



Genetic Improvement for Auxiliary Traits in Canada

For obvious reasons, the main emphasis in dairy cattle improvement is placed on selection for increased levels of milk production and its components as well as improved body conformation required to sustain the high production. In Canada, bull proofs are also provided for a group of auxiliary traits which include milking speed, calving ease, lactation persistency, somatic cell score and herd life. Although these traits may not be of primary importance in a sire selection program, they do have significant economic importance as it relates to herd profitability. This article takes a closer look at the interpretation of bull proofs for each of these auxiliary traits and recent rates of genetic improvement.

Milking Speed

Following the third or fourth month of milking during the first lactation of each cow, herd owners provide their milk recording representative with a subjective appraisal of the cow's relative milking speed. This appraisal is recorded on a 5-point scale as "Very Slow", "Slow", "Average", "Fast" or "Very Fast". These data are combined with pedigree information in a genetic evaluation system, which accounts for various factors including the test day milk yield at the time of the milking speed appraisal. Published bull proofs in each dairy breed average 69% and reflect the percentage of future daughters which are expected to be appraised as "Average" or "Fast" for milking speed during their first lactation. Note that sire selection for this trait (range is from 55% to 80%) represents an intermediate optimum since "Very Slow", "Slow" and "Very Fast" milkers are not desired. Milking speed proofs should only be considered in mating decisions which involve either extreme for this trait with the objective of avoiding common problems between the cow and the mating sire.

Calving Ease

As with milking speed, herd owners provide milk recording personnel with an evaluation of the ease of birth associated with each calving on the farm. These appraisals are categorized as either "Unassisted/Unobserved", "Easy Pull", "Hard Pull" or "Surgery Required". Adjustments for herd and season of calving, sex of calf as well as first versus later calvings are included with pedigree information into a genetic evaluation system which is run for Holstein bulls only. Bulls are evaluated for "Calving Ease" which reflects how easily their progeny are born when mated to virgin heifers and for "Maternal Calving Ease" which reflects how easily their daughters give birth as first calvers. Published proofs for both components of calving ease average 85% with a range from 75% to 90%. A bull with a "Calving Ease" rating of 87%, for example, is expected to have 87% of his future progeny appraised as "Unassisted" or "Easy Pull" when mated to virgin heifers. Due to the nature of this trait, mating decisions should only focus on avoiding the use of poor calving ease sires (ie: 82% or lower) on virgin heifers and smaller cows. Bull proofs for "Maternal Calving Ease" are available from the CDN web site but are not widely used in the field.

Lactation Persistency

Bull evaluations for this trait reflect the average lactation curve of their daughters between days 60 and 280 in lactation. These evaluations are derived using test day information analysed within the Canadian Test Day Model for production traits (see Holstein Journal, March 1999 issue for details). Bull proofs for each of the first three lactations are combined with half of the emphasis on first lactation persistency and one-quarter on each of second and third lactation. The average combined proof varies for each breed and is 63% for the Holstein breed with extremes being $\pm 10\%$. A bull with a published proof of 67% indicates that his daughters have an above-average lactation persistency based on performance during the first three lactations. Because this trait has only been available since February 1999, its exact economic importance and optimum mating strategies have not yet been defined.

Somatic Cell Score

Essentially all herds enrolled on milk recording in Canada also participate in somatic cell count analyses performed for each individual cow at the time of each test generally done monthly. The resulting somatic cell counts are converted to somatic cell scores ranging from 0 to 10 whereby the population average is close to 3. These test day measures of somatic cell score for the first three lactations are analysed in conjunction with the respective test day milk, fat

and protein yields using the Canadian Test Day Model. From this sophisticated genetic evaluation system, bulls receive a somatic cell score (SCS) evaluation for each lactation which is combined into a published proof based on a relative emphasis of 25% on first lactation, 65% on second and 10% on third. The average SCS proof for each breed is set to a value of 3.00 and bulls generally range from 2.50 (most desired) to 3.50 (least desired). Sire selection for SCS is aimed at reducing the frequency of mastitis within the herd and it is therefore included in the Total Economic Value as the most important factor related to udder health.

Herd Life

Canadian dairy producers provide milk recording agencies with culling information which reflect the actual survival of each dairy cow in the milking herd. Herd Life evaluations in each breed are a combination of actual daughter survival data throughout the first three lactations and predicted longevity information derived from daughter type classification data for mammary system, feet and legs, capacity and rump. For young bulls with only first lactation daughters, little survival data is known so the Herd Life proof mainly reflects the indirect measure of longevity determined by the combination of his proofs for the various conformation traits. As a bull's daughters age and continue into second, third and later lactations, more survival information becomes available and the Herd Life reflects this increased accuracy with less emphasis being placed on the indirect measure. Published bull proofs for Herd Life in each breed are set to an average of 3.00 simply as a point of reference. As an example, a bull with a proof of 3.33 is expected to have daughters which will survive one-third of a lactation longer (ie: 100 days) for reasons other than production performance compared to daughters of an average bull.

Genetic Improvement

Table 1 provides the auxiliary trait proofs for the current Top 5 Lifetime Profit Index (LPI) sires in the Holstein breed. Review of these figures shows that these particular sires generally have favourable proofs for most or all of the auxiliary traits. In fact, analysis of all proven Holstein sires shows that, with the exception of calving ease and maternal calving ease which show no relationship, the other four auxiliary traits have a desirable relationship with both LPI and TEV so selection for these overall indexes will result in indirect improvement for these auxiliary traits as well.

Table 1: Auxiliary Trait Proofs¹ for the Top 5 LPI Holstein Sires - November 1999

	Milking	Calving	Maternal	Lactation	Somatic	Herd
	Speed	Ease (CE)	CE	Persistency	Cell Score	Life
Sunny Boy	61%	87%	86%	61%	3.34	2.97
Meadowlord	73%	84%	85%	65%	2.75	3.29
Stoneham	73%	86%	NA	63%	3.04	3.25
Rudolph	71%	89%	86%	64%	2.92	3.34
Jolt	74%	84%	82%	66%	2.99	3.29
Breed Average	69%	85%	85%	63%	3.00	3.00

Note 1: Higher proofs are desired for all traits except Somatic Cell Score since lower values reduce the incidence of mastitis.

Another approach to evaluating the level of genetic improvement in a population is to examine rates of genetic progress based on recently proven bulls. Table 2 shows the total amount of genetic change achieved in the Holstein breed for each trait during the past 5 years. In order to compare across traits, the average annual genetic change is also presented in standard units. Although no genetic change has been achieved for milking speed, progress for maternal calving ease (cows are genetically improving for their ability to give birth) is countered by a slight decrease in the genetic potential for calves to be born easily. Desired trends in genetic improvement have been realized for lactation persistency, somatic cell score and herd life. As expected, however, progress for any of these auxiliary traits is significantly slower than for primary traits such as protein yield and conformation where the average annual gain in standard units is +0.21 and +0.20, respectively.

In summary, it appears that current selection approaches and tools are leading to genetic improvement for the primary traits of importance as well as most auxiliary traits in dairy cattle breeding. For the best use of the numerous traits published, a basic understanding of the interpretation and use of bull proofs for each auxiliary trait is beneficial.

Table 2: Genetic Change for Auxiliary Traits in Canadian Holsteins		
Trait	Total Genetic Change During Past 5 Years	Average Annual Change in Standard Units
Milking Speed	-0.05% Average or Fast	-0.002
Calving Ease (Direct)	-0.29% Unassisted or Easy	-0.026
Maternal Calving Ease	+0.54% Unassisted or Easy	+0.045
Lactation Persistency	+1.51% at 280 vs 60 DIM	+0.104
Somatic Cell Score	-0.076 (desired direction)	-0.069 (desired)
Herd Life	+0.032 lactations	+0.047