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A comparison of production and management between Wisconsin organic and conventional dairy herds

K. Sato*, P.C. Bartlett, R.J. Erskine, J.B. Kaneene

A107 Vet Med Center, College of Veterinary Medicine, Michigan State University, East Lansing, MI 48823, USA

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Abstract

An observational study was conducted in Wisconsin to compare production and management on organic and conventional dairy farms. Thirty organic dairy herds, where antimicrobials are rarely used for calves and never used for cows, were compared with 30 neighboring conventional dairy farms on which antimicrobials were routinely used for animals of all ages. A seven-page questionnaire regarding milk production, milking practices, housing, incidence of the major dairy diseases and medical treatments was used to assess management and production during 2000–2001. Body condition scores (BCS) of lactating cows and environmental and animal sanitation scores (EASS) were also collected on each of two occasions. The organic herds had significantly fewer cattle than did the conventional herds (P=0.017). The average daily milk production per cow in organic dairy herds (20.2 kg/day) was lower than that of conventional herds (23.7 kg/day). The incidence of clinical mastitis (CM) on organic farms (28 cases per 100 cow-years at risk) was not statistically different from that of on conventional farms (32 cases per 100 cow-years at risk). No significant difference in bulk tank somatic cell count (BTSCC) was observed between organic farms (262,000 cells/ml) and conventional farms (285,000 cells/ml). The average annual cull rate was 18.0 cases per 100 cow-years for the conventional farms and 17.2 for the organic farms (P=0.426). Our paired t-test results indicated significantly higher parasite burden on organic dairy farms; however, no significant difference between the two farm types when controlling for season (March and September), grazing intensity (no grazing, little grazing, grazing with access to housing and grazing only) and herd average milk production per cow. There was little evidence of other fundamental differences between the two farm types in other management and production parameters.

Keywords: Clinical mastitis; Bulk tank milk; Somatic cell count; Organic dairy

1. Introduction

Organic dairy production is drawing increasing attention because of public concerns about food safety, animal welfare and the environmental impacts of intensive livestock systems (Weller and Cooper,

* Corresponding author. Tel.: +1 517 432 3100x215; fax: +1 517 432 0976.
E-mail address: satokenj@msu.edu (K. Sato).

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1996; Sundrum, 2001). The annual U.S. organic food market is approximately US$6 billion, which is less than 1% of total food consumption in the United States. However, the organic market has been growing at 20–30% per year (Greene, 2000; 2001). In the UK, a 30% to 40% per annum increase of organic products was observed (Weller and Bowling, 2000). In contrast, the organic (økologisk) milk market in Denmark is approximately 14% of the total milk consumption (Mann, 1999) and more than 25% of total sales of dairy products in Switzerland is labeled as organic (Busato et al., 2000). Organic agriculture is increasingly being recognized by governmental bodies as a tool to improve rural income diversity and stability (FAO, 2000). In Wisconsin, the organic dairy farmers sell their milk for almost twice as much as what conventional farmers receive. As such, organic milk production has created a niche market that has allowed many small dairy farms to stay in business during a time when profit margins are small, the dairy industry is consolidating and many small and moderately sized dairy herds are going out of business.

The standards for using antibiotics in organic dairies in the United States are stricter than those in the EU. The USDA Organic Standard prohibits the use of antimicrobial drugs for organic dairy cows (USDA, 2001). The standard also stipulates that all appropriate medications and antimicrobial treatments must be applied to restore an animal to health. When methods acceptable to organic production standards fail, however, this means that the animal will lose its organic status.

Mastitis is a major cause of economic loss in the dairy industry and the primary reason for which antibiotics are used in dairy operations (Kaneene and Miller, 1992). Field studies in Pennsylvania, Ohio and California indicated that the average annual herd incidence of CM was 45 to 50 cases per 100 cows (Hady et al., 1993). Milking hygiene and environmental sanitation are traditional ways to prevent the disease (Bartlett et al., 1992a). However, antimicrobial use for treating and preventing CM is also a common practice on most U.S. dairy farms. Routine intramammary treatment for all cows with long-acting antimicrobials after the end of lactation (dry cow treatment) is widely adopted in the United States as a preventive method. (Jayarao and Cassel, 1999; Hardeng and Edge, 2001). Although mild cases of CM may not always receive antibiotic treatment during the lactational period, dairy producers and veterinarians often treat severe cases with supportive therapies and intramammary antibiotic infusion or injection.

It has been suggested that organic dairy herds may have higher culling rates, primarily due to intramammary infections and reproductive problems (AHI (Animal Health Institute), 1998). However, Weller and Bowling (2000) reported that the incidence of CM in 10 organic dairies in the UK was not significantly different from the rate of CM in conventional dairies. Busato et al. (2000) reported that the prevalence of subclinical mastitis in organic dairies in Switzerland was lower than the national average. Few studies have compared the incidence of CM on organic and conventional dairy farms in the United States. Barlow (2001) reported bacteriological analysis of 109 CM quarters on six organic farms in Vermont; however, no incidence of CM was given or compared with conventional dairy farms.

It is generally assumed by the dairy industry that organic farms have lower milk production and higher culling and disease rates because farmers are not allowed to treat sick cows with antibiotics. However, valid comparisons are not available and are confounded by comparisons between small extensive organic dairies and large total-confinement dairy operations which employ a very different intensive nutritional and management strategy. In general, the organic restrictions on the use of insecticides and herbicides for producing animal feed have induced most Midwestern organic dairy farms to employ grazing to a much greater extent than do conventional farms. This generally creates less intensive feeding and housing management systems compared with what is seen in the mainline dairy industry.

The overall purpose of this study was to compare the major health, management and milk production parameters between organic and neighboring conventional Wisconsin farms.

2. Materials and methods

2.1. Data

A geographical cluster of 30 organic dairy farms in Southwestern Wisconsin were selected from 110 members of an organic dairy association (Sato et al., 2002). All farms were certified as complying with the U.S. national organic standards and had been selling organic milk through their organic association for at least 3 years (mean=8.0 years) before the start of our study. For each organic farmer selected, a neighborhood "conventional" dairy farmer was asked to volunteer their farm to serve as a control. The conventional dairy farms were chosen from the nearest neighboring conventional farms, with only five cases of a farmer declining to participate.

All herds were visited twice; once in March and once in September. Fecal specimens were collected for comparison of antimicrobial resistance, as described elsewhere (Sato et al., 2004a,b). Numbers of cows sold or culled were recorded. Herd average milk production, bulk tank somatic cell count (BTSCC) and bacteria counts of the previous month were obtained from the milk production receipts or other production records whenever available. Average daily milk production per cow was computed from the amount of bulk tank milk per day divided by number of lactating cows. A seven-page questionnaire regarding milk production, milking practices, housing, incidence of the major dairy diseases, medical treatments, years of organic dairy operation and other management factors was conducted at the first farm visit; 10 pairs of herds in the Spring of 2000, 10 pairs in the Fall of 2000 and 10 pairs in the Spring of 2001. On the second farm visit, previously collected management and production data were reviewed and verified.

Clinical mastitis (CM) was defined as a cow having a swollen or hard udder or noticeable clots or strings in its milk. The dairy producers were asked to retrieve from their records (or recall from memory) the number of CM cases in the 3 months before the interview. Recurrent episodes of disease were counted as the same case if the recurrence occurred within 2 weeks of initial onset. Cows with multiple quarters affected with CM were counted as the same case. The CM rate for each herd was calculated as the number of CM cases per 100 cow-years at risk.

Bulk tank milk samples from each of the two visits were collected and sent to the laboratory at the Atlantic Veterinary College, University of Prince Edward Island for serologic testing for *Ostertagia ostertagi* by an indirect enzyme-linked immunosorbent assay (ELISA; Guitian et al., 2000). The optical density (OD) values of ELISA test were adjusted with positive and negative controls, and the adjusted OD data were used for our analysis.

At each visit, the body condition score (BCS) was measured on a convenience sample of 10 lactating cows selected by walking into the cow pen at a random place and time. Cows were scored from 1 (thin) to 5 (fat), with increments of 0.25, (Wildman et al., 1982). A body condition score guide with photographs (Church & Dwight, Princeton, NJ) was used for standardization. The mean of 10 BCS values was used as a representative value for each farm for each farm visit.

Environmental and animal sanitation was measured with subjective scores of cow cleanliness and the amount of moisture and manure in the bedding and exercise areas, as previously described (Bartlett et al., 1992a,b). Sanitation was graded as 1 (presumed upper 1/3 of all dairy farms in Wisconsin), 2 (middle 1/3) and 3 (lower 1/3), given current weather conditions. The scores were considered to be ordered categorical data, and the mean value of all environmental and animal sanitation scores (EASS) were computed as an index for each farm each season.

2.2. Statistical analysis

The questionnaires were reviewed with the farmers at the second farm visits and were proofread twice for correct data entry. No data were excluded as being unreasonable or impossible responses. The milk production per cow, CM rate, BTSCC, BCS, EASS and adjusted OD data from ELISA test were tested for normality with the Shapiro–Wilk test and no transformations were deemed necessary (W>0.95 in each instance). Bacteria count and total cows per herd (herd size) were transformed with a log function and the transformations yielded W-values of 0.96 and 0.98, respectively. A mixed linear model with random effects was used to estimate the difference in continuous production variables between organic and conventional dairy farms. Farm type, season and interaction of farm type and season were included in the model as fixed effects. Pairs (each organic farm and its conventional neighbor farm) were included as a random effect to reflect the pairwise matching. For discrete variables, such as grazing intensity, milking methods and mastitis treatments, McNemar's test was used to examine differences between the two farm types. For culling and mortality analysis, Poisson regression was used to estimate the difference between the two types of farms. The adjusted OD values of ELISA test for each season were tested by paired *t*-test, and then analyzed with a mixed liner model which included farm type, season, grazing intensities and milk production per cow as fixed effects and pair as a random effect. All statistical analyses were performed using SAS statistical software (SAS Institute, Cary, NC).

3. Results

3.1. Herd structure

The mean herd size was 72 cows (range 35–223) for conventional herds and 51 cows (range 37–132) for the organic herds (P=0.017). Eighteen organic herds and 22 conventional dairy herds consisted of 100% Holstein breed, whereas 12 organic and 8 conventional herds consisted of a mix of cows including Holstein, Jersey, Brown Swiss, Guernsey or mixed breeds. Estimations of herd breed composition (percentage of Holstein breed) showed a preference of the organic dairy farmers for non-Holstein and mixed breeds (P=0.10).

3.2. Milk production and mastitis rate

Organic farms had about 15% lower milk production per cow (20.2 kg/day) compared to conventional farms (23.7 kg/day; P=0.025, Table 1). The CM rates were 27.7 (S.D.=20.7) and 32.1 (S.D.=21.8) cases per 100 cow-years at risk for organic and conventional herds (P=0.65), respectively. The frequency distribution of herd CM rates is shown at Fig. 1. The overall mean BTSCC was 274,000 cells/ml (S.D.=89,700) and was approximately normally distributed (Shapiro–Wilk=0.968). The arithmetic mean BTSCC for organic herds was 263,000 cells/ml (S.D.=101,000) and 285,000 cells/ml (S.D.=137,000) for conventional herds (P=0.328), as shown in Fig. 2. Half of the organic herds (15 farms) employed intensive grazing during summer, whereas only two conventional herds used intensive grazing (P=0.008, Table 2). Free stalls were used on nine conventional herds, in contrast to being used on only four organic herds (P=0.059).

3.3. Culling and mortality rate

The total number of milking-age cows culled for any reason was 367 per year from the conventional herds and 247 per year from the organic herds. The average annual cull rates were thereby calculated as 18.0 cases per 100 cow-years (S.D.=9.0) for the conventional farms and 17.2 cases per 100 cow-years (S.D.=9.8) for the organic farms (P>0.426). Ninety cow deaths (4.2 cases per 100 cow-years at risk) occurred on conventional farms and 47 (3.1 cases per 100 cow-years) occurred on organic dairy herds (P=0.082). Only four cows from two organic farms were reportedly sold to conventional farms to be used for dairy purposes. The years in organic operation were not associated with herd size, milk production, mastitis rate, culling rate or mortality (P>0.25, in each instance).

Table 1
Comparison of management and production variables between organic and conventional dairy herds (continuous variables)

Continuous variables	Organic (n=30)	S.D.	Conventional (n=30)	S.D.	Type III test P-value
Number of lactating and dry cows	51.1	28.1	71.7	44.0	0.017
Average milk production per cow (kg/day)	20.2	6.2	23.7	5.3	0.025
Mastitis rate per 100 cow-years	27.7	20.7	32.0	21.8	0.654
BTSCC (cells/ml)	263,000	75,000	285,000	102,000	0.328
Bacteria count of bulk tank milk (cells/ml)	4200	4876	4800	5267	0.433
Body condition score in March	2.58	0.28	2.81	0.28	0.001
Environmental sanitation score in March	1.88	0.69	1.79	0.60	0.548
Body condition score in September	2.81	0.27	2.84	0.35	0.662
Environmental sanitation score in September	1.83	0.54	2.02	0.53	0.157
Average labor (person-minutes) per cow per milking	2.66	0.82	2.68	1.46	0.925

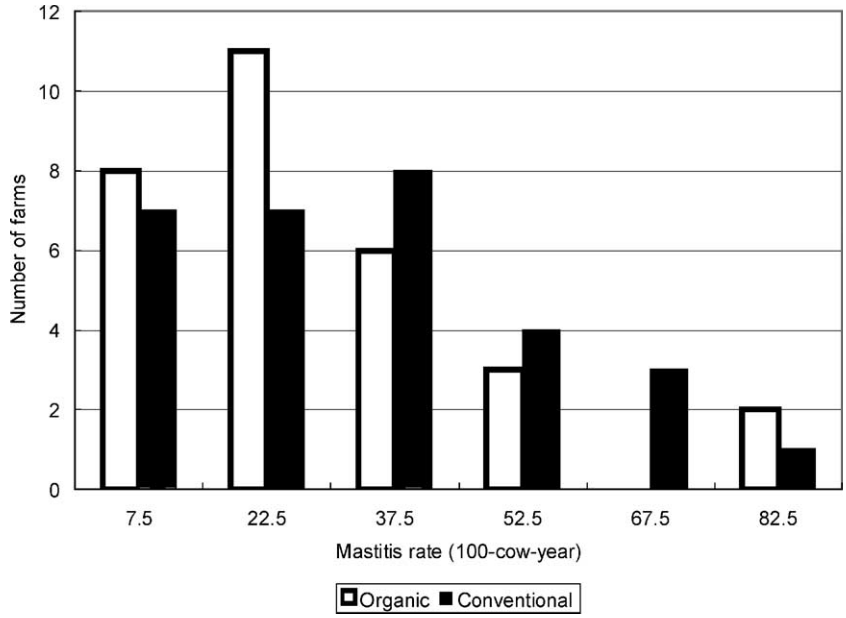

Fig. 1. Frequency distribution of mastitis rates (100 cow-years) of organic farms (*n*=30) and conventional farms (*n*=30). Mean mastitis rates were not statistically different between the two farm types (*P*=0.432).

3.4. Milking procedure

The most common type of milking systems was stanchion or tie stall systems (51/60). Only one organic farm used a milking parlor compared to eight conventional farms (*P*=0.008, Table 2). There was no significant difference in nine milking procedures that were assessed and compared between pairs of organic

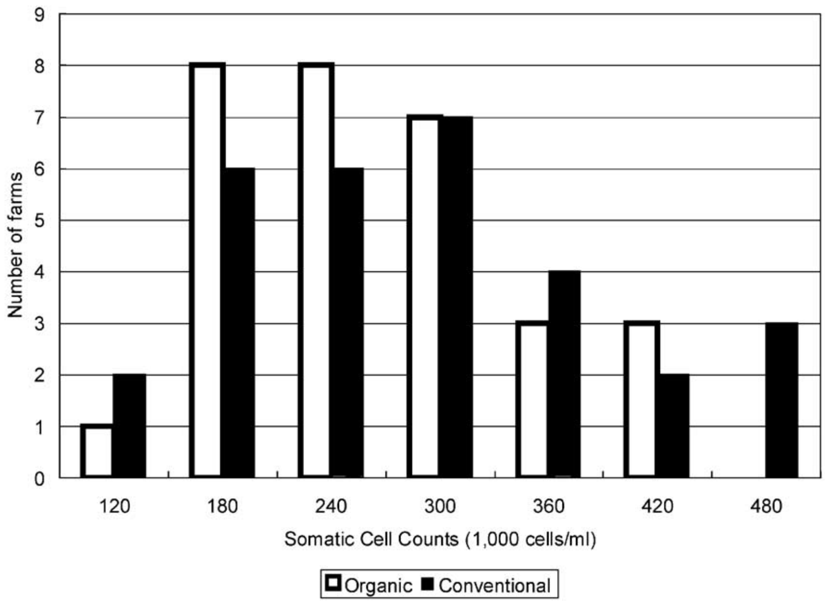

Fig. 2. Frequency distribution of milk somatic cell count (SCC) of organic farms (*n*=30) and conventional farms (*n*=30). Arithmetic means were not statistically different between two farm type (*P*=0.333).

Table 2
Comparison of management and production variables between organic and conventional dairy herds (discrete variables)

	Organic (n=30)	Conventional (n=30)	McNemar's test P-value
100% Holstein breed	18	22	0.248
Purchase of any cows in previous 12 months	4	9	0.132
Dry cow treatment with antibiotic infusion	0	26	NA
Grazing			
No grazing	1	7	0.096
Outside exercise area with little grazing	3	8	0.593
Grazing pasture with access to housing	11	13	0.001
Intensive grazing (grazing only)	15	2	0.008
Housing			
Free stalls	4	9	0.059
Loose housing	2	0	NA
Tie stalls	24	21	0.257
Bedding			
No bedding	3	1	0.317
Straw or corn shredder	20	13	0.090
Wood shavings or sawdust	3	10	0.008
Sand	3	5	0.480
Rubber mat	1	1	1.000
Milking			
Cows were milked in stanchion/tie stalls	29	22	0.008
Dry massage or wipe with no water used	6	6	1.000
Wash bucket usually used	10	6	0.206
Individual cow paper towel or cloths used for washing	14	11	NA
Shared towel or cloths used for washing	3	1	0.317
Premilking teat dipping usually used	14	17	0.405
Postmilking teat dipping always used	27	30	NA
Gloves used for washing udder	7	12	0.197
Individual towels (cloth or paper) used for drying	15	21	0.058
Teats are usually not dried before milking	4	1	0.180
Mastitis prevention and treatment			
Dry cow treatment with antibiotic infusion	0	26	NA
Strip out the quarter at frequent intervals	20	25	0.132
Anti-inflammatory or antipyretics drugs	10	6	0.317
Administer oxytocin to assist milkout	1	13	0.002
Udder infusions of antibiotics	0	18	NA
Systemic antibiotic injection	0	8	NA

NA: McNemar's test cannot be performed because some cells contain zero.

and conventional dairy farms (Table 2). Fourteen organic farms and 17 conventional farms used premilking teat disinfections (predipping) and most farms (27 organic and all conventional farms) use postmilk teat disinfections (postdipping).

3.5. Mastitis treatment and prevention

Although 26 conventional dairy farms used antibiotic udder infusions for dry cow treatment, only 18 conventional producers reported regular use of antimicrobial udder infusion for CM treatment. Udder infusion of cephapirin was frequently used by nine conventional producers and penicillin was frequently used by four conventional producers, whereas the remaining others conventional producers did not report which specific antibiotic products were used. One conventional producer did not know what treatments were given by his veterinarian and two producers used only injectable antimicrobials for treatment of CM. Seven other conventional dairy producers reported that they usually did not use antimicrobials for CM. Thirteen conventional producers used oxytocin and 25 conventional producers reported frequent stripping out (emptying of the udder) as CM treatment. None of the organic producers used antimicrobials to treat CM. They reported using anti-inflammatory drugs and stripping out the quarters at frequent intervals as the most common CM treatments. On 19 organic farms, natural remedies (whey products, herb, mineral oil, vinegar), vitamin E (parenteral), C and selenium were occasionally used. Two organic producers allocated mastitis cows for sucking by calves as the mastitis therapy and one organic producer provided no special care for CM for several years. Table 2 shows the major differences between the two farming types in the treatment of CM.

3.6. Body condition score and internal parasite

In the spring, cows in organic dairy farms had significantly lower BCS values (thinner) than did the conventional herds (P=0.001); however, no significant difference was observed in September (P=0.66). We did not find any difference in environmental and animal sanitation scores between the two farm types. Neither CM nor BTSCC showed any association with BCS and EASS in the mixed liner analysis. A paired t-test of adjusted optical density data from ELISA test showed a significant higher burden of *O. ostertagi* antigen in organic than conventional farms in both seasons (P=0.0059 for March and P=0.0067 for September). However, a mixed liner analysis indicated that the type of farm (organic or conventional) was not significant (P=0.8730) when controlling for season, grazing intensity and milk production. The season (P= 0.0081), grazing intensity (P=0.0217) and average milk production per cow (P=0.0053) were highly associated with adjusted OD value of the milk ELISA test. Higher burden of intestinal parasites was found in September than March, cows under intensive grazing had higher intestinal parasite, and lower milk production was associated with higher parasite burden.

4. Discussion

4.1. Sampling bias

Although using neighboring conventional herds as a comparison group helped control for regional differences, the selection of the control farms was not random and was not representative of Wisconsin conventional herds or the national dairy industry. Due to their proximity, it is likely that organic and conventional farms shared many management characteristics. For example, milking procedures were very similar between matched pairs of farms, so few significant associations were found between milking procedures and CM rate or BTSCC.

4.2. Herd structures and management

Herd size (71.7 cows) and milk production per cow (23.7 kg/day) in our conventional herds were similar to the Wisconsin average (67.0 cows and 25.5 kg/day), but were lower than the national average (93.4 cows and 27.0 kg/day; USDA, 2002). We subjectively noticed that organic farms tended to have cows that were smaller in stature (size). They were less likely to use artificial insemination, which may have resulted in a gene pool of cows more suitable for organic management compared with what is commonly seen in today's herds that have used AI to produce large cows with high milk production per cow. Organic farms also had a greater proportion of smaller non-Holstein breeds. Therefore, because smaller cows eat less feed, comparisons in milk production between organic and conventional herds must consider this lower cost of production. In addition, other differences in nutrition and management most likely act to reduce the per-cow cost of feeding and maintaining smaller grazing cows, as compared with larger cows being fed a high-energy diet in total confinement.

Dairy cow mortality (4.2 deaths per 100 cow-years) on the conventional dairy herds was compatible with the U.S. average (4.4 for less than 100 herd size); however the culling rate (18.0) was lower than the U.S. average (24.9 for less than 100 herd size; USDA, 2002). Another unique feature of this region of Wisconsin regarded the preponderance of the more traditional style of tie stall or stanchion housing. Twenty-two percent (13/60) of operations used free-stall housing, which was lower than the national average of 31%. Seventy-five percent (45/60) of the operations used tie stall or stanch ion housing, which was higher than the national average of 52% (USDA, 2002). This probably is reflective of the small herd size and harsh winter climate of Wisconsin.

4.3. Body condition score

We found significantly lower BCS in organic dairy cows in early spring. Because organic dairy producers are required to feed "organic feed", which must be grown without herbicides and pesticides, purchase of organically produced feed is difficult. Rations may be running low by spring or grazing may be attempted before adequate pasture is available. Cows in year-round confinement may have a less variable feed supply as compared with herds which employ seasonal grazing.

4.4. Parasites

Internal parasites are one of the main causes for lower heifer growth and reduced milk production in older cows. Anthelmintic treatment is prohibited on organic dairy farms, so the prevalence of gastro-intestinal nematodes in organic cows could expectedly be higher than what is commonly found in conventional dairy herds. The frequency and type of deworming was not measured in our conventional farms. According to a recent NAHM study, over 60% of dairy operations in the United States normally use dewormers for at least some lactating cattle (USDA, 2002). Fecal egg counts are commonly used for detecting gastrointestinal nematodes; however, the test is time consuming and expensive, and the result is highly variable. The ELISA test uses a crude antigen of *O. ostertagi* that has been evaluated in number of previous studies (Kloosterman et al., 1996; Borgsteede et al., 2000). The OD value of ELISA has been found to be a reasonable overall measure of parasite burden with the common intestinal nematode species, and bulk tank milk is useful for testing whole-worm antigen (Guitian et al., 2000; Sanchez et al., 2002). Our paired *t*-test results indicated significantly higher parasite burden on organic dairy farms; however, no significant difference was found between the two farm types when controlling for season (March and September), grazing intensity (no grazing, little grazing, grazing with access to housing and grazing only) and herd average milk production per cow. The result may indicate that the organic farms may have a greater worm burden because of the increased use of grazing. Our data shows a significant association with season, with higher OD values in late summer and lower values in spring. Our observed seasonal trend agrees with the serum antibody results of Borgsteede et al. (2000). Herd average milk production per cow was also a significant predictor of the adjusted OD value in our study, with herds with lower worm burdens having higher milk production.

4.5. Mastitis

Although mean CM incidence on organic farms was 12.5% lower than that of conventional farms, the difference was not statistically significant. The measure of herd CM in this study may have been affected by reporting bias. Conventional farmers must keep meticulous records of antimicrobial treatments, especially mastitis treatments, in order to avoid the substantial penalty resulting from contaminating an entire milk truck with antimicrobial residues. Organic farms have no such impelling need to record or remember their non-antimicrobial treatments and, therefore, incomplete reporting may have existed for organic farms. In addition, farmers generally record or remember episodes of clinical treatment rather than episodes of disease. Clinical signs not sufficiently advanced to warrant medical treatment may not considered to be case of that particular disease. As such, disease reports on both organic and conventional farms likely reflect episodes for which the farmer decided that clinical signs were sufficiently severe to warrant treatment. Diagnostic acumen may therefore have differed between organic and conventional farms because antimicrobial treatment generally entails withholding milk from sale for several days, and is usually not given to mild cases. Although we have no direct evidence for this speculation, Berry and Hillerton (2002) reported that farmers converting to organic status in the UK were less likely to report cases of CM. It is therefore certainly possible that underreporting of clinical mastitis may have been greater on the organic farms as compared to conventional farms.

The arithmetic mean of BTSCC on 30 organic farms (263,000 cells/ml) was 7.9% lower than that of conventional herds (285,000); however, the difference was not statistically significant. Reporting of BTSCC from the milk receipts was uninfluenced by farmer reporting and therefore are consistent with the lower CM and culling results which we observed. Busato et al. (2000) studied 152 certified organic farms in Switzerland and found the geometric mean of 85,600 cells/ml, which was 15% lower than the Swiss average of 100,000 cells/ml. The 7.9% difference we found in BTSCC between organic and conventional farms was not statistically significant given the relatively small number of herds that we studied. Bennedsgarrd et al. (2003) compared herd structure, milk production and mastitis rate in three groups of organic (økologisk) herds and one group of conventional herds. They found significant lower daily milk production, lower BTSCC and lower mastitis rate in the organic farm group that converted to organic production before 1990; however, smaller differences in mastitis and SCC between the conventional herds and the newly converted organic herds were found. There was no association between the year in organic operation and mastitis or SCC in our study.

4.6. Antimicrobial use on farm

According to the NAHMS study (USDA, 1996), 88% of dairy operations use udder infusion for all four quarters on almost all cows, which agrees relatively closely with our observation that 26 conventional dairy farms (87%) used udder infusions for dry cow treatment. However, the percent of conventional operations that use injectable antimicrobials for milking cows was lower in our study (60%) compared to the 1996 NAHMS study (93.5%). It was difficult to identify the specific type and dose of antimicrobials used on conventional farms. Two conventional dairy producers in our study claimed they had not used any antimicrobials for several years and seven reported that they usually did not use antimicrobials for CM.

Despite the possible reporting bias speculated for CM, the results of both CM rate and BTSCC suggested that organic dairy farms managed to successfully control mastitis without the use of antibiotics. Antibiotics are often ineffective for mastitis pathogens, such as *S. aureus* and nonsevere coliforms (Kirk et al., 1994). Dry cow therapy infusions are effective against contagious mastitis pathogen, but are often ineffective against environmental coliforms (Berry et al., 1997). A retrospective study of 9007 cases of subclinical mastitis cases in New York and northern Pennsylvania showed the overall spontaneous bacteriological cure rate was 65% and the cure rate with antimicrobial treatment was not much better at 75% (Wilson et al., 1999). The majority of CM may be cured by udder immune mechanisms without much benefit of antimicrobial treatment, as witnessed by the fact that only 18 of 30 conventional producers reported regular use of antimicrobial udder infusion for CM treatment. Some organic producers claimed that they keep their cows at a less stressful milk production level and thus maintain high immune function. Effective mastitis control should rely on prevention rather than treatment (Erskine et al., 1993) and early identification, culling and segregation is probably the best management approach for controlling mastitis (Kirk et al., 1994).

Higher producing cows and herds tend to have greater problems with mastitis. Grohn et al. (1995) studied 8070 cows in 25 herds and found high producing cows are more susceptible to mastitis. Schukken et al. (1990) studied 125 herds and found a higher incidence of CM in herds with high milk production. The 15% lower milk production in the organic herds could account for at least some of the nonsignificant trend in reduced mastitis and BTSCC which we observed for organic farms.

5. Conclusion

The study showed that organic dairy farms, as compared with matched conventional farms, were producing milk without increased rates of reported CM, BTSCC, culling rate, lameness scores or sanitation scores. Notable differences between organic dairy farms and conventional farms were lower milk production per cow and smaller herd size. Organic herds were more likely to use intensive grazing, which may have accounted for their higher rate of gastrointestinal nematodes as compared with conventional herds.

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