

Canadian Genomic Evaluations Have Arrived!

Without doubt, the topic of genomics has been the main focus of extension information during the past year in Canada, the United States and many countries around the world. For quite some time now, research scientists have been examining ways to use information at the DNA level for identifying genes of importance in dairy cattle improvement, or any markers associated with them. Even with such a longstanding research effort, it was impossible to predict the sudden global race towards the adoption of genomics into national genetic evaluation systems. Thanks to a North American research effort involving major A.I. organizations, research scientists at USDA in the United States and the Centre for Genetic Improvement of Livestock (CGIL) at the University of Guelph, as well as Canadian Dairy Network (CDN), official genomic evaluations will be a reality in the Holstein breed starting with the genetic evaluation release on August 18, 2009. Beyond the technical methodology underlying genomic evaluations, this article concentrates on the practical application and publication of results from this new and powerful technology for genetic selection and improvement.

Genetic Evaluation Terminology and Labels

With traditional genetic evaluations young bulls and heifers receive a Parent Average (PA) while official domestic genetic evaluations for cows with performance data and progeny proven sires are labelled as “EBV”. Foreign proven sires without an official domestic evaluation receive a “MACE” evaluation, which is the same label assigned to converted genetic evaluations for foreign dams from another country (mainly USA), when they are available at CDN. For genotyped animals with an official genomic evaluation, the traditional genetic evaluation labels will be modified to GPA (for young bulls and heifers), GEBV (for cows and sires with an official domestic evaluation) and GMACE (for foreign sires and dams with a MACE evaluation in Canada). Similarly, the labels used for their LPI will be modified to GLPI (instead of LPI), GMACE LPI (instead of MACE LPI) and GPA LPI (instead of PA LPI). Published genomic evaluations will reflect a combination of the animal’s traditional genetic evaluation and their Direct Genomic Value (DGV). On average, the relative weights on each component are 35:65 (PA:DGV) for young sires and heifers, 45:55 (EBV:DGV) for younger cows and nearly equal emphasis of 50:50 for older cows with daughters and progeny proven sires.

Top Lists for Bulls, Cows and Heifers

The official “Top LPI Bull Report” for bulls with an official domestic progeny proof will remain the same except for the addition of a new column for “Genomic Status” (or GS) that will display the letter “G” only for bulls that have their own genomic information included in their officially published proof. Similarly, the official “Top 500 Foreign Bulls by MACE LPI” that lists bulls with an official progeny proof in another country, and therefore a MACE evaluation in Canada, will remain unchanged except for the new “Genomic Status” column. “G” will be displayed for those bulls with a genomic evaluation

in Canada that has been combined with their MACE evaluation on the Canadian scale as provided by Interbull.

For cows and heifers, the situation will be different since two lists of top animals will be provided by CDN for each of these groups. The official “Top LPI Cow Report” will be renamed to the “Top GLPI Cow Report” and list **only** cows that have an official GLPI that includes their own genomic evaluation after being genotyped with the Illumina BovineSNP50™ BeadChip, known as the “50K” panel. Similarly, the top Canadian-owned heifers with a genomic evaluation will be listed on the “Top Heifer GPA LPI Report”. Non-genotyped cows and heifers will be listed on separate reports entitled “Top Candidate Cows for Genotyping by LPI” and “Top Candidate Heifers for Genotyping by PA LPI”, respectively.

Genomic Evaluation Details and Reports

With the official launching of genomic evaluations in August 2009, the CDN web site will provide a new Genomic Evaluation Details tab linked to the Genetic Evaluation Summary page for all animals with an official GPA, GEBV or GMACE, which includes its genomic information. In addition, Holstein Canada will continue its service to Canadian breeders of providing a Genomic Value Report for Canadian-owned females with a genomic evaluation. In conjunction with each official genetic evaluation release in August, January and April, Holstein Canada will generate a report for all such females with a genomic evaluation. For the genomic evaluation updates done monthly by CDN, Holstein Canada will produce a Genomic Value Report only for new cows and heifers with their first official genomic evaluation in Canada and the CDN web site will provide a monthly list of these females as well as a link to their Genomic Evaluation Details page.

Reliability Values for LPI

With the arrival of genomic evaluations also comes the opportunity to use semen from young bulls with increased confidence, before they have any daughters in lactation. This opportunity, however, also reinforces the need for producers to look at the Reliability value associated with each bull’s genetic evaluation in Canada. For this reason, CDN will be publishing a specific Reliability value for LPI and its three components on its web site. In general, the average LPI Reliability for animals with genomic evaluations will be roughly 60% for young sires and heifers, 70% for younger cows in first or second lactation, 80% for US-proven sires with a MACE evaluation, and 90% for domestically progeny proven sires. Therefore the difference in selection accuracy remains significant for “genomically proven” young bulls at 60% Reliability for LPI compared to progeny proven sires in Canada with genomic information at 90% Reliability for LPI.

Genotyping in Canada

Within the North American agreement that has led to the introduction of national genomic evaluations in the United States and Canada, only authorized A.I. organizations may presently submit DNA for a bull to be genotyped. On the other hand, Holstein Canada coordinates a DNA genotyping service for all Canadian females in the Holstein and Jersey breeds with the intent to expand to other breeds as the need arises. To date, nearly 1,400 Holstein females in Canada have been genotyped, of which 41%

have been heifers. These genotyped females are from 248 different herds in nine provinces across Canada with 48% from Québec and 45% from Ontario.

Summary

In August 2009, Canada enters the very short list of early countries to introduce genomics into official national genetic evaluations. This 50th genetic evaluation release by CDN is an important milestone and has practical implications on how genetic evaluations are published, labelled and eventually used by Canadian dairy producers and industry for accurate genetic selection decisions. Details related to the genomic evaluation of genotyped animals will be available on the CDN web site (www.cdn.ca) and Holstein Canada will continue to provide similar information directly to Canadian owners of genotyped females.

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