
Organic Milk Production in Rio de Janeiro State, Brazil

Produção de Leite Orgânico no estado do Rio de Janeiro, Brasil

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ABSTRACT

This research constitutes the first overview of the organic milk production chain in the state of Rio de Janeiro, Brazil. The main objective is to identify the profile of the producers, as well as their motivations and difficulties of remaining in the sector, plus to characterize the production units. Data were obtained through interviews with producers by a semi-structured questionnaire, from April to December of 2019. Data analysis was performed in a descriptive and exploratory manner, with a quantitative and qualitative approach. The average size of properties was about 149.5 hectares. The daily average of milk production was 194.3 L/day. As for properties, 86% used mechanized milking and adopted forage and concentrate supplementation for lactating cows. It was found that obtaining organic inputs for animal feed is the most challenging difficulty for producers. Nevertheless, there was a low utilization of some areas on the properties, which could be used for the production of these organic inputs (voluminous and concentrated), and contribute to their self-sufficiency.

Keywords: Productive indices; Organic inputs; Organic milk; Nutritional management; Dairy herd.

RESUMO

Esta pesquisa constitui o primeiro panorama da cadeia produtiva de leite orgânico no estado do Rio de Janeiro, Brasil. Objetivou-se identificar o perfil dos produtores, bem como suas motivações e dificuldades em permanecer no setor, e caracterizar as unidades de produção quanto ao sistema de criação, instalações, alimentação e composição do rebanho, produção de leite e manejo de resíduos e dejetos. As visitas às propriedades ocorreram de abril a dezembro de 2019. Os dados foram obtidos por entrevistas com os produtores através de um questionário semiestruturado. A análise dos dados foi realizada de forma

descritiva e exploratória, com abordagem quantitativa e qualitativa. O tamanho médio das propriedades foi de 149,5 hectares. A média da produção diária de leite foi de 194,3 L/dia. Quanto às propriedades, 86% utilizavam a ordenha mecanizada e adotavam a suplementação de volumoso e concentrado para vacas em lactação. Constatou-se que a obtenção de insumos orgânicos para a alimentação animal constitui a maior dificuldade dos produtores. Contudo, observou-se um baixo aproveitamento das áreas nas propriedades, que poderiam ser utilizadas para a produção destes insumos orgânicos (volumosos e concentrados), e contribuir para a autossuficiência das mesmas.

Palavras-chave: Índices produtivos; Insumos orgânicos; Leite orgânico; Manejo nutricional; Rebanho leiteiro.

INTRODUCTION

Brazil is the 3rd largest producer of organic food in Latin America, with 1.3 million hectares (ha) cultivated, and has the largest consumer market on the continent (Willer et al., 2022). However, bovine milk production in organic systems in the country represents a small percentage of total production, varying around 0.1% (Langoni et al., 2009).

Rio de Janeiro (RJ) has in fact a growing demand for organic foods, since one of the main niches for the consumption of these products in Brazil is located in the state capital. These consumers look for agroecological foods and chemical-free residues. Consequently, ranchers in RJ have shown interest in the production of milk and organic by-products. Moreover, in the National Register of Organic Producers (CNPO) of the Ministry of Agriculture, Livestock and Supply (MAPA, 2020) seven certified properties for the production of organic milk in the State are listed, which represents 7.3% of the national register of all producers.

For milk or dairy products to be characterized as organic in Brazil, production must follow the regulations related to animal production established by Ordinance No. 52 of March 15, 2021, which establishes the technical regulation for organic production systems (Brazil, 2021). Nonetheless, the absence of data on the structuring of production units, technologies and practices used, such as the challenges faced by producers, hinders the growth of the sector in the country.

This research takes on the first panorama of the production chain of organic milk in the state of Rio de Janeiro, in which the objective was identifying the profile of the producers, as well as their motivations and difficulties in remaining in the sector, and to characterize the production units in terms of the system breeding, facilities, feeding and herd composition, milk production and waste management.

MATERIAL AND METHODS

The project of this research was submitted and approved by the Research Ethics Committee of the Federal Rural University of Rio de Janeiro (UFRRJ) under process n° 23083.009686/2019-45.

Study area

The study was carried out in the seven properties certified for the production of organic milk in the state of Rio de Janeiro, which are listed in the CNPO (MAPA, 2020), and which represent 7.3% of the production units in Brazil.

The properties are located in the municipalities of Barra do Piraí, Mendes, Miguel Pereira, Sapucaia and Teresópolis.

All production units used the Participatory Assurance System, also called the Participatory Organization for Organic Conformity Assessment – OPAC, as a certifying mechanism. In this system, producers, technical advisors and consumers consolidate a reliable source, according to which the agents involved jointly attest the responsibility of each other. The properties were linked to the Association of Biological Producers of the state of Rio de Janeiro – ABIO, which mediated and coordinated the OPAC.

Collecting Data

Visitations to properties and interviews with producers took place from April to December 2019. After clarification on the research, a Free and Informed Consent Term (FICT) was signed by all producers. Next, qualitative and quantitative data were obtained through a semi-structured questionnaire, covering the following aspects:

Profile of Producers

Information on age, gender, education and other occupations/professions were obtained. In addition, producers reported their main motivations and difficulties in remaining in the sector.

Characterization of production units

Data of the property size, distance from the nearest urban center, time in organic milk production, destination of the milk produced, link with association/cooperative, characterization of labor and milk remuneration were collected.

Facilities and equipment

Information about the rearing system, calves housing, milking parlor, milk weighing scale, animal weighing scale and milk cooling tank were collected.

Feeding the herd

Information on pasture management, roughage and concentrate supplementation, mineral supplementation and alternative food sources were collected.

Composition of the herd

Data on the breed pattern of the herd, just as on the categorization (breeder, lactating cow, dry cow, heifers, etc.) were obtained.

Milk production

Quantitative data were obtained on total daily milk production, number of lactating and dry cows, average daily production per lactating cow and per the total amounts of cows, and number of milkings per day.

Waste and residual management

Information on the destination of residues and waste was obtained, as on the practices used for their correct disposal.

The information obtained was verified with the observation in loco of the property, the herd and the management. When necessary, information/notes regarding possible incompatibilities with the questionnaire responses and personal observations were signaled by the evaluator.

Data analysis

The study was descriptive and exploratory, with a quantitative and qualitative approach, in which the simple frequency of occurrence of each answer was verified, using an Excel spreadsheet and the results were presented in percentages and averages.

RESULTS AND DISCUSSION**Producers Profile**

Organic milk producers in the state of Rio de Janeiro were on average 60 years old, which shows the predominance of older people in the sector. The age factor linked to the children's low involvement in the activity (only in 43% of the productive units there was the participation of children) generates a substandard perspective regarding family succession and continuity of organic milk production in the state. In a different way, when studying organic dairy cattle in the state of Santa Catarina, Honorato et al. (2014) observed that the producers were younger, with an average age of 41 years old.

As for gender, 72% of respondents were male and 28% were female. Although in smaller numbers, these data likely suggest the interest of women in organic production, since according to Gomes and Valle (2010) conventional dairy farming in the state of Rio de Janeiro is historically composed by male influence in the management of properties.

Regarding education, 72% of the producers had achieved higher education, 14% had incomplete secondary education and 14% had postgraduate studies at the doctoral level. There is a positive association between higher education (86% of respondents) and interest in organic

production. Similar results were found by Aroeira et al. (2005), who found that 67% of organic milk producers in the Northeast, Midwest and Southeast regions of Brazil had attended higher education and 33% had participated onto primary and secondary education.

In addition to rural producers, 86% of respondents had another profession and occupation, such as engineering (29%), arts (15%), veterinary medicine (14%), law (14%) and education (14%), and therefore, didn't use milk production as their main remunerative activity. While 14% of respondents were only rural producers and the organic dairy activity was the main source of family income.

When asked about the main factors that motivated them to stay in the organic sector (figure 1), the responses of producers were related to the quality of milk and dairy products (28.7%), which are free of chemical residues, hormones and genetically modified organisms. Environmental preservation (23.8%), since one of the objectives of organic production is economic and ecological sustainability (Brazil, 2003); and the price of milk and value coupled to it (19%), mainly for those properties that processed milk and commercialized its derivatives. Other informed motivations were: the consumer market, animal welfare, which is one of the principles of organic production, and social interactions with the group of producers, which is characteristic of this production system.

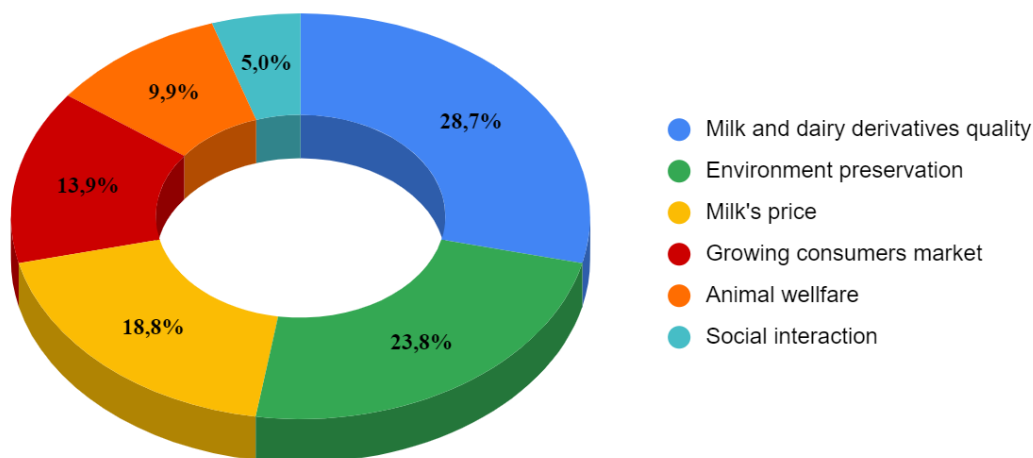


Figure 1: Factors that motivate producers to remain in the organic milk production sector in the state of Rio de Janeiro.

As for the difficulties encountered in the sector (figure 2), producers reported that accessibility and purchase of organic inputs for cattle feed is one of the major problems (29%). The legislation (Ordinance n° 52) allows that only 15% of the dry matter consumed by the animals has a conventional origin, but without genetically modified organisms (Brazil, 2021), and the rest of the food (85% of the dry matter) must follow organic origin standards. In this context, although Brazil is one of the largest grain producers in the world, most of the production of corn and soybeans, which are the basis of concentrated cattle feed, is transgenic (Croplife Brazil, 2021),

and their production is not allowed to be used in animal feeding of organic production system. Few organic farms produce and sell grain. The imbalance between supply and demand raises the price of these inputs, which can make the production of organic milk economically unfeasible.

The shortage of technicians specialized in organic production was listed by the interviewees as a difficulty in the sector. Producers reported that it is difficult to find professionals, such as veterinarians, who specialize in alternative therapies and who believe in their effect in the short and long term. This problem is also reflected in the lack of committed and trained workforce to use homeopathy, for example. Another difficulty reported by the producers was the lack of knowledge in the different aspects of production and, mainly, in relation to animal health. Many producers had difficulties in dealing with the occurrence of diseases in cattle and in the use of preventive techniques and unconventional treatments.

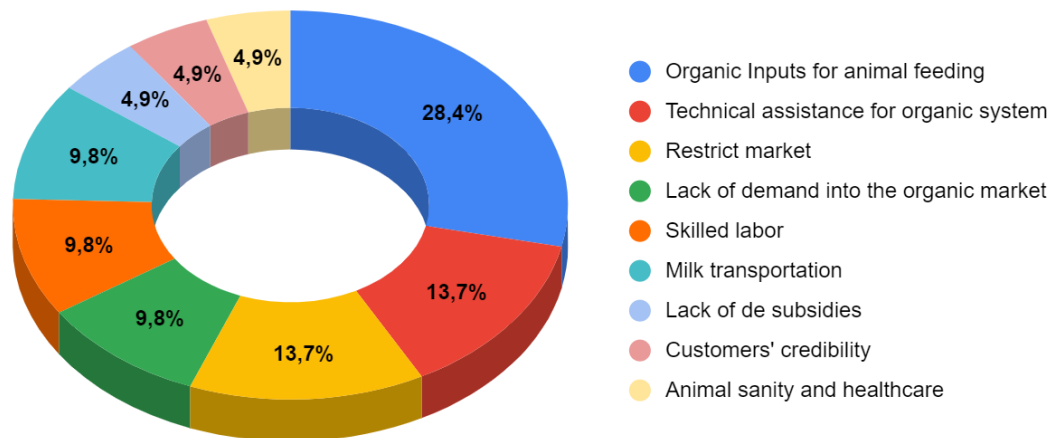


Figure 2: Difficulties faced by producers in the organic milk sector in the state of Rio de Janeiro.

The data from the present work corroborate those found by Pacheco (2013), in a study on organic dairy production in recognized and certified properties in Paraná and Santa Catarina, South of Brazil. The author found that, according to the producers, sanitary management was the factor that represented one of the main difficulties for the organic transition, followed by the limited obtention of information and technologies aimed at production plus the lack of technical assistance aimed at the organic system. In addition, there was the difficulty in providing food to the animals in accordance with the regulations.

Although the consumer market was listed as a motivation for the production of organic milk, it only corresponded to 14% of the difficulties encountered by producers. The explanation for this is that the organic consumption niche in RJ is restricted to a certain region of the state capital. Therefore, access to them is difficult and demands the up building of a credible relationship with customers. Another objection to the production of organic milk was the transport of it and dairy products, due to the difficulty of delivering dairy products to consumers.

The difficulties found by producers in the present study are also in line with the data observed by Frizon and Rover (2014), who, when studying milk producers in conversion to the organic system, observed the difficulty of obtaining basic inputs as the main obstacles to production. Organic products themselves, non-differentiated sale of products and the limited technical assistance focused on organic production.

Characterization of organic milk production units in RJ

Information on the characterization of production units is in table 1.

Table 1. Characterization of organic milk production units in the state of Rio de Janeiro.

	Specification	Frequency %	Average
Property size	Up to 50 ha	0	149.5 ha
	From 51 to 100 ha	44	
	From 101 to 150 ha	28	
	Larger than 151 ha	28	
Distance from the property to the nearest urban center	Up to 10 km	57	12.3 km
	From 11 to 20 km	14	
	From 20 to 30 km	0	
	Over 31 km	29	
Organic milk production time	Up to 10 years	72	8.5 years
	From 11 to 20 years	14	
	More than 20 years	14	
Average price per liter of milk	From BRL 1.5 to BRL 2.00	28	BRL 4.14
	From BRL 2.10 to BRL 5.0	28	
	From BRL 5.10 to BRL 8.00	44	
Labor	Familiar	14	-
	Family and contractor	14	
	Contractor	72	
Production type	Milk	28	-
	Milk and dairy	72	
Milk destination	Dairy sales	28	-
	Dairy manufacturing	72	

Characterizing organic milk production in some regions of Brazil, Aroeira et al. (2005) have reported that the properties had an average of 325 ha of total area and had been dedicated to the activity for an average of 4.5 years. In RJ, therefore, the properties are smaller (149.5 ha) and the owners dedicate more time to the activity (8.5 years).

The average price of a liter of milk observed in the present study was R\$ 4.14 and there was a large variation in value (R\$ 1.50 to R\$ 8.00). This difference was attributed to the destination of the milk produced (Table 1), since properties with dairy products (72%) were able to add value to dairy by-products, while those that produced only raw milk (28%) had difficulty selling production and sold at a lower value to conventional and organic dairy products.

As for the workforce, 72% of the properties used hired employees, 14% used only family labor and 14% had the participation of their family members with the help of hired people. These data are similar to conventional dairy farming in RJ, in which 64% of the workforce was hired and 26% family (Gomes; Valle, 2010).

Characterization of facilities

Information on the facilities of organic milk production units in the state of RJ can be found in table 2.

Table 2. Characterization of facilities on organic properties in the state of Rio de Janeiro.

Specification		Frequency %	
Calves	Neonates and lactating	Individual stall	14
		Collective stall	86
	Over 90 days	Individual stall	0
		Collective picket	100
Milking type and structure	Milking parlor	Line	14
		Fishbone	14
	Feeding pen or stable	Manual	14
		Bucket on foot	58
Milk weighing scale	Yea	28	
	No	72	
Animal weighing scale	Yea	28	
	No	72	
Milk cooling tank	Yea	72	
	No	28	

Newborn and suckling calves were allocated in individual pens until they were between one and two months old (14%), when they were later placed in collective paddocks and in collective pens without separation by age (86%). In all properties, calves over 90 days old, the age allowed for weaning according to legislation (Brazil, 2021), were housed in paddocks containing pasture, shelter against rain, drinking trough, salt trough and trough for concentrate supplementation and/or feed. or bulky. Separating calves over three months old into small lots by age for distribution in the paddocks was the measure reported by one (14%) of the producers.

In general, the properties did not have a specific location for milking (72%) and management/containment trunk. For this, they used the feeding pens/stable as containment, in the kennels and troughs, and milking management. Most used mechanical milking (58%) and carried out individual production control through buckets graduated in liters of milk (72%).

Regarding the type of milking, 86% of the production units used mechanized, while 14% used manual. The proportion of use of a mechanical milking machine in the present study was higher than that observed by Aroeira et al. (2005), who found the use of the equipment by 50% of the producers. This is explained by the ease of access of producers to these technologies over the years, which also occurred due to the lack of trained labor for manual milking.

The production units had waiting corrals, outside the milking area, usually without covered up ceilings and with fences, and feeding/stable corrals, with individual or collective troughs, drinking fountain and mineral salt troughs (100%), had an expansion tank for milk cooling (72%) and forage chopper (86%). The properties that did not have an expansion tank for milk cooling (28%) processed the milk immediately after milking in their dairies.

In addition, 72% of the properties did not have a scale for weighing the animals and, therefore, did not regularly control weight gain and, when necessary, used a weighing belt. Only 28% of the properties have a cylinder for storing semen. This fact correlates with the low adherence to artificial insemination (28%).

Herd Feeding

Rotational grazing is a pasture management technique used on all properties (figure 3). The rotation arrangements and forage species used varied between properties, but generally constituted around 20 paddocks with grasses of the *Urochloa* spp, *Cynodon* spp or *Megathyrus* spp. According to Cazale (2006), the best economic result occurs due to the reduction of production costs, with the reduction of the need to purchase feed and inputs, since this management provides a better use of the pasture.



Figure 3: Rotated grazing system with grass of the genus *Cynodon* spp in an organic dairy farm in the state of Rio de Janeiro.

Although the use of plants with high protein content is a relevant alternative for feeding animals in organic systems, only 14% of the properties used this strategy, with the species *Tithonia diversifolia*. In addition, none of the properties used alternative grazing systems, such as silvopastoral, agrosilvopastoral, or consortium of grasses with vegetables.

In relation to supplementation with roughage, 86% of respondents provided it to lactating cows throughout the year and also to other categories during the dry season. As a source of supplementation, 57% used chopped sugar cane, 86% chopped elephant grass, 43% produced hay from pasture leftovers to feed calves, 43% also used grass silage and 43% corn silage or sorghum. Similar data were observed by Aroeira et al. (2005), who characterized organic dairy properties in Brazilian regions, which used roughage during the dry season: napier grass, sugar cane and sorghum silage. All roughage foods were produced within the properties in an organic way. Only 14% of the producers did not supplement the animals with roughage at any time of the year and the herd's food source was exclusively pasture.

The forage plants belonging to the *Urochloa* ssp genera corresponded to 21% of the species most used by producers. Other varieties of *Pennisetum purpureum* Schum (elephant grass, napier grass, capiaçu etc.) were used in capineiras¹ and corresponded to 18% of the forage plants used. The *Cynodon* ssp (typhton, African star) corresponded to 15% of the owners' choice for use in calf pastures and rotational system. Mombasa grass (*Megathyrsus maximus*) represented 12% of the most adopted species and was used exclusively in pasture rotation areas. Sugarcane (*Saccharum officinarum*) corresponded to 12% of the most cultivated forages and was used as a supplement during dry periods. Corn (*Zea mays*) (6%) and sorghum (*Sorghum bicolor*) (3%) were used to make silage. Oats (*Avena sativa*) (3%) and ryegrass (*Lolium multiflorum* Lam.) (3%) were cultivated for grazing during the dry season, as they are forages in a temperate climate and adapt to the microclimate of some properties, mainly in the Serrana region of RJ. Fat grass (*Melinis minutiflora*) was used on some properties for grazing and corresponded to 3% of forage plants used by producers to feed the herd.

As for the concentrated supplementation for lactating cows, 86% of respondents said they use it throughout the year, 14% responded that they do not do this supplementation at any time of the year. Among the strenuous foods most used by producers, are: soybean meal (25%), cornmeal (25%), wheat bran (25%), barley (brewery residue) (19%) and citrus pulp (6%). When asked about the origin of these foods, all said that they buy them from organic companies, or from conventional companies as long as they are not transgenic. According to the legislation that

¹ Capineiras: generally, small areas cultivated with grasses with high potential for forage production that will be cut and chopped to provide green pastures that produce large amounts of plant matter. These forages are generally used in the dry season, a period of greater food shortage.

regulates the production of organic milk, up to a maximum of 15% of the dry matter ingested by animals is of conventional origin, as long as it does not come from genetically modified organisms (Brazil, 2021).

Herd composition

On average, the composition of the herd in cattle was one sire, 22 lactating cows, 15 dry cows, nine females up to one year old, 10 females from one to two years old, 16 females from two to three years old, four males up to one year and one male over one year of age. The total average of the herd was 79 heads of cattle. This composition is much lower than that observed by Aroeira et al. (2005), who characterized organic dairy production in the Northeast, Midwest and Southeast regions of Brazil and observed that the herd consisted of 41 lactating cows, 35 dry cows, 44 calves from zero to two years of age, 42 heifers of more of 24 months, and two bulls.

In the present study, it was observed that lactating cows accounted for only 28% of the herd. This percentage should be at least 40% for the activity to be considered efficient (Gomes; Valle, 2010), since this category is responsible for generating income on the property. The percentage of lactating cows corresponded to 59% of the total number of cows and, as previously mentioned, for the herd to be considered efficient, this percentage should be above 75% under pasture management conditions (Ferreira; Miranda, 2007). The percentage of “males up to 1 year” and “males over 1 year” (6%) in the herd, although reasonable, is considered inefficient, as they occupy an area that could be used by lactating cows. Although, the creation of males can represent an extra income for the properties with the subsequent sale of them for meat production or as breeding stock.

As for the racial pattern of the herds, 14% of the producers adopted the Brown Swiss breed, 14% have used the Jersey, 14% adopted crosses of Holstein x Jersey (Jersolanda) and 58% used mixed crosses of Dairy Gir x Holstein (Girolando), considered crossbred animals. These data are similar to those observed by Honorato et al. (2014), who found that organic dairy herds in western Santa Catarina were made up of 20% Holstein cattle, 50% were the result of crosses involving Holstein and/or Jersey and/or Gir and 30% were Jersey cattle. The legislation on organic milk production suggests the use of genotypes adapted to climatic conditions and the type of management used, such as dairy zebu and their crosses, which have greater rusticity and are capable of producing satisfactorily under natural conditions of creation (Brazil, 2011). Therefore, the majority of the herd studied was consistent with this recommendation.

When asked if they use artificial insemination (AI) or other reproductive technology for genetic improvement, 72% of respondents answered that they did not use it and that the service was performed exclusively by natural mating while 28% answered that they used AI. Half of these producers who adopted AI used it exclusively, while the other half associated it with bull pass-through.

Unlike the results observed in the properties studied in RJ, Pacheco (2013) found that AI was used in 56.7% of organic milk production units in Paraná and Santa Catarina. However, the author reports that this rate could be higher if it were not for the difficulties cited by producers in finding professionals able to perform insemination and obtain semen quality. According to Ordinance No. 52 of March 15, 2021, which regulates the specifications for animal and plant production and, moreover, for the production of organic milk, in reproductive management, only natural mating and artificial insemination are allowed. Embryo transfer (ET) and in vitro fertilization (IVF), or other protocols that use hormonal manipulation are considered forbidden. (Brazil, 2011).

Organic milk production

Data on organic milk production in RJ are available in table 3. The average production per cow observed in the present study (5.4 L/cow) is related to the high proportion of dry cows (41%) in relation to lactating cows. (59%), since the last category should correspond to at least 80% of the total number of cows, the ideal being 83%. And so, under pasture milk production conditions, results above 75% of lactating cows can be considered good indices (Ferreira; Miranda, 2007). Even under extensive production conditions, the average observed in the properties studied (59%) is still not considered a good result.

Table 3. Characterization of organic dairy production in properties in Rio de Janeiro.

Specification	Frequency %	Average
Average daily milk production	Up to 70 L	28
	From 71 to 150 L	14
	From 151 to 250 L	29
	From 251 to 350 L	29
Average number of lactating cows	Up to 10 cows	14
	From 11 to 20 cows	14
	From 21 to 30	72
	Over 30 cows	0
Average number of dry cows	Up to 10 cows	29
	From 11 to 20 cows	57
	From 21 to 30	14
	Over 30 cows	0
Average daily milk production per lactating cow	Up to 7 L	29
	From 7.1 to 12 L	57
	From 12.1 to 16 L	14
Average daily milk production per cow	Up to 3 L	28
	From 3.1 to 7 L	43
	From 7.1 to 9 L	29
Number of milkings per day	1 milking/day	43
	2 milkings/day	57

As for the number of milkings per day, 57% of the producers performed two milkings daily (morning and afternoon), while 43% adopted only one, this being in the morning. Similar

data were observed by Aroeira et al. (2005), who found that half of organic producers in different regions of Brazil used only one milking per day, while the other half performed two.

Waste management

The production units adopted different methods of disposal and treatment of waste, as shown in figure 4.

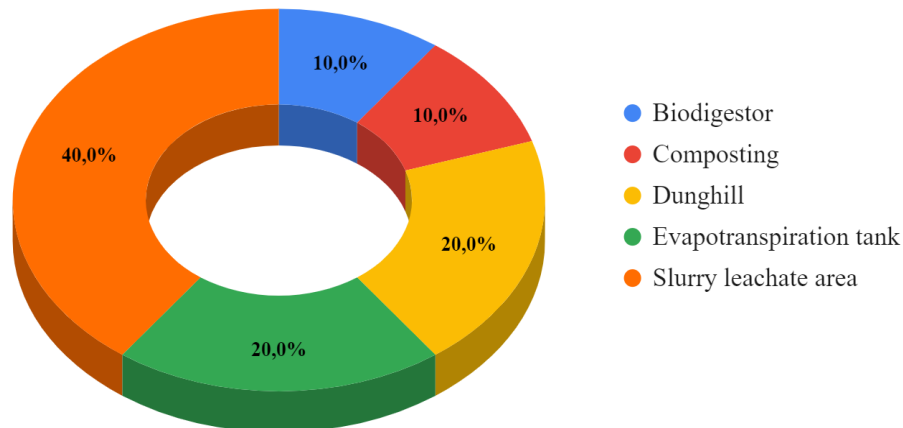


Figure 4: Disposal of waste in certified organic dairy farms in Rio de Janeiro.

Among the techniques used for disposal of waste are: slurry leachate area (40%), for storage and subsequent application of liquid waste in pastures; the evapotranspiration tank (20%), which is used to treat waste from washing equipment, through the consumption of water and nutrients by plants grown on the reservoir, such as bananas, from the process of anaerobic digestion of organic matter and filtering in the inside the tank; the manure (20%), which consists of a place of manure deposition for the nutrient stabilization process through aerobic fermentation; composting (10%), which is characterized by the aerobic decomposition of organic materials, in order to obtain a stable compost; and the biodigestor (10%), which through the anaerobic digestion of waste promotes the generation of biogas and biofertilizer.

Animal production systems differ in their environmental impacts (SILVA et al., 2014). In organic production, the principles employed constitute a radical break with the productivist paradigm and are poorly documented in most animal species (Cabaret, 2003). One of the biggest problems in dairy farming is the large amount of waste generated every day. Konzen and Alvarenga (2008) state that the production of manure, feces and urine generated daily by dairy cattle corresponds to approximately 10% of their body weight, representing an amount of 45 to 48 kg/cow/day. Therefore, in organic production, which has sustainable and ecologically correct management as one of its pillars, it is essential that producers adopt strategies to minimize impacts on the environment through the correct destination and reuse of waste, as sources of nutrients for pasture fertilization, for example.

CONCLUSION

The organic properties in the state of Rio de Janeiro show moderate technological adherence, using techniques such as artificial insemination, nutritional supplementation in the dry season, pasture rotation and mechanical milking.

The majority of organic milk producers in the state have a high level of education and their main motivations are product quality and environmental preservation. It has been also found that obtaining organic inputs for animal feed is the greatest difficulty for producers. However, there was a low utilization of the areas on the properties, which could be used for the production of these organic inputs (voluminous and concentrated), and contribute to their self-sufficiency.

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