



Genomic Evaluations Without Published DGV

December 2, 2019

Unlike any other country, Direct Genomic Values (DGV) have been published in Canada for genotyped animals as part of its genomic evaluation system. The intent of doing so was to provide producers and industry personnel a better insight into the “black box” of genomic evaluations when they were first introduced in 2009. Ten years later, as of the December 2019 release, DGV will no longer be published or included in any outgoing data files associated with Canadian genetic evaluations. Some breeders have expressed their disagreement with this decision and misunderstanding continues to be propagated. This article provides further clarification regarding the decision to no longer publish DGV.

What Information Contributes to An Animal’s Genetic Evaluation?

After genomics was first introduced in Canada in 2009, Canadian Dairy Network (CDN) and industry partners launched an extensive education effort to help everyone better understand how the animal’s DNA analysis contributed to its genetic evaluation, resulting in the increased accuracy. The information in Figure 1 was regularly used as part of this educational campaign.

Figure 1: Contribution Sources to an Animal's Genetic Evaluation with Genomics

Animal	Label	Contributions to Genetic Evaluation				Label with Genomics
Young Animal	PA	= Pedigree			+ DNA	GPA
Cow	EBV	= Pedigree	+ Own Performance	+ Daughter Performance	+ DNA	GEBV
Sire	EBV	= Pedigree		+ Daughter Performance	+ DNA	GEBV

Every young calf born in Canada and registered in the breed association herd book, whether it's a heifer or bull, receives a Parent Average for each trait as its first official genetic evaluation, labelled as a PA. This estimate of its genetic potential is simply based on a formula that averages the genetic evaluation of its recorded parents. In this sense, each animal's pedigree serves as the first source of information for its genetic evaluation.

As a heifer calf ages and becomes a cow after first calving, her own performance data contributes to her genetic evaluation, labelled as an EBV (Estimated Breeding Value). Performance data can include production data recorded through milk recording, classification data recorded by Holstein Canada and any other data that contributes to genetic evaluations for the various functional traits (i.e. health traits, fertility, longevity, etc.). Including a cow's own performance data to her genetic evaluation adds significant accuracy over and above the accuracy of its Parent Average from pedigree alone. For cows that eventually have daughters old enough to have their own performance data, this also contributes to their genetic evaluation as a dam and further increases its accuracy.

For young bulls that enter A.I. and end up with many daughters with performance data, they end up reaching progeny proven status with an evaluation that is also labelled as an EBV. While sires don't have any of their own performance data included for dairy cattle traits, progeny proofs

for sires end up with higher levels of accuracy (i.e.: Reliability) compared to cows, with their own data and with their daughter data, simply because of the volume of daughters that are included.

The significant difference that genomics has offered is the ability to genotype an animal at any stage of its life and have an analysis of its own DNA contribute to the estimate of its genetic potential. Doing so gives an increased accuracy of the resulting genetic evaluation with the greatest benefit occurring for young animals that otherwise would only have a Parent Average based on pedigree data alone. In Figure 1, adding the contribution from the animal's DNA is represented in red text and the resulting evaluation labels add the letter "G" to become either a GPA (for young animals) or a GEBV (for cows and progeny proven sires).

What is DGV and Why Stop Publication?

As shown in Figure 1, genotyping an animal means that an analysis of its DNA can contribute to the estimation of its genetic potential, which adds significant accuracy to that evaluation. After introducing genomic evaluations in 2009, CDN coined the term "Direct Genomic Value", or DGV, to represent this new source of contribution to genetic evaluations. The terminology of Direct Genomic Value later became widespread around the world in the area of dairy cattle improvement. The decision by CDN to publish DGV for each genotyped animal was simply to help everyone understand how genomics works. The specific DGVs were not meant to be considered as an animal's genetic evaluation and were never promoted to be used as a tool for selection or mating.

Direct Genomic Values (DGV) are an intermediate step in the calculation of each animal's most accurate genetic evaluation and serve as one of various sources of information that contribute to each animal's estimate of genetic potential.

As an intermediate step in the process of estimating each animal's most accurate genetic evaluation, it turns out that DGV are also not expressed on the same scale as the official evaluations of GPA. The most elite

animals of the breed have DGV that have a range that is higher than that for official GPA. For this reason, it seems that various breeders and some A.I. organizations started to pay special attention to DGV and, on occasion, market their animals based on these higher values.

Once the Genetic Evaluation Board (GEB) of CDN, which includes breeders nominated by breed associations and other industry partners, announced its recommendation to the Board of Directors to no longer publish DGV, some of those breeders and A.I. companies that were marketing animals based on DGV made their opposition public and well known. As a consequence, senior staff at CDN and Holstein Canada met with some of the most vocal advocates of keeping DGV to listen to them and hear their perspectives on how DGV was important to their genetic selection and mating decisions. Following extensive additional research into each of those perspectives presented to CDN and Holstein Canada, there remains no scientific evidence available that demonstrates that DGV provides any more information for good selection and mating decisions compared to using the official value of GPA. It is based on this scientific evidence that the GEB and the Board of Directors of both CDN and Lactanet Canada have supported the direction to no longer publish Direct Genomic Values effective the December 2019 genetic evaluation release.

Since the initial research regarding the relative accuracy of Direct Genomic Values for selection decisions was openly presented in April 2018, there has been much input from and consultation with producers as well as various breed associations, all of which was considered by the GEB when making the recommendation to no longer publish DGV as well as by the CDN and Lactanet Boards of Directors.

What About Transparency and Data Ownership?

The decision to no longer publish DGV does not reflect the position of CDN, or now Lactanet, as it relates to transparency of information and data ownership. The calculation of genetic and genomic evaluations is complex and uses advanced methods and models that involve several steps and

sources of data contribution. In addition to the contributions for domestic animals represented in Figure 1, there is also the use of data from international sources such as Interbull, CDCB in the United States and cow evaluations received from other countries. The genetic evaluation details on a trait by trait basis that are available via the former CDN web site, and the future Lactanet web site, are made available to help everyone understand the main traits presented on each animal's Genetic Evaluation Summary page.

In terms of data ownership, Lactanet and other industry partners recognize that the raw data collected on dairy farms across the country belongs to the dairy producer. Milk recording, classification, health recording, breeding data... all what is recorded and paid for by the producer belongs to them. Even for genotyping, the use of the DNA sample provided by the producer, and the resulting genotype received from the laboratory, is treated seriously by Holstein Canada, CDN and now Lactanet Canada. The role and challenge of the various industry organizations is to take that raw data from the farm and transform it into valuable information for herd management decisions. For genetic selection and mating decisions, the official genetic evaluation for genotyped animals, either GPA or GEBV, is the most accurate and valuable genetic decision tool, and not the intermediate value of DGV.

Share





By Brian Van Doormaal

Brian has dedicated his professional career of nearly 35 years involved in the genetic improvement of dairy cattle in Canada. He is well-known for his numerous extension articles and public speaking engagements in both official languages.

