J. Dairy Sci. 96:4269–4285
http://dx.doi.org/10.3168/jds.2012-5980

Risk factors for clinical mastitis, ketosis, and pneumonia in dairy cattle on organic and small conventional farms in the United States

R. M. Richert,* K. M. Cicconi,† M. J. Gamroth,‡ Y. H. Schukken,† K. E. Stiglbauer,‡ and P. L. Ruegg*[1]
*Department of Dairy Science, University of Wisconsin, Madison 53706
†Quality Milk Production Services, Cornell University, Ithaca, NY 14850
‡Department of Animal Sciences, Oregon State University, Corvallis 97331

ABSTRACT

The US regulations for production of organic milk include a strict prohibition against the use of antimicrobials and other synthetic substances. The effect of these regulations on dairy animal health has not been previously reported. The objective of this study was to characterize disease detection and identify risk factors for selected diseases on organic (ORG) and similarly sized conventional (CON) farms. Dairy herds (n = 292) were enrolled across 3 states (New York, Oregon, Wisconsin) with CON herds matched to ORG herds based on location and herd size. During a single herd visit, information was collected about herd management practices and animal disease occurring in the previous 60 d, and paperwork was left for recording disease occurrences during 60 d after the visit. For analysis, CON herds were further divided into grazing and nongrazing. Poisson regression models were used to assess risk factors for rate of farmer-identified and recorded cases of clinical mastitis, ketosis, and pneumonia. An increased rate of farmer-identified and recorded cases of clinical mastitis was associated with use of CON management, use of forestripping, presence of contagious pathogens in the bulk tank culture, proactive detection of mastitis in postpartum cows, and stall barn housing. An increased rate of farmer-identified and recorded cases of ketosis was associated with having a more sensitive definition of ketosis, using stall barn housing, and feeding a greater amount of concentrates. An increased rate of farmer-identified and recorded cases of pneumonia was associated with a lack of grazing, small or medium herd size, and Jersey as the predominant breed. Overall, disease definitions and perceptions were similar among grazing systems and were associated with the rate of farmer-identified and recorded cases of disease.

Key words: organic management, clinical mastitis, ketosis, pneumonia

INTRODUCTION

Organic (**ORG**) dairy farms in the United States often have characteristics that differ from conventional (**CON**) dairy farms, including a smaller herd size, use of non-freestall housing, and grazing-based diets (Zwald et al., 2004; Sato et al., 2005; Pol and Ruegg, 2007). These management factors have also been associated with incidence and prevalence of various diseases, and therefore may confound the potential effect of ORG management on disease incidence. In a US survey (n = 858 farms) that assessed antimicrobial usage for several common diseases of dairy cattle, small herd size (30–99 cows) was associated with a greater within-herd prevalence of any given disease (Hill et al., 2009). Likewise, Valde et al. (1997) reported that Norwegian dairy herds that used stall barn housing (n = 59) had greater incidence rates of clinical mastitis and ketosis compared with herds housed in freestalls (n = 533). Researchers have not consistently linked grazing to improvements in cow health. In one study, grazing was associated with a decreased risk of metritis (Bruun et al., 2002), whereas Barkema et al. (1999) reported that overnight pasturing of dairy cattle was associated with an increased incidence rate of *Escherichia coli* clinical mastitis.

It is difficult to determine how the definition and perception of disease by animal caregivers influences the incidence and detection of disease. Attitudes about mastitis have been associated with the incidence rate of clinical mastitis (Nyman et al., 2007; Jansen et al., 2009). Organic and CON farmers have different options available for treating most diseases, which may influence disease perception. For example, the availability of efficacious treatments and previous experience with alternative treatments might influence farmers' perception about disease control (Vaarst et al., 2002). Hardeng and Edge (2001) speculated that reduced rates of veterinary-treated disease in cows on ORG compared with CON farms may be due to differing attitudes and disease management practices, but research in this area is lacking.

Researchers comparing rates of clinical mastitis on ORG and CON farms often report less disease on or-

Received July 25, 2012.
Accepted March 6, 2013.
[1]Corresponding author: plruegg@wisc.edu

ganic farms (Sato et al., 2005; Pol and Ruegg, 2007; Valle et al., 2007). The occurrence of less clinical mastitis among ORG farms has been attributed to reduced milk production (Valle et al., 2007) and improved cow cleanliness (Ellis et al., 2007). However, the farmer's definition and perception of mastitis may result in an apparent difference in the rate of clinical mastitis. Pol and Ruegg (2007) documented differences in monitoring mastitis and definition of cure of mastitis after treatment between ORG and CON farmers in Wisconsin. In this study, visual observation of abnormal milk was used to detect mastitis by 90% of CON farmers in contrast to only 45% of ORG farmers. Organic farmers relied more on other methods for detecting mastitis, such as visualization of swollen quarters, California Mastitis Test results, and observation of abnormal milk on the milk filter (Pol and Ruegg, 2007; Ruegg, 2009). Swedish researchers reported an association between the definition of mastitis and the incidence rate of veterinary treatment (Nyman et al., 2007). Farmers who characterized mastitis based on mild symptoms (such as abnormal milk only) reported a greater incidence rate of veterinary-treated mastitis compared with farmers who treated cows only after observation of systemic signs.

Risk factors for metabolic diseases of dairy cows (such as milk fever and ketosis) include stage of lactation, parity, milk production, and nutritional management (Radostits et al., 2007; Smith, 2008; LeBlanc, 2010). The incidence of ketosis was less on ORG compared with CON farms and was attributed to reduced milk production among ORG herds (Hardeng and Edge, 2001) and different threshold criteria for calling a veterinarian (Bennedsgaard et al., 2003a). Studies comparing disease rates and risk factors between cattle on ORG and CON farms must account for potential differences in perception. The objective of this study was to characterize farmers' perceptions of disease and identify risk factors for disease on ORG, CON grazing, and CON nongrazing dairy farms.

MATERIALS AND METHODS

Data Collection

Information about herd recruitment and data collection has been previously described (Richert et al., 2013; Stiglbauer et al., 2013). In brief, farms (n = 292) were recruited between April 2009 and April 2011 from dairy herds located in New York State (**NY**), Oregon (**OR**), and Wisconsin (**WI**). All herds were required to have a minimum of 20 cows and must have been shipping milk for at least 2 yr. Organic herds must have been shipping certified ORG milk for at least 2 yr. During a single farm visit, a questionnaire on management practices was administered (available at http://milkquality.wisc.edu/organic-dairies/project-c-o-w/) and information was collected on occurrence of disease during the retrospective period, which was defined as the 60 d before the farm visit. Prospective data were collected for the 60-d period after the farm visit using defined recording forms. Farmers were instructed to recall or record information about all sick animals, regardless of administration of treatment. Study approval was obtained from the Institutional Review Board and Animal Care and Use Committee at Oregon State University.

During the farm visit, lactating cows were scored for udder hygiene according to the method of Schreiner and Ruegg (2003). Udder hygiene scores (**UHS**) were obtained from all lactating cows (up to 50), or for larger herds, a randomly selected, representative sample of 20% of lactating cows was scored. Samples of bulk milk were collected by study personnel and sent to a single laboratory in NY for analysis. Bulk milk samples were tested for SCC, plate loop count (**PLC**), and mastitis pathogens including *Mycoplasma*.

Definitions of Variables

For all analyses, disease definitions were herd specific, and the selected risk factors eligible for inclusion in the analysis were rolling herd average (**RHA**), percentage of lactating and dry cows in third or greater lactation, percentage of lactating herd in early lactation (<90 DIM), herd size category (20–99 lactating and dry cows, 100–199, ≥200), predominant breed (>50% of cows; Holstein, Jersey, other), season of herd visit (spring, summer, autumn, winter), primary housing for lactating cows at the time of herd visit (freestall, group pen, pasture or drylot, stall barn), performance of any routine postpartum cow exam (yes, no), likelihood of farmer to call a veterinarian for an off-feed cow (low, medium, high), rate of routinely scheduled veterinary visits per 100 cows per year (none, few, some, many), site (NY, OR, WI), utilization of grazing (≥30% of DMI for lactating cows was obtained from pasture during the grazing season; yes, no), and management system (ORG, CON). Management system and utilization of grazing were combined to create a new 3-level variable (grazing system): (1) ORG, (2) CON grazing (**CON-GR**), and (3) CON nongrazing (**CON-NG**).

Cases of clinical mastitis were identified and recorded by the farmer during the retrospective or the combined (retrospective and prospective) data collection period. Cow-days at risk for clinical mastitis were calculated for each herd by multiplying the number of lactating cows at the time of the herd visit by 60 d if data were available for only the retrospective data collection pe-