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Loss of income from cows shedding *Mycobacterium avium* subspecies *paratuberculosis* prior to calving compared with cows not shedding the organism on two Minnesota dairy farms

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ABSTRACT

Quantification of the financial effect of *Mycobacterium paratuberculosis* infection on lactation performance is essential to encourage participation of dairy cattle producers in Johne's disease (JD) control programs. The objective of this study was to evaluate the differences in net income per lactation of cows shedding *Mycobacterium paratuberculosis* before calving compared with test-negative cows. Two Minnesota dairies were enrolled in the study and fecal samples were collected from 1,048 cows during the close-up period. Milk production, clinical diseases (other than clinical JD), and reproductive performance data were recorded for each cow. Overall, fecal-culture-positive (FCP) cows produced 1,355 kg less than fecal-culture-negative (FCN) cows. Fecal-culture-positive cows that survived their current lactation produced $276 less in milk income than cows that were FCN ($1,956 vs. $1,680; SD $526, $570). Fecal-culture-positive cows were 3.0 (95% confidence interval: 1.6–5.8) times more likely to be culled than FCN cows. The mean days open (number of days from calving to conception) was not statistically significant and the cost differences for clinical disease other than JD were small and neither statistically nor economically significant between FCP and FCN cows. Among all FCP cows, income over feed costs losses were $366 per cow per lactation compared with FCN cows. Among FCP nonculled cows, income over feed costs losses were $276 more compared with FCN cows and this difference was statistically significant. There was a total loss of $155 per lactation for nonculled FCP cows retained in the herd compared with FCN cows retained in the herd. Among culled cows, FCP cow losses were $50 less because of age at culling and $120 for reduced beef value. This totaled a loss of $441 for culled FCP cows compared with culled FCN cows. The losses as a result of lower lactation performance and early culling from the herd should alarm dairy producers and motivate them to implement the appropriate control measures for the disease.
Key words: *Mycobacterium paratuberculosis* shedding, milk production, income over feed cost, dairy cow

INTRODUCTION

Johne's disease (**JD**), a chronic and progressive intestinal disease in ruminants caused by *Mycobacterium avium* ssp. *paratuberculosis* (**MAP**), imposes large direct and indirect productivity losses on affected farms (Bennett et al., 1999; Chi et al., 2002). Production losses include reduced milk production, increased mortality, weight loss, premature culling, and reduced slaughter value (Chiodini et al., 1984; Raizman et al., 2007).

Infection with MAP in cattle can be categorized into 4 stages (Whitlock and Buergelt, 1996). In stage 1, cattle are infected although no clinical signs are observed and MAP cannot be detected in feces. In cattle in stage 2, MAP can be detected in feces, although clinical signs of disease are not evident. Cattle may remain in these stages without developing clinical disease or may progress to clinical stages, typically after at least 2 yr of infection. Fecal shedding of MAP can be intermittent and its detection in culture is imperfect, especially when few organisms are shed in the feces (Merkal et al., 1968). Stage 3 cattle have observable clinical signs with weight loss and diarrhea, sometimes advancing to stage 4 with advanced clinical disease signs including lethargy, emaciation, and profuse diarrhea. Development of clinical signs is generally gradual and varies among individuals.

Although increasing information is becoming available on lactation performance of fecal-culture-positive (**FCP**) cows (Lombard et al., 2005; Beaudeau et al., 2007; Gonda et al., 2007; Raizman et al., 2007), limited studies have addressed the financial effect of the disease on a dairy farm. Since the first economic evaluation on the herd level was published in the United States by

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Ott et al. (1999), only a few studies have addressed the cost of maintaining or culling JD serologic- or fecal-positive cows in the herd. The literature provides different estimations about production losses per individual ELISA-positive cow within the herd or for a serologic- or fecal-positive herd. More accurate estimates of the financial effect would be useful because this information coupled with within-herd prevalence will help producers, veterinarians, and animal health authorities make cost-effective decisions about how to control the disease. The objective of this study, therefore, was to evaluate the financial effect of cows shedding MAP in 2 large Minnesota dairy herds.

MATERIALS AND METHODS

Herds

Two Minnesota dairy herds (approximately 650 and 750 cows, respectively) with a total of approximately 1,400 milk cows were selected for this study based on 4 criteria: 1) at least 400 milking cows, 2) at least 10% of culled cows with clinical signs consistent with JD in the previous year, 3) routine use of computerized dairy herd management software program (Dairy Comp305, Valley Agricultural Software, Tulare, CA), and 4) participation in DHIA.

General Herd Management

In each herd, cows were housed in a freestall barn and grouped into pens based on parity (primiparous and multiparous) and stage of lactation. Cows were milked twice per day and milk yields were recorded monthly for individual cows through official DHIA testing. Lactating cows were fed a TMR formulated by the herd nutritionist. In herd A, lactating cows were fed 3 different TMR: fresh, milking, and late lactation/pregnant cow rations. In herd B, all lactating cow groups were fed a single TMR. Both herds fed cows a transition ration in the last 3 wk of gestation. In herd A, recombinant bST (Posilac, Monsanto Corp., St. Louis, MO) was used from 63 d postcalving (DIM) to 200 d postconception (days carried calf; **DCC**), whereas in herd B recombinant bST was started on d 90 and 120 postcalving for cows and heifers, respectively, and was stopped for heifers and cows at 220 DCC.

Fresh Cow Management

In each herd, rectal temperatures and clinical ketosis (defined as a cow with decreased appetite and evidence of elevated ketones in milk, urine, or breath in the absence of other concurrent disease) were monitored daily in fresh cows for the first 10 d postcalving. Temperature above 39°C was considered abnormal. In herd B, the uterus of each postpartum cow was examined by the herd veterinarian once a week to detect metritis.

Reproductive Management

The voluntary waiting period for the first postpartum AI in herd A was 50 d postcalving and in herd B was 70 and 90 d for cows and heifers, respectively. Pregnancy diagnosis was performed in herd A by transrectal ultrasonography beginning 30 d postbreeding and repeated at 60 d postbreeding to identify abortions or twins. In herd B, pregnancy diagnosis was performed by weekly rectal palpation of all cows that were not already confirmed pregnant and were more than 36 d postbreeding. In both herds pregnancy confirmation was performed between 180 and 170 DCC for herds A and B, respectively. Cessation of lactation (dryoff) occurred at approximately 200 and 220 DCC for cows in herds A and B, respectively.

Cow Sampling

In both herds, all cows and heifers calving between January 2002 and March 2003 were enrolled in the study. A fecal sample was collected from enrolled animals during the close-up period preceding calving (average 262 DCC). Each sample was collected with a single-use disposable obstetric glove lubricated with sterile water. Cow and heifer sampling was performed during visits to the farm by the first author, approximately every 14 d from January 2002 through March 2003.

Milk production, clinical diseases (other than clinical JD), and reproductive performance data were recorded for each cow as described below.

Fecal Testing

Fecal samples were processed at the Minnesota Veterinary Diagnostic Laboratory (University of Minnesota, St. Paul) using the bacterial culture method described previously (Wells et al., 2002). Briefly, a sedimentation culture procedure was used with 72 h of sedimentation before inoculation of 4 tubes containing Herrold's egg yolk medium. Colony counts were recorded weekly for 16 wk and final results were reported as negative, light (mean of 0.25 to 9 colonies/tube), moderate (mean of 10 to 49 colonies/tube), and heavy (mean of >50 colonies/tube) fecal shedding. For the purposes of this study, we assumed 99% specificity for the fecal culture method. It is important to mention, however, that this specificity refers to the method itself and not to the individual cow infection status because in a heavily infected herd