SEMINA
Ciências Agrárias

DOI: 10.5433/1679-0359.2022v43n1p107

Socioeconomic profile of producers and dairy technological of farms in the southern mesoregion of Santa Catarina

Perfil socioeconômico dos produtores e tecnológico de propriedades leiteiras da mesorregião sul de Santa Catarina

Thalyta Marcílio[1]; Bruno Alexandre Dombroski Casas[2]; Diego Hemkemeier Silva[3]; Vanessa Peripolli[4]; Carlos Eduardo Nogueira Martins[4]; Ivan Bianchi[4]; Fabiana Moreira[4]; Juahil Martins de Oliveira Júnior[4]; Elizabeth Schwegler[4]*

Highlights

The main activity of the farms was related with dairy farming.
Farms are characterized by a small area and a low milk production.
The first and the second clusters were composed by larger farms and areas.
There is clearly a deficiency in technical support for producers.

Abstract

This study characterized the socioeconomic profile of milk producers and dairy technological of farms in the southern mesoregion of Santa Catarina. Following a 6.5% sampling of total farms by municipality, 95% confidence level, 5% sampling error, and group heterogeneity, data were collected from 308 farms, 22 of which were excluded due to insufficient data. The farmers were selected randomly, and information extracted from an electronic form, addressing social, economic, technical and technological issues. The data were analyzed using factor, cluster, and discriminant analysis. As farms with the main activity of dairy farming, they have an average area of 20.79 hectares and a production of 12.18 liters per animal per day. I n the factor analysis, the first factor was related to the area and productivity of farms and the second factor to sanitary control and the feed variety of the animals. The cluster analysis formed three clusters; the first and the second were composed of larger farms and areas, and the other consisted of smaller farms, the latter involving more

[1] Animal Science Researcher, Master Student, Post-Graduation Program in Animal Production and Health, Instituto Federal Catarinense, IFC, Araquari, SC, Brazil. E-mail: thalytamarcilio@yahoo.com.br
[2] Veterinary Medicine Graduate Students, IFC, Araquari, SC, Brazil. E-mail: brunoadc.medvet@gmail.com
[3] Animal Science Researcher, Agronomist Engineer, Institute of the Environment of Santa Catarina, SC, Brazil. E-mail: diegohemk@gmail.com
[4] Animal Science Profs., Post-Graduation Program in Animal Production and Health, IFC, Araquari, SC, Brazil. E-mail: vanessa.peripolli@ifc.edu.br; carlos.martins@ifc.edu.br; ivan.bianchi@ifc.edu.br; fabiana.moreira@ifc.edu.br; juahil.oliveira@ifc.edu.br; elizabeth.schwegler@ifc.edu.br
* Author for correspondence

Received: Apr. 16, 2021 - Approved: Oct. 18, 2021

producers. As farms are characterized by low production, there is clearly a deficiency in technical support for producers.
Key words: Cattle raising. Dairy production. Indicators. Structured questionnaire.

Resumo

O objetivo desse estudo foi caracterizar o perfil socioeconômico dos produtores de leite e o tecnológico de propriedades leiteiras da mesorregião sul do estado de Santa Catarina. Seguindo uma amostragem de 6,5% sobre o total de propriedades por município, nível de confiança de 95%, erro amostral de 5% e heterogeneidade no grupo, foram coletados dados de 308 propriedades, sendo que 22 delas foram excluídas por apresentarem dados insuficientes. Os produtores foram selecionados de forma aleatória e as informações extraídas através de um formulário eletrônico, abarcando questões sociais, econômicas, técnicas e tecnológicas. Os dados foram analisados pelas análises fatorial, de agrupamento e discriminante. As propriedades apresentaram como principal atividade a bovinocultura leiteira, possuem área média de 20,79 hectares e uma produção de 12,18 litros por animal por dia. Na análise fatorial, o primeiro fator esteve relacionado com a área e produtividade das propriedades e o segundo fator com controle sanitário e a variedade alimentar dos animais. A análise de agrupamento formou três clusters, o primeiro e o segundo, compostos por propriedades com áreas e produtividade maiores e outro constituído por propriedades de menor porte, sendo esse último o que envolveu mais produtores. As propriedades são caracterizadas por baixa produção, existindo claramente uma deficiência no acompanhamento técnico aos produtores.
Palavras-chave: Bovinocultura. Indicadores. Produção leiteira. Questionário estruturado.

Introduction

In 2019, Santa Catarina State produced 3.0 billion liters of the 34.8 billion liters of milk produced in Brazil (Instituto Brasileiro de Geografia e Estatística [IBGE], 2020). The state has established itself as the fifth largest milk producer in Brazil, only behind Minas Gerais, Rio Grande do Sul, and Paraná (IBGE, 2020). The south and west regions of the state have been gaining great prominence in milk productivity, representing about 90% of state production (IBGE, 2020), with family farming accounting for almost 90% of all Santa Catarina production. However, when compared to industrial systems, these traditional systems generally present great difficulties in understanding the production demands, which are distinct in terms of objectives, land ownership, technology, use of genetic improvement, and tax allowances, factors that highlight the gap between the techniques (Temoso, Villano, & Hadley, 2016).

For the dairy activity in Santa Catarina to become competitive nationally and internationally, it is assumed that for any intervention action, both at the level of operations on the farms and for the establishment of new public policies, prior knowledge of the sector as well as the region is essential. Ney and Hoffmann (2008) highlighted the need to examine the secondary and tertiary sectors, seeking to clarify income inequality in the rural environment, making it essential to understand the profile of each region since there are numerous particularities, such as preference for breed, production system, and education levels of producers.

Thus, this study characterizes the milk producers of the southern mesoregion of Santa Catarina State, Brazil, regarding the socioeconomic profile and the characteristics of the farms in terms of productive, nutritional, health, and reproductive aspects.

Materials and Methods

Procedures throughout the study followed protocols approved by the Committee on Ethics in Human Beings of the Santa Catarina Federal Institute (IFC), reference number 2827063/2018.

The study was conducted in municipalities of the southern region of Santa Catarina, geographically defined by Brazilian Institute of Geography and Statistics [IBGE] (2020), which has a humid subtropical climate, according to the Köppen classification.

For the development of the research, the methodology of Tagliacarne (1978) was used, where a sampling of 6.5% of the total number of economically active dairy farms was collected and taking a 95% confidence level, a 5% sampling error, and heterogeneity in the group into account. Information was extracted from 308 farms, covering 39 of the 45 municipalities in the region. A total of six cities were excluded because they had a lower sampling than determined in the study.

After the random sampling process of the farms, an electronic form was elaborated using the Zoho Office® computer application (Zoho Corporation, 2005), listing questions about infrastructure, labor, area used for the activity, as well as data on nutritional, health, and reproductive management (Table 1). The internal validation of the form was carried out through 20 test interviews applied to producers in the city of Braço do Norte - SC.

The data were evaluated via multivariate analysis techniques (factor, discriminant, and cluster analysis), using the statistical program SAS version 9.3 (Statistical Analysis Institute, Cary, NC, USA). After an initial analysis, 22 questionnaires with insufficient information were removed, leaving remaining valid data from 286 farms. Multivariate analyses were conducted on standardized (STANDARD) data following Sneath and Sokal (1973). The variables were selected for their communality to compose the factors, reaching three clusters, defined from the milk production per cow per day of each farm. Factor analysis was performed using the FACTOR procedure and considering the common variance between the variables, with Varimax rotation. Because it is an orthogonal rotation, it maximizes the variation between the weights of each factor. Only variables with Kaiser-Meyer-Olkin (KMO) sampling adequacy greater than 0.5 were maintained in the analysis. For grouping analysis, the FASTCLUS and CLUSTER procedures were used, followed by the DISCRIM procedure, followed by the STEPDISC, as confirmatory analysis, using the Ward method based on Euclidean distance. The comparison between high, mean, and low milk production groups (defined in the cluster analysis considering the milk production per cow per day of each farm) was made by analysis of variance, using the GLM or GLIMMIX (binary response variables) or NPAR1WAY (categorical variables), and the means of the groups were compared by the Tukey test, at a significance level of 5%.

Table 1
Attribute groupings for dairy cluster in the southern region of Santa Catarina State, Brazil

Attribute	Cluster 1 (n=9) High milk production	Cluster 2 (n=105) Mean milk production	Cluster 3 (n=172) Low milk production	P>F
Main activity of the farm (%)[1],*	66.67	70.48	51.74	0.3644
Other activity (%)[2]	66.67	64.76	69.77	0.6858
Easy access to the farm (%)[2]	88.89[b]	100.0[a]	100.0[a]	<0.0001
Telephone (%)[2]	100.0	98.10	97.09	0.7759
Internet (%)[2]	100.0	98.10	92.44	0.0950
Vehicle (%)[2]	100.0	100.0	99.42	0.7171
Type of house (%)[3],*	77.78	77.14	63.95	0.1427
Number of residents	4.00	4.22	4.04	0.5465
Age of the producer (years old)	39.44	43.01	44.14	0.3917
Education of the producer (%)[4],*	44.44	36.19	34.30	0.3862
Monthly income in minimum wage (%)[5],*	66.67	82.86	84.88	0.6965
Has a spouse (%)[2]	77.78	81.90	90.70	0.0748
Uses Family labor only (%)[1]	100.0[a]	81.90[b]	95.93[c]	0.0003
Total dairy herd	81.77[a]	61.08[a]	29.25[b]	<0.0001
Average of lactating animals	36.11[a]	31.04[a]	16.04[b]	<0.0001
Total farm area (ha)	30,54[a]	25,00[b]	17,70[b]	<0.0001
Area for milk production (ha)	15,88[a]	14,61[a]	9,42[b]	<0.0001
Average daily milk production (L)	923.33[a]	485.49[b]	158.98[c]	<0.0001
Average milk production per animal (L)	24.50[a]	15.10[b]	9.75[c]	<0.0001
Price of milk liter (R$)	1.18	1.18	1.17	0.2427
Quantity of weekly milk collection	1.55[b]	1.95[b]	2.16[a]	<0.0001
Perform dairy control (%)[2]	66.67[a]	68.57[a]	38.95[b]	<0.0001
Type of milk parlor (%)[6],*	88.89[b]	71.43[b]	38.95[a]	<0.0001
Type of milking (%)[7],*	100.0[a]	58.10[b]	48.23[c]	<0.0001
Production system (%)[8],*	77.78[a]	92.38[b]	99.42[b]	<0.0001
Technical assistance (%)[2]	100.0[a]	89.52[b]	66.28[c]	<0.0001
Management of the farm (%)[2]	55.56	72.24	65.70	0.1705
Time in activity (years)	16.55	15.95	14.08	0.1844
Provides concentrate (%)[2]	100.0	98.10	60.42	0.5492
Months with concentrate	12.00	11.90	11.68	0.0934
Concentrate consumption per month (Kg)	9777.81[a]	4977.62[b]	1326.43[c]	<0.0001
Produces concentrate (%)[2]	66.67[a]	46.67[b]	22.67[c]	<0.0001
Concentrate purchase (%)[2]	33.33[c]	55.24[b]	76.74[a]	<0.0001
Provides minerals (%)[2]	100.0[a]	93.33[ab]	75.58[b]	0.0003
Performs diet adjustments (%)[2]	77.78[a]	70.48[b]	36.05[c]	<0.0001

continue...

continuation...

Nutritionist monitoring (%)[2]	55.56[a]	40.0[b]	5.33[c]	<0.0001
Residue in the diet (%)[2]	0.00[c]	30.48[b]	41.86[a]	0.0113
Produces silage (%)[2]	88.89[a]	86.67[a]	68.60[b]	0.0020
Provides silage (%)[2]	100.0[a]	93.33[a]	71.51[b]	<0.0001
Uses inoculant in silage (%)[2]	22.22[a]	20.95[a]	6.98[b]	0.0021
Mineral salt in the diet (%)[2]	100.0[a]	97.14[a]	86.05[b]	0.0056
Uses homeopathics in diet (%)2	22.22[c]	45.71[a]	30.23[b]	0.0230
Prebiotics and probiotics in diet (%)[2]	22.22[a]	14.29[b]	3.49[c]	0.0017
Prepartum diet (days)	22.33[a]	15.72[a]	8.86[b]	0.0002
Water source (%)[9],*	55.56	45.71	51.74	0.5137
Treated water (%)[2]	0.00	4.76	3.49	0.7198
Annual grazing crops (%)[2]	88.89	89.52	87.79	0.9078
Type of soil fertilization (%)[10],*	66.67[a]	60.0[ab]	0.44[b]	<0.0002
Perform vaccination schedule (%)[2]	100.0[a]	76.19[b]	50.58[c]	<0.0001
Rabies vaccine (%)[2]	44.44	61.90	52.33	0.2356
Pre-dipping (%)[2]	88.89[a]	68.57[b]	43.60[c]	<0.0001
Post-dipping (%)[2]	55.56[c]	78.10[a]	63.95[b]	0.0325
CMT (California Mastitis Test) (%)[2]	66.67[a]	58.10[b]	39.53[c]	0.0054
Strip cup for mastitis test (%)[2]	44.44	33.33	30.23	0.6151
Hypocalcemia (quantity)	0.44[ab]	0.63[a]	0.41[b]	0.0449
Clinical mastitis (quantity)	1.33	1.28	1.34	0.7475
Reproduction method (%)[11],*	66.67[a]	40.00[b]	45.35[ab]	<0.0001
Bovine somatotropin test (%)[2]	66.67[a]	24.76[b]	9.88[c]	<0.0001
Gestation diagnosis (%)[1]	66.67[a]	49.52[b]	18.60[c]	<0.0001
Genetic improvement in the herd (%)[2]	55.56[a]	55.24[a]	26.16[b]	<0.0001
Repetition of heat (quantity)	1.66[a]	1.40[a]	1.05[b]	<0.0001
Uterine infection (quantity)	1.00[a]	0.76[a]	0.43[b]	<0.0001
Dystocic parturition (quantity)	0.88[a]	0.48a	0.23[b]	<0.0001
Age for disposal of animals (years)	8.00[b]	9.33[b]	11.18[a]	<0.0001
Heifer replacement (%)[12],*	88.89	71.43	58.72	0.1150

Averages followed by different letters on the lines indicate significant difference by Tukey's test (P<0.05). [1]salaried 0, poultry farming 1, beef farming 2, dairy farming 3, trade 4, fruit farming 5, tobacco farming 6, cassava farming 7, maize farming 8, olericulture farming 9, service 10, fish farming 11, rice-growing farming 12, pig farming 13, transport 14. [2]yes 0, not 1. [3]brickwork 0, wood 1, mixed 2. [4]complete elementary education 0, incomplete elementary education 1, complete higher education 2, incomplete higher education 3, postgraduate education 4, complete high school 5, incomplete high school 6. [5]10 to 20 minimum wages 0, 1 to 3 minimum wages 1, 3 to 5 minimum wages 2, 5 to 7 minimum wages 3, 7 to 10 minimum wages 4. [6]herringbone style milking parlors 0, beaten floor and bucket type 1, waterproof floor and bucket type 2, In line 3, parallel 4, [7]bucket 0, piped 1, manual 2, protractor 3. [8]feedlot or compost barn 0, pasture 1, semi-feedlot or compost barn 2. [9]weir 0, weir and river 1, spring 2, spring and weir 3, spring, weir and river 4 spring and well 5, spring, well and weir 6, spring, well, weir and river 7, spring, well and river 8, spring and river 9, other 10, well 11, well and weir 12, well, weir and river 13, well and river 14, public mains 15, river 16, river and public mains 17. [10]mineral 0, mineral and organic 1, organic 2. [11]controlled natural mount and artificial insemination 0, artificial insemination 1, controlled natural mount 2, uncontrolled natural mount 3, artificial insemination and IATF (fixed time artificial insemination) 4, controlled natural mount and artificial insemination 5, IATF 6, natural mount non controlled and artificial insemination 7. [12]buy 0, buy and own herd 1, own herd 2. *Percentage of producers at highest level.

Results and Discussion

The southern region of Santa Catarina State presented a large concentration of producers who had dairy cattle farming as their main economic activity (59.09%), with an average daily milk production of 302.90 ± 18.60 liters and an average daily milk production per cow of 12.18 ± 0.23 liters, delivering the product to the dairy industry 2.06 ± 0.03 times a week, and received an average price of R$1.17 ± 0.004 per liter (ranging from R$0.91 to R$1.40).

All farms had easy access throughout the year, telephone, internet, and vehicles for transport. A total of 69.23% of the residences were brickwork and housed more than four residents (4.11 ± 0.08). The producers had an average age of 43.58 ± 0.67 years, varying from 20 to 69 years, the majority were married (87.06%), 83.57% had a monthly income of 1 to 3 minimum wages, 90.91% used family labor exclusively, and 34.62% had completed high school. Schooling was taken into account, since the higher the level of education, the easier it will be to understand the current productive and technological situation (Deoke, Deoke, Saoji, & Hajare, 2012).

The rural establishments had a total area ranging from 1 to 100 hectares (ha), with an average of 11.53 ± 0.41 ha being used for dairy production. They had an average total herd of 42.59 ± 2.00 (ranging from 6 to 220) animals, with an average of 22.18 ± 0.95 in lactation. According to Oliveira, Campos, Oliveira, Ferreira and Melo (2016), the size of the farm and the number of animals have a high correlation with cost efficiency, because a larger land area with more animals will have a large economic impact, especially in nutritional planning.

The most common production system in the region was the grassland system with concentrate supplementation, with annual pasture cultivation and fertilization of the soil predominantly with minerals. A higher technological level of the farm has as main consequence of a possible future investment and search for higher productivity levels (Parré, Bánkuti, & Zanmaria, 2011).

The cows were milked in herringbone style milking parlors (45.45%) and with a piped system (37.76%). About half of the producers performed some kind of productive control, similar to the northwestern region of Santa Catarina (Costa, Hötzel, Longo, & Balcão, 2013), and 75.87% received some kind of technical assistance. Nero et al. (2005) consider the development of assistance programs and integration between producers, since the isolated adoption of management measures is not sufficient for the production of good quality milk.

Most of the farms (98.95%) supplied concentrates throughout the year, 67.48% bought commercial concentrates and showed an average consumption of 2,932.83 ± 272.64 kg (ranging from 150 to 50000 kg) per month. A total of 82.87% of the establishments were supplied by minerals in the diet. Only 19.58% of the producers formulated the diet with the help of a nutritionist and about half made adjustments whenever they felt it was necessary. In addition, 75.87% of the producers produced silage, 80.42% provided silage for the herd, and 12.59% used some type of inoculant to increase the quality of the final product. For Yalçin, Yildiz, Sariözkan and Günlü (2010), nutritional management through the use of food obtained from the farms themselves has a positive impact on reducing production costs.

To complement the diet, a small proportion of farmers used residues (36.26%), homeopathics (35.66%), and also prebiotics and probiotics (8.04%). Incorrect nutrition may directly affect aspects of physiology and reproductive performance of bovine females (Sartori & Guardieiro, 2010).

As a prevention of metabolic and reproductive diseases, producers provided the anionic diet on average 11.80 ± 0.92 days (ranging from 2 to 60 days) before the expected date of parturition, but the use of this diet is generally indicated at least 21 days before parturition (Pizoni et al., 2017). The reported cases of hypocalcemia were 0.50 ± 0.03, uterine infection 0.56 ± 0.03, and obstructed parturition (also known as dystocia) 0.34 ± 0.03. According to Goff and Koszewski (2018), the addition of anions in the diet induces metabolic acidosis in the cow, with the objective of slightly reducing blood pH, improving tissue sensitivity to parathormonium (PTH). Thus, there is a restoration of the competence of the homeostatic mechanisms of calcium and facilitates a rapid return to physiological calcemia after the decrease in calcium concentration in the blood at the beginning of lactation. A total of 61.54% of the farms performed one or more practices recommended by the health calendar for dairy herds of the Federation of Agriculture and Livestock of the State of Santa Catarina and 55.59% performed herbivorous rabies control.

As a form of clinical mastitis control, which affected about 1.32 ± 0.03 animals on the farms, pre-dipping was carried out on 54.20% of the farms and post-dipping on 68.88%. The California Mastitis Test (CMT) was performed in 47.20%, and the strip cup for mastitis test in 31.82% of the farms. According to Magalhães et al. (2006) a high somatic cell count (SCC) generates a lower economic return, reduced production, penalties applied by dairy industry, and higher spending on medication.

Another key point in controlling herd health is the quality of water sources, with the vast majority of producers collecting water from springs (49.65%) and only 3.85% had access to treated water. Furthermore, in line with Elmoslemany et al. (2010), farms that do not perform any type of water treatment are 5.5 times more likely to present high bacterial contamination in milk than those that do.

As for reproductive management, only 37.76% of farmers made some kind of genetic improvement in the herd and 31.47% made gestation diagnosis being artificial insemination the main method of reproduction used (34.62%). The quantity of heat repetitions observed was 1.20 ± 0.04 and the mean age for the disposal of animals was 10.40 ± 0.17 years (ranging from 5 to 18 years), with the replacement of heifers coming mainly from the herd itself. For Olmo et al. (2017), the identification of significant factors and interventions leads to recommendations for intervention that can potentially improve reproductive efficiency, combat population decline, and improve the capacity of small producers to meet the expansion of regional demand.

In factor analysis, factors 1 and 2 explained 24.70% of the total variation (Figure 1). The first factor was related to the area and productivity of the farms. The second factor was related to the more effective sanitary control and a greater diversity in the supply of feed for the animals, but not necessarily with the supervision of a trained professional in the area. Both factors, which characterize the dairy farms of the southern region of Santa Catarina State, were similar to other studies, such as Gabbi et al. (2013).

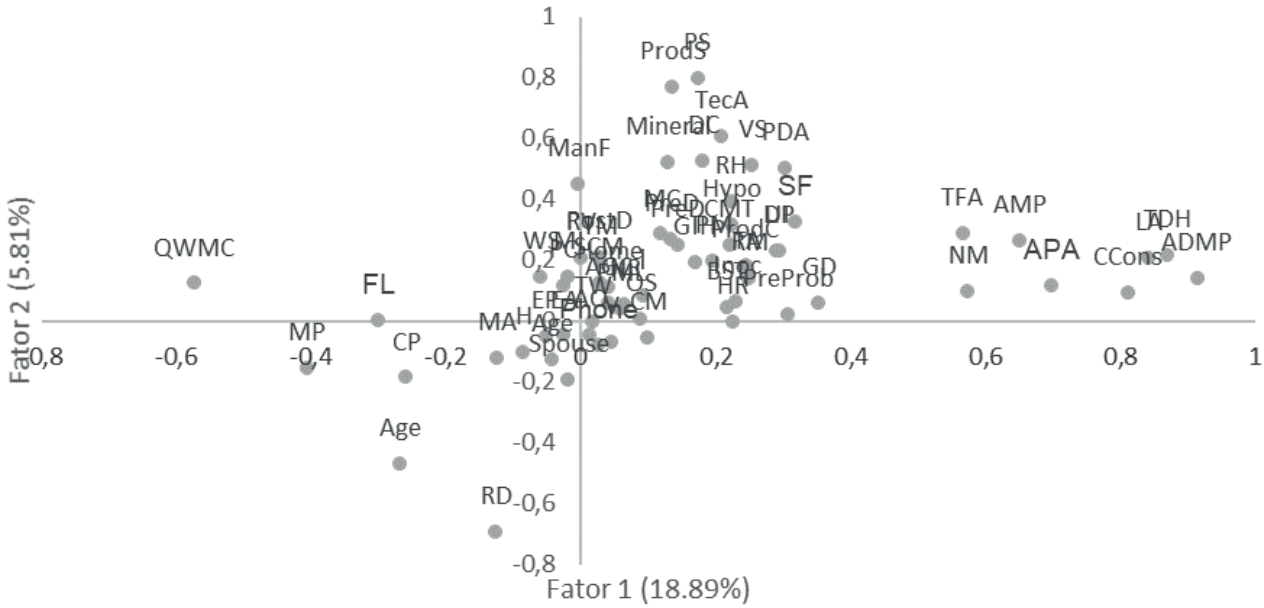

Figure 1. Dispersion of factor loads (characterization of dairy farms in the southern mesoregion of Santa Catarina, Brazil).
MA = Main activity of the farm, OA = Other activity, EA = Easy access to farm, Phone = Telephone, I = Internet, V = Vehicle, TH = Type of house, NR = Number of residents, Age = Age of the producer, EP = Education of the producer, MI = Monthly income in minimum wage, Spouse = Has spouse, FL = Uses family labor only, TDH = Total dairy herd, LA = Average of lactating animals, TFA = Total farm area, AMP = Area for milk production, ADMP Average daily milk production (L), APA = Average production per animal (L), PML = Price of milk liter (R$), QWMC = Quantity of weekly milk collections, DC = Perform fairy control, MP = Type of milk parlor, TM = Type of milking, PS = Production system, TecA = Technical assistance, ManP = Management of the farm, TA = Time in activity, PC = Provides concentrate, MC = Months with concentrate, CCons = Concentrate consumption per month, ProdC = Produces concentrate, CP = Concentrate purchase, PM = Provides minerals, PDA = Performs diet adjustments, NM = Nutritionist monitoring, BST = Bovine somatotropin test, RD = Residue in the diet, ProdS = Produces silage, PS = Provides silage, Inoc = Uses inoculant in silage, Mineral = Mineral salt in the diet, Home = Uses homeopathics in the diet, PreProb = Prebiotics and probiotics in the diet, PreD = Prepartum diet, WS = Water source, TW = Has treated water, AGC = Annual grazing crops, SF = Type of soil fertilization, VS = Perform vaccination schedule, RV = Rabies vaccine, PreD = Pre-dipping, PostD = Post-dipping, CMT = California Mastitis Test, SCM = Strip cup for mastitis test, Hypo = Hypocalcemia, CM = Clinical mastitis, RM = Reproduction method, GD = Gestation diagnosis, GIH = Genetic improvement in the herd, RH = Repetition of heat, UI = Uterine infection, DP = Dystocic parturition, Age = Age for disposal of animals, HR = Heifers replacement.

The first factor (18.89%) presented a highly positive relationship between the total number of animals in the dairy herd, the average number of lactating animals, the total area of the farms, the area destined for dairy production, the average daily milk production, the average production per animal, the consumption of concentrate per month, and the nutritionist monitoring on the farm. The number of times milk was collected per week presented an inverse relationship with the aforementioned variables, demonstrating

problems in the logistics of milk collection to meet the regional demand for dairy products. Moreover, there was a positive relationship between the size of the farm, and nutrition, and consequently, higher productivity of animals, factors considered fundamental to increase the profitability of production (Oliveira et al., 2016).

The second factor (5.81%) indicated a positive relationship between production and supply of silage, the use of mineral salt in the diet, the formulation of the diet, technical assistance, control of milk production, and implementation of the vaccination schedule, but negative with the use of residues in the diet, which could reduce production costs, as performed with citrus pulp, cotton seed, beet pulp, and others with low acquisition cost according to the region (Chaves, Stefanello, Burin, Ritt, & Nornberg, 2014).

The cluster analysis formed three clusters (Table 1) based on the individual milk production of the animals, which obtained high significance. Cluster 1 grouped the farms (n=9) larger (30.54 ha) and with higher productivity per animal (24.50 L/day), with greater support from nutritionists, generating more adjustments in the diet, in addition to presenting higher production and consumption of concentrate. According to Sartori and Guardieiro (2010), nutritional monitoring can explain the higher productivity of animals. This group also presented a greater technical assistance on the farm (100%), favoring a greater monitoring of reproductive pathologies. The presence of qualified professionals also improved important management on the farm, such as the completion of the vaccination schedule (100%), the provision of anionic diet (22.33 days), and the use of pre-dipping in milking (88.89%), one of the factors favoring a higher quality final product (Picolli et al., 2014).

The predominant structure and type of milking in clusters 1 and 2 was the herringbone and piped, respectively, cluster 3 presented a structure with waterproof floor and bucket type. Another difference between the clusters were the soil fertilization and reproduction methods used, where the producers of cluster 3 (n=172) used mineral soil fertilization and controlled natural mounts, and clusters 1 and 2 used mineral and organic soil fertilization and artificial insemination. This can be explained by the size and technification of the farms, since larger farms with a higher number of animals tend to seek better cost efficiency (Oliveira et al., 2016), such as the use of organic soil fertilization in pasture from pig residues, resulting in an increase in the level of crude protein, which is responsible for raising the cost of formulating supplements for cattle and, if present in pasture, may have its supply reduced via supplement, reducing production costs (Silva, Lana, Lana, & Costa, 2015).

For Dantas et al. (2016), schooling compromised access to knowledge and technological innovations in products, processes, and management. Clusters 2 and 3, which were considered less productive, had the majority of producers with complete secondary education, while cluster 1, with higher productivity, had mostly producers with incomplete primary education. In addition, clusters 2 and 3 had easy access to the farms during the whole year, but only cluster 2 had a larger number of producers who perform post-dipping at milking.

Cluster 3, comprising the largest number of producers (n=172), and was composed of smaller farms, with higher

purchase of concentrated feed, and a reduced number of animals, but had a higher number of milk collections during the week. It also found to have a lower nutritionist monitoring and technical assistance, generating lower levels of sanitary and reproductive control, higher age of disposal of animals. These factors demonstrate the need for the development of regional programs of assistance and integration among producers, industry, research centers, and inspection agencies (Nero et al., 2005).

In discriminant analysis (Table 2), using the STEPDISC procedure, only the variables important for the differentiation of clusters were included, such as average production per animal, average of lactating animals, average daily milk production, existence of easy access to the farm throughout the year, production system adopted, performance of the bovine somatotropin test, use of family labor only, presence of spouse, number of reported cases of dystocic parturition and clinical mastitis, concentrate production, use of residues and homeopathics in the diet, if there was a nutritionist monitoring, performance of the strip cup for mastitis test, milk control, and the area destined for milk production.

Table 2
Attribute values based on discriminant analysis of dairy farm characteristics in the southern region of Santa Catarina, Brazil

Attributes	R2 partial	P>F	P<Lambda	P>ASCC*
Average production per animal (L)	0.7460	<0.0001	<0.0001	<0.0001
Easy access to farm[1]	0.0853	<0.0001	<0.0001	<0.0001
Production system[2]	0.0417	0.0025	<0.0001	<0.0001
Average of lactating animals	0.0398	0.0034	<0.0001	<0.0001
Average daily milk production (L)	0.1133	<0.0001	<0.0001	<0.0001
Bovine somatotropin test[1]	0.0320	0.0109	<0.0001	<0.0001
Uses family labor only[1]	0.0227	0.0416	<0.0001	<0.0001
Has a spouse[1]	0.0190	0.0713	<0.0001	<0.0001
Dystocic parturition (quantity)	0.0191	0.0705	<0.0001	<0.0001
Produces concentrate[1]	0.0211	0.0537	<0.0001	<0.0001
Strip cup for mastitis test[1]	0.0194	0.0693	<0.0001	<0.0001
Perform dairy control[1]	0.0186	0.0774	<0.0001	<0.0001
Dietary residue[1]	0.0183	0.0815	<0.0001	<0.0001
Area for milk production (ha)	0.0200	0.0650	<0.0001	<0.0001
Clinical mastitis (quantity)	0.0167	0.1038	<0.0001	<0.0001
Uses homeopathics in the diet1	0.0142	0.1478	<0.0001	<0.0001
Nutritionist monitoring1	0.0141	0.1500	<0.0001	<0.0001

*ASCC: Average Squared Canonical Correlation.
[1] yes 0, not 1, [8]feedlot or compost barn 0, pasture 1, semi-feedlot or compost barn 2.

The average production per animal was the most significant variable to differentiate clusters 1 from 2 and 2 from 3, while the average daily milk production from the farms was the most significant to differentiate cluster 1 from 3 (Table 3). In addition to the aforementioned variables, the nutritionist monitoring, the production system, and the performance of the bovine somatotropin test were also responsible for the discrimination of cluster 1 of 2. The use of homeopathics in the diet, easy access to the farm, the number of dystocic parturition reported, the area destined for milk production, the presence of spouse, and the average production per animal were the variables responsible for discriminating cluster 1 from 3. For discriminating cluster 2 from 3, the most important variables were the area destined for milk production and the presence of a spouse, in addition to the average production per animal (Table 3).

Table 3
Significant variables that defined the formation of clusters determined on the basis of average daily milk production per animal

Cluster	Cluster	
	1 - High milk production	2 - Mean milk production
2 - Mean milk production	**Average production per animal** Nutritionist monitoring Production system Bovine somatotropin test	
3 - Low milk production	**Average daily milk production** Uses homeopathics in the diet Easy access to farm Dystocic parturition Area destined for milk production Has a spouse Average production per animal	**Average production per animal** Area destined for milk production Has a spouse

***Variables in bold are highly significant (P<0.0001) in the discrimination of clusters.

Conclusions

The socioeconomic profile of milk producers in the southern mesoregion of Santa Catarina is comprised of a low level of education, with an average monthly income of 1 to 3 minimum wages, and the properties are characterized as small and with low productivity.

References

Brazilian Institute of Geography and Statistics (2020). *Municipal cattle production.* Rio de Janeiro: IBGE. Recovered from https://www.ibge.gov.br

Chaves, B. W., Stefanello, F. S., Burin, A. P., Ritt, L. A., & Nornberg, J. L. (2014). Use of industrial residues in the diet of dairy cattle. *Revista Eletrônica em Gestão,*

Educação e Tecnologia Ambiental, 18, 150-156. doi: 10.5902/2236117013046

Costa, J. H. C., Hötzel, M. J., Longo, C., & Balcão, L. F. (2013). A survey of management practices that influence production and welfare of dairy cattle on family farms in southern Brazil. *Journal of Dairy Science, 96*(1), 307-317. doi: 10.3168/jds.2012-5906

Dantas, V. V., Oaigen, R. P., Santos, M. A. S., Godoy, B. S., Silva, F., Corrêa, R. P.,... Marques, C. S. S. (2016). Characteristics of cattle breeders and dairy production in the southeastern and northeastern mesoregions of Pará state, Brazil. *Semina: Ciências Agrárias, 37*(3), 1475-1488. doi: 10.5433/1679-03 59.2016v37n3p1475

Deoke, A., Deoke, S., Saoji, A., & Hajare, S. (2012). Profile of modifiable and non-modifiable risk factors in stroke in a rural based tertiary care hospital - a case control study. *Global Journal of Health Science, 4*(3), 158-163. doi: 10.5539/gjhs.v4n3p158

Elmoslemany, A. M., Keefe, G. P., Dohoo, I. R., Wichtel, J. J., Stryhn, H., & Dingwell, R. T. (2010). The association between bulk tank milk analysis for raw milk quality and on-farm management practices. *Preventive Veterinary Medicine, 95*(1), 32-40. doi: 10.1016/j.prevetmed.2010.03.007

Gabbi, A. M., Mcmanus, C. M., Silva, A., Marques, L. T., Zanela, M. B., Stumpf, M. P., & Fischer, V. (2013). Typology and physical-chemical characterization of bovine milk produced with different productions strategies. *Agricultural Systems, 121,* 130-134. doi: 10.1016/j.agsy.2013.07.004

Goff, P. J., & Koszewski, N. J. (2018). Comparison of 0.46% calcium diets with and without added anions with a 0.7% calcium anionic diet as a means to reduce periparturient hypocalcemia. *Journal of Dairy Science, 101*(6), 5033-5045. doi: 10.3168/jds.2017-13832

Magalhães, H. R., Faro, L., Cardoso, V. L., Paz, C. C. P., Cassoli, L. D., & Machado, P. F. (2006). Effects of environmental factors on somatic cell count and reduction of milk yield on Holstein cows. *Revista Brasileira de Zootecnia, 35*(2), 415-421. doi: 10.1590/s1516-35982006000200011

Nero, L. A., Mattos, M. R., Beloti, V., Barros, M. A. F., Pinto, J. P. A. N., Andrade, N. J. de., Silva, W. P. da., Franco, B. D. G. M. (2005). Raw milk from four Brazilian milk-producing states: perspectives of compliance with the microbiological criteria established by the Instrução Normativa 51. *Food Science and Technology, 25*(1), 191-195. doi: 10.1590/S0101-20612005000100031

Ney, M. G., & Hoffmann, R. (2008). A Contribuição das atividades agrícolas e não-agrícolas para a desigualdade de renda no Brasil rural. *Economia Aplicada, 12*(3), 365-393. doi: 10.1590/S1413-80502008000300002

Oliveira, M. C., Campos, J. M. D. S., Oliveira, A. S., Ferreira, M. A., & Melo, A. A. S. (2016). Benchmarks for milk production systems in the Pernambuco agreste region, northeastern Brazil. *Revista Caatinga, 29*(3), 725-734. doi: 10.1590/1983-21252016v29n324rc

Olmo, L., Ashley, K., Young, J. R., Suon, S., Thomson, P. C., Windsor, P. A., & Bush, R. D. (2017). Improving smallholder cattle reproductive efficiency in Cambodia to address expanding regional beef demand. *Tropical Animal Health and Production, 49,* 163-172. doi: 10.1007/s11250-016-1175-6

Parré, J. L., Bánkuti, S. M. S., & Zanmaria, N. A. (2011). Perfil socioeconômico de produtores de leite da região sudoeste do Paraná: um estudo a partir de diferentes níveis de produtividade. *Revista de Economia e Agronegócio, 9*(2), 276-300. doi: 10.22004/ag.econ.121299

Picolli, T., Zani, J. L., Bandeira, F. S., Roll, V. F. B., Ribeiro, M. E. R., Vargas, G. D.,... Fischer, G. (2014). Handling milking as a risk factor in the occurrence of microorganisms in raw milk. *Semina: Ciências Agrárias, 35*(4), 2471-2480. doi: 10.5433/1679-0359.2014v35n4Suplp2471

Pizoni, C., Feijó, J. O., Londero, U. S., Pereira, R. A., Corrêa, M. N., Brauner, C. C.,... Rabassa, V. R. (2017). Anionic diet on clinical, haematological and biochemical parameters of heifers with subclinical hypocalcemia prepartum. *Arquivo Brasileiro de Medicina Veterinária e Zootecnia, 69*(5), 1130-1138. doi: 10.1590/1678-4162-9035

Sartori, R., & Guardieiro, M. M. (2010). Nutritional factors associated with reproduction in heifers and cows. *Revista Brasileira de Zootecnia, 39,* 422-432. doi: 10.1590/S1516-35982010001300047

Silva, A. A., Lana, A. M. Q., Lana, R. M. Q., & Costa, A. M. (2015). Fertilização com dejetos suínos: influência nas características bromatológicas da brachiariadecumbens e alterações no solo. *Engenharia Agrícola, 35*(2), 254-265. doi: 10.1590/1809-4430-Eng.Agric.v35n2p254-265/2015

Sneath, P. H., & Sokal, R. R. (1973). *Numerical taxonomy: the principles and practice of numerical classification.* San Francisco, USA: W. H. Freeman.

Tagliacarne, G. (1978). *Pesquisa de mercado: técnica e prática.* São Paulo, SP: Atlas.

Temoso, D., Villano, R., & Hadley, D. (2016). Evaluating the productivity gap between commercial and traditional beef production systems in Botswana. *Agricultural Systems, 149,* 30-39. doi: 10.1016/j.agsy. 2016.07.014

Yalçin, C., Yildiz, A. S., Sariözkan, S., & Günlü, A. (2010). Producer profiles, production characteristics and mastitis control applications at dairy herds in Konya, Burdur and Kırklareli provinces, Turkey. *Ankara. Üniversitesi Veteriner Fakültesi Dergisi, 57*(1), 43-48. doi: 10.1501/Vetfak_0000002308

Zoho Corporation (IN). (2005). *Zoho Office® computer application.* Recovered from https://www.zohocorp.com/