J. Dairy Sci. 95:918–924
doi:10.3168/jds.2011-4523

Short communication: Fertility, somatic cell score, and production of Normande × Holstein, Montbéliarde × Holstein, and Scandinavian Red × Holstein crossbreds versus pure Holsteins during their first 5 lactations

B. J. Heins[1] and L. B. Hansen
Department of Animal Science, University of Minnesota, St. Paul 55108

ABSTRACT

Normande (NO) × Holstein (HO) crossbred cows (n = 251), Montbéliarde (MO) × HO crossbred cows (n = 503), and Scandinavian Red (SR) × HO crossbred cows (n = 321) were compared with pure HO cows (n = 416) for fertility, somatic cell score (SCS), and 305-d projected milk, fat, and protein production during their first 5 lactations. The SR was a combination of Swedish Red and Norwegian Red. Cows were housed in 6 commercial herds in California and calved from June 2002 to January 2009. The NO, MO, and SR sires of crossbred cows were artificial insemination bulls via imported semen. The NO × HO, MO × HO, and SR × HO cows had fewer days to first breeding, enhanced first-service conception rates, higher pregnancy rates, and 12 to 26 fewer days open than did pure HO cows during their first 5 lactations. Mean SCS across lactations was similar for NO × HO (3.25) and pure HO (3.27) cows; however, MO × HO (2.98) and SR × HO (3.12) cows were significantly lower for SCS than were pure HO cows. The MO × HO cows and SR × HO cows were only 3 and 4% lower, respectively, than pure HO cows for 305-d projected production of fat (kg) plus protein (kg); however, NO × HO cows were 10% lower than pure HO cows for fat plus protein production. Therefore, the MO and SR are candidate breeds for crossbreeding with HO to improve the fertility and udder health of herds with high mean production.
Key words: crossbreeding, fertility, somatic cell score, production

Short Communication

The reduction of fertility of pure Holstein (**HO**) cows around the world has resulted in interest in crossbreeding of dairy cattle. Higher milk production, larger herd sizes, compromised cow health, and higher levels of inbreeding may have contributed to the reproductive decline of HO cows (Lucy, 2001). Furthermore, crossbreeding of dairy cattle has become more popular because of concerns of dairy producers regarding calf survival, cow fertility, and health of pure HO cows (Weigel and Barlass 2003; Funk, 2006).

The main reason for avoidance of crossbreeding in dairy cattle has been the fear of lower production of crossbreds compared with pure HO cows (Weigel and Barlass, 2003). However, Dechow et al. (2007) reported that Brown Swiss × HO crossbreds had higher daily fat and protein production, with similar milk volume, compared with pure HO cows for first to fifth lactation. Also, Walsh et al. (2008) reported that Normande (**NO**) × HO crossbreds had similar milk, fat, and protein production to pure HO cows, and Montbéliarde (**MO**) × HO crossbreds had similar milk and protein production to pure HO cows. Additionally, Swalve et al. (2008) concluded that Swedish Red × HO and Brown Swiss × HO crossbreds had higher daily fat and protein production during first lactation than did pure HO cows.

Heins et al. (2006a) reported that NO × HO, MO × HO, and Scandinavian Red (**SR**) × HO crossbreds had 3 to 7 d fewer mean days to first breeding (**DFB**) and 19 to 27 d fewer mean days open (**DO**) than did pure HO cows during the first lactation. From the same study, Heins et al. (2006b) reported that SR × HO cows were not significantly different from pure HO cows for 305-d projected fat plus protein production during the first lactation.

The results of Heins et al. (2006a,b) were only for first lactations of crossbred versus pure HO cows, and the present study compares the same crossbred and pure HO cows beyond first lactation to the fifth lactation. Specifically, the objectives of this study were to determine the differences of NO × HO, MO × HO, and SR × HO crossbreds versus pure HO cows in 6 commercial herds in California for fertility, udder health, and production during their first 5 lactations.

The NO × HO, MO × HO, SR × HO crossbreds, and pure HO cows calved for the first time from June 2002 to January 2005. Data for later lactations were collected on the same cows through January 2009. The

Received May 10, 2011.
Accepted October 21, 2011.
[1]Corresponding author: hein0106@umn.edu

pure HO cows were required to be sired by AI bulls and have a National Association of Animal Breeders (Columbia, MO) sire code in the United States. All sires for the European breed crossbreds had frozen semen imported into the United States. The SR was a combination of Norwegian Red and Swedish Red. In addition, the dams of all animals were required to be sired by an HO bull coded by the National Association of Animal Breeders, which permitted adjustment for the production potential of cows according to the genetic merit of their dams. This edit removed all cows from the study that had natural-service sires or maternal grandsires, because natural-service sires have unknown genetic worth.

Breeds used for crossbreeding in this study were thoroughly reviewed in Heins et al. (2006b), and the authors reported genetic levels for sires of cows and the number of daughters of each bull for this study. All cows in the study were sired by AI bulls, and the 6 California herds historically used high-ranking AI bulls from the HO breed for the Net Merit index. Among the European breeds, the AI bulls tended to rank highly within breed; however, the MO-sired cows in this study likely had a disadvantage relative to mean rank of their sires within breed (Heins et al., 2006b). The MO bulls with the most daughters in this study tended to be those with comparatively low ranking within breed for production.

One herd from the original study of Heins et al. (2006b) had only 20 cows, and the cows in that herd were excluded from this study. Hence, 251 NO × HO, 503 MO × HO, 321 SR × HO, and 416 pure HO cows that calved for the first time were compared for fertility, SCS, and production throughout their lifetimes. The distribution of breed groups among herds is reviewed in Heins et al. (2012). The NO × HO, MO × HO, SR × HO crossbred, and pure HO cows were daughters of 24, 23, 13, and 71 AI bulls, respectively. The 13 SR bulls were 4 Swedish Red and 9 Norwegian Red.

Calving dates, breeding dates, pregnancy diagnosis, and disposal dates were provided by the herds, and fertility traits were calculated using data from the herd management program [DairyComp 305 (Valley Agricultural Software, Tulare, CA), DHI-Plus (DHI Computing Service Inc., Provo, UT) or DairyQuest (ProfitSource LLC, Athens, WI)] used by each of the 6 herds. The DFB were calculated as the day of first service minus the calving date. The first-service conception rate (**FSCR**) was recorded in a binary manner as either conceived or not conceived at first service. The crossbred and pure HO cows were also compared for pregnancy rate (**PR**), which is the most common assessment tool for fertility of dairy herds used by veterinarians and dairy consultants in the United States. The PR is defined as the proportion of cows that become pregnant during a 21-d period of time; therefore, calculation of PR included cows that failed to conceive, were culled or died, or had greater DIM than the voluntary waiting period in the herd. The method of de Vries et al. (2005) was used to calculate PR.

The DO of crossbred and pure HO cows were measured as actual DO for cows that had a subsequent calving or had pregnancy status confirmed by a veterinarian. If no insemination was recorded, the date of conception was calculated by subtracting a mean gestation length of 280 d from the date of subsequent calving. To be included in the analysis for DO, crossbred and pure HO cows were required to have at least 250 DIM. A lower limit of 35 d for DO was applied, and cows with more than 250 d for DO had DO set to 250 d. These minimums and maximums are used by the Animal Improvement Programs Laboratory of the USDA for routine genetic evaluations in the United States (VanRaden et. al., 2004).

The standard edits for test-day observations for SCS and production used by the USDA for routine genetic evaluation were applied in this study and were described in Heins et al. (2006b). The SCS and milk, fat, and protein production for 305-d lactations were calculated with best prediction (Cole et al., 2009). Lactational records were adjusted for age at calving, milking frequency, and previous DO, and lactations less than 305 d were projected to 305 d. To calculate SCS and 305-d projected production, best prediction was applied separately to each of the 6 herds in the study, because lactation curves may have differed for herds.

Herd-year-season of calving was based on 4-mo seasons and derived from climatic conditions in this region of California. June, July, August, and September are hot months; October, November, December, and January are rainy months; and February, March, April, and May are cool and dry months. With data spanning June 2002 to January 2009, each herd had the potential of contributing 20 year-seasons of calving. However, cows in herd-year-seasons that contained only cows from a single breed group for first lactation were eliminated from the study.

Independent variables for statistical analysis of DFB, FSCR, DO, SCS, 305-d milk, fat, protein, and fat plus protein production were effects of herd-year-season, breed group, and parity nested within breed group, along with cow nested within breed group as a random effect. Additionally, for analysis of production, a linear regression on the PTA of each cow's HO maternal grandsire was included in the models to account for the genetic level of HO dams of cows. The PTA for