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Sylvie Granger, Christophe-Toussaint Soulard, Stéphane Ingrand, Claude Compagnone. Functions of permanent grasslands in forage system of beef cattle farms in Burgundy. Impacts on technical implementations. 14. Symposium on Permanent and temporary grassland: plant, environment, economy. EGF 2007, Sep 2007, Gent, Belgium. hal-01195186

**HAL Id: hal-01195186**

**<https://hal.science/hal-01195186>**

Submitted on 3 Jun 2020

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**File: 1318GRANGLay.doc**

Functions of permanent grasslands in forage system of beef cattle farms in Burgundy. Impacts on technical implementations.

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## **Abstract**

In Burgundy, one third of the farms are specialised in beef cattle systems in which permanent grassland is the main feed resource. Forage production to meet animal requirements remains one of the main concerns of beef cattle farmers. Technical references on fertilisation, pasture management or sowing more productive species are available. Despite of this favourable context, farmers buy hay and straw, or use concentrates to compensate for the lack of forage resources.

In order to identify the factors of dissemination and adoption of technical innovations in the forage domain, we characterized grasslands management in sixty-three farms chosen according to: (i) farm size and stocking rate; (ii) range of fodder crops. We analysed: (i) balance between grazing and cutting; (ii) proportion of permanent grasslands in the forage system, especially for hay or silage. The diversity of sown species and duration of temporary grasslands, the use of wrapping, as an innovative harvesting technique, are discussed.

Keywords: permanent grassland, temporary grassland, management, beef cattle farms

## **Introduction**

In Burgundy, one third of the farms are specialised in beef cattle production with permanent grassland as the main feed resource. Forage production to meet animal requirements remains one of the main concerns of beef cattle. Indeed, lack of forage has to be compensated for buying hay and straw, or using concentrates. Previous studies (Gateau *et al.*; 2006) conducted in the area of the Saône et Loire, Burgundy, showed that the economic efficiency of beef cattle farms widely depends on the contribution of grasslands to the total diet. Economic efficiency was higher on farms where: (i) proportion of cut grasslands was the highest; (ii) grasslands received more fertilisers; (iii) animals received less concentrates.

Whereas technical studies on fertilization or rotational grazing management received much attention, the management intensity on permanent grasslands seemed to be limited. Permanent grasslands were mainly grazed: 61% and 56% of the area in Burgundy and France, with lower level of intensification in Burgundy: 38% were fertilized with an average of 45 kg/ha of nitrogen. Over all France, 63% of the acreage of permanent grasslands were fertilised with a mean rate of 64 kg N/ha (Agreste, 2000).

In order to analyse the factors of dissemination and adoption of technical innovations in forage systems (*i.e.* the way the farmers acquired and used information and new techniques), we studied the function of permanent grasslands in beef cattle farms assuming that the way permanent grasslands are managed by farmers depended on the assessment of their function. We hypothesized that the function of permanent grasslands was positively correlated with the proportion of permanent grasslands (*vs* temporary grasslands) on the farm and the intensity of their management (fertilization, use for grazing or harvesting, harvesting method). We

focused on forage of wrapping as a technical innovation analysing reasons for its adoption by farmers and relationships with the value they assigned to permanent grasslands.

## Materials and methods

We described forage management by surveys performed in 63 farms among 4894 in the study area, chosen in order to take into account the diversity found in beef cattle farms in Burgundy. Each farm was characterized by: (i) farm size and stocking rate; (ii) range of fodder crops. We devised the questionnaire to evaluate in detail: (i) the balance between grazing and cutting; (ii) the proportion of permanent grasslands in the forage system, especially their use for hay or silage. To gather some explicative factors, the farmers were also interviewed about: (i) farm structure: total area and labour force, field pattern and livestock housing; (ii) grasslands management: grazing and harvesting practices, fertilisation; (iii) livestock management: calving dates, range of animals sold, feeding practices; (iv) social frameworks of farmers: technical information and interactions with the extension services.

## Results

### Classification of forage management

The main characteristics of forage management differing between the farms were: (i) the farmer's priority and balance between grazing and cutting; (ii) the function of permanent grasslands regarding their use and management. We used these two criteria as typological keys to sort the farms using a multicriteria analysis. We obtained five groups (table 1) corresponding to different forage management systems.

Table 1: Main characteristics of the five forage management systems differing by: (i) priority between grazing and cutting; (ii) function of permanent grasslands in the farm (mean values).

	Group 1 (16)	Group 2 (16)	Group 5 (5)	Group 4 (15)	Group 3 (11)
Priority of the forage system		Harvesting		Grazing	
Function of permanent grasslands in the farm *	+	-	--	++	+++
Total area (ha)	89	182	265	150	98
Livestock unit/ha	1.06	1.20	1.72	1.25	1.49
Suckling cow/labour unit	40-50	60-90	60-90	50-70	35-50
Beef production	male lean female lean	lean fat	lean or fat	Various, breeds	lean fat
Temporary grassland type	% forage area TG1	12% TG2	40% TG1&TG2	18% TG1	0% -
Harvested area (first cut) (% grassland area)	36%	42%	35%	36%	32%
Forage stores	Hay (PG)	Wrapping (TG2) Hay (PG)	Silage (TG2) Hay (TG1)	Silage or wrapping, hay (TG1, PG)	Hay (PG)
Topping for hay	none	Various **	Whole area	Various**	Whole area
Grasslands fertilized	none	Harvested areas	Harvested areas	Grazed and harvested areas	Harvested areas
TG1	more than 3 species (including rye-grass, cocksfoot, white clover), duration = more than 5 years, used for grazing or cutting (one cut)				
TG2	one or two species, duration = 2 to 3 years, only used for cutting (2 to 3 cuts)				
PG	permanent grassland				
*	main interest (+++) to low interest (-) on permanent grasslands				
**	on some farms only and/or never the whole hay area				

Three groups (1, 2 and 5) prioritised forage conservation: at the first growth cycle, the proportion of harvested grassland ranged from 35% (with several cuts) to 42% (with only one cut). The harvested grasslands were those considered by farmers as the most productive. The other two groups (3 and 4) prioritised grazing on the most fertile paddocks. These paddocks were fertilised; grazed by suckling cows, often using a rotational grazing system.

The management of permanent grasslands showed a contrast between the groups 2 and 5 on one hand and the three others on the other hand.

Farmers of groups 2 and 5 harvested temporary grassland sown with one or two species (Italian rye-grass, cocksfoot, lucerne or red clover) with short crop duration (TG2). These grasslands were fertilised, cut 2 or 3 times a year for silage or wrapping. Farms of group 5 also used another type of temporary grasslands (TG1) sown with complex mixtures for a long life duration (more than 5 years). These grasslands were used for hay production in the first cycle and then for grazing. When needed, *i.e.* because of a low proportion of temporary grassland in the farm, hay was produced on permanent grasslands. Farmers of group 2 harvested sown set-aside too.

In groups 1, 3 and 4, both temporary or permanent grasslands were either grazed or harvested. The establishment of temporary grasslands, belonging to the type TG1, was justified by the necessity of pasture renovation (group 1, situation with low potential for forage production, animals sold prior to fattening) or of production early in spring (group 4). Farmers of group 3 considered permanent grasslands to be of good quality.

***Relationships between permanent grasslands and innovative behaviour of farmers: the example of wrapping.***

Wrapping appears in our surveys as a good example of technical innovation in beef cattle farms. This technique is not really new; it was known and offered to farmers from the 1980's but its use on beef cattle farms in Burgundy seems to be more recent (Liénard *et al.*, 1998). This last point was confirmed in our surveys. Among the interviewed 63 farmers, 31 used wrapping. Date of introduction and reasons for choosing this technique depended on the farmers group they belonged to (table 2).

Table 2: Use of wrapping (decreasing range) in the 63 farms according to the five groups described in table 1.

Group	3	4	2	5	1
% farms using wrapping	64%	60%	63%	60%	12%
Date of introduction	In the 1990's		Since 2000	In progress or foreseen	Not yet with a few exceptions
Reasons	Harvesting earlier 2 <sup>nd</sup> cut	Forage quality Flexibility	Use of sown set-aside or forage legumes	Replacement of grass silage	No interest

The example of wrapping shows how the adoption of a technical innovation is relevant to different strategies and different practices. The farmers who took first the opportunity of wrapping prioritised grazing (groups 3 and 4). They considered this harvest technique as a way to optimise grazing. Indeed, an earlier harvest favoured a better growth in the second growth cycle, a high yield in the second cut or gave more flexibility during grazing. This harvest method was equally used on permanent and temporary grasslands. On the opposite, farmers of group 5 organised with collective silage harvests were the last to be interested in wrapping. Wrapping replaced silage in farms where the labour resource or mutual aid decreased. In all cases, silage or wrapping was used on highly productive grasslands, *i.e.* on sown grasslands (TG2). With wrapping technique, farmers of group 2 took the opportunity to

use forage legumes and sown set-aside as fodder crops. They did not use wrapping on permanent grasslands.

In group 1, the livestock farming system (lean beef cattle, late calving dates) did not require high quality forage. Moreover, the economic situation did not permit a lot of investment.

### **Discussion and conclusion**

The statistical trend of using permanent grasslands for grazing is verified in the set of the interviewed farms, whatever the forage management. The management intensity on grazed areas, such as fertilisation and grazing method of suckling cows (set stocking or rotational) depended on the forage management. The management of grazed paddocks was of low intensity in groups 1, 2 and 5, as priority was given to harvesting. Farmers of groups 1 and 4 worried about the quality of grazed pastures and were used to renovating grasslands with a mixture well suited to grazing. To their minds, sown grasslands (TG1) behave similarly to permanent grasslands.

For making stores, permanent grasslands were not a priority in the forage management observed in groups 2 and 5 with no technical investments like harvesting method. As a consequence, hay was produced on permanent grasslands while silage or wrapping was performed on temporary grasslands. Permanent grasslands received less or even no fertilisation compared to the other harvested areas.

The classification of forage management is a way for rural extension people to promote extension operations and councils the most adapted to farmers. Farms of group 1 were characterized by a low production potential (structural, soil and climate). Farmers were concerned with effects of production factors to improve grassland production and possibility for low-intensity animal production. In group 2, permanent grasslands which were not easily tillable contributed to a high proportion of the forage area. Temporary grasslands were located in the tilled part of the farms. Farmers were interested in the diversity and choice of species for the cultivation of complementary forage, such as set-aside or inter-crops. Farmers of group 5 wanted to increase the productivity of labour and chose to simplify crop and animal management through choice of highly productive forages, set stocking grazing, grouping of calvings. Farmers of groups 3 and 4 looked after decision making tools for grazing, advices on use of manure on permanent grasslands and composting of animal manure.

More specifically, on permanent grasslands, farmers were concerned with their degradation. They considered phosphorus and potassium fertilisation as a positive factor on forage quality and on animals growth and reproduction. On the opposite, nitrogen fertilisation was seen as a factor of degradation. The way of renovating permanent grasslands, historically made by ploughing and resowing, has to be changed taking into account constraints of the new CAP regulation for permanent areas. Overseeding and direct seeding of grassland as well as the choice of forage species and varieties adapted to drought were discussed. Beef-farmers were interested in getting more information on these different topics and their request could promote new dialogues.

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