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Survival, lifetime production, and profitability of Normande × Holstein, Montbéliarde × Holstein, and Scandinavian Red × Holstein crossbreds versus pure Holsteins

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ABSTRACT

Pure Holstein (HO) cows (n = 416) were compared with Normande (NO) × HO (n = 251), Montbéliarde (MO) × HO (n = 503), and Scandinavian Red (SR) × HO (n = 321) crossbred cows for survival, lifetime production, and profitability in 6 commercial herds in California. The SR crossbred cows were sired by both Swedish Red and Norwegian Red bulls. Cows calved from June 2002 to January 2009. For analysis of survival to subsequent calvings, lifetime production, and profitability, data were restricted to 3 of 6 herds because they had at least 20 cows in each of the breed groups. All cows had the opportunity to calve at least 4 times. Best prediction, which is used by USDA for national genetic evaluations in the United States, was used to determine lifetime production to 4 yr (1,461 d) in the herd after first calving from test-day observations. Production and survival were estimated after 4 yr to calculate lifetime profit. A profit function was defined to include revenues and expenses for milk, fat, protein, and other solids production; somatic cell count; reproduction; feed intake; calf value; salvage value; dead cow disposal; and fixed cost. The NO × HO (1.2%), MO × HO (2.0%), and SR × HO cows (1.6%) had significantly fewer deaths than did pure HO cows (5.3%) during the first 305 d of first lactation. All crossbred groups had significantly more cows that calved a second, third, and fourth time, and had mean survival that was 300 to 400 d longer than did pure HO cows. The NO × HO, MO × HO, and SR × HO cows had significantly higher lifetime fat plus protein production than did pure HO cows up to 1,461 d after first calving. For profitability (ignoring possible differences in health costs), NO × HO cows had 26% greater projected lifetime profit per cow, but 6.7% less profit per cow-day, than did pure HO cows. On the other hand, MO × HO and SR × HO cows had 50 to 44%, respectively, more projected lifetime profit per cow and 5.3 to 3.6%, respectively, more projected profit per cow-day than did pure HO cows.
Key words: crossbreeding, heterosis, survival, economics

INTRODUCTION

The Holstein (**HO**) breed has dominated global milk production for the past 25 yr, and the success of selection for milk production has contributed to the domination of the HO breed. However, dairy producers with HO cattle have observed a substantial decrease in survival of cows (Hare et al., 2006), increased death rate of cows (Miller et al., 2008), and a sharp decrease in cow fertility (Norman et al., 2009) in recent years. From an economic standpoint, high culling rates in pure HO cows are of great concern to dairy producers (Weigel et al., 2003); therefore, dairy producers around the world have turned to mating pure HO heifers and cows to AI bulls from breeds of dairy cattle other than HO to reduce these problems.

Touchberry (1992) reported survival of crossbred cows versus pure Guernsey and pure HO cows over a 20-yr period from 1949 to 1969, and 88% of HO and Guernsey crossbred heifers survived to first calving, whereas only 83% of pure HO heifers survived to first calving. Eighty-five percent of crossbred cows calved twice; however, only 77% of pure HO cows calved twice (Touchberry, 1992). Furthermore, Touchberry (1992) combined measures of survival, growth, production, and reproduction into an economic index to calculate the total income per cow for crossbreds and purebreds. Crossbreds had 11.4% greater income per lactation at $1,497 for crossbreds and $1,344 for purebreds.

At Agriculture Canada, Vesely et al. (1986) reported no difference between crossbred cows of Ayrshire × HO and pure HO cows for percentage leaving the herd from first to second lactation. However, from the same experiment, Hocking et al. (1988) used survival analysis and found crossbred cows of Ayrshire and HO had

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greater herd life than did pure HO cows. McAllister et al. (1994) used lifetime data for all animals until culling, death, or the end of the study, and lifetime survival and health, growth, reproduction, production, and salvage value were recorded. The result was that Ayrshire × HO cows had significantly greater annualized and discounted net return than did pure HO cows. From the same experiment, but with an alternative economic analysis using data from the first 3 lactations of cows, Gunjal et al. (1997) found that pure HO cows had the highest net present value, pure Ayrshire cows had the lowest net present value, and the crossbred cows were intermediate. The net present value indicated that pure HO cows were the most profitable compared with pure Ayrshire cows and crossbred cows.

McDowell and McDaniel (1968) reported that Ayrshire × HO and Brown Swiss × HO cows did not differ significantly from pure HO cows for milk revenue or income over feed cost during first lactation; however, the inclusion of health treatments and mortality in their study resulted in crossbred cows being more profitable than pure HO cows.

The Animal Improvement Program Laboratory of the USDA (VanRaden and Sanders, 2003) reported that the mean productive life for crossbred cows was 24.3 mo compared with 23.8 mo for pure HO cows. Furthermore, VanRaden and Sanders (2003) compared the Net Merit, Cheese Merit, and Fluid Merit economic indexes for crossbreds and purebreds. Brown Swiss × HO and Jersey × HO cows were more profitable than pure HO cows for Net Merit and Cheese Merit, although no crossbred group was superior to pure HO cows for Fluid Merit (VanRaden and Sanders, 2003).

In Denmark, Sørensen et al. (2008) reported substantial heterosis (+18%) for the productive life of crossbred cows compared with purebred cows. Furthermore, heterosis for traits of economic value for 3-breed rotational crossbreeding was greater than 21%, and the study concluded that crossbreeding may provide a substantial amount of heterosis for total economic merit.

During the past decade, the Normande (**NO**), Montbéliarde (**MO**), and Scandinavian Red (**SR**) breeds were introduced into the United States and many other countries in the world for crossbreeding. Each of the 3 breeds has more than 300,000 cows on milk recording in its home country and has a sophisticated progeny-testing program. No previous research has compared NO × HO, MO × HO, and SR × HO cows to pure HO cows for high-input dairying. Therefore, the objectives of this study were to compare NO × HO, MO × HO, and SR × HO cows with pure HO cows for 1) deaths and removals to first milk recording and to 305 d postpartum during first lactation, 2) survival to subsequent calving (up to fourth calving), 3) lifetime production, and 4) profitability. A companion paper (Heins and Hansen, 2012) reported results for the same herds of cows for fertility, SCS, and 305-d projected production.

MATERIALS AND METHODS

Data

A detailed description of the study and number of daughters per sire is reported in Heins and Hansen (2012). In brief, all cows initiated their first lactations between June 2002 and January 2005. Also, data collection spanned the period of time from June 2002 to January 2009. Calving dates, number of calves, and sex of calves born alive, breeding dates, pregnancy diagnoses of cows, DHI production, and disposal dates, along with reasons for disposal were provided by 6 commercial herds in California.

Data for this study were originally edited on test-day records (Heins et al., 2006b). However, many cattle did not survive to first milk recording; therefore, they were excluded from previously published results (Heins et al., 2006a). Data from herd records allowed the addition of 64 cows (9 NO × HO, 12 MO × HO, 7 SR × HO, and 36 pure HO) that calved in these 6 herds in the same window of time as the previously reported cows, but died or were culled before first milk recording. Therefore, 251 NO × HO, 503 MO × HO, 321 SR × HO, and 416 pure HO cows that calved for the first time from June 2002 to January 2005 were compared. The distribution of cows by herd and breed group is in Table 1, and the 6 herds were variable in number of cows and in extent of use of breeds for crossbreeding.

However, for the analysis of survival to subsequent calving, lifetime production, and profitability, the data were restricted to 3 of the 6 herds because they had at least 20 cows in each of the breed groups to provide a meaningful comparison of cows for lifetime performance within herds. Those 3 herds were herds 2, 4, and 6 in Table 1 with 168 NO × HO, 369 MO × HO, 218 SR × HO, and 165 pure HO cows to analyze survival, lifetime production, and profitability. The data for this study included only crossbreds with HO dams and pure HO cows, and therefore, the mating system did not permit the separation of additive genetic and heterotic effects.

Deaths and Survival

Crossbreds and pure HO cows were compared for survival to the first test day for milk recording and to 305 d postpartum during first lactation. Cows that died or were removed before the first test day and up to 305 d postpartum were recorded in a binary manner as died or removed (1) or alive in the herd (0). Further-