Réseau laitier canadien
Canadian Dairy Network

DGV is a Tool
NOT a Selection Criterion!

With the first official release of Holstein genomic evaluations, August 18, 2009 became an important date in the history of dairy cattle genetic improvement in Canada. All indications from breeders and industry personnel suggest that this new information was welcomed with high anticipation and many are ready and willing to incorporate genomics into their breeding decisions and herd improvement programs.

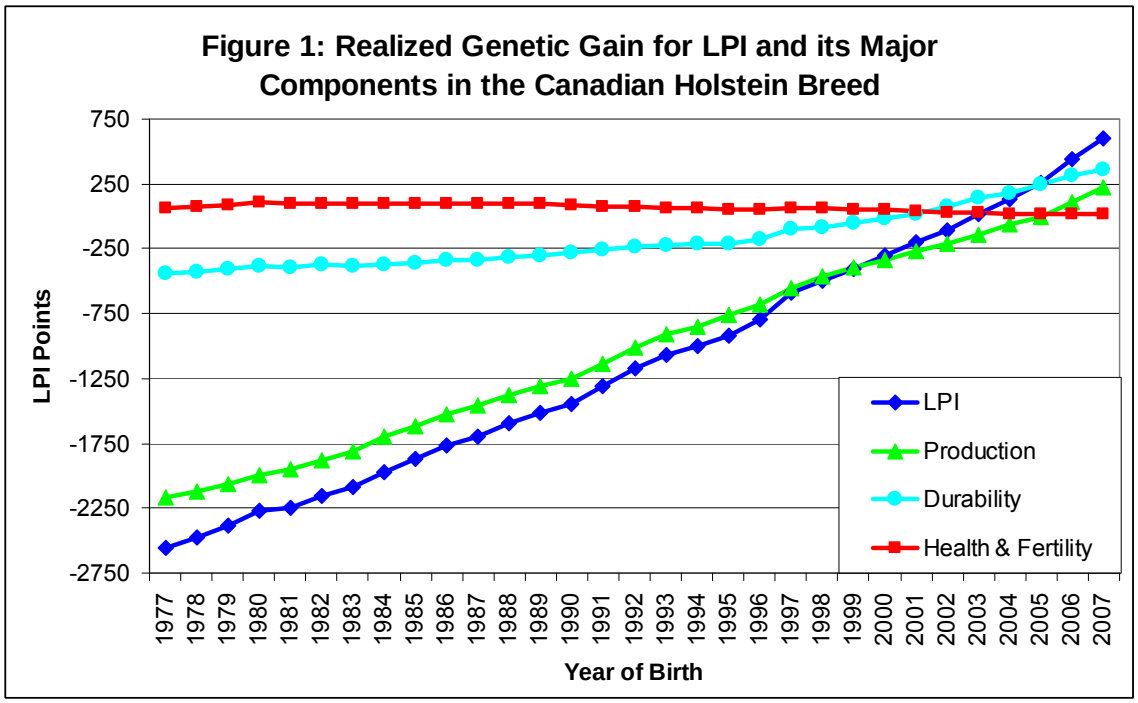
The inclusion of genomic information into officially published evaluations for bulls, cows, young sires and heifers has also led to the introduction of a new piece of information for genotyped animals, namely their Direct Genomic Value or DGV. A common question now asked by breeders is *"How should I interpret and use the animal's DGV compared to their officially published genetic evaluation?"*

Traditional Genetic Evaluations

For more than 30 years now, dairy cattle selection and breed improvement programs have been based on traditional genetic evaluation systems. Over the years, the complexity of the genetic evaluation methods and models has increased and so has the number of traits evaluated. The underlying principle of these traditional systems is that we can learn something about an animal's genetic merit for a given trait by looking at data recorded for that trait for the animal and its relatives. In dairy cattle breeding, most traits are only expressed in the female, primarily in cows that have calved at least once. The main goal of the traditional genetic evaluation calculations is to identify the component of an animal's recorded performance, say lactation yield or classification score, etc., that is due to management and environmental factors in an effort to isolate the genetic component on its own. Only this estimated genetic component is what can be transmitted from parent to progeny.

Success To-Date

Figure 1 shows the realized genetic gain over the past 30 years within the Canadian Holstein population for LPI and each of its three major components. The trends in this graph are not only clear but very significant. Traditional genetic evaluation systems in Canada have resulted in excellent selection and mating decisions, yielding an average LPI gain of 119 points during the past 10 years. While LPI gain in previous years was mostly (i.e.: ≈85%) due to genetic improvement for production, during the past decade the traits included within the Durability and Health & Fertility components have taken on greater importance and production gains represented only 61% of the gain in LPI. This said, Figure 1 shows that no substantial genetic change has occurred for traits associated with the Health & Fertility component and this is one area where genomics can play an important role.



New Tool With Genomics

For each genotyped animal, its DNA profile is now recorded for over 43,000 genetic markers, known as SNPs or "snips". Since every animal's genetic makeup is coded within its DNA, the recorded genotype that results from DNA extraction and analysis at a laboratory can also tell us something about that animal's genetic potential for traits of interest. With genotyped proven sires acting as a reference population, statistical analysis done at Canadian Dairy Network (CDN) identifies associations between DNA profiles and genetic evaluations on a trait-by-trait basis. These estimated associations are then applied to all genotyped animals, both males and females, to derive their Direct Genomic Value (DGV) for each trait analyzed.

What to Use for Selection Decisions?

Research at CDN has focused on how to best combine results from traditional genetic evaluation systems and from genomic evaluations, specifically the DGVs. The end result of this work, perhaps not surprisingly, is that both systems provide useful information and should be used together to maximize the accuracy of selection decisions made today by breeders and A.I. companies purchasing young bulls. For this reason, the officially published genetic evaluations are a blend of both evaluations, traditional and genomic, and should be the primary genetic selection tool. If you are one who is reluctant to jump on the genomics train then you will continue to make genetic progress in your herd, as shown in Figure 1, but you will eventually fall behind your neighbours that include genomics with the appropriate level of risk management. On the other hand, if you are so convinced that genomics is the ultimate tool such that only DGV should be consider for selection decisions, then you too will miss the boat. Such a belief or strategy basically says that you no longer believe that the information recorded on a cow has anything to do with her genetic potential, which has been the basis of our traditional genetic evaluation systems for decades.

Summary

Official genomic evaluations have arrived in Canada and this brings with it public access to Direct Genomic Values (DGVs) on a trait-by-trait basis for every genotyped animal. While it may be tempting to place more emphasis on this new tool for genetic selection decisions, the optimal use of genomics is achieved when combined with traditional genetic evaluation information. Research at CDN has identified the most desired method for combining these two estimates of an animal's genetic potential, one based on pedigree and performance records and the other based on analysis of DNA profiles, to maximize the accuracy of selection and future rates of genetic progress. Officially published GEBVs, GPAs and GMACE evaluations represent the combination of all available genetic evaluation information and should therefore be the primary criterion for genetic selection, not the DGVs themselves.

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