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Crossbreds of Jersey × Holstein Compared with Pure Holsteins for Production, Fertility, and Body and Udder Measurements During First Lactation

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ABSTRACT

Jersey × Holstein crossbreds (J×H; n = 76) were compared with pure Holsteins (n = 73) for 305-d milk, fat, and protein production; conception rate; days open; proportion of cows pregnant within fixed intervals postpartum; and body and udder measurements during first lactation. Cows were housed at 2 research locations of the University of Minnesota and calved from September 2003 to May 2005. The J×H were mated to Montbeliarde sires, and Holstein cows were mated to Holstein sires. Best Prediction was used to determine actual production (milk, fat, and protein) for 305-d lactations with adjustment for age at calving, and records less than 305 d were projected to 305 d. The J×H (274 kg) and pure Holsteins (277 kg) were not significantly different for fat production, but J×H had significantly less milk (7,147 vs. 7,705 kg) and protein (223 vs. 238 kg) production than pure Holsteins. The J×H had significantly fewer days open than pure Holsteins (127 vs. 150 d). Also, a significantly greater proportion of J×H were pregnant at 150 and 180 d postpartum than pure Holsteins (75 vs. 59% and 77 vs. 61%, respectively). The J×H had significantly less body weight (60 kg) at calving, but significantly greater body condition (2.80 vs. 2.71). Furthermore, J×H had significantly less udder clearance from the ground to the bottom of the udder than pure Holsteins (47.7 vs. 54.6 cm), and greater distance between front teats (15.8 vs. 14.0 cm) than pure Holsteins during first lactation.
Key words: crossbreeding, heterosis, Jersey

INTRODUCTION

Success of selection for milk production has contributed to the domination of the Holstein breed around the world. However, crossbreeding is a topic of growing interest in recent years in response to dairy producers' concerns about fertility, cow health, and calf survival (Funk, 2006). In a survey by Weigel and Barlass (2003), dairy producers indicated crossbreeding improved fertility, survival, and profitability of dairy cows.

Many research studies have documented the effects of crossbreeding in dairy cattle, but most studies are dated (Bereskin and Touchberry, 1966; McDowell, 1982; Touchberry, 1992; McAllister et al., 1994). A crossbreeding study conducted at the University of Illinois (Touchberry, 1992) concluded that pure Holsteins were superior to Guernsey × Holstein crossbreds for milk production, but crossbreds exceeded purebreds on an economic basis. Income produced per cow per lactation was 14.9% greater for crossbreds than the average of the purebreds in the Illinois study. McAllister (2002) reported that crossbreds of Ayrshire and Holstein were similar to pure Holsteins for milk production, and 2 crossbred groups from crosses of Ayrshire with Holstein had similar economic return compared with pure Holsteins.

First-generation crosses of 2 breeds (F_1) comprise 1.2% of cows recently evaluated by the Animal Improvement Programs Laboratory (**AIPL**) of USDA (VanRaden et al., 2007). Fat and protein production was similar for Jersey × Holstein crossbreds (**J×H**) compared with pure Holsteins in the United States (VanRaden and Sanders, 2003), and J×H were more profitable for Net Merit and Cheese Merit than were pure Holsteins. Lesmeister et al. (2000a,b) reported that J×H had significantly less milk and protein production than pure Holsteins; however, the breed groups were not different for fat production.

Crossbreeding of the Jersey and Holstein breeds is common in New Zealand, and many studies have assessed the benefits of crossbreeding in pastoral systems. Ahlborn-Breier and Hohenboken (1991) reported that J×H were superior to pure Holsteins for fat production. In a more recent study, Bryant et al. (2007) concluded that J×H in New Zealand had greater fat and protein production than pure Holsteins due to heterosis. The University of Wisconsin reported that crossbred calves had lower birth weights, less calving difficulty, fewer

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stillbirths, and lower incidence of scours than pure Holstein calves (Maltecca et al., 2006).

Reduction in fertility, health, and survival of pure Holsteins led managers of 7 large commercial dairies in California to begin crossbreeding of pure Holsteins, and Heins et al. (2006a) reported that Scandinavian Red-sired calves had significantly less calving difficulty and fewer stillbirths than Holstein-sired calves. Furthermore, Scandinavian Red × Holstein and Montbeliarde × Holstein crossbred cows had significantly less calving difficulty and fewer stillbirths than pure Holsteins at first calving. Scandinavian Red × Holstein crossbred cows were not significantly different from pure Holstein cows for fat plus protein production; however, Normande × Holstein and Montbeliarde × Holstein crossbred cows were significantly lower for fat plus protein than pure Holsteins during first lactation (Heins et al., 2006c). Also, Normande × Holstein, Montbeliarde × Holstein, and Scandinavian Red × Holstein crossbreds had significantly fewer days open than pure Holsteins, and all crossbred groups in the study survived longer than pure Holsteins during first lactation (Heins et al., 2006b).

The objectives of this study were to determine differences between J×H and pure Holsteins during first lactation for 305-d milk, fat, and protein production; SCS; conception rate (**CR**); days open (**DO**); proportion of cows pregnant (**PP**) within fixed intervals postpartum; and body and udder measurements in 2 research locations at the University of Minnesota.

MATERIALS AND METHODS

Experimental Design

The Dairy Cattle Teaching and Research Facility on the St. Paul campus (**SP**) of the University of Minnesota has a 90-head tie-stall facility, and the West Central Research and Outreach Center, Morris (**MO**) has a 150-head low-input grazing research facility, and these 2 locations share a crossbreeding design. Crossbreeding began in December 2000 with the mating of 50% of pure Holstein cows and heifers at both locations to Jersey AI sires and the other 50% to Holstein AI sires. Heifers and cows at both locations were paired by age and sire, and 1 member of each pair was randomly assigned to 1 of the 2 breeding groups. Jersey sires were randomly mated to Holstein heifers and cows, but inbreeding coefficients were not allowed to surpass 6.25% for matings of Holstein heifers and cows with Holstein sires.

Jersey and Holstein service sires were selected based on Net Merit within breed, with consideration of semen price and availability, and 3 sires were selected per year from each breed. Both locations breed seasonally; cows at SP calve in the fall and cows at MO calve mostly in the spring with some calving in the fall. All virgin heifers are reared and bred at MO. The mating design was used for 2 yr, and all resulting J×H were bred to Montbeliarde sires, and their pure Holstein contemporaries were mated to Holstein sires.

Data

Pure Holstein heifers and cows bred to Jersey or Holstein sires calved from September 2001 to September 2003. From the foundation pure Holsteins, 98 J×H and 91 pure Holstein heifer calves were born. Two J×H and 3 pure Holstein heifer calves were stillborn; and 2 J×H calves and 1 pure Holstein heifer calf were freemartins; therefore, 94 J×H and 87 pure Holstein live heifer calves remained. Three heifers from each breed group were removed from the study for health reasons before 12 mo of age; consequently, the numbers of heifers at 1 yr of age were 91 J×H and 84 pure Holsteins. Five J×H heifers and 2 pure Holstein heifers were culled due to infertility; therefore, 86 J×H and 82 pure Holsteins calved for the first time from September 2003 to November 2005. Three J×H and 2 Holstein first-calf heifers were culled as a result of calving injuries, and 1 J×H and 2 pure Holsteins were culled before the first test day for DHI. The J×H cow was culled for a leg injury, and the 2 pure Holstein cows were culled as a result of gangrene mastitis. One J×H and 1 pure Holstein were eliminated from the study because they did not calve until 34 and 35 mo, respectively, of age.

Season of calving was spring (March to June) or fall (October to January). However, 2 J×H calved in the summer of 2003, and 3 J×H calved in the fall of 2005 at MO without pure Holstein contemporaries, and 4 pure Holsteins calved in the fall of 2005 at SP without J×H contemporaries; therefore, these 9 animals were removed from the study. All calvings at SP were in fall 2004 for this study. At MO, cows calved in fall 2003, spring 2004, and spring 2005. All J×H and pure Holsteins calved within each of these 4 location-seasons of calving (1 at SP and 3 at MO). Following edits, 76 J×H (24 at SP and 52 at MO) and 73 pure Holstein (18 at SP and 55 at MO) first-calf heifers remained for comparison.

Genetic Level of Sires of Cows

The number of daughters of sires; PTA for production, type, and functional traits; and Net Merit of sires, as well as weighted averages, are in Table 1. The PTA for production traits, functional traits, and Net Merit were obtained from the May 2007 genetic evaluation of AIPL (http://aipl.arsusda.gov). The PTA for type traits were obtained from the May 2007 genetic evaluation of the American Jersey Cattle Association (http://greenbook.usjersey.com) and the Holstein Association USA (http://www.holsteinusa.com).

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