the farm system operational processes (Thénard, 2002; Marey, 2003). The aims of this work are to have a better knowledge of the farmer's scope for action as regards the change in the forage system.

II Methods

To carry out this work we used a lot of data from different sources. We illustrate our methods using this type of data and we explain our methodological approach.

1. Technical data from a large sample of dairy farms

To analyse the range of regional feeding systems, we used technical data from agricultural advisers and survey data from almost all dairy farms in the region. We had data from 423 farms. First we have tried to describe different feeding systems. Hence we have defined the grazing period with or without supplements, the indoor feeding period and the forages used. Secondly we used this result and other variables to describe the diversity in regional dairy farming systems and their closeness to the specifications. We made a statistical correspondence analysis. All variables used are given in table 1. We used the PROC CORRESP and PROC CLUSTER with the Ward method of the SAS programs (SAS, 1989).

2. Technical data and survey of a dozen dairy farms using grassland

To describe with precision forage systems and herd management we have chosen to study a limited number of cases. The thirteen farms chosen are representative of the regional dairy farms. They use grassland for dairy cow feeding and they belong to the research and development groups.

Our objectives were to identify firstly the livestock production management, and secondly the grass area management, that we call grass use. Next we tried to make a synthesis of these two subjects to explain the different management types.

First we used technical data which had already been collected by farm advisers. These data concerned (i) milk production and herd management over 5 years to identify some of the livestock husbandry practices and to link them with the rate of milk production, (ii) the grass area management described from area use calendars that explain cutting and grazing management. But these area use calendars required a comparison of the localisation and timing of farmers' interventions. We transformed time into a degree-day scale as used for phenology studies (Theau & al., 1998). In order to analyse grass use practices with area use calendars and to identify decision rules we used 3 variables:

- Feeding in late winter and spring: 3 feeding types are used. 3 farms use maize silage throughout the year; grazing when used is always combined with maize silage. 5 farms use maize silage during winter and grazing during spring without feeding with another forage. 5 farms use hay during winter and grazing during spring.
- Turnout date and date of the end of the first grazing cycle allow us to characterise spring grazing management. For all of the farms, turnout occurs between 300 and 550°C.days. 8 farms have an early turnout date, before 380°C.days. 2 have a late turnout date between 400 and 500°C.days. 3 farms have a turnout after 500°C.days. To analyse the date of the end of the first grazing cycle we considered the farms that end the first grazing cycle before the threshold of reproductive apex ablation. 4 farms ended the first grazing cycle before this threshold; the other 9 did not.
- Grazing management on hay meadows and the hay quality allow cutting practices to be characterised. 4 farms have a majority of their meadows grazed before apex emergence; 4 have the majority of their meadows grazed after apex emergence and 5 farms have specialised meadows, the ones which are cut not being grazed.

We also made a survey using "semi-managerial interviews" concerning:

- livestock husbandry practices like feeding, breeding and herd replacement practices; and grassland management practices, in particular cutting and grazing management practices. After the interview, graphical methods (like Bertin's method, Bertin, 1977) were used to identify different management types. Bertin's method permits individuals be grouped together without using statistical methods but only with a visual comparison between the different variables that describe the individuals. We made a table with individuals (the farms) as rows and variables as columns, whose different forms are represented by different colours. Successive permutations of the order of rows and columns reveal the closeness between individual farms. We analysed data to describe farming system operational processes with "practice combining" (Landais & Desfontaines, 1988).
- decision rules of the herd management and fodder production. The aim was to produce a management scheme of the grass area allocation (Coleno & Duru, 1999). The combination of this point of view and the practice approach has led to the identification of different management types and their proximity to the "tome des pyrénées au lait cru" PGI specifications.

III Results

1. A wide diversity in the feeding system in the Piedmont plain area, but few farms based on a grassland system.

The study of the 423 farms give us a description of five different feeding systems:
Type1: Grazing without supplementation for 3 to 6 months; hay and aftermath for winter feeding.
Type2: Grazing for 3 to 6 months with a hay distribution; hay and aftermath for winter feeding.
Type3: Grazing for 3 months or more, often with another forage distribution (hay or maize silage); silage (grass or maize) and hay (4-5 kg per day) for winter feeding.
Type4: 3 months grazing, generally with a silage distribution; maize silage for winter feeding.
Type5: No grazing, maize silage fed every day

The new specifications of the PGI label require a 3-month grazing period and a quarter of the forage to be fed as hay during the no-grazing period. We established how close feeding management types were to the "tomme des pyrénées au lait cru" PGI specification (table2).

This result shows that the requirements for the change in the forage system change are different for type3 and type4, i.e. the majority of farms. They will be to confirm grass use in type3 and to develop it in type4 where farmers wish to join the PGI scheme. To change feeding practices it is not only necessary to transform the forage system organisation but farmers need to take stock of the herd management and the milk production objectives.

2. Different production objectives depending on farmers

2.1. Livestock production management

The livestock husbandry practices study distinguishes 4 combinations of practices that characterise: (i) the milk production level (see the columns of table 3). This level is mainly due to livestock feeding and animal breed; (ii) 3 combinations of practices that characterise milk production distribution throughout the year (see the rows of table 3), these combinations of practices depend on culling and calving.

Table 3 shows some proximity between level and timing of milk production. We therefore proposed three livestock management types:

- Winter production with productive animals (+5500 litres of milk per cow), mainly Holstein fed with maize silage in winter i.e. feeding type 3 and/or 4 described above.
- Spring production with less productive animals (4000 to 5400 litre of milk per cow) fed with grazing during spring and summer but with a high level of concentrates in some cases (feeding type 1 and 2).
- Milk production all through the year with animals producing from 4000 to 5000 litres of milk, mainly Montbéliardes ou Brune des Alpes. Feeding is based on grass and sometimes maize silage (feeding type 2 and 3).

2.2. Grass use practices

In a Bertin's table (table 4) we used 5 variables: (i) winter and spring feeding, (ii) beginning of spring grazing, (iii) type of cutting, (iv) hay quality, (v) date of ending of supplementation in spring. We could describe 5 grass use functions:

- For 3 farms, use of grass to feed the herd is not specific because maize silage is used all through the year.
- High quality grazing with maize silage (3 farms): maize silage is used for winter feeding and a high quality of grazing in spring with specialisation of the grass area to either grazing or cutting.
- High quality grazing and hay with maize silage (2 farms): nearly the same as the previous one, but grazing before apex emergence allows high quality hay to be made.
- High level of constraints on grazing (2 farms): These mountainous farms have a low use of grazing because of the steep slopes.
- High quality grazing (3 farms): the herd is only fed with grass (grazing and hay). An early turnout date results in high quality grazing in spring.

2.3. *Management types*

The convergence between livestock production management and grass use practices allows us to identify 5 management types.

Type 1 (3 farms): milk production during winter with a productive herd and use of maize silage all through the year and little use of grazing. These farms are technically very far from the PGI specification.

For two other types the lactation period is more important than the forage management system.

Type 2 (3 farms): Milk production in winter with a highly productive herd fed with maize silage and high quality hay in small quantities in winter and grazing in spring when the feeding needs of the herd are lower. These farms do not use enough hay in winter to meet the PGI specification.

Type 3 (2 farms): this is type is characterised by milk production all through the year, use of maize silage in winter, and grazing in spring. These farms are close to the PGI specification.

Type 4 (2 farms) is concerned with farms producing cheese which grazing in spring presented a high level of environment constraints, the herd is therefore fed with a high level of concentrates. These farms easily meet PGI specifications but there is a possibility of increasing the amount of feeding.

Type 5 (3 farms): milk production in spring with hardy breeds and a grassland situation. The herd is fed with hay in winter and with grazing during spring and summer. The grass area technical management permits high quality feeding with grass. These farms are already in the PGI scheme.

IV Discussion and reflections on the evolution of farm technical systems

The five management types that we identified are either near to or far from the "tomme des Pyrénées au lait cru" PGI specifications. Type 1 is not able to produce milk for this cheese. This production system does not aim to produce milk for a quality cheese but for industry, using highly productive animals. By contrast, types 4 and 5 do meet the PGI specifications. It is to be expected for type 4 because this type already produces milk for this cheese. But farmers of type 4 use large quantities of concentrates which are not reflected in the animal production level. This can be partially explained by environment constraints, these farms being mainly in the mountains. These constraints force farmers to make poor quality hay in insufficient quantity. They make up for this by using concentrates. Farmers of type 5 are not subject to these constraints; their farms are not in the mountainous zone and so can produce hay of

good quantity and quality. This system is the one which fits best with the PGI specifications. Type 2 and 3 are intermediate. They do not meet PGI specifications because they mostly use maize silage for herd feeding. However they are not so far from the specifications because they use grazing as all or part of their feeding during spring and summer. To fit with the specifications these farmers should increase the amount of hay fed to the herd. The consequence of such an increase would be a decrease in animal productivity. We note that grazing is used with an other feed. This is specially the case of type 3, and partially case of type 2. The grazing management and feeding management using grazing could therefore be improved on these farms. An increased proportion of grazing in the feeding could have two consequences: modification of the area allocated and an increase in stock feeding management problems, such as an increase in stock or of feeding interruptions (Coléno & al, 2002).

Taking into account the 5 management types it is possible to propose different forms of technical advice to teach farmers how to meet or to keep within PGI specifications. If we exclude type 1, which is too far from specifications, it is possible to propose 3 forms of advice which can be used for the different management types:
-Identification of demonstration farms which may provide data on management systems that fit with PGI specifications and that show other farmers how to meet the specifications. These demonstration farms will come mainly from type 5. A specific piece of advice for farms of this type could be about co-ordinating grazing and cutting on the same areas. This advice could be made using tools that analyse area use over time taking account of grass quality (Theau & al, 2001).

- Technical advice for hay making. This concerns types 2, 3 and 4. The objective is to convince farmers that a late cut does not contribute to hay quantity because of senescence loss, but does contribute to poor hay quality (Theau & al, 1998).
- An advice for grazing management that mainly concerns farms of types 2 and 3. The objective in this case is to convince farmers (i) that it is possible to have an earlier turnout date using simulation models (Coléno & Duru, 1999), and (ii) that it is necessary to use areas where the grass does not grow too much. This allows the amount of rejected herbage to be decreased so as to prepare a high quality re-growth. The latter is better when residual herbage is low (Duru & al., 1999; Duru & al., 2000). Use of the “practice analyser tool” proposed by Theau & al. (2001) showing the effect of residual herbage and early grazing could be a useful tool when discussing these situations.

We should consider the PGI specifications when considering the advice to be given. In the specifications it is recommended to use hay for conserved feed. No other cutting and storage forms are considered. But the Pyrenees have a temperate climate and an early hay cut is difficult to make in such a humid climate (Charpenteau & Duru, 1983). Hence the use of other techniques that allow grass to be cut when wet, such as bale wrapping, should be given more attention. Negotiation between farmers and the cheese industry to mak common PGI specifications are moving in this direction.

References

Barham E. 2003. Translating terroir: the global challenge of French AOC labelling. Journal of Rural Studies, 19:127-138.

Barjolle D. and Sylvander B. 2002. Quelques facteurs de succès des "produits d'origine" dans les filières agroalimentaires européennes Economie et Société. Serie AG, 25

Bertin 1977. Le graphique et le traitement de l’information. Ed. Flammarion. Paris. 277pp.

Brunschwig G. 2000. Terroirs d’élevage laitier du Massif central : indentification et caractérisation. Ed. ENITAC, 223pp.

Chatellier V. and Delattre F. 2003. La production laitière dans les montagnes françaises. INRA Productions Animales, 1: 61-76.

Charpenteau J.L., and Duru M. 1983. Simulation of some strategies to reduce the effect on climatic variability on farming. The case of Pyrenees Mountains. Agricultural Systems 11:105-125.

Coléno F.C., and Duru M. 1999. A model to find and test decision rules for turnout date and grazing area allocation for a dairy cow system in spring. Agricultural Systems 61:151-164.

Coleno F.C., Duru M., Soler L.G. 2002. A simulation model of a dairy forage system to evaluate feeding management strategies with spring rotational grazing. Grass and Forage Science, 57 :312-321.

Duru M., Chaurand M.C., Foucras J., Weber M., 1999. Le volume d'herbe disponible par vache: un indicateur pour la conduite du pâturage tournant en élevage laitier. Fourrages, 157, 47-62

Duru M., Ducrocq, H., and Bossuet, L. 2000. Herbage volume per animal: a tool for rotational grazing management. Journal of Range Management 53:395-402.

Landais E. & Desfontaines J.P., 1988. Les pratiques des agriculteurs. Point de vue sur un courant nouveau de la recherche agronomique. Etudes Rurales, n°109 : 125-158.

Marey L. 2003. Analyser la conduite du système fourrager et du troupeau pour comprendre le fonctionnement de systèmes d'élevage laitier. Mémoires de fin d'études. Enitac. 40pp.

SAS Institute Inc., SAS user's guide : statistics, SAS Institute, Cary, NC, USA, 1989.

Sylvander B. 1994. La qualité : du consommateur final au producteur in Qualité et système agraire. INRA, Etudes et Recherches sur les Systèmes Agraire et le Développement, 28:27-49.

Theau,J.P., Coleno F.C., Duru M., Rauzy Y., 1998. L'utilisation de l'herbe pâturée et fauchée en référence au potentiel de production des prairies. Fourrages, 156, 589-601;

Theau J.P., Magda D., Foucras J., Rauzy Y., 2001. De nouveaux outils testés en ferme, pour améliorer l'efficience du pâturage: Une grille de caractérisation des pratiques de pâturage et de fauche. Colloque AFPF 2001.

Thénard, V., Renard, J. P., and Trommenschlager, J. M. Quelles relations entre systèmes fourragers et performances laitières dans les grandes exploitations laitières des Vosges. INRA/Institut de l'Elevage. 9ème Rencontres autour des Recherches sur les Ruminants, 9 :120.

Table1: variables of the analysis

Name and description of the variables	Number of modality for the different variables	Using in analysis
Forages used and closeness of the PGI label	4	Principal
Use of a technical adviser	2	Principal
Cheese-making farms or milk producing	2	Principal
Quantity of milk produced	4	Principal
Number of dairy cows	3	Principal
Specialisation with Holstein breed	3	Principal
Agricultural area (AA)	4	Principal
Crop area	4	Principal
Part of the grassland in the AA	3	Principal
Part of the grassland in the main fodder area	3	Principal
Other production in the farm	5	supplementary
Sub-region	4	supplementary

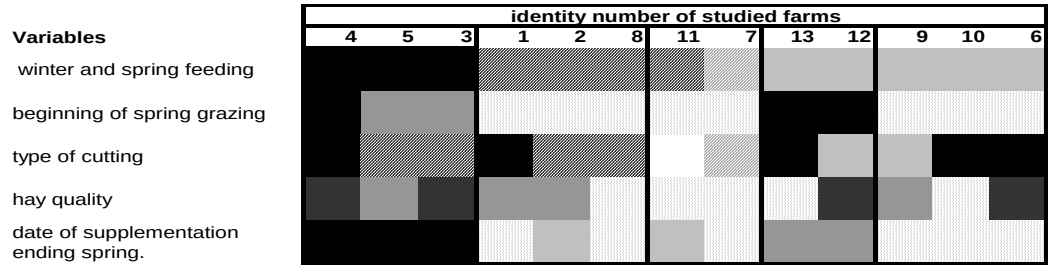
Table2: Feeding management and conformity to the "tomme des Pyrénes" PGI specifications

Feeding management	Number of farms	Conformity to the specifications	Milk production in comparison with milk production area
Type1	29	++	1.5 %
Type2	27	++	1.3 %
Type3	85	+	18.8 %
Type4	236	-	61.9 %
Type5	46	--	16.5 %

Table 3: management of milk farms

Milk production / Livestock management	Low productivity with concentrates	Low productivity using grass	High productivity with hardy breed	High productivity with specialised breed
Management for a winter production			1 farm	5 farms
Management for production throughout the year	1 farm	1 farm	2 farms	
Management for spring production	1 farm	2 farms		

Table4: grass use practices described with Bertin's method



different colours are used to represent the modality of the best explanatory variables. Each groups of farms are made with the visual aspect. For each group we could described a grass use management defined with the homogenous modalities alone.