Socioeconomic profile of sheep farmers and environmental aspects of beef sheep farming in the Santarém and Mojuí dos Campos municipalities of Pará State, Brazil

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Abstract – In this study, we aimed to describe the socioeconomic profile of sheep farmers and the environmental aspects involving the raising of beef sheep in the municipalities of Santarém and Mojuí dos Campos, Pará State, Brazil. This research was carried out by means of an in loco interview, which collected data from 21 sheep farmers. Here, we present for the first time the overview of the breeding system in these municipalities, the data revealed that 90.47% of the breeders were men, most have a complete college education, none of the producers participate in social programs and end up raising sheep by family influence. Even so, more than 60% of the breeders use beef sheep farming as their main source of income. The system most used on the properties was the semi-extensive system, with feed supplementation offered in troughs. An important fact is that only three properties end up using permanent protection areas in the production system. The biggest costs associated are in feed supplementation and diseases, It is notorious for the lack of technical support from entities that promote production, improvement and guidance about the production of supplementary feeding on the property.
Keywords: Animal production. Sheep farm. Small ruminants.

Perfil socioeconômico dos ovinocultores e aspectos ambientais da criação de ovinos de corte dos municípios de Santarém e Mojuí dos Campos, no estado do Pará, Brasil

Resumo – Neste estudo, objetivou-se descrever o perfil socioeconômico dos ovinocultores e os aspectos ambientais que envolvem a criação de ovinos de corte nos municípios de Santarém e Mojuí dos Campos, Estado do Pará, Brasil. Esta pesquisa foi realizada por meio de entrevista in loco, que coletou dados de 21 ovinocultores. Aqui, apresentamos pela primeira vez o panorama do sistema de criação nesses municípios, os dados revelaram que 90,47% dos criadores eram homens, a maioria possui ensino superior completo, nenhum dos produtores participa de programas sociais e acabam criando ovinos por influência familiar. Mesmo assim, mais de 60% dos criadores utilizam a ovinocultura de corte como principal fonte de renda. O sistema mais utilizado nas propriedades foi o semi-extensivo, com

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suplementação alimentar oferecida em cochos. Um dado importante é que apenas três propriedades acabam utilizando áreas de proteção permanente no sistema de produção. Os maiores custos associados estão na suplementação alimentar e nas doenças. É notória a falta de apoio técnico das entidades de fomento à produção, melhoria e orientação sobre a produção de alimentação suplementar na propriedade.
Palavras-chave: Produção animal. Ovinocultura. Pequenos ruminantes.

Introduction

The high demand for food results from population growth, increased consumption and per capita income, and a higher concentration of people in urban centers. There is still the possibility of this increase being exponential until 2050 (FAO, 2009; Neto *et al*., 2021), which consequently will further intensify the emissions of Greenhouse Gas in the atmosphere. The animal protein consumer market has demanded more product quality, with requirements for improved management in production systems to make them more sustainable, which can produce positive economic consequences for the Amazon Region (Oliveira, 2008).

Moreover, this coexistence of sheep production and environment, well managed, is one of the few global examples of economically viable and sustainable activity in relation to the conservation of biological diversity, when compared to agriculture (Crawshaw *et al*., 2007). However, the links of the sheep production chain are related to inputs, production, processing, industry, distribution and retail. The sheep production chain presents favorable and jointly limiting factors for the competitiveness of the sector. The rising demand, tradition, the possibility of integration with other activities, access to niche markets and the addition of value are the main structuring and positive points (Bittencourt *et al*., 2016; Viana *et al*., 2013).

Even being an economically profitable business, sheep meat production and supply still does not meet the domestic market. Thus, Brazil continues importing sheep meat, a fact that justifies the importance of sheep agribusiness as a strategy for rural development. However, all production chain agents act in isolation, which reflects in the disintegration and disorganization of management, which hinders the development of beef sheep farming (Bittencourt *et al*., 2016).

Therefore, there is a need to obtain information about the production of beef sheep, because we can see how this theme is incipient of information. Moreover, there is a growing demand from consumers, regarding ethical and environmental implications, now observed as essential attributes of quality and food safety (Mazzuco, 2008). Based on the above, this research aims to describe the socioeconomic and environmental profile of the breeding of beef sheep in the municipalities of Santarem and Mojuí dos Campos, of Pará State, Brazil.

Material and methods

The study was conducted in sheep-producing communities in the rural areas of the municipalities of Santarém and Mojuí dos Campos, both in the State of Pará, Brazil. The city of Santarém is inserted in the basin of the Tapajós and Amazon rivers, under centroid 2° 24' 52" S and 54° 42' 36" W, occupying an area of 22,887.080 km². The municipality of Mojuí dos Campos is located at centroid 2° 41' 5" S, and 54° 38' 35" W, and an area of 4,988.2 km². The region has a tropical climate, with temperatures of approximately 25°C per year, and annual rainfall of 2,000 mm and relative humidity of 80% (FAPESPA, 2015; Gomes *et al*., 2017).

The study comprised the producers of beef sheep in the municipalities, considering only the producers registered with the Technical Assistance and Rural Extension Company (*Empresa de Assistência Técnica e Extensão Rural* - EMATER), Santarém Rural Union (*Sindicato Rural de Santarém* - SIRSAN) or Santarém Rural Workers' Union (*Sindicato de*

Trabalhadores e Trabalhadoras Rurais de Santarém - STTR). Therefore, we collected data from 21 producers of beef sheep through a questionnaire with open and closed questions in March 2023. After obtaining the data, they were entered into Microsoft Excel 2016 spreadsheets and the analysis was performed by means of descriptive statistics.

We emphasize that during data collection the participants had access to the Informed Consent Form - ICF and were asked to sign it, after the necessary explanations about the development of this research. This study was submitted to the Research Ethics Committee of the Federal University of Oeste do Pará, Pará State, Brazil, and was approved under number 5.923.206.

Results and discussion

The socioeconomic profile of the participants showed that 19 (90.47%) were male, of different ages, more than half had completed university education, none of them participated in social programs, and for 61.90% of the participants, the production of beef sheep is their main source of income. In addition, the main motivation for raising beef sheep is influence and family origin (Table 1). More than half of the participants (52.38%) reported that they have a family habit of consuming sheep meat and innards.

Table 1 – Socioeconomic profile of 21 sheep farmers in the municipalities of Santarém and Mojuí dos Campos, Pará state, Brazil

	Evaluation Parameters	**Absolute**	**Relative (%)**
Sex	Man	19	90,47
	Woman	2	9,53
Age (Years)	18 to 24	1	4,76
	25 to 34	-	-
	35 to 44	4	19,04
	45 to 54	6	28,57
	55 to 64	5	23,80
	65 to 80	5	23,80
Education	Illiterate	-	-
	Primary School Complete	2	9,52
	Primary School Incomplete	1	4,76
	High School Complete	7	33,33
	High School Incomplete	-	-
	University Education	11	52,38
Participation in social programs	Yes	0	0
	No	21	100
Reason for raising sheep	Family influence	13	61,90
	Aptitude for cattle raising	5	23,80
	Appreciate the meat	3	14,28

Font: The authors (2023)

Regarding the production system, the most used in the properties is the semi-extensive system (81%), followed by the intensive system (14%) and lastly, extensive (5%). Whereas the size of the properties ranged from <20 hectares to >150 hectares, the practice of the Crop-Livestock-Forest Integration (*Integração Lavoura Pecuária Floresta* – ILPF) system is carried out by only 28.57% of the farmers. In addition, when it comes to facilities for raising sheep, most have roofed sheepfold, but in relation to other items for the proper management of production, few farmers have maternity paddocks and corral management (Table 2).

Table 2 – Characteristics of the properties of 21 sheep farmers in the municipalities of Santarem and Mojuí dos Campos, Pará State, Brazil

	Evaluation Parameters	Absolute	Relative to total number of farmers (N= 21) (%)
Production System	Extensive	1	4,77
	Semi-extensive	17	80,95
	Intensive	3	14,28
Property size	≤ 5 ha	5	23,80
	> 5 ≤ 20 ha	4	19,04
	> 20 ≤ 100 ha	9	42,85
	> 100 ha	3	14,28
Sheep farming facilities	Roofed Sheepfold	20	95,23
	Management corral	8	38,09
	Maternity Paddocks	12	57,14
	Brete	7	33,33%
	Weighing scale (simple)	7	33,33%
Supplementary feeding	Corn	15	71,42
	Mineral Salt	18	85,71
	Silage	3	14,28
	Others (cassava paste, rice and wheat brans, etc.)	8	38,09

Font: The authors (2023)

Considering that the most used system is the semi-extensive one, with the animals grazing being the main food source, the farmers use other food supplements, mineral salt being the most used, followed by the use of corn, which is available in troughs. In financial terms, silage, even being little consumed as mentioned above, tends to cause higher costs to the sheep breeder, reaching average values of US$ 216,48 (R$ 1.190,00) per ton, followed by the purchase of mineral salt, an average value of US$ 27,66 (R$ 152,06) per bag of 30 kg, as well as the use of other supplements, such as rice bran or wheat, sold on average for US$ 16,71 (R$ 91,88) per bag of 40 kg (Table 3).

Another important question in sheep farming is related to the main diseases in sheep farming and their associated costs. Thus, producers reported that verminosis is indicated as present in 20 properties, followed by foot pad dermatitis in 16 properties. However, the costs associated with the treatment of other diseases such as anthrax, caseous lymphadenitis, etc., are the highest, reaching the annual average of US$ 103,88 (R$ 571,07) per property (Table 3).

Table 3 – Profile of costs associated with sheep production of 21 farmers in the municipalities of Santarém and Mojuí dos Campos, Pará State, Brazil

	Disease	Average annual cost
Sheep disease costs	Foot Pad Dermatitis	US$ 29,33 (R$ 161,25)
	Verminosis	US$ 37,70 (R$ 207,25)
	Other diseases (caseous lymphadenitis, anthrax, scabies, etc.)	US$ 103,88 (R$ 571,07)

Supplementary feeding costs	Corn	US$ 15,34 (R$ 84,33) per bag of 50kg
	Mineral Salt	US$ 27,66 (R$ 152,06) per bag of 30kg
	Silage	US$ 216,48 (R$ 1.190,00) per ton
	Others (cassava paste, rice and wheat brans, etc.)	US$ 16,71 (R$ 91,88) per bag of 40kg

Font: The authors (2023)

In relation to the environmental aspects of the properties, the farmers highlighted that 71,42% had flat land, and others with gently undulating terrain (19,04%). Moreover, when asked about the use of Permanent Protection Areas (*Áreas de Proteção Permanente* - APP) in sheep production, only three properties end up using these areas in the production system (Table 4). In addition, when asked about the use and destination of manure produced on the properties, 71.42% of the farmers reported that they leave the manure in open areas for tanning and later use it on the pasture as fertilizer. The other producers reported that they collect and sell to increase income from production.

Table 4 – Profile of costs associated with sheep production of 21 farmers in the municipalities of Santarém and Mojuí dos Campos, Pará State, Brazil

Land Profile		
	Absolute	**Relative (%)**
Montane	1	4,76
Moderate	1	4,76
Gently Undulating Terrain	4	19,04
Flat Land	15	71,42
Soil Erosion		
Evident soil erosion	0	0
No evidence of soil erosion	21	100
Use of APP in the productive system		
Areas without native vegetation cover (outside APP) included in the productive system	13	61,90
Areas with native forest (outside APP), but with partial use in the productive system	5	23,80
Areas with native forest (APP) and included in the productive system	3	14,28
Destination of Manure Produced		
Keep in open areas to tanning and use in pasture fertilization	15	71,42
Keep in open areas for tanning and marketing later	6	28,57
Only collects and does not give disposal	-	-

Font: The authors (2023)

This study shows that the participation of women in agricultural activities is still lower when compared to men, and the division of labor is the main responsible for the subordinate position of women, having their work considered as auxiliary, even when they dedicate themselves in the same intensity and develop the same labor activities (Marques and Pierre, 2020).

In relation to the level of schooling, the results found in this study do not corroborate the study of Hoffmann *et al*. (2004), in which they evidenced that the low level of schooling and poverty in agriculture tend to reproduce themselves, with greater severity in regions where educational performance is lower, such as in the northeastern region of Brazil, where almost 50% of farmers have schooling of less than 1 year and about 90% have not even started elementary school. In this context, the study region presents a higher level of schooling among the interviewed farmers, which ensures better qualification of the sheep farmer, with improvements in technical knowledge, in the use of new technologies added to the production system, and in the search for resources.

The production system most commonly employed on the properties was the semi-extensive system, a result opposite to that found by Filho (2018), who investigated the forms of sheep production on his properties and found that the extensive method was performed by most owners, leaving the semi-extensive system as a secondary alternative. In the semi-extensive system, the animals are free in the morning and return to the installations in the afternoon to receive supplementary feed. In the intensive system, the animals are kept in stalls, corrals or sheepfolds and receive balanced feed with rations, voluminous food, and mineral salts, in addition to being offered a free supply of water. In the extensive method, the animal stays in the pasture areas freely (Coelho *et al*., 2011).

Regarding the food offered to sheep, mineral salt was the feed supplement used by most producers, followed by corn. Farias *et al*. (2020) found in Cariri paraibano, Paraíba State, Brazil, that the use of silage is the most used technique in the production of ruminants since it has less dependence on weather conditions, less space for storage and conserves water. However, in our study, it was found that the use of silage is performed by a few producers, given the high cost per ton of the product sold in the region. In addition, the lack of technical instruction, which could provide subsidies for the producer himself, to perform the production of silage on his property.

In our study, the highest costs with production are for food, especially with regard to the purchase of corn and mineral salts. However, the costs go beyond, because they also include the care for the health of the herd through vermifugation and vaccinations (Martins and Lucena, 2018). Therefore, regarding the main diseases in sheep farming, the owners reported that pododermatitis is the main one, but the highest cost was with other diseases (caseous lymphadenitis, anthrax, etc.), corroborating with data from Belchior *et al*. (2014), in which the flocks studied in Tauá, in Ceará State, Brazil, presented high expenses in the treatment mainly of anthrax and pododermatitis.

In this study, it was possible to verify that less than one-third of the properties use the Crop-Livestock-Forest Integration (*Integração Lavoura Pecuária e Floresta* - ILPF) system of production. This system, when executed with the sheep animal component, may ensure the capture and fixation of atmospheric carbon and lower nitrous oxide emissions, besides mitigating the emission of methane gas by ruminants, favoring the insertion of livestock in the context of environmental preservation (Reis *et al*., 2015; Assmann *et al*., 2014). However, the lack of knowledge of the method by producers, in addition to the challenge of managing diversity within the system and due to the large gap of public policies, low incentives for investments, lack of government programs to support the development of the activity, especially with regard to the provision of credit, is that sheep farming is still used as a secondary source of income (Castro *et al*., 2022).

In this study, greater environmental awareness by the farmers is noted, which can be attributed to the higher level of education, since most of them respect the specially protected spaces since the Permanents Protection Areas (*Áreas de Preservação Permanentes* - APP) are areas specially protected by legislation and have the environmental function of preserving water resources, landscape, geological stability, biodiversity, the gene flow of fauna and flora,

protect the soil and ensure the well-being of human populations. In addition, the breeding sites do not have areas with erosion, being mostly flat or gently undulating. Santello *et al.* (2006), point out that most sheep are produced in tropical and subtropical regions, occupying areas unsuitable for agriculture, mountainous and semiarid regions, unlike what was found in our study.

Corroborating with the data obtained in this research, Pereira (2019) cites that in most properties the manure remains in areas around the facilities, while the ideal management occurs with the removal and deposit in a place intended to store the solid and liquid manure. Nevertheless, the production of manure for use on the property itself becomes highly significant, favoring the cultivation of pastures, perennial crops and horticultural products, having a direct effect on the increase of productivity of the property and the capitalization of the producer. In addition, the sale of the product generates a new source of income to support the production of sheep.

Final considerations

It becomes essential to a robust presence of technical assistance in the field, providing training to producers of beef sheep through workshops, demonstration of methods, courses, field days, and finally, exchanges between producers. Another important factor is to invest in training the producer with the financial management content of the activities developed because it is as important as the management techniques of beef sheep farming. Workshops should be promoted to provide training in cash accounting activities, with inputs and outputs of financial resources, in order to help control costs and profits with the production.

In order to expand the market and make it more attractive to both farmers and consumers, the construction of a suitable slaughterhouse that meets the health requirements for the slaughter of small animals is essential, as this is the only way meat production can be included in large local and regional supermarket chains. In Manaus State, Brazil, an average of 20,000 kilos of sheep and goat meat is consumed every month, and about a thousand pieces of leather are sent to other regions of Brazil (Jornal do Comércio, 2008). In our study, there is no estimate of the consumption or use of leather for export or in local tanneries.

Reproductive management is another important factor in increasing sheep production in the region. While technical support is of paramount importance, there is no good selection of breeding stock. Since the greatest reproductive efficiency is achieved through rigorous selection of matrices, selecting those with multiple births and good genetic origin and discarding those with birth intervals of more than twelve months (Cunha et al., 2001). Therefore, to obtain high production with economic and reproductive efficiency, producers must invest in animals genetically specialized for meat production, with good health control practices, adequate feeding and good reproductive management practices that directly affect reproductive efficiency and increase the quality of their herd (Siqueira, 1990; Pilar et al., 2000; Veríssimo *et al*., 2002).

In terms of zootechnical management, it is essential that the producer has a good command of the herd's bookkeeping, with notes containing data such as identification of the reproductive animals, births, deaths, diseases, and treatments used on the animals. Not forgetting the investment in preventive calendars, which include the main sheep diseases, in order to minimize excessive spending on curative treatments and loss of animals from the herd.

To conclude, it is relevant to launch agro-ecological practices to beef sheep farming in the Amazonian context, using the *ILPF* and its subdivisions, associating strategic sanitary practices in the control of endo-parasitoses. This study will provide the basis for future extensionist and informative actions for sheep producers in the study region.

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