

Crossbreeding at the University of Minnesota

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Crossbreeding has become the hottest genetic topic in dairy cattle over the past couple of years. As recently as five years ago, the topic of crossbreeding seldom was mentioned by dairy producers. Why the interest in crossbreeding of dairy cattle? These are the reasons:

- Fertility of lactating cows is declining
- Cows have more health problems than in the past, especially postpartum
- Cows are calving less frequently during their lifetimes
- The calving difficulty of first-calf Holstein heifers is a burden
- Inbreeding depression might be contributing to poorer cow fertility and health
- Milking pricing has changed to emphasize the solids in milk
- Herd profitability is gauged increasingly by factors other than level of milk production

The complementarity of breeds and the expression of hybrid vigor permits crossbreeding to influence each of the factors listed above. Also, it should be noted that crossbreeding has been used routinely for commercial beef, pig, and sheep production for more than 50 years.

Dairy cattle genetics tends to involve a lot of emotion, tradition, and loyalty, compared to the other disciplines related to dairy cattle (nutrition, reproduction, herd health, and facilities). However, profit-conscious dairy producers are looking beyond emotion, tradition, loyalty to find ways to lower production costs.

When the words “dairy cattle” are used in Minnesota, we are really talking about “grade Holsteins”. Among the leading dairy states, Minnesota stands out as a state of commercial Holsteins. A comparatively small percentage of Minnesota cows are registered, and more than 90% of Minnesota DHI cows are Holstein. Therefore, most concerns about genetics in Minnesota revolve around commercial Holsteins.

Research indicates that the average Holstein cow has become too big and too sharp for functional purposes. Through time, the industry has favored A.I. sires with daughters that are high producing and look like they are high producing. At the same time, the industry has discriminated against sires with daughters that are high producing but don't look like they are milking heavily (they maintain adequate body condition for reproduction). In retrospect, this has been a rather foolish thing to do, but hindsight is always better than foresight.

Calving difficulty is closely related to cow fertility, because cows that have difficulty giving birth often have postpartum reproductive problems. The Holstein breed has selected substantially for wider rumps based on the hypothesis that wider rumps should lead to less calving difficulty. Ironically, Holstein cows have the widest rumps, on average, of all breeds of cattle. Yet, Holstein is the only breed of dairy cattle that has a major problem with calving difficulty.

Holsteins are getting more inbred, on average, each year. The breed hit a milestone during 2003, with an average level of inbreeding of 5% for heifer calves born during the year. Cows have chromosomes with pairs of genes at each location (one gene on each of the two chromosomes). The 5% level of inbreeding means that 5% of the pairs of genes are identical because they came from the same ancestor. The recommendation for commercial milk production is that the inbreeding of cows should not surpass 6.25%. With an average of 5%, many Holsteins now surpass that maximum recommended level of inbreeding.

Despite the current interest in crossbreeding at the producer level, almost no recent research is available to base recommendations on crossbreeding. Very dated research has been used to predict consequences of crossbreeding, but updated research with crossbreds versus pure Holsteins is sorely needed to gauge the results for cattle exposed to 21st century management.

The University of Minnesota Effort

Two of three dairy cattle research herds at the University of Minnesota are involved in research with crossbreeding. The 90-cow teaching/research tie-stall facility on the St. Paul campus and the 125-cow low-input research facility at the West Central Research and Outreach Center at Morris share a crossbreeding design. Crossbreeding began in December 2000 with the mating of 50% of the pure Holstein cows in both locations to Jersey A.I. sires and the other 50% of Holstein cows to Holstein A.I. sires. Both herds breed seasonally, and this mating design was used for two years. Jersey and Holstein sires were selected based on Net Merit, and three sires were used per year from each breed. From the two years of matings at both locations, the result was 94 Jersey x Holstein crossbred heifers and 91 pure Holstein heifers. The Jersey breed provides calving ease, higher solids concentration in milk, and more moderate cow size to a crossbreeding system, as well as hybrid vigor for many traits.

Beginning in December 2002, Montbeliarde A.I. sires (breed-leading sires from France) were mated to two-thirds of the pure Holstein cows, and one-third of Holstein cows were mated to Holstein A.I. sires, at both St. Paul and Morris. Furthermore, all of the Jersey x Montbeliarde crossbred virgin heifers were mated to Montbeliarde sires, and their pure Holstein contemporaries were mated to Holstein sires. Over time, roughly one-third of cows at both locations should be pure Holsteins, and two thirds of the cows should be crossbreds of one breed combination or another.

The long-term mating design is tentative, but includes three breeds (Holstein, Jersey, and Montbeliarde) with Jersey x Holstein crossbreds mated to Montbeliarde sires and Montbeliarde x Holstein crossbreds mated to Jersey sires. In other words, the design will be initiated with three-breed crosses. In subsequent generations, Holstein A.I. sires will be used every other generation, with Jersey and Montbeliarde sires used in sequence in the alternating generations. Starting with the breed of dam (Holstein), the order of breeds (from left to right), is:

H - J - M (3-breed cross) followed by **H - J - H - M** , etc.

and **H - M - J** (3-breed cross) followed by **H - M - H - J** , etc.

Some will ask, "What in the world is a Montbeliarde?" Montbeliarde is the #2 dairy breed in France with 333,767 cows on test in 2001 (which compares to 157,885 Jerseys and 15,012 Brown Swiss on test in the U.S. in 2001). The Montbeliarde breed samples 160 young sires each year, and the selection index for the breed has weights of 50% on production, 12.5% on type (with a positive weight on body condition), 12.5% on SCS, 12.5% on female fertility (similar to DPR in the U.S.), and 12.5% on productive life. Globally, Montbeliarde likely ranks below Holstein, Brown Swiss, and Scandinavian Red for milk production, but Montbeliarde likely ranks above all other breeds of dairy cattle in the U.S. and elsewhere for milk production. The breed has very good udders and outstanding feet and legs. In France, Montbeliardes have advantages over Holsteins for calving ease, stillbirths, cow fertility, and postpartum health disorders.