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Strategies used by dairy family farmers in the south of Brazil to comply with organic regulations

L. A. Honorato,*† L. C. P. Machado Filho,* I. D. Barbosa Silveira,† and M. J. Hötzel*[1]
*Laboratório de Etologia Aplicada e Bem-Estar Animal (LETA), Departamento de Zootecnia e Desenvolvimento Rural, Universidade Federal de Santa Catarina, Rod. Admar Gonzaga, 1346 - Itacorubi, 88034-001, Florianópolis, SC, Brazil
†Grupo de estudos em comportamento de animais de produção (GECAP), Programa de Pós-graduação em Zootecnia, Universidade Federal de Pelotas, RS, Brazil

ABSTRACT

The aims of this study were to investigate the environmental, feeding, and health management of organic (ORG) family dairy farms in the south of Brazil in comparison with conventional (CONV) farms, and to assess their degree of compliance with Brazilian organic legislation and the strategies they adopt to accomplish this (n = 17 per group). During 2 visits to each farm in March and September, 2010, observations were made on the environment, feed, and health management, followed by bulk milk testing, clinical evaluation, and breed assessment of each individual cow, and an evaluation of diseases and treatments reported within the period. Additional data were collected directly from the farmers through direct interviews. The number of lactating cows was, on average, 11 (range 5 to 19) in the ORG and 16 (range 7 to 42) in the CONV herds. The ORG herds presented a lower percentage of the Holstein breed; whereas CONV herds were predominantly Holstein, in the ORG herds, only 2 herds were 100% Holstein and the remaining herds were crosses of Holstein, Jersey, and Gir (*Bos indicus*) cattle. Milk production per cow was lower (10.2 vs. 15.1 ± 1.22 L/cow, respectively) in ORG than in the CONV farms. The ORG farms offered less concentrate feed than CONV farms and had better pasture management. Organic farmers reported using phytotherapic and homeopathic products, and pasture management as a strategy to keep infection levels of endo- and ectoparasites low, whereas CONV farmers regularly used anthelmintics and acaricides. Milk production was lower in ORG than in CONV farms, but cow health and condition scores were broadly similar, indicating that the with these strategies ORG farms were able to secure levels of animal welfare comparable with CONV farms while complying with organic regulation, although at the cost of lower cow productivity.

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[1]Corresponding author: mjhotzel@cca.ufsc.br

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INTRODUCTION

Milk ranks fifth among all agricultural products in Brazil, the largest producer in South America with approximately 30.7 billion liters per year (FAO, 2012a). The growth of the dairy activity within in the last years has led Brazil to fifth place in worldwide milk production (FAO, 2012a). A peculiarity of Brazil's dairy production is that small family farms are responsible for 58% of the total milk supply for consumption; although family farms occupy merely 24% of the area, family agriculture represents 84% of all rural establishments (de França et al., 2009). This makes milk production essential for the livelihood of a significant number of families, who may benefit from the development of alternative forms of production to survive in the competitive market of milk (Schneider and Niederle, 2010; Blanc and Kledal, 2012). In South America, organic production has grown significantly in the last several years: its area of production has increased 66% from 2004 (5,679,000 ha) to 2009 (8,600,000 ha; FAO, 2012b). In southern Brazil, many farms are currently in the process of conversion to organic production, with encouragement from the Ministry of Agricultural Development, which developed a participatory certification program.

Within the last several years, industrialized countries have advanced studies on organic animal production, with special focus on animal health (Ivemeyer et al., 2009, 2012; Rutherford, et al., 2009) and famer attitudes (Hardeng and Edge, 2001; Vaarst et al., 2006). Although the agroecological movement in Brazil has spanned decades, legislation and enforcement of compliance with requirements are yet recent. Legislation on Brazilian organic agriculture was sanctioned in 2003. The technical standards and the list of substances that are allowed and prohibited for organic production were made official in 2008 through the Normative Instruction IN64/2008 (MAPA, 2008), and recently updated by the

Normative Instruction IN46/2011 (MAPA, 2011). As a consequence of the emergent nature of organic dairy farming, practically no publications exist on animal husbandry and health in organic farming in Brazil; specifically, no reports exist on the degree of compliance with organic rules in Brazilian farms. In particular, no information exists on how farmers that converted from conventional to organic dairy are coping with the limitation or prohibition of the use of allopathic medicines and nonorganic and transgenic-free feedstuff.

Due to the demands and restrictions imposed by regulations, the health of lactating cows raised in organic systems may be negatively affected. Although reducing the use of allopathic drugs is important because of the resistance to several drugs and the danger to human health arising from residues in the environment and food, this restriction may affect animal welfare. For example, it has been shown that the ban on the regular use of long-term antibiotics may increase the risk of mastitis in subsequent lactations (Marley et al., 2010). Brazilian organic legislation encourages organic producers to make a plan to identify risks and strategies to promote and maintain animal health (MAPA, 2011). European organic dairy farms that adopt an animal health and welfare plan can minimize the need for treatments of diseases (Ivemeyer et al., 2012). Despite these restrictions in medication and feed sources, or because of them, other studies have already indicated that organic farms adopt alternative husbandry practices capable of maintaining udder health (Haskell et al., 2009) alongside levels of production (Garmo et al., 2010) similar to those of conventional farms. Besides mastitis, due to the typical farming and climatic conditions of Brazil, a further significant health problem is the high infection rate of internal and external parasites (de Souza et al., 2008; Mendes et al., 2011), which organic farmers need to control without the aid of allopathic drugs. The practices used by organic farmers and their effectiveness are not described in the literature. Furthermore, although studies carried out in other countries have presented conflicting results regarding the sanitary quality of the milk of organic systems (Zwald et al., 2004; Sato et al., 2005; Roesch et al., 2007; Fall et al., 2008), comparable data does not exist for Brazilian herds.

Furthermore, the requirement that the feed be produced organically may also create a certain difficulty to maintain adequate nutritional intake or even result in lower BCS (Sato et al., 2005). This may be an important challenge if certified organic concentrates are scare or unavailable in a region, which is the case in the south of Brazil.

The aims of this study were to investigate the environmental, feeding, and health managements of organic family dairy farms in the south of Brazil in comparison with conventional farms, and to assess their degree of compliance with Brazilian organic legislation and the strategies that they adopt to accomplish this.

MATERIALS AND METHODS

Location and Selection of Farms

The study was carried out in family farms of 7 municipalities of the western region of the state of Santa Catarina, Brazil (27°25′S 48°30′W). This region was chosen as it represents an important dairy belt within the state (ICEPA, 2011), where the production of organic milk is expanding. Seventeen farms with organic (**ORG**) milk production were compared with 17 other farms managed under a grazing system, which were considered conventional (**CONV**).

The ORG farms were either certified (n = 10) or had started the certification process at least 18 mo prior (n = 7), in accordance with Brazilian legislation. To select ORG farms, we gathered information from the dairy producers' network of cooperatives in the study region, Ascooper. At the time, 10 farms were certified organic dairy producers and a few others in the process of conversion. Seven farms that were at least 18 mo into the conversion process were included in the ORG group (full certification usually occurs in the third year, as reported by certified producers). The Brazilian legislation establishes a minimum period of 12 mo of conversion to perennial pastures and a minimum of 6 mo for cattle rearing purposes; this time is considered necessary to ensure that the production units are able to produce in accordance with the technical regulations of organic production and that the producers received the necessary training (MAPA, 2011).

Our criteria for selection of CONV dairy farms were that they were smallholding family farms producing milk in conventional systems, that they were associated with Ascooper, located close to the organic farms, as similar as possible in size, and used grazing as the main source of nutrition for the cows. Thus, when these farms entered the study their management practices needed to comply with the organic legislation.

Brazilian Organic Farming Legislation

The Brazilian organic farming legislation (MAPA, 2003) is similar and in accordance with the standards of the International Federation of Organic Agriculture Movements (IFOAM, 2012). We describe here some parts of the legislation relevant to dairy cow farming. The current organic regulation, IN 46/2011 (MAPA, 2011), refers in general terms to production without the use of fertilizers and pesticides of chemical synthesis, transgenic feedstuff, or allopathic veterinary drugs and compliance with animal minimum welfare standards. Allopathic drugs may be used when considered essential, provided that their withholding periods are doubled, and they are used no more than twice in 1 yr, respecting a minimum interval of 3 mo between each treatment, and at most 3 times during the lifetime of the animal. All vaccinations and examinations determined by the law are also required in organic systems. For herbivores, the use of the grazing system must be maximized, and fresh, dried, or ensiled fodder should constitute at least 60% of the DM of the diet, or 50% for animals producing milk, for a maximum period of 3 mo from the start of lactation. The use of NPN compounds and synthetic nitrogen in animal feeding is not allowed. Grazing systems preferably should be rotational, to control parasites. The use of conventional feedstuff is limited to a maximum of 15% of daily DMI. Regarding animal welfare, the regulation states that organic livestock production systems should be designed so that they are productive and meet the needs and welfare of animals, and lists the Five Freedoms (FAWC, 1979) as a reference. Preference should be given to animal breeds adapted to the climatic conditions and the type of use. Pastures must contain woody vegetation to meet their ecosystem function and provide shading necessary to the welfare of the grazing species.

Even in the conversion phase, producers must comply with the IN 46 regulation. The Ecovida Network, an organization recognized by the International Federation of Organic Agriculture Movements (Bonn, Germany), which takes responsibility for the formal set of activities in a participatory guarantee system (http://www.ecovida.org.br), was responsible for the certification of the farms.

Data Collection

Each farm was visited twice: in March (autumn) and September (spring) 2010. Data on farm size, herd composition, pasture and feed management, hygiene and milking management practices, reproductive management, sanitation, preventive procedures, and use of medications in animals were obtained through face-to-face interviews with the farmers during the first visit. Hygiene and milking management practices were also observed directly during both visits.

When evaluating the environment, observations on pasture management, free access to water and shade, water troughs, milking parlor, and housing facilities (material, hygiene, ventilation, and lighting) were made. In the milking routines, the procedures of teat pre- and postdipping and the California mastitis test (**CMT**) were recorded.

A veterinary health examination was performed on all lactating cows at the moment of each visit, totaling 461 cows in March and 465 in September, as detailed in Table 1. Genotypes (Holsteins or crossbreeds) were estimated within each herd to categorize the genetic percentage of the Holstein breed in 4 levels as follows: 25, 50, 75, and 100%.

Information on the number and duration of lactations, intervals between parturitions, breeds, dirt, hoof growth, ectoparasite infestation, BCS, gait score, and udder assessment was collected in the interviews and in the medical examinations (see Table 1 for description). Clinical and subclinical mastitis incidences were estimated by means of visual analysis of milk and CMT. The percentage of cows that presented at least 1 quarter positive by the CMT (CMT $\geq$1+) was calculated. The incidences of clinical mastitis per cow (percentage of cows in the herd), and subclinical mastitis per quarter (percentage of affected quarters in the herd) were calculated. A notebook was given to each farmer so that he/she could register all diseases and treatments of animals between the researcher's visits, in March and September.

During each visit, fresh milk samples were aseptically removed from the cooling tanks and sent to a laboratory certified by the Ministry of Agriculture. Levels of TS, protein, fat, and lactose were measured by means of the infrared method (IDF, 2000). The flow cytometry method was used for both the bulk tank SCC (**BTSCC**; IDF, 2004) and the bulk milk bacterial counts (**BMBC**; IDF, 2006).

Data Analysis

Each farm, classified according to its productive system (ORG or CONV), was considered an experimental unit. All reported results are the average of all farms in each treatment. For production per cow per day, gait, BCS, udder hygiene and skin lesions, and ectoparasites, the mean of each herd per farm was considered. Recurrent episodes of the same disease within a period of 14 d were considered as the same occurrence. From these data, the percentages of occurrences of disease and of use of antibiotics in each herd in the period were estimated. The Fisher exact test and chi-squared test (PROC FREQ of SAS; SAS Institute Inc., Cary, NC) were used to identify associations between the system, the environmental variables, and farm characteristics, such as pasture management, supply of water and shade, and use of predipping, postdipping, CMT, and AI. All variables were tested to verify normality of variance by the Shapiro-Wilk test. Values for gait, udder hygiene, BTSCC, and BMBC were transformed into logarithmic functions to meet the criteria of normality

Table 1. Summary of the conceptual framework and indicators of animal health and environment

Theme	Description	Indicator/form of recording the variable
Environment	Environmental evaluation	Availability of shade at all times (yes or no) Availability of water at all times (yes or no) Water supply (trough or other form) Outdoor access (h/d) Pasture management (intensive or extensive) Milking hygiene: predipping (yes or no); postdipping (yes or no) Feed quality and quantity: raw materials for concentrate feeds (kg); concentrate feed (yes or no)
Health	Physical and sanitary evaluation of the cows	Risk of acute or chronic mastitis (positive California mastitis test) Udder hygiene: 4-point score (0 = free of dirt; 3 = covered with dirt on >30% of surface area)[1] Udder evaluation: asymmetry (yes or no); dry teats (no.) Locomotor evaluation: 5-point score (1 = best; 5 = worst)[2] BCS: 5-point score (1 = too thin; 5 = too fat)[3] Skin lesions (yes or no) and type Presence of ectoparasites (0 = low; 1 = moderate; 2 = high)[4] Occurrence of disease (notes of the period) Frequency of use of medication (from notebooks) Types of treatments (from notebooks); dry cow therapy (yes or no)
Productivity	Production data of cows	Daily production (L/d); AI or natural mating (AI × NM)

[1]Adapted from Ruegg (2006).

[2]Adapted from Flower and Weary (2006).

[3]Adapted from Edmondson et al. (1989).

[4]Visual assessments of ticks, human bot flies, and horn flies. The presence of up to 10 specimens on 1 side of the animal's body was considered a low infestation, 11 to 29 was considered moderate, and >30 was considered high.

(W >0.95, where W = Wald test parameter). Original means and standard errors are presented in the results. Quantitative data were analyzed by the linear mixed model (PROC MIXED of SAS), including the fixed effects of the systems (ORG and CONV) and period (March and September). The system by period interaction was excluded, as it was not significant. The farm was included as a random effect, and the period as repeated measure. A descriptive analysis comparing the use of dry cow therapy and the rate of treated cows in the 6-mo period, within both systems, was carried out. Analyses were performed with SAS 9.0 software.

RESULTS

Farm and Herd Characteristics

Organic farms were, on average, 19 ha (range 5.5–85) and CONV farms were 31 ha (range 7.2–84). The number of lactating cows was, on average, 11 (range 5 to 19) in the ORG and 16 (range 7 to 42) in the CONV ($P <$ 0.04) farms, similar to the average in the state of Santa Catarina (ICEPA, 2011). Overall, CONV herds were predominantly Holstein, and 13 of the 17 herds were 100% Holstein. In the ORG farms, only 2 herds were 100% Holstein; in the remaining farms, herds were mainly crosses of Holstein, Jersey, and Gir (*Bos indicus*) cattle.

Environment and Management Practices

In the ORG farms, food was primarily grass based, and most farms implemented Voisin rotational grazing (Table 2). They also offered less concentrate feed (up to 2 kg/d) than the CONV (up to 7 kg/d). Organic farms were more self-sufficient in the production of grains and were, thus, less dependent on concentrate feed; however, 2 acquired external inputs, which were not certified as transgenic free.

Permanent access to drinking water, in water troughs or natural sources, tended to be greater in the ORG than in the CONV farms (P = 0.08); access to pasture and availability and provision of shade did not differ (Table 2). Throughout the year, cows remained outdoors at all times in both systems, except during milking. In most farms, shade was limited to certain specific places, to which the animals were led during the hottest periods. Only 2 ORG and 2 CONV farms offered permanent access to shade.

A tendency also existed for the ORG farms to apply the CMT and to use predipping more frequently than CONV farms ($P <$ 0.08). The use of antibiotics for dry cow therapy was a common practice in the CONV farms, whereas in the ORG farms, it was used only in cases of chronic mastitis (Table 2).

Animal Health, Hygiene, and BCS

No difference existed between systems regarding quarters with subclinical mastitis, but variation between periods was observed, with a larger occurrence in March ($P <$ 0.05; Table 3). In both systems, approximately 1% of the quarters were dry. The incidence

Table 2. Environmental and management practices in organic (ORG) and conventional (CONV) herds

Variable (% of farms)	CONV (n = 17)	ORG (n = 17)	*P*-value[1]
Voisin Rational Grazing	53	88	0.05
Permanent access to shade	12	12	1.00
Permanent access to water	41	71	0.08
Water supply in trough	65	82	0.24
Buys concentrate feed	35	12	0.10
Buys raw materials for concentrate feeds	65	47	0.10
Production of grains for feed on farm	47	88	0.01
AI as single reproductive method	53	29	0.14
Milking management			
Performs California mastitis test weekly or every 2 wk	35	65	0.08
Performs teat predipping	12	35	0.09
Performs teat postdipping	59	59	1.00
Uses dry cow therapy (antibiotics)	76	18	0.001

[1]Chi-squared and Fisher exact test.

of clinical mastitis was lower in the ORG than in the CONV farms. On the first visit, 1 case of clinical mastitis was found in the ORG and 5 in the CONV farms. In September, 1 case was detected in the ORG compared with 10 cases in the CONV farms ($P = 0.05$).

Infestations of ectoparasites—ticks (*Boophilus microplus*), horn flies (*Haematobia irritans*), and human bot flies (*Dermatobia hominis*)—were greater in the ORG than in the CONV herds in March; in September infestations were similar in both systems (Table 3).

The ORG farms presented better gait and udder dirtiness scores than the CONV (Table 3). Skin lesions were rare in both systems, and of the 23 uncovered cases (8 in the ORG and 15 in the CONV), most lesions were sunburn. Body condition scores were similar in both systems (Table 3).

Disease Occurrences and Treatments in the 6-mo Period

Two farmers within each system did not fill the notebook throughout the experimental period. From March to September, 15 mastitis cases were reported in the ORG system, 14 of which were treated with antibiotics and 1 with phytotherapics (arnica). In the CONV farms, 37 cases were reported, all of which were treated with antibiotics. Besides mastitis, antibiotics were also used in treatments for reproductive problems (2 in ORG and 12 in CONV farms), redwater fever (3 in ORG and 9 in CONV farms), diarrhea (2 in ORG farms), hoof abscess (1 in ORG farms), and conjunctivitis (1 in CONV farms). Overall, the use of antibiotic therapy in the 6-mo period was greater in the CONV than in ORG herds ($P = 0.05$; Table 3).

Notwithstanding all ORG farmers having reported the use of phytotherapic and homeopathic medicines to prevent disease, we observed that curative therapies, in the vast majority of cases, were based on antibiotic use. The phytotherapeutic medicines reported were ointments and tinctures for pre- and postdipping, all used in the prevention of mastitis. Plants used were carqueja (*Baccharis trimera*) and flaxseed (*Linum usitatissimum*). Other medicines listed were *Wedelia* (*Wedelia paludosa*) tea to avoid placental retention, and black elder or lace (*Sambacus nigra*) and Brazilian pine (*Araucaria angustifolia*) tincture, used externally as a parasitic repellent. The use of a neem- (*Azadirachta indica*), garlic- (*Allium sativum*), and a sulfur-based

Table 3. Animal health, hygiene, and BCS of organic (ORG) and conventional (CONV) herds

Variable	CONV (n = 17)	ORG (n = 17)	SE	*P*-value
Quarters with subclinical mastitis in March (%)[1]	14.3	12.8	1.92	0.58
Quarters with subclinical mastitis in September (%)[1]	9.6	8.2	2.03	0.48
Average udder dirtiness score (0–4)	0.24	0.09	0.04	0.02
Udder asymmetry (%)[1]	11	8.8	3.5	0.31
Average gait score (1–5)	1.11	1.03	0.03	0.01
Average BCS (1–5)	3.16	3.07	0.07	0.16
Presence of ectoparasites in March (0–2)	0.5	0.9	0.09	0.01
Presence of ectoparasites in September (0–2)	0.2	0.2	0.06	0.60
Antibiotic use in the period of 6 mo (%)[1]	26.1	9.2	5.92	0.05

[1]Percentage value of the herd.

commercial product was also reported for the prevention of endo- and ectoparasites. Doses and frequency of use were not studied, as they were out of the scope of this study.

Conventional farmers regularly used anthelmintics and acaricides. A common practice among these farmers was the application of ivermectin when drying the cows. The use of conventional anthelmintics was not reported in the ORG farms throughout the experimental period. The external application of cypermethrin-based acaricides was frequent during the summer, with applications monthly and even every 2 wk in CONV herds. In the ORG system, however, only 2 farmers reported using the latter within the experimental period.

Milk Production and Quality Indicators

Milk production per cow was lower in the ORG farms (10.2 L/cow per day) than in the CONV farms (15.1 L/cow per day; $P < 0.001$). Fat and TS contents were greater ($P = 0.005$ and $P = 0.01$, respectively) and the BTSCC smaller in the ORG than in the CONV system (Table 4). Period exerted an effect, with greater values of BMBC ($P = 0.01$), BTSCC ($P = 0.02$), and fat ($P = 0.02$) in March (end of summer) than in September (beginning of spring) in both systems.

DISCUSSION

Organic farms were, in general, able to comply with the organic regulation while maintaining health and nutrition standards comparable with CONV farms. To do that, they made use of several different technologies and management practices compared with CONV farms, among which we highlight the use of herds of adapted genotypes, an increase in the adoption of preventive health measures, use of alternative therapies, and a reduction in the use of concentrate feed. Milk production was lower than in CONV farms, mainly due to the breed composition of the herds and lower use of concentrate feed, but cow health and condition scores were broadly similar, indicating that the strategies used by ORG farms were able to secure levels of animal welfare similar to CONV farms and compliance with regulations, although at a cost of lower cow productivity.

Choice of Genotype and Its Influence on Milk Productivity and Composition

Perhaps the main characteristic of ORG farms was the crossbreeding of cows. This factor may have been crucial for many of the differences between ORG and CONV farms: mainly those relating to milk production, milk fat content, and incidence of disease. Up to the present, most researchers have studied ORG and CONV farms that used the same breeds (e.g., Fall et al., 2008; Rutherford et al., 2009; Garmo et al., 2010). Nevertheless, the preference for crossbreeds among ORG producers has already been noted in other investigations (Sato et al., 2005; Roesch et al., 2007, Stiglbauer et al., 2013). Herd racial composition similar to the ORG farms in the current study, with varying proportions of Holstein, Jersey, and Gir (*Bos indicus*) animals is commonplace in ORG farms in the south of Brazil (Kazama et al., 2012). Local farmers use crosses with *Bos indicus* breeds due to their resistance to disease, and Jersey genetics due to their grazing skills and suitability to hilly terrains typical of the region. Furthermore, the Brazilian organic legislation suggests giving preference to animals of breeds adapted to the climatic conditions and the type of treatment used (MAPA, 2011).

As in the current study, lower production of milk among ORG than among CONV herds has been reported in studies from other countries (Sato et al., 2005; Roesch et al., 2007; Stiglbauer et al., 2013), which can be attributed to factors such as breed, udder health, feed, and management. Therefore, our results should not be interpreted as a direct consequence of the ORG condition per se, but of the combination of genotype and feeding strategy.

Feeding Management

Organic farmers complied with the organic regulation regarding feeding, an exception being 2 farmers

Table 4. Milk production, composition, and quality in organic (ORG) and conventional (CONV) herds

Variable	CONV (n = 17)	ORG (n = 17)	SE	P-value
Milk production/cow per day (L)	15.1	10.2	1.22	0.001
Fat (%)	3.60	3.93	0.08	0.005
Protein (%)	3.14	3.25	0.04	0.19
Lactose (%)	4.40	4.38	0.02	0.69
TS (%)	12.09	12.55	0.12	0.01
BTSCC[1] (×1,000 cells/mL)	631 (159–1,745)	439 (100–946)	60.44	0.03
BMBC[2] (×1,000 cells/mL)	1,050 (18–7,383)	1,810 (37–9,861)	358.86	0.14

[1]Bulk tank SCC. The numbers in parentheses represent the range.

[2]Bulk milk bacterial count. The numbers in parentheses represent the range.

that bought concentrates, which are likely to contain transgenics, as these are widespread in the region and animal feedstuff is not tested for transgenics. In fact, although ORG farmers could use CONV feed within the limits of 15% of DMI, as specified in the organic normative, the lack of testing for transgenics and organized markets for ORG grains prevents ORG farmers from buying concentrates. This may explain the greater proportion of ORG farmers that produce grain for feed on the farm.

The similar BCS of cows in both systems indicates that, despite seasonality of forage production and lower supply of concentrates than used by CONV farms, the feeding strategy adopted by ORG famers was efficient in maintaining acceptable BCS. The main source of feed for the ORG cows was pasture, with Voisin rotational grazing widely adopted by ORG farmers. Intensively managed rotational grazing is a common feature in ORG farms (e.g., Stiglbauer et al., 2013), which has been proven to have the potential to reduce feed costs, optimize pasture supply, and increase grazing efficiency (Goldberg et al., 1992).

Cow Comfort: Provision of Drinking Water and Shade

Organic farms tended to have a better supply of drinking water, which is known to result in better water intake (Machado Filho et al., 2004; Teixeira et al., 2006). Most farms in both groups did not offer shade in pasture permanently. It has been argued that cultural habits and inadequate access to technical assistance may underlie the low provision of shade, despite the recognition by farmers that this is important for cow productivity and health (Cardoso et al., 2012). These barriers need to be overcome, as ORG producers must comply with the IN46 normative, which determines a period of 5 yr for the establishment of enough vegetation. Public policies and extension programs need to support this change through financial credit, technical support, and with extension methods that recognize the need to overcome cultural barriers.

Health Management and Treatment of Diseases

Organic farms used fewer treatments for mastitis than CONV farms, as in other studies (Hardeng and Edge, 2001; Valle et al., 2007). Those authors attributed better udder health in ORG herds mainly to the lower milk production per cow in the system, which was the case in the present study. Furthermore, the higher udder cleanliness score observed in the ORG group is an indicator of better environmental conditions for cows, another factor that may have had an impact on the better state of health of the udder within this system. Ellis et al. (2007), using the same udder health score as in the current study, showed a relation between hygiene and milk quality, with a lower BTSCC and lower dirtiness score strongly related to ORG herds. Recent investigations have shown that the ORG status does not influence BTSCC, but that factors of ORG management, including preventive sanitary measures, are effective in the control of mastitis (Haskell et al., 2009). In conclusion, it appears that the overall management practices adopted by ORG farmers to comply with the organic standards results in better udder health.

Organic milk presented lower levels of BTSCC, but we must emphasize that in our study, both BTSCC and BMBC were high in both systems and 50% of farms did not fall within the limits set by law, which at the time of the study delimited a maximum of 750,000 cells/mL (MAPA, 2002); in 2011, the legislation was amended and even stricter criteria for milk quality were introduced, dictating 600,000 cells/mL (MAPA, 2011). Low milk quality is a common problem in farms in the region of our study, independent of production system (Winck and Thaler Neto, 2009; Costa et al., 2013).

Although less often than CONV farmers, who used synthetic antibiotics for the treatment of all diseases, ORG farmers also used these products, mainly to treat mastitis. Notwithstanding the legal prohibition of regular use of these products in ORG farms (MAPA, 2011), they are allowed for therapeutic purposes in exceptional cases. The use of allopathic drugs may be related to the farmers' reported lack of veterinary assistance specializing in ORG production (Honorato, 2011). In interviews made by Vaarst et al. (2006), all ORG producers have manifested the desire to be able to use antimicrobial drugs in situations of emergency, expressing concern for the recovery of animals. This indicates the need for further development of affordable and effective alternative treatments to cure and prevent disease in ORG herds, especially but not exclusively, mastitis. It is important to note that in Brazil, no effective control exists over the sale of veterinary drugs, including antibiotics; thus, in practice, mastitis is treated by the producers themselves, without veterinarian assistance, which may increase the risk of use and indiscriminate drug residues in animal products and drug resistance.

Better gait score in ORG than in CONV herds may be associated with many factors, such as feeding lower amounts of concentrates, lower milk production, less intensive management, and use of pasture, all of which are known to contribute to better gait scores in ORG farms (Rutherford et al., 2009). In our study, cows of both groups had access to pasture, but ORG cows produced less milk and received less concentrates; additionally, larger cows are at greater risk of suffering hoof injuries in rough terrain, as is the case in this region, suggesting that the genotypes used by ORG farmers were better suited to this environment.

CONCLUSIONS

In general, smallholder ORG dairy producers in the south of Brazil seem to be able to comply with the organic regulations. The ORG farms could produce milk with fewer demand for external inputs compared with the CONV farms, without compromising animal health. However, they face some difficulties, specifically regarding the supply of feed supplements because no production of ORG feeds exists, and products are not tested to determine if they are transgenic. Thus, most ORG farmers seem to use pasture as the main energy supply, which, added to the choice of genotypes more resistant to disease and adapted to the environment, limits the cow production and farm productivity.

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