Forage systems and work organisation in small-scale cattle farms in Brazilian Amazonia

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Abstract
In family farms holdings in the Brazilian Amazon region, grassland is the basic all-year-round feed for cattle. The technical model elaborated to reduce pasture degradation by weeds is not implemented by the farmers with dairy-beef production. Work organization is a determining factor of the forage system management. Work organization, considered as the links between workers and tasks, would induce the failure to respect the grass management model. Extensive grassland are basically managed, without equipment or mechanisation, tasks demanding in workforce, and few workers availables. The aim of this study is to explore how work organization induce or not the forage system management over a year. The data, for seven dairy-beef farms, are taken from a monitoring of farmers' practices with pasture and work organization characterized from the "Work Assessment" method focussing on the seasonal work with the forage system. We identified two categories of seasonal work : pasture and land use, the varaibiliy of working times (17 to 276 days per year), the distribution over the year, and the workforce to carry out the task. We present how farmers organize their work with their forage system management over the year, and the differents strategies : delegation to salaried workers, distribution of the tasks over the year, made the work alone. The study concludes that work organization is a main factor to explain forage system mangament.

1. Introduction

On the pioneering fronts of Brazilian Amazonia, the sustainability of small-scale farms is a crucial question. Since the early 1990s, livestock has occupied an increasingly important place in the complex production systems developed by smallholders which, until then, were essentially based on crops. Economic, social and technical reasons explain the growth of this production in the farming system, with had made it an important activity in the recent years for the smallholders' sustainability (Tourrand et al. 2004). However, livestock farming is subject to strong polemics because of it is the main responsable for the deforestation (Laurance et al. 2001). In dairy-beef, herds are managed all year on pastures established after deforestation (Muchagata and Brown, 2003). Grassland in the Brazilian Amazon region is not considered as a sustainable land use because of the invasion processes by weeds (Fearnside and Barbosa, 1998). After 8 to 10 years, the pasture is complety degraded with low forage productivity and herd performances. Then, the farmer has to abandon the area and to establish another one on the forest. The degradation process induce environmental consequences with the deforestation of the main tropical forest in the world, economic consequences with low herd performances and also low economic performances of the livestock farmin system. The farmers' inappropriate management practices are identified as one of the reason for the pasture degradation. A management model has been worked out by research and development organisms to ensure the perennity of grasslands. It recommends fertilizer, two annual cuttings of the weeds and herbicide treatments (Costa et al. 2000). However, this model is not implemented by the dairy farmers who adopt other management practices for the forage system. In fact, work with grasslands differs very considerably from one farm to another

(Hostiou et al. 2006b). The technical organization of the work, defined as the links between tasks and workers (Madelrieux et al. 2004), seems to be a determining factor of the forage systems management in dairy farms (Hostiou et al. 2006a). In this sense, work constraints would induce the failure to respect the grass management model, because the work to be realized seems to more important in relation with the woerkforce available. The farms are characterized by a problem of dimensioning between the work to do and the workforce. The farms are, in many case, characterizd by large size with more 40 – 50 hectares of pasture. Due to a few equipment and mechanization, all the tasks are carried out by hand as milking the cow, cutting the weeds. They are difficult and demanding in terms of work time and workforce. The work is essentially carried out by the family, and sometimes made by only one worker. Because of their low financial capacities, the families have few recourse to salaried workers (Vosti et al. 2001; Norgaard-Richard et al. 1988). Moreover, the livestock activity is combined with others agricultural and non agricultural activities, as crops, causing global pressure on work at farm level. The objective of this article is (i) to describe work organization, focusing on the forage system in dairy-meet farms, specifying the types of tasks, the volumes of work and the workforce, and (ii) to understand how the work organization induce or not the forage system management.

2. Material and methods

This study was realized in the district of Uruará on the Transamazon road, in the east of the Pará state in Brazil. As there is no dairy industries, the farmers sell directly their milk to the city consumers (Poccard-Chapuis et al. 2002). They produce between 5,800 and 51,700 litres of milk per year (Hostiou et al. 2003). The research for this paper was based on a survey of seven dairy farmers over a period of one year (Table 1)(box 1). To take account work organization, data was collected during interviews on : (i) farmer' practises with herd and pasture management ; (ii) the manpower organization and time devoted to tasks with forage system management. For this point, we used the "Work Assessment" method (called "*Bilan Travail*"). The Work Assessment method proposed by livestock researchers (Dedieu et al. 1999) aims at "integrating the work dimension into the analysis of how livestock farming systems operate". The mean is to quantify the work linked to the management of the herds and areas (box 2). In this study, focussing on the seasonal work with pasture management, we are characterized the work organization with the type of tasks, the volume of work expressed in days per year, the workforce that carry out the tasks and the distribution over the year.

Figure 1. The localization of the district of Uruará on the Transamazon road, in the east of the Pará state in Brazil

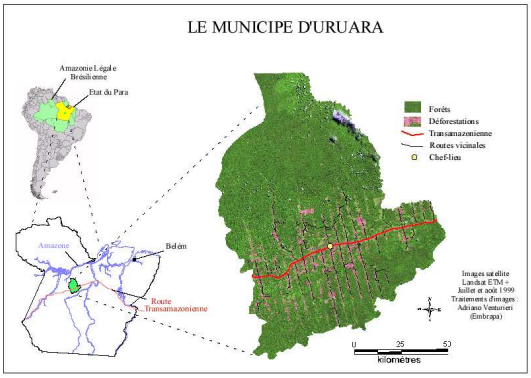

Table 1. Farm size

Farm	Farm size (ha)	Grass surface area (ha)	Number of cows for milk	Quantity of milk (L/y)
Fbo	100	53	11	5.300
Fdo	100	90	14	8.800
Fcu	100	70	33	15.500
Fdv	105	75	45	21.800
Fir	100	80	70	51.700
Fdr	20	16	17	17.200
Fdn	100	32	13	6.000

Box 1 : The average of the farm size is 100 ha due to the colonization in the 1970s. In all the 7 farms, the pasture represents the first land use of the area after deforestation, with 16 to 80 ha. Pastures are established after the forest by slash and burn. Herd feeding is based mostly upon cultivated pastures all over the year. The herd result from crossings between taurines and zebus races (Nelore, Gir, Indo-Brasil, etc). The herd varies between 31 to 157 heads including 13 to 70 cows for the milk and the calf. The quantity of milk produced varies from 6.000 to 51.700 liters over the year.

Box 2 : For the Work Assessment method (Bilan Travail), the principle of the survey is inspired by analytical reconstitution (Lacroix and Mollard, 1991) of the agricultural year work during a semi-directive interview (Darré et al., 1993). Beyond the method of collecting information (by survey, and on working times), the categorization of tasks and labour is the foundation of the specific features of the approach to livestock farming work at year level. At farm level, the data is analysed to characterize and quantify the routine and seasonal work load of the different contributors. Tasks are differentiated according to the rate at which they are completed. The routine work, expressed in hours and performed daily, is difficult to concentrate and defer ; the seasonal work includes tasks that can easily be deferred or concentrated, be it cultures, fodder or herd management and is quantified in numbers of days per year. All the workers are not equivalent according to their function in the working group, their rhythm of involvement (Allaire, 1988) and the way there are remunerated for their work. Thus the method distinguish : the workers whose agricultural activity is preponderant and who organize the work on the farm (the farmer, the farming couple, the associates of a farming association…). This group is named “basic group”. The workers outside the basic group consist of volunteers (retired people and people giving a hand), salaried workers, mutual help and the intervention of sub-contracting companies and temporary workers.

3. Results

3.1. Work organization with forage system management in the dairy-meet farms

3.1.1. Types and volumes of work

From the analysis of the Work Assessment data, we categorized two types of seasonal work with the forage system : (i) the seasonal work made with pasture; (ii) the seasonal work made with land use. The seasonal work with pasture includes the cutting of the weeds done by hand using a sickle. This task is done in all the 7 farms, with high variability : from 17 to 124 days per year. The seasonal work the land use, which is characterized by ocasional tasks as :

- the restoration of invaded pasture (cutting weeds, slash-and-burn and sowing forage grass),

- the establishment of pasture after forest (cutting trees, slash-and-burn, sowing forage grass),
- putting up and repairing fences.

The seasonal work with land use also presents important variabilities in working time over the year. The restoration and establishment of pasture are carried out in 3 farms. The task of restoration of degradated pasture is between 20 to 88 days per year ; the task of establishing pasture is between 40 to 101 days. The task with fencing varies from 14 to 56 days per year, and it is made in 6 farms. The task with the fences is made in 6 farms (14 to 56 days per year).

3.1.2. Workforce

Several categories of workforce are mobilized to carry out the seasonal work with the forage system. The basic group is composed by one to two permanents workers from the family, which is the farmer or/and his son. The basic group may carry out the work alone (case of the farmer Fbo). Four farmers are helped by the voluntary help of a family member. This voluntary help can be important (22% of the seasonal work). In three farms, the basic group may also use temporary salaried, which can represent an important part (60 % of the seasonal work). The contribution of the paid workers may be greater with the employment of permanent staff in two farms. The seasonal work may be partly or wholly delegated to them.

3.1.3. Periods of work

The periods to made the seasonal work differ according to the farms : dry season (january to june) / wet season (july to december) / all over the year. The distribution of the work over the year depends partly of the type of task. The work with the land use is carried out in the dry season because these activities cannot be put off as the restoration and establishement of pasture. Theses tasks include the cut of the trees, which must be carried out in the dry season to enable the biomass to dry out and then be burned until the first rains. Livestock farmers carry out grassland upkeep work in the rainy season. This distribution can be a choice determined by the forage system management. The farmers aim at cutting the weeds during the rainy season which corresponds to the rapid growth of the grass. Another factor to explain the distribution of the tasks with pasture depends on the interactions with others agricultural activities during the year as the crops, for which the main activities are concentraded in the wet season.

Table 2. Work organization in the seven dairy-beef farms in Uruará

Farm	**Type of seasonal work (d/y)**				**Season of work**	**Workforce (% of seasonal work)**			
	Pasture	**Land use**				**Basic group**	**Voluntary work/mutual aid**	**Permanent salaried**	**Temporary salaried**
		Restoring pasture	**Establishing pasture**	**fencing**					
Fbo	17	0	0	0	Wet season	100	0	0	0
Fdo	17	0	0	20	Wet season	70	22	0	8
Fdv	106	20	101	40	All the year	33	7	0	60
Fcu	22	54	40	20	All the year	38	2	0	60
Fir	124	0	0	30	Wet season	14	0	38	49
Fdr	15	0	0	14	Wet season	0	0	100	0
Fdn	0	88	80	56	Dry season	90	10	0	0

3.2. Qualification of work organization

3.2.1. Low seasonal work

Some farms have low volumes of seasonal work (17 to 37 days) but with two different organization.

a) Realized in autonomous

In two farms, the farmers limit the seasonal work to the manual cutting of the weeds on dairy cows plots (17 d/y). The objective is to reduce the development of self-propagating vegetation to make it easier to supervise and monitor the cows in the field. One farmer made the putting up fencing (20 d/y). The work is carried out only by the basic group composed by the farmer or with voluntary help from the family.The sesaonal work is made in the rainy season, but with few time to made it because this period is subject to competition with the crops. In the others periods of the year, the basic group has anothers activities with the farm and outside the farm. These farms are characterized by the large dimensions of the livestock unit in relation to the size (50 to 90 hectares of pasture) of the basic group (1 permanent) and to the low availability of voluntary help from the family. Moreover, they are marked by a combination of agricultural (livestock-crops) and non-agricultural activities. The pressure on work at farm level is considerable. With low income from the livestock production (low milk production with 6000 to8000 liters selling by year, selling of few heads of cattle), the farmers don't want to mobilize their income to employ salaried.

b) Delegation to one permanent salaried

In a farm, the seasonal work is based on the seasonal work with pasture (15 days). During the year, all the plots are cleaned by hand to maintain a low level of invasion. The work with land use consists of putting up fencing (14 days). The seasonal work is entirely delegated to a permanent paid worker because the farmer has an another economic activity outside his farm and lives in the town.

3..2. High seasonal work

Some holdings are characterized by high volumes of seasonal work (116 to 277 days). Several work organisations can be identified.

a) Concentrated the work in the dry season

One farm is characterized by seasonal work exclusively with the land use (224 days). The restoration of the pastures replaces the cutting of the weeds which has not been carried out for years. The establishment of pasture on the forest aims to increase the available grass. Fencing is put up to modify the management of the cows at grazing. The work is carried out exclusively the basic group, composed by the farmer and his son. Voluntary help from the family mades one part of the seasonal work with establishment of pasture on the forest (10%). The seasonal work is carried out only during the dry season because the periods are imperative for restoration and establishment, and because in the rainy season, the family workforce realized only the work with crops.

b) Delegation to temporary salaried

Two farms are characterized by a large amount of seasonal work with the grasslands and with the land use (136 to 267 d/y). They work on grasslands allocated to milked cows by cutting the weeds by hand. The work is carried out during the rainy season, to benefit from the rapid growth of the grass. With an objective of increasing the herds, the grassland area is modified by : establishment of pasture on the forest and renovation of invaded grasslands. Fencing is also put up on the grasslands afterthe establishment phase to enable the herd to use the grass. These activities that cannot be put off are carried out in the dry season. The basic group, composed by farmer, mades seasonal work with pasture and land use. A large part (50 % of the seasonal work) is delegated to temporary paid workers taken on during the dry season for restoration and establishment work.

c) Delegation to permanent and temporary salaried

The seasonal work is made with pasture (cutting the weeds) and lanu use (fencing). The basic group, composed by the farmer, delegates a large proportion of the work to full-time (38 %) and temporary workers (49 %). The work is concentrated in the rainy season, because the objective is to benefit from the growth of grass to improve the effectiveness of the cutting of self-propagating vegetation. In this farm, the objective is to maintain the grasslands at a low level of invasion with regular upkeep of the grassland area.

4. Discussion/Conclusion

From this exploratory study taken account a technical approach, we are able to spectify the work organization in relation with forage system management, focussing on the seasonal work for dairy-beef farms in an agricultural border on the Amazon region. In this context, where the farmers have no recourse to mechanization, work organization with the forage system is based on the types of tasks, the volumes of work and the workforce mobilized. Thus questions of work organization are not asked in the same way for all the farmers. Some farmers have done a priority to maintain grassland to produce milk, which induces a regular unkeep of the grassland by cutting of the weeds done by hand and repairing the fences. These farms are characterized by the relative stability of heads of cattle and hectares of pasture. In this sense, work with pasture is a priority, and can involve considerable times of work depending on the area. The work is carried out at a defined period : the rainy season. The farmers have recourse to full-time and occasional paid workers to complete their own workforce. Some farmers aim to adjust grass resources to the herd, with cutting, restoration and establishment of pastures. The farmers accept to losses of forage production because the upkeep is not annual on all the grassland. They have recourse to occasional workers (help or salaried) to complement their workforce. The work organization is marked by alternating the types of tasks to be carried out during the year (pasture/land use). Some farmers aim at carrying out the work with the forage system from their one workforce. They are characterized by a combination of agricultural and non-agricultural activities. The work carried out depends on the availability of the family workforce. Farmers are implementing different ways to organize their work in relation with forage system management : delegation to salaried workers or voluntary help; distribution of the tasks over the year for example. Thus, reflexions about work organisation in order to promote sustainable management of pasture, and reducing pasture degradation, can not be the same for all the farmers.To provide adapting advices and reference for the farmers to improve their work conditions and the sustanibiliy of the grassland, one prospect is to continue the research about work organization using the Work Assessment method to produce knowlegde and references. From this study, we identified some important criterias to study some important situations : interactions between livestock and others activities (specialized livestock farms, farms with a combination of agricultural and non-agricultural activities); the workforce (size and composition of the basic group ; presence of occasional and full-time paid workers, family volunteers); forage system management (use of mechanization, forage and animal intensification). The aim of research and development actions about work organization is to improve farmers' work conditions and encourage the livelihood and the transmissibility of the farms from one generation to the next.

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