

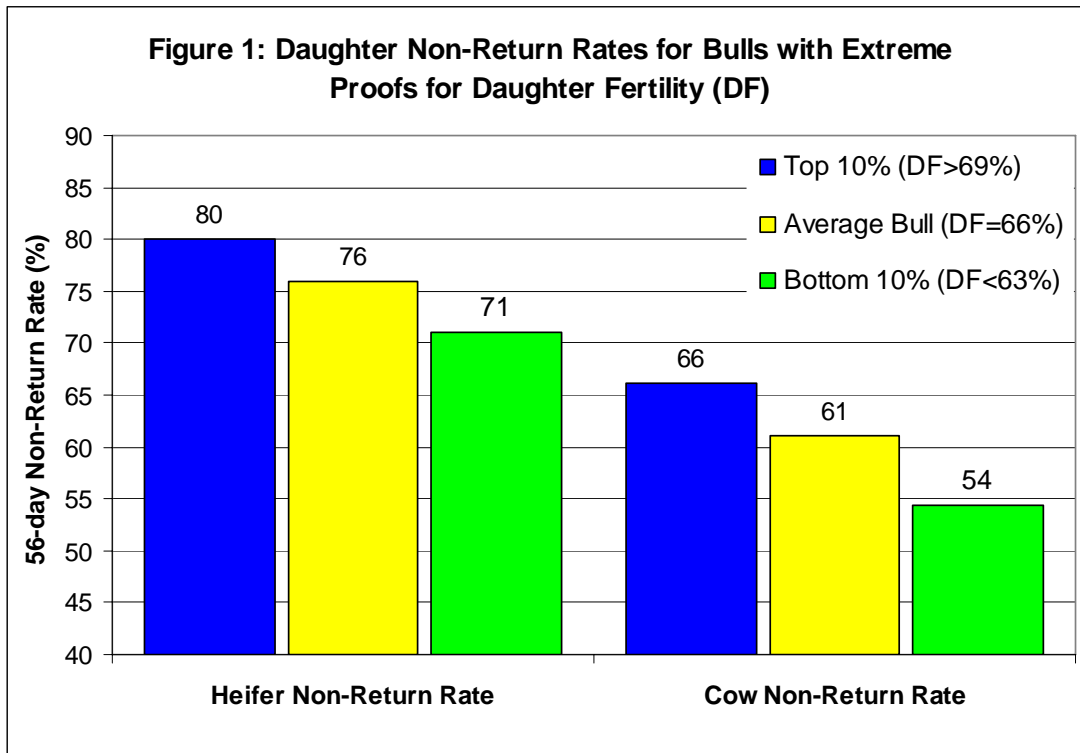
Genetic Variation for Daughter Fertility and Longevity

For an increasing number of dairy producers, functional traits are gaining emphasis within their genetic selection programs. Traits such as Somatic Cell Score have a clear economic impact on profitability and producers are familiar with bull proofs for calving ease, milking speed and temperament since they have been available for several years. Two traits of economic importance that seem to be less understood, however, are Daughter Fertility and Herd Life. Even though these traits are less heritable, there is ample genetic variation within each dairy breed such that sire selection can have an important impact on herd profitability.

Daughter Fertility

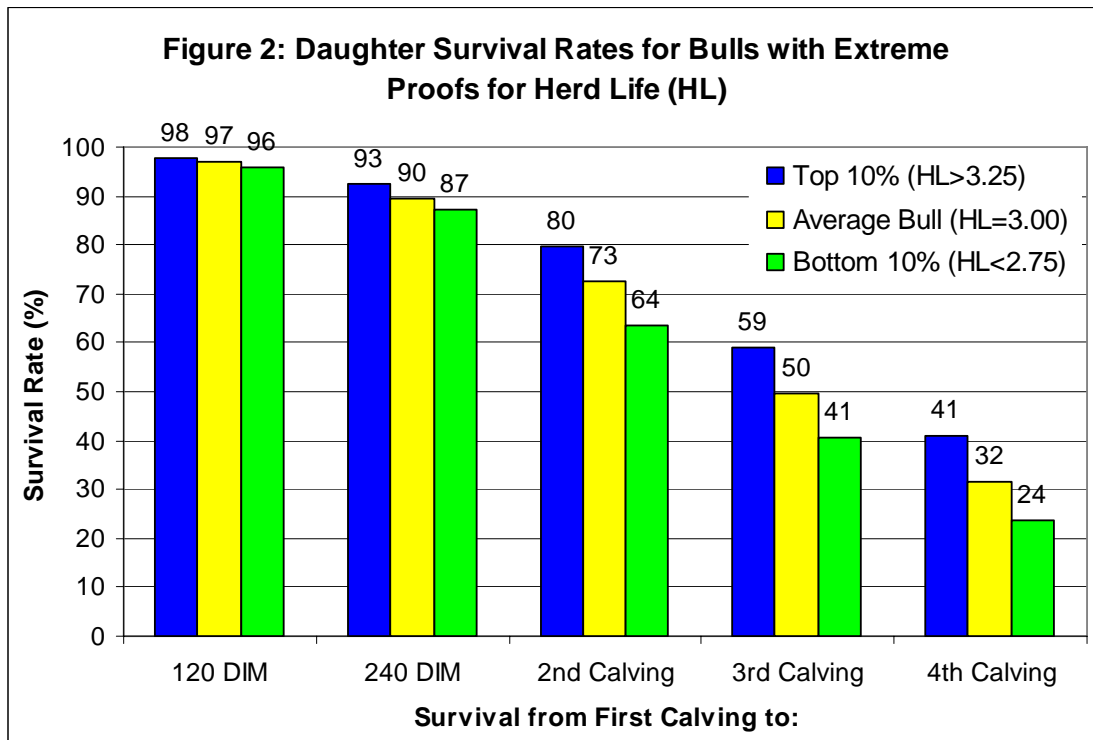
Bull proofs for Daughter Fertility combine genetic information for various measures of fertility in their daughters, both as heifers and lactating cows. For each breed, the average proof for Daughter Fertility is set equal to the breed average for 56-day non-return rate, which is 66% for Holsteins. In recent years, various producers have vocalized concerns about a decreasing trend in fertility rates within their herd and some have selected crossbreeding with other dairy breeds as their solution. Analysis of phenotypic and genetic trends for female fertility, conducted at Canadian Dairy Network (CDN) using the national database, indicate that dairy cattle populations in Canada have not been deteriorating in terms of female fertility at the same rate as indicated by research in other countries. Also, bull proofs for Daughter Fertility within each breed show significant variation amongst proven bulls and therefore allow for an alternative to crossbreeding for addressing reproductive problems within individual herds.

Within each breed, Daughter Fertility proofs have a range of approximately 10 percentage points on either side of the breed average. For Holsteins, proven bulls vary from 55% to 75% for Daughter Fertility with the average being 66%. Of course, not all of the extreme breed improvers for Daughter Fertility also offer superior genetics for other traits of importance but even amongst high LPI sires variation exists for Daughter Fertility. Bulls amongst the top 10% of the breed for Daughter Fertility have a proof of 70% or better and those below 63% represent the bottom 10% of the breed. Figure 1 shows the average daughter performance for 56-day non-return rate in heifers and cows for each group of proven bulls. For heifer fertility, the difference is approximately $\pm 5\%$ non-return rate for bulls in either the top or bottom 10 percentiles compared to daughters of average bulls. In cows, this difference is increased to a total of 12% for non-return rate showing that sire selection for Daughter Fertility can yield significant improvement in the fertility performance of their daughters.



Daughter Survival

Another area of importance to producers is cow survival since they aim to produce profitable cows that will last for several lactations. From a genetic perspective, CDN calculates bull proofs for daughter survival to five specific stages of lifetime production and combines these into an overall bull proof, namely Herd Life. The new CDN web site launched in February 2006 provides detailed information associated with bull proofs for production and type traits as well as for each of the functional traits. For Herd Life, genetic and phenotypic information is provided as part of the Functional Trait Details link to each bull's Genetic Evaluation Summary. The five measures of longevity include daughter survival from first calving to (1) 120 days in milk in first lactation, (2) 240 days in milk in first lactation, (3) second calving, (4) third calving, and (5) fourth calving. On average, 34% of first calvers in Canadian herds survive to start a fourth lactation. Amongst proven bulls, however, the range varies from a low of under 20% to a high of nearly 60%. This represents a variation of close to 40% survival to fourth calving (2 daughters out of 5) between extreme bulls for Herd Life. When focussing on bulls within the top 10% for Herd Life (above 3.25) and the bottom 10% (below 2.75), differences in daughter survival are evident for each of the longevity measures (Figure 2). For example, bulls in the top 10% of the breed have an average daughter survival to fourth calving of 41%, which is 9% higher than daughters of average bulls and 17% higher than bulls in the bottom 10% of the breed. This variation amongst daughters of proven bulls shows that genetic selection using Herd Life evaluations can yield significant gains in the longevity of dairy cattle in Canada.



Summary

Daughter Fertility and Herd Life evaluations are important genetic selection tools for improving female fertility and daughter survival, respectively. Analysis at CDN has shown the clear relationship between bull proofs and the average daughter performance for these traits. The wide genetic variation amongst proven bulls in each breed indicates that genetic progress can be achieved by consideration of these traits in sire selection decisions. For this reason, both traits are included in the Lifetime Profit Index (LPI) with appropriate relative weights.