

New genetic evaluation software 2019

Technote # 19

The 2019 genetic evaluation software:

- Replaces a system that was more than 20 years old.
- Has been tested to ensure it is as good as, or better than, the old system at predicting future performance across the traits.
- Can process much more data, faster.
- Has its own testing environment (sandpit) allowing faster, more thorough testing of new breeding values.
- Will be easier to maintain as it is written in a modern, versatile language.

DataGene's new genetic evaluation system refers to the Australian dairy industry's IT software/ infrastructure that evaluates Australian Breeding Values and indices and produces the associated reports with each genetic evaluation run.

The previous system was more than 20 years old and needed updating for modern usage. It was not capable of supporting the explosion of data entering the system from genomic testing. It could not support advances in IT technology that provide modern user-friendliness and functionality.

Benefits

The benefits of the new system include:

- **Faster processing speed:** the time taken for a genetic evaluation run will be cut from 2 weeks to about 4 days. This will allow DataGene to run more frequent evaluations.
- **Automating labour intensive tasks:** Under the old system, many of the reports involved manual intervention in programs involving thousands of lines of code. The new system is fully automated, so a genetic evaluation run can be performed with the click of a button (1-click).
- **Capacity to process much more data:** the genetic evaluation system currently involves 13 million cows, 10 million lactations, 190 million test days, 12 million mating records and over 100,000 genotypes. The new system is designed to handle this, and more as genotyping continues to supply vast volumes of data.
- **Easier to maintain:** The new system is written in modern, widely-used programming language which allows much easier maintenance and further development without needing rare specialists in the old language.
- **Smarter:** The new system has its own testing environment (called a sandpit) that allows researchers to test new breeding values with a full data set. In the past, testing was a separate, lengthy process. The outcome will be faster development of new breeding values, models and reports.

Confidence

DataGene's extensive testing shows the new system is good as, or better than, the old system at predicting future performance across the traits. Animal rankings can be expected to be more stable over time.

Results from test runs have been provided to key industry users for reality-checking, feedback and discussion. Issues of concern have been addressed.

The testing process involved multiple comparisons of:

- The results from the old and new system for individual traits.
- Movement of bull rankings between the old and new system, including the Good Bulls Guide.
- Stability across time (ABV runs).
- Forward predictions from old and new system.

Our testing also assessed:

- Performance across breeds.
- Performance in females.
- Compliance with Interbull Trend Validation criteria.

While our testing has been extensive, we will continue to be vigilant in identifying issues or opportunities for improvement.

Changes to expect

Refinements to the system that contribute to more accurate and more stable breeding values include:

- Residual Survival ABV has been removed from BPI, HWI and TWI to provide more stability between runs.
- Fertility ABV model now includes all lactations rather than just five.
- Calving ease model now uses multiple traits resulting in a more reliable breeding value. (Genomics will be added later in the year)
- Single pedigree across all traits should result in small improvements in type ABVs.

- Improvements to the consistency of data rules eliminates poor quality data that was previously included.
- Reliability calculations have been refined.
- Type ABVs continuously adjusted to 100 +/- 5 which will smooth out bumps between runs.

Residual survival

Until now, the three indices – BPI, HWI and TWI – included seven trait groups that influence profit and longevity in the herd: Production (ASI), Fertility, Cell Count, Feed Saved, Type, Workability and Residual Survival.

Residual Survival was introduced to capture the economic value of traits that influence survival that we don't measure, such as lameness and metabolic disorders; while avoiding double counting those traits already included in the indices.

Residual survival presented some challenges. It is unstable from run to run (when information from different sources is added to bulls). This instability, combined with residual survival's high contribution to the BPI (8%), led to larger movements of bulls run to run than was originally anticipated.

The decision to remove residual survival out of the indices was made by industry through the Genetic Evaluation Standing Committee.

For more information, refer to [Tech Note 4](#).

Animal movements

Some animals have moved due to refinements made to the system. Most animals have not moved significantly. In fact, the correlation* between December 2018 and April 2019 for production traits is 0.97 to 0.99 for Holstein and Jersey bulls and cows with average differences ranging between -2 and 14 depending on the group. However, the BPI correlations are lower due to the removal of residual survival and improved Fertility ABV model.

The most noticeable movements are the result of the removal of residual survival from the BPI. In Holsteins, the average difference is -2 for proven bulls, +6 for genomic bulls with the range of movement for most bulls (66%) being +/- 35 BPI.

In Jerseys, the average difference is -9 for proven bulls, -13 for genomic bulls with the range of movement for most bulls (66%) being +/- 45 BPI.

Some individual animals have been affected by refinements to specific traits, such as fertility. Fertility is a significant contributor to the BPI, so some bull rankings will move due to changes in their Fertility ABV.

DataGene has explored the largest movements and is comfortable they are consistent with model and data changes. We are confident the new breeding values provide a better prediction of future performance.

Run frequency

There is a global trend towards more frequent genetic evaluation runs. In the coming months, DataGene will review the frequency of ABV runs with our clients. The decision will be made by industry through the Genetic Evaluation Standing Committee and the DataGene board.

Terminology

The new genetic evaluation software is part of an integrated product with a customer portal, collectively known as DataVat.

CDR Central Data Repository; the IT infrastructure that connects data from a variety of external sources.

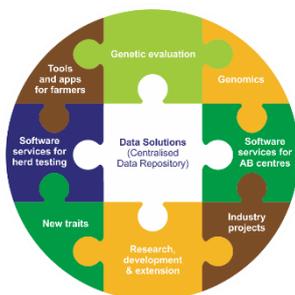
GESNP New platform Genetic Evaluation System – the IT software/infrastructure that evaluates Australian Breeding Values, indices and produces the associated reports with each genetic evaluation run.

DataVat The web portal that allows for customised, secure access to various reports, tools and resources that draw upon data in the CDR and information from GESNP.

More information

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** Correlations help us understand how close the data is between two time periods. If it was the same data, the correlation would be 1.*



About DataGene

DataGene is an independent and industry-owned organisation responsible for driving genetic gain and herd improvement in the Australian dairy industry. DataGene performs pre-competitive herd improvement functions such as genetic evaluation, herd testing and herd improvement software development and data systems. DataGene is a Dairy Australia and industry collaboration.

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