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Short communication: Jersey × Holstein crossbreds compared with pure Holsteins for body weight, body condition score, fertility, and survival during the first three lactations

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ABSTRACT

Crossbred cows (n = 80) resulting from the use of Jersey (JE) semen on their pure Holstein (HO) dams were compared with pure HO cows (n = 77) for body weight, body condition score, fertility, and survival during their first 3 lactations. Cows were in 2 research herds of the University of Minnesota and calved from September 2003 to June 2008. The JE × HO crossbred cows had significantly less body weight during the first (−56 kg), second (−67 kg), and third (−82 kg) lactations than pure HO cows. However, JE × HO cows had significantly greater body condition score during the first (2.94 vs. 2.84), second (2.97 vs. 2.84), and third (2.99 vs. 2.87) lactations than pure HO cows. For fertility, JE × HO cows had fewer days to first breeding during the first (−10.6 d), second (−8.4 d), and third (−12.3 d) lactations than pure HO cows. Crossbred cows were not significantly different from pure HO cows for number of services during first lactation; however, JE × HO cows had significantly fewer services (2.2) than pure HO cows (2.7) during the second lactation. Also, JE × HO cows had significantly fewer days open than pure HO cows in the first (−24 d), second (−42 d), and third (−42 d) lactations. For survival, JE × HO cows were not significantly different from pure HO cows for percentage of cows calving a second time; however, a tendency existed for a higher percentage of JE × HO cows (63.8%) than pure HO cows (49.4%) to calve a third time, and a higher percentage of JE × HO cows calved a third time within 28, 34, and 40 mo of first calving than pure HO cows.
Key words: crossbreeding, Jersey, body condition, fertility

Short Communication

Fertility has decreased for Holstein (**HO**) cows globally, and selection for milk production has likely contributed to increases in the number of services (**NoS**) and to greater days open (**DO**) of pure HO cows (Oseni et al., 2003). The antagonism of milk production and cow fertility is well documented, and research has reported substantial genetic correlation (0.30 to 0.35) between milk production and DO (VanRaden et al., 2004). The decrease in fertility and survival of pure HO cows over time around the world has resulted in increased interest in crossbreeding of dairy cattle. In a survey by Weigel and Barlass (2003), dairy producers indicated that crossbreeding improved fertility and survival of dairy cows. During recent years, milk pricing in most markets has placed greater emphasis on the solids in milk rather than fluid, which resulted in the HO breed having less of a competitive advantage compared with other breeds.

Jersey (**JE**) × HO crossbred cows in some countries have advantages over pure HO cows for profitable dairying. In Australia, JE × HO cows had 40 kg less BW than did pure HO cows; however, they had greater BCS and higher first-service conception rates than did pure HO cows (Auldist et al., 2007). Also, Prendiville et al. (2009) reported mean BW was 50 kg less, but BCS was higher for JE × HO cows compared with pure HO cows in Ireland. In 2 other Irish studies, JE × HO cows had lower BW, but greater BCS compared with pure HO cows (Prendiville et al., 2010, 2011). In New Zealand, JE × HO cows had lower BW and greater survival through their lifetime than did pure HO cows (Lopez-Villalobos et al., 2000). The JE × HO cows had significantly higher conception rates than did pure HO cows in Germany, although the 2 groups did not differ for survival during first lactation (Freyer et al., 2008).

Two research herds at the University of Minnesota shared a crossbreeding design beginning in 2000. The research dairy on the St. Paul campus of the University of Minnesota has 90 tie-stalls and a 40-head compost barn, and the West Central Research and Outreach Center in Morris, Minnesota, has a 150-head, low-input grazing system. The design of the experiment and a detailed description of heifers born, raised, and number of cows calving a first time were thoroughly described in Heins et al. (2008, 2011). The genetic level of sires of

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cows and the number of daughters per sire are reported in Heins et al. (2008). All AI bulls had PTA greater than the 90th percentile for the Net Merit index of the United States within breed at the time of selection, and bulls had predominately North American ancestry.

Both herds (St. Paul and Morris) calve seasonally, and all virgin heifers for both locations were reared and mated at Morris. Cows at St. Paul are bred with the aid of synchronization hormones mostly during the winter (January to March), and cows and heifers at Morris are bred during the winter (January to March) and summer (June to August), first by observation and with the aid of synchronization hormones for cows not observed in heat. Cows in St. Paul calved mostly in the fall, and in the Morris herd cows calved mostly in the spring. Season of calving was spring (March to July) or fall (September to February). Seasons containing less than 5 calvings for each breed group were combined (fall season with following spring season) at Morris. Cows calved for the first time from September 2003 to May 2005. Data for later lactations was collected on the same cows through September 2008.

The BW was recorded on cows using a digital scale as cows exited the milking parlor approximately once per month during lactations, and BCS was measured at the same time as BW on a 1 to 5 scale in increments of 0.25, with 1 = excessively thin, and 5 = excessively fat (Wildman et al., 1982). Neither BW nor BCS has been routinely reported for JE × HO cows versus pure HO cows in the United States. The BW and BCS were analyzed for 45-d intervals postpartum (1 to 45 d, 46 to 90 d, 91 to 135 d, 136 to 180 d, 181 to 225 d, 226 to 270 d, and 271 to 315 d) up to 315 d, and independent variables for statistical analysis were effects of herd, year-season of calving nested within herd, breed group, parity nested within breed group, and 45-d period nested within parity and breed group. The MIXED procedure of SAS (SAS Institute, 2008) was used, with cow nested within breed group as a random variable with repeated measures. The autoregressive covariance AR(1) structure was used, and the lowest Akaike information criterion (Littell et al., 1998) resulted. Preliminary analysis for both BW and BCS indicated that interaction of herd and breed group was not significant, so the interaction effect was removed from the model. Parity nested within breed group and 45-d period nested within parity and breed group were included in the statistical model because of the potential for different rates of maturity of the breed groups and, consequently, potentially different shapes of the curves of BW and BCS for breed groups.

Days to first breeding (**DFB**) was the date of first service minus the calving date, and NoS was the total number of services recorded during lactations with a maximum of 6 services. Only 1 JE × HO cow and 4 pure HO cows exceeded the maximum of 6 services. The NoS was recorded for the duration of the lactation and was limited to 6 services to avoid an exaggerated increase in variance because of the small number of cows with NoS beyond 6. The DO of cows was measured as actual DO with pregnancy status confirmed by ultrasound and reconfirmed, when possible, with a subsequent date of calving. To be included in the analysis for DO, cows were required to have at least 250 DIM, which is the requirement in the United States for cows to be included in genetic evaluation for DO (VanRaden et al., 2004). Unadjusted DO ranged from 46 to 610 d; however, cows with more than 250 d for DO had DO set to 250 d. Seventeen percent of JE × HO cows and 31% of pure HO cows had DO greater than 250 d.

For statistical analysis of DFB, NoS, and DO, independent variables were effects of herd, year-season of calving nested within herd, breed group, and parity nested within breed group. The MIXED procedure of SAS (SAS Institute, 2008) was used with cow nested within breed group as a random variable to obtain solutions and conduct the ANOVA. Preliminary analysis for DFB, NoS, and DO indicated that interaction of herd and breed group was not significant, so the interaction effect was removed from the model.

The JE × HO and pure HO cows were also compared for pregnancy rate (**PR**), which measured the proportion of cows that became pregnant during each 21-d estrus cycle. The PR required cows to have at least 1 breeding and greater DIM than the voluntary waiting period of each herd. The method of de Vries et al. (2005) was used to calculate PR, and the LIFETEST procedure of SAS (SAS Institute, 2008) was used for analysis of PR. The NoS and PR were not analyzed for third-lactation cows, because 7 JE × HO and 2 pure HO cows that calved a third time were sold within 10 d of first breeding for dairy purposes at Morris. Potentially, culling or herd management biases, or both, may have contributed to the higher percentage of JE × HO cows sold; however, all 9 of the cows calved 3 times and were sold to reduce the size of the herd to facilitate other research studies.

For survival, JE × HO and pure HO cows were compared for percentage of cows calving a second and third time, and all cows in this study had the opportunity to calve 3 times. Survival to second and third calving was recorded in a binary manner as calved a second or third time (1) or did not calve a second or third time (0). Additionally, JE × HO and pure HO cows were compared for 3 thresholds for calving interval (14 m, 17 m, and 20 mo) from first to second calving and from second to third calving. Furthermore, JE × HO and pure HO cows were compared for 3 thresholds of calving interval