

Characterization of dairy farms in a family-farm system in the municipality of Senador Guimard, Acre State, Western Amazon

Diagnóstico de propriedades leiteiras em regime de agricultura familiar localizadas no município de Senador Guimard, Acre, Amazônia Ocidental

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ABSTRACT

National dairy production is characterized by significant heterogeneity in production techniques and herd and farmer profiles. Our objective was to characterize 18 dairy farms under family farming in Senador Guimard, Acre State, from January to December 2019. Data were gathered through 255-question semi-structured forms applied to farmers in monthly visits. The data were then stored in Excel® spreadsheets and subjected to descriptive statistics. A joint analysis showed the following characteristics: farmers with low schooling level (89%); farmers of advanced age (61%); non-adoption of good dairy practices (100%); inadequate milk transport (72%); adequate brucellosis vaccination (100%); non-specialized herds (40%); pasture production system (100%); low productivity per area (873 L/ha/year) and per cow (4.0 liters/cow/day); low number of lactating cows (53%); and gross milk income (29,466.65 R\$/year) representing 69% of the total gross income. The region studied has positive factors such as market guarantees, proximity to large market centers, reasonable land prices, suitable climate, ease of credit, rural education, and technical assistance. Overall, the farms are managed under a traditional production system, with low use of technology and unsatisfactory zootechnical indexes. However, the region has favorable conditions for dairy farming development.

Keywords: Productivity. Gross income from the activity. Production system. Lactating cows.

RESUMO

A produção nacional leiteira é caracterizada por grande heterogeneidade, tanto nas técnicas de produção, quanto no rebanho e perfil dos produtores. Objetivou-se caracterizar 18 propriedades rurais produtoras de leite em regime de agricultura familiar, no município de Senador Guimard, Acre, durante o período de janeiro a dezembro de 2019. Para obtenção dos dados, foi aplicado um formulário semiestruturado contando 255 questões e atualizações mensais dos indicadores durante visitas técnicas às propriedades. Os dados foram tabulados em planilhas no software Excel® e submetidos à estatística descritiva. A análise conjunta resultou em baixa escolaridade dos produtores (89%); idade avançada (61%) dos produtores; não realização de boas práticas de ordenha (100%); transporte inadequado do leite (72%); realização de vacina para brucelose satisfatória (100%); rebanho não especializado (40%); sistema de produção a pasto (100%); baixa produtividade por área (873 L/ha/ano) e por vaca (4,0 litros/vaca/dia); baixo índice de vacas em lactação (53%); e renda bruta do leite (29.466,65 R\$/ano) representando 69% da renda bruta da atividade. A região estudada apresenta fatores positivos como garantia de mercado, proximidade dos grandes centros, preço da terra, clima, facilidade de créditos, educação rural e assistência técnica. Concluiu-se que as propriedades possuem sistema de produção tradicional com baixo emprego de tecnologia e indicadores zootécnicos insatisfatórios. No entanto, constatou-se que a região apresenta condições favoráveis para o desenvolvimento da produção.

Palavras-chave: Produtividade. Renda bruta da atividade. Sistema de produção. Vacas em lactação.

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Introduction

Brazil is the third largest milk producer worldwide and first in South America. Its production has continuously increased, reaching more than 35 billion liters in 2020. This growth was 2.37% higher than in 2019, while productivity has reached 2,192 kg/cow/year. However, it is pretty low when compared to other countries such as the USA (10,610 kg/cow/year) and New Zealand (4,289 kg/cow/year) (Empresa Brasileira de Pesquisa Agropecuária, 2021).

Despite its evolution, Brazilian dairy production is still highly heterogeneous. It can be seen in both production techniques and herd and producer profiles. In this context, most farmers (66.6%) produce up to 50 liters daily, making up only 30.2% of the national production (Matte Júnior & Jung, 2017).

In Acre State, herds are characterized by low productivity. According to Queiroz & Souza (2021), the average milk production per cow in Acre is 3.3 liters per day compared to the average of 3.6 liters for the dairy basin in the northern region and the national average of 7.4 liters. In the state, there are about 23 thousand dairy farms. Among them, 83% are run by small producers, with herds of up to 100 heads (Instituto Brasileiro de Geografia e Estatística, 2018; Reis et al., 2019). However, the state produced 46 million liters of milk in 2018.

Given the above scenario and the importance of dairy farming to family agriculture, the production methods used should be evaluated for efficiency. In this sense, the information generated must be dependable, regional, and essential. With this, an action instrument can be provided for decision-making about productivity- and profitability-related variables (Lopes et al., 2010; Matte Júnior & Jung, 2017). Thus, diagnosis and information obtained on the

producer profile of a particular region become essential tools as it supports activity planning or improvement of indexes (Gomes et al., 2018).

Therefore, this study aimed to characterize dairy farms under family farming in the municipality of Senador Guiomard, Acre State, Western Amazon (Brazil).

Material and Methods

The survey was carried out in 18 dairy farms under a family labor regime, in the municipality of Senador Guiomard, state of Acre, from January to December 2019. The farms used in the study participated in the first year of technical and managerial assistance from the SENAR-ACRE in partnership with the SEBRAE-ACRE. They were selected considering their willingness to participate and the availability of good-quality data.

A semi-structured form containing 255 questions was applied to farmers. It was divided into 1) farmer and farm registration (52 and 12 questions, respectively) and 2) herd and milk production characterization with emphasis on milk quality and milking management (191 questions).

Moreover, farm performance indicator indexes were updated monthly during technical visits throughout one year, which is the productive cycle of dairy cattle (Almeida et al., 2017). The indexes evaluated were: 1) annual milk production (L/year) as the sum of total milk production sold and on-farm consumed for 12 months; 2) daily volume of milk produced (L/day); 3) annual milk production divided by the 365 days of the year; 13) productivity (L/ha/year) as the annual milk production divided by the total area (in ha) intended for dairy activity; 12) animal per area (heads/ha) as the total herd divided by the total area (in ha) intended for dairy activity; 8) is used for agricultural activity (ha): total area in ha used for dairy activity; 7) total herd (heads) as the average number of the total herd including all animal categories; 9) production per cow (liters/cow/day) as the volume of daily milk production divided by the number of lactating cows; 4) lactating cows (heads); 5) an average number of lactating cows in the month; 6) dry cows (heads) as the average number of dry cows per month; 10) lactating cows/total cows (%) as the lactating cows divided by total cows multiplied by 100; 11) lactating cows/total herd (%) as lactating cows divided by the total herd multiplied by 100; 14) milk price (R\$) as the average price received per liter of milk throughout the year, calculated using a weighted average; and 15) gross milk income (R\$/year) as the income from the sale of milk during the year.

Data were tabulated in Excel® spreadsheets, with responses being grouped according to a category on the diagnostic

form. Descriptive statistics were used, calculating the mean, standard deviation, and minimum and maximum values.

Results and Discussion

Dairy farming is one of the most essential activities in Brazilian agriculture. In Acre, the economic development model is primarily based on extractivism. Livestock has been gaining ground since the 1980s and is still performed by smallholder farmers (Assis, 2014). Dairy farming in Acre State is typically carried out by small and medium-sized producers, with a daily production of less than 50 L of milk. The dairy farms in the state have an average of 37 heads, and animals are crossbred herds (Queiroz & Souza, 2021).

The socioeconomic analysis (Table 1) showed that most of the interviewed farmers (61%) were over 51 years old, six (33%) were between 31 to 50 years old, and only one (6%) was under 30 years old. Among them, 12 (67%) inherited

the dairy farming business from their families, and six (33%) migrated from other activities, the vast majority from extractivism. These results indicate that dairy farming is managed by farmers over 50 years old, and young people (children) go to the city to study and work and do not return to the rural area. Different results were observed in the same municipality in the 1990s by Franke et al. (1998). They found that most of the population was around 30 years old (51.6%). As a result, failures in family succession were observed, as this is no longer the reality in the farms in Acre State nor throughout the country.

Studies by Reis et al. (2019) in the Acre State and by Cunha et al. (2018) in the region of Lago de Tucuruí (Pará State) showed similarity in age profile, with most farmers being around 50 years old. Matte & Machado (2016) believed that the age of farmers is an essential factor in technological adoption and long-term business health. Population aging

Table 1 – Socioeconomic summary of the 18 dairy farms surveyed in 2019 in Senador Guiomard, Acre (Brazil)

Question	Finding	Number (n=18)	%
Age	Up to 30 years old	1	6
	31 to 50 years old	6	33
	> 51 years old	11	61
Schooling	Illiterate	3	17
	Elementary unfinished	10	56
	High school unfinished	3	17
	High school finished	2	11
Family succession	Yes	12	67
	No	6	33
Type of labor	Familiar	17	94
	Hired	1	6
People involved in the activity	1	9	50
	2	9	50
	3	0	0
Place of birth	Within the state	11	61
	From another state	7	39
Family income	Up to 1 MW	1	6
	2 to 4 MW	10	56
	5 to 7 MW	6	33
	> 8 MW	1	6
Residing on the property	Yes	18	100
	No	0	0
Land-use regime	Own	18	100
	Rented	0	0
Land registration	INCRA	17	94
	State	0	0
	National	0	0
	None	1	6
Other activities developed	Beef cattle	3	17
	Fruit growing	2	11
	Horticulture	2	11
	Fish farming	4	22
Ease of access to the property	Good year-round	4	22
	Bad in the rainy season	14	78

is a reality in most countries due to the rural exodus of young people. The leading cause of this rural exodus is the perception that agricultural activities are poorly paid, in addition to divergences within the family, causing successors to migrate to big cities in search of opportunities (Foguesatto et al., 2016; Matte; Machado, 2016).

Regarding education (Table 1), more than half of the farmers had incomplete elementary education (56%), and three (17%) declared themselves to be illiterate, while none had higher education. This result may have occurred due to the difficulties of producers in attending school, often because of distances between their homes and schools, the overload of work on the farm taking up all their time, or even the lack of schools nearby. Also, in this study, it was possible to observe the failure in school transport due to the precarious conditions of the roads in the rural area and the low government incentive and lack of teachers in schools.

Similar results of the present study were also found in all regions of the country (Lenz et al., 2019; Pereira et al., 2019; Soares et al., 2013; Vasconcelos & Schilindwein, 2018). Picoli et al. (2015) conducted analytical research and reported a negative correlation between lower education levels and milk quality, management, and productivity. This association might be due to a common understanding of proper techniques and practices, resulting in non-investment.

This study has shown that dairy farming is characterized by smallholders who raise dairy cows in extensive grazing systems, occupying family labor. The activity is an income complement for most producers since many also raise beef cattle. Moreover, exclusive use of family labor (Table 1) was found in all farms (94%). Bayma et al. (2018) also observed a similar result in the region of Tarauacá and Acre State (79%). Family labor is a common feature throughout the Amazon region (60%) and is considered of great social importance. However, it can also be considered a limiting factor for technological innovations, as family farming is strongly related to traditional farming (Santos et al., 2017).

In all 18 properties (100%) (Table 2), hand-milking was done once a day, cows were milked in the presence of their calf, and in only one farm (6%), milking was performed twice a day. Before milking for oxytocin release, the presence of calves is widely used on Brazilian farms. Some of the possible advantages of this management are higher milk production, better performance of calves, and lower incidence of mastitis and diarrhea in calves. Otherwise, the disadvantages are more significant labor, the need for their facilities, and non-monitoring of calf milk intake, which may also reduce the reproductive performance of cows (Junqueira; El Faro; Vercesi Filho, 2018). It is also

possible to point out that in the Acre region, the dairy herd comprises Zebu breeds due to the tropical climate and the management adopted. These breeds usually experience difficult adaptation to milking because, to release adequate concentrations of oxytocin, most cows need the presence of the calf during milking (Glória et al., 2010). For van Amburgh & Drackley (2005), conventional suckling (natural) often does not meet the nutritional requirements of dairy calves for growth and development. Pereira et al. (2019) surveyed family properties in northwestern Minas Gerais State and noted that only three (25%) milked cows in the presence of their calf.

Mechanical milking was observed in more than half of the farms (56%), and eight (44%) used manual milking (Table 2). Reis et al. (2019) studied the Vale do Acre mesoregion and obtained different results. Only 20% of the farms had a mechanical milking machine, which could be associated with advantages such as maximizing the workforce and faster milking. The milking equipment on the studied farms came from a state incentive project, which donated milking machines and other essential equipment.

Several corral structures were found (Table 2), namely open-air unpaved corral (22%), covered unpaved corral (44%) and covered paved corral (33%). It was not a priority for the farmers to have adequate facilities for milking due to the low milk quality requirements and the little importance that the local dairies gave to the quality of the milk. A similar result was also reported in the municipality of Xapuri - Acre State, in which (43%) of the facilities were covered, (22%) had a milking room, and (19%) had paved corrals (Assis, 2014).

According to the Normative Instruction 76 of the Ministry of Agriculture, Livestock, and Supply (Brasil, 2018), milking parlor facilities must allow easy cleaning, have a covered structure, and waterproof floor paved with rough cement for easy water drainage, in addition to water installation for sanitation. Most of the farms studied (67%) were out of that standard, which, as reported by the owners, is due to their low investment power.

In 13 farms, milk was not stored on site (72%) (Table 2) but transported to the dairy plant and the consumer within the same day. Only two farms had bulk tanks (11%), while three farms stored milk in domestic freezers (17) from informal sales. Pantoja et al. (2011) reported that milk storage temperature (4°C) and time (48 h) pronouncedly determine the intensity of the multiplication of microbial species.

Milk was transported in cans (83%) by uncovered pickup trucks, refrigerated vans (6%), or recyclable plastic bottles

Table 2 – Characterization of milk quality-related aspects in the 18 dairy farms in Senador Guiomard, Acre (Brazil)

Question	Finding	Number (n=18)	%
Milking	cows milked in the presence of calf	18	100
	No calf	0	0
Number of milkings per day	1	17	94
	2	1	6
Type of milking	Manual	10	56
	Mechanic	8	44
Types of corral design	Open air and unpaved	4	22
	Covered and unpaved	8	44
	Covered and paved	6	33
Milk storage	Freezer	3	17
	Expansion tank	2	11
	No storage	13	72
Milk analysis access	Yes	0	0
	No	18	100
Water treatment	Yes	0	0
	No	18	100
Cow drying	Yes	4	22
	No	14	78
Tests for brucellosis and tuberculosis	Yes	8	0
	No	18	100
Types of pre-milking teat hygiene	Water washing	8	44
	Collective cloth	4	22
	None	6	33
Pre-dipping	Yes	1	6
	No	17	94
Post-dipping	Yes	0	0
	No	18	100
Material used to dry teats	Cloth	7	39
	Paper towel	0	0
Disposal of milk unfit for consumption	Yes	6	33
	No	12	67
Product used for cleaning utensils	Soap bar	11	61
	Neutral detergent	7	39
	Up to 1 hour	4	22
Time from the end of milking until delivery of milk	From 1 to 2 hours	2	11
	From 2 to 3 hours	4	22
	> 3 hours	8	44
	Tin	15	83
Milk transport	Freezer truck	1	6
	Plastic bottle	2	11
	Yes	1	6
California Mastitis Testing	No	17	94
	Yes	3	17
Performance of screened mug/ black-bottomed	No	15	83
	Informal	5	28
Type of marketing	Formal	13	72

(11%) (Table 2). These results show the transport stage's fragility due to the lack of official inspection.

For Vargas et al. (2013), inadequate milk storage and refrigeration may significantly increase total bacterial counts, posing a health risk to consumers. Vasconcelos & Schilindwein (2018) found that most family farmers in the municipality of Muriaé, Minas Gerais, cooled the milk in a collective bulk tank (46%), their tanks (15%) or stored it in

an immersion freezer (13%). In contrast, Matsubara et al. (2011) noted that in the Pernambuco countryside, none of the farmers surveyed cooled the milk on the farm.

Milk was informally sold on five (28%) farms interviewed (Table 2), a common practice in Acre. In 2017, only 59% of the milk produced in the state was sold to the dairy industry. The remaining 41% comprised informal sales (Instituto de Defesa Agropecuária e Florestal do Estado do Acre, 2018).

Commercialization of raw milk in Brazil has been prohibited since 1952. However, a large part of the population buys it directly from producers, as they believe it is healthier and tasty, in addition to having a more affordable price (Molina et al., 2015). Motta et al. (2015) found that milk sold informally in the countryside of São Paulo State did not meet the hygienic and sanitary standards required by Normative Instruction 62. However, the study by Linhares et al. (2021) in the same region showed that producers who carried out informal marketing were interested in introducing measures of good milking practices to improve milk quality. This is due to the more significant concern with the final consumer through direct contact with them.

Regarding milking management, most farmers did not perform good practices (Table 2). Only water (44%) or a collective cloth towel (22%) was used for teat hygiene. Pre-dipping was done by only one (6%) and post-dipping by none of the farms because cows were milked in the presence of their calf. The products used for cleaning utensils were inappropriate, such as bar soap (61%) and neutral detergent (39%). This is a typical result found in studies on small dairy farms nationwide (Lenz et al., 2019; Soares et al., 2013; Vasconcelos & Schilindwein, 2018). Often this is due to the lack of knowledge of these practices. Picoli et al. (2014) also reported a negative correlation between family farming and the producer's education, milk quality, management, and productivity.

California mastitis test (CMT) was not done on 17 of the farms evaluated (94%), and clinical mastitis detection before milking was not done on 15 (83%). Part of the farmers did not perform any treatment of cases of clinical mastitis (33%), as they reported being ineffective. Mastitis causes direct and indirect economic losses due to reduced milk production, costs of medicines, veterinary assistance, decreased quality, discard of contaminated milk, and culling of animals, which could represent 15 to 24% of gross income (Lopes et al., 2012; Vissio et al., 2015).

In addition to microbiological control of milk, good milking practices are crucial for mastitis control in dairy herds (Busanello et al., 2017). According to Santos & Fonseca (2019), mastitis detection tests (CMT and strip cup testing) should be included in the milking routine since early diagnosis and prompt initiation of adequate treatment of clinical mastitis are essential to achieve control program goals.

Low-quality milk causes economic, technological, and social problems. It can be related to several factors, including poor handling and hygiene in milking, high mastitis rates, improper equipment maintenance and disinfection, unskilled labor, and inefficient or non-existent refrigeration (Bánkuti et al., 2016).

On all farms, the production system adopted was extensive grazing, with occasional concentrates supplementation during periods of forage shortage. Regarding the pastures, all dairy farms used tropical grasses, with the genus *Urochloa* present in 100% of the farms (*Brizantha*, *decumbens*, and *humidicola*). Only two (11%) respondents reported cultivating the species *Panicum maximum* of the Mombasa variety on their land.

The predominant breeds were Girolando and crossbred (CB) animals. Only one farm (6%) had a herd with added genetic value due to the implementation of artificial insemination. In the state of Acre, animals' low dairy genetic potential is seen as a limitation for milk production (Bayma et al., 2019).

Table 3 lists the zootechnical indexes found on dairy farms. The average annual production was 24,982 liters of milk, accounting for a daily average of 68 liters. This average milk yield is higher than that found by Jamas et al. (2018) (40 liters/day) on family farms in the municipality of Bofete, state of São Paulo (Brazil).

As for production per cow (liters/cow/day), the average was 4.0 L, like the average found by Assis (2014) (4.2 liters/cow/day) in the region of Tarauacá, Acre State. However, lower than the values obtained in other regions of Brazil, namely in Minas Gerais State (13.11 L/cow/day) by Bassotto et al. (2018), in Rio de Janeiro State (12.15 L/cow/day) by Moraes et al. (2016), and in the central region of Paraná State (6.04 L/cow/day) by Battaglini et al. (2013). Notably, all the studies cited were under pasture production systems.

It is worth noting that, according to Oliveira et al. (2001), productivity per lactating cow directly influences land productivity and that increasing animal productivity is the most viable alternative for increasing profitability. Among the farms, the average area intended for dairy activity was 32 ha (Table 3). The mean productivity reached 873 (L/ha/year), similar to the finding by Silva et al. (2011) in Pernambuco State (846.42 L/ha/year) but much lower than those of Moraes et al. (2016) in Rio de Janeiro State (13,085.59 L/ha/year) and of Bassotto et al. (2018) in the south end of Bahia State (2,146.2 L/cow/year).

Lopes et al. (2010) observed that smaller farms (ha) achieved higher yields (5,896.20 L/ha/year), while larger ones had worse results (830.66 L/ha/year). Productivity per area is the most complete performance indicator used to predict whether the farm is economically efficient in using resources. According to Lopes et al. (2003), this indicator must be at least 4,380 L/ha/year for proper land use. The productivity indicators found in this research are considered low due to factors linked to inadequate nutrition and the herd and low genetic value of the animals. This limitation needs to be worked on with the technical and managerial assistance of SENAR-ACRE.

Table 3 – Descriptive statistics of the zootechnical indexes of 18 family farms from January to December 2019 in Senador Guimard, Acre (Brazil)

Zootechnical index	Average	Minimum	Maximum	SD
Production (L/year)	24,982	9,125	47,815	27,358
Daily volume of milk produced (L/day)	68	25	131	75
Lactating cows (in heads)	18	5	45	28
Dry cows (in heads)	20	53	71	12
Total herd	71	17	188	121
Area for the activity (in ha)	32	7	77	49
Production per cow (liters/ cow/ day)	4.0	2.5	6.1	2
Lactating cows/ total n° of cows (%)	53	20	71	37
Lactating cows / total herd (%)	26	10	34	17
N° of animals per area (in heads/ ha)	2	1	4	2
Milk productivity (L/ ha/ year)	873	395	1414	721
Price of milk (in R\$)	1.30	1.00	2.50	1
Gross income from milk (R\$/ year)	29,466.65	11,242.00	52,596.50	29,242.00

SD = Standard deviation

The average number of lactating cows (Table 3) was 18 heads, with a ratio of 53% over total cows (20% \pm 71%). Neves et al. (2011) found a similar result (52.1%). Still, ours were lower than that of Moraes et al. (2016) (77%) and Resende et al. (2019) (> 80%). This index is characterized by gestation, dry, and lactation periods, and it is influenced by factors such as environment, management, feeding, and animal health practices. Therefore, assuming that the calving interval should be 12 months and the lactation period 10 months, the desired percentage is 83% (Almeida et al., 2017). Also, according to the authors above, the correlation between the number of lactating cows in a herd with increased revenue reduces the number of unproductive animals. It affects the capital turnover rate, providing productivity gains that are important to balance costs.

The average milk price sold in the region (Table 3) was R\$1.30, slightly below Brazil's annual average (R\$1.42). Considering that the milk sold informally in the region is twice (R\$2.00) the price paid by local dairy products (R\$1.00), the gross income obtained by milk was, on average, R\$29,466.65 in the year. It is noteworthy that in non-specialized herds, the contribution of the sale of calves can reach 50% of the gross income from the activity (Almeida et al., 2017).

Among the farms interviewed, milk sales accounted for 69% of gross income, with the other 31% coming from animal sales. Therefore, calf rearing and fattening contributed significantly to the total income of dairy activity. These percentages are higher than those Lopes et al. (2004) found, in which animal sales did not exceed 13%.

The evaluation of the performance indexes can be used to estimate productive herd levels and may help in seeking a balance between technical and economic outcomes. Given the present scenario, organizational and

even technological efforts should be aimed at increasing daily averages with an increase in productive efficiency, that is, productivity per lactating cow, thus optimizing labor and care with handling and animal health, and nutrition. Considering the results of this study, we observed that dairy activity is of fundamental importance for the sustainability of small farms. Additionally, it is responsible for keeping the local population in rural areas and making up the family income. The study also raises important points about the region's current reality of dairy farms. The results may be used as a database for further studies and essential decision-making for producers and the governmental agencies responsible for supporting local agricultural production.

Conclusions

This study highlights the regional characteristics of the milk production system based on family farming in the municipality of Senador Guimard, state of Acre (Brazil). Dairy farms adopt a traditional production system, with little or no use of technologies (mechanical milking machine and herd genetic improvement) or good milking practices. However, dairy farming in Acre is growing, and the region has the potential and conditions for good milk production.

Conflict of Interest

No conflict of interest.

Ethics Statement

The contribution is original and unprecedented. The manuscript is not being evaluated for publication by another journal.

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