Analysis Enhancements 2023

A summary for Sheep Genetics members

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Sheep GENETICS

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A message From Sheep Genetics

Dear Valued Breeders,

Sheep Genetics continually strives to provide a world leading genetic evaluation for our clients. We implement annual analysis enhancements to ensure that we continue to provide world-leading genetic evaluation services to our Sheep Genetics clients. Sheep Genetics works alongside the Animal Genetics and Breeding Unit (AGBU) who are responsible for the cutting-edge research and development behind the enhancements to the Sheep Genetics evaluations. I would personally like to acknowledge the work of the team at AGBU for the many years' worth of work that have gone into this year's enhancements.

In summary the enhancements implemented this year fall under 2 key themes:

1. There are more phenotypes and genotypes being used in the genetic evaluation than ever before, which enables new and updated ways for this data to be utilised.
2. The software used to develop indexes has undergone a major redevelopment to better model on-farm production systems and account for traits that will become important in breeding objectives in the future.

The analysis enhancements will be implemented for the following runs:

- 21st May for MERINOSELECT/DOHNE
- 1st June for LAMBPLAN
- 21st June for MERINOSELECT Research Indexes

The new MERINOSELECT indexes will be initially released as research indexes, which will be run in parallel with the existing Merino indexes until analysis enhancements 2024. Over the coming 12 months these indexes will be refined before replacing the old indexes in 2024. The work that has been undertaken for MERINOSELECT parameters and indexes will be used to update these for Maternals and Terminals in 2024 and 2025.

This document includes further details about the Analysis Enhancements for 2023. You can also find short videos on our website with information about this year's enhancements. Please review these if you have any questions, alternatively you can contact one of the Sheep Genetics team.

Your Sincerely,

Peta Bradley
Manager – Sheep Genetics

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Enhancement 1 – Update to Genetic Parameters

In the last 10 years, the Sheep Genetics database has seen substantial growth. There has been continued increases in the number of flocks, animals, amount of data, and the number of genotypes contributing to the calculation of Australian Sheep Breeding Values (ASBVs). Over this time, there have also been improvements in the quality of data that is collected by breeders.

The genetic parameters utilised in MERINOSELECT required updating as a result of the increases in volume of recording and as a continuation from the implementation of the new database (where new age stage definitions were updated). This update to genetic parameters involved the review of 71 traits, using data from the analysis. These enhancements will affect Merino, Dohne and SAMM animals.

Genetic parameters refer to set values used within the evaluation to underpin breeding values, and include heritability, genetic correlations, and trait means. The data included in the analysis has been reviewed to ensure these parameters reflect the changes in data collected by breeders over time, resulting in more accurate, reliable, and relevant values being used in the genetic evaluation to underpin ASBVs.

Many of these changes are minimal. However, larger changes are seen in traits with recent growth in data submitted to the analysis. Examples of traits which have been more affected include visual traits like breech wrinkle and cover, as there has been increased interest more recently in traits associated with welfare and sustainability. Routine recording of these traits is far more prevalent compared to previous year drops, which means there is now more data available to inform the estimation of parameters. Post-weaning fleece and adult traits are now also more frequently recorded.

Key Parameters Updated:

- A general overhaul of genetic parameters including heritability, genetic variance, and trait correlations. The traits most impacted by this change include visual traits, post-weaning fleece traits, and adult traits. An example is adult weight (AWT), which previously had an estimated variation of 40kg. Upon review of MERINOSELECT data, this estimated variation is closer to 18kg. Heritability was also reviewed and will increase for this trait by 0.14.
- Reviewing and updating of the standard means for traits to ensure they are more relevant to industry, based on the data supplied to the evaluation. AWT, prior to the analysis enhancements, had a trait mean of 44kg, where the review found that data supplied suggested this should be updated to 60 to better represent the current and future data supplied to the analysis.

- Reviewing the pre-adjustments for fixed effects and updating these where necessary. The adjustment for birth type and dam age has remained similar, however the adjustment for rear type and age have increased to better reflect the data now available in the evaluation.
- The standard weights for carcase traits have been reviewed and updated to better reflect industry. This will mean that a more relevant age stage standard weight will be used for eye muscle depth (EMD) and fat depth (FAT) traits. For example, yearling carcase traits were previously adjusted to 60kg, but will now be adjusted to a standard weight of 50kg.

This work has also been used to support the Merino index development (see the Merino Index section for more information).

What this means for ASBVs

There will be some changes to ASBVs, with the largest changes seen in animals with lower accuracy breeding values and some traits will also be more impacted. With the updates to the genetic parameters coming into effect with the results of the 21st of May run, high accuracy animals will remain relatively stable. In the same way, higher accuracy flocks will also remain steady compared to lower accuracy flocks. Re-ranking will occur for individual traits and indexes, but the correlation of current breeding values for the 2021 and 2022 drops to the updated ASBVs is 0.98.

Traits groups where the largest changes in ASBVs may be observed include:

- Adult age stage traits, particularly AWT, and adult fleece traits.
- Visual traits – including DAG, EBWR and EBCV.
- Post-weaning fleece traits.
- Carcase traits that are adjusted for body weight, including FAT and EMD.

Genetic parameters will be reviewed in future Analysis Enhancements for the Terminal and Maternal evaluations.

Who is impacted?

MERINOSELECT/DOHNE/SAMM breeders

The update will provide a more accurate estimate of an animal's genetic merit and better reflects the data submitted to the evaluation. We expect to see some re-ranking of animals within the database because of the updates.

Enhancement 2 - Updated partitioning of genomic and pedigree information

Within the MERINOSELECT analysis we have seen exponential growth in the number of genotypes submitted. Therefore, it is important to review how genomic information is used within the analysis.

Within the analysis, ASBVs are derived from different sources of information, including pedigree relationships, traits measurements and genomic information if available. The weighting of genomic vs pedigree relationships has previously been estimated at approximately 0.5 this was initially done when Single Step genetic evaluations were introduced in 2017. With the exponential amount of genotyping in MERINOSELECT this weighting has been reviewed. This weighting and has been increased to 0.75. Meaning the genomic relationship between animals will have a bigger impact on the animals ASBV calculation.

Who is impacted?

MERINOSELECT

Genomic relationship weighting will be increased in the analysis. There will be minimal change to ASBVs as a result of the enhancement.

Enhancement 3 – Updated SNPs used in the genetic evaluation

The genomic Single Nucleotide Polymorphisms (SNP) panel used in the Maternal, Terminal, and MERINOSELECT evaluations has been updated to include new SNPs on panels provided by some genomic providers. Less informative SNPs have been removed. There has been a net increase in the number of SNPs used in the Single Step Analyses. The refinement of the SNPs used in the analysis is an important enhancement that will be reviewed frequently. This enhancement has no impact on the ASBVs for these analyses.

Who is impacted?

Merino, Maternal and Terminal

More SNPs will be used in the main evaluations. Whilst it is important process to undertake this will have no impact on ASBVs or indexes.

Enhancement 4 – New Single Step Evaluation for Lambing Ease in LAMBPLAN for Terminals

Lambing ease (LE) is an important welfare and production efficiency trait. As such, lambing ease was introduced as an ASBV in 2007 and incorporated into Terminal indexes as part of the 2022 analysis enhancements. Currently, LE is a tri-variate analysis, meaning the analysis takes into account lambing ease score, birth weight, and gestation length when calculating ASBVs for lambing ease. The analysis up until June 2023 does not use genomic information when calculating lambing ease ASBVs. There are also efficiencies which can be made to this analysis to produce more accurate ASBVs in a timely manner.

Addition of dead at birth (DAB) data in the analysis model for lambing ease

As part of this year's enhancements dead at birth (DAB) information supplied by breeders will be included in the model (along with lambing ease score, birth weight, and gestation length) to calculate lambing ease ASBVs. Using DABs as a correlated trait in the lambing ease analysis improves the accuracy of the analysis. Expression of variation in lambing ease in pure-bred flocks is a challenge. In the data supplied by breeders there is more expression of DAB and this information will be used to inform the calculation of LE ASBVs.

Moving Lambing Ease to a Single-Step Genomic model

Lambing ease was one of the only analysis models that did not use genomic information. As part of the updates to the lambing ease analysis, a single step analysis model will now be used. Single step evaluations use both trait measurement, pedigree relationships and genomic information. Updating the lambing ease analysis to a single step model, and therefore the inclusion of genomic information and improved data filtering, will ensure increased accuracy of lambing ease ASBVs. As a result more animals will receive a Lambing Ease ASBV.

What these enhancements mean for LE ASBVs:

- The new model will result in increased in accuracy of lambing ease ASBVs.
- There is a change in the genetic trend and the scale of the ASBVs. It will be important to look at the updated percentile bands from the analysis.
- More animals will receive lambing ease ASBVs due to improved data filtering procedures.

Who is impacted?

LAMBPLAN - Terminal breeders

Updating lambing ease to a single step model will mean more accurate ASBVs, as well as more animals receiving ASBVs for lambing ease. There will be changes to the ASBVs and percentile ranking for Lambing Ease ASBVs.

Enhancement 5 – Updated accuracy calculation

Accuracy values are provided with each ASBV to indicate the amount of information informing the ASBV. They are a measure of the amount of data, including pedigree, trait measurements, genomic data, and genomic relationships, used to calculate each ASBV. Accuracy values are required to be reported alongside an ASBV.

The calculation of ASBV accuracy was updated for the Maternal and Terminal analyses as part of a large-scale updates during the 2022 analysis enhancements. As part of the work undertaken for the 2023 analysis enhancements, a coding error was discovered which resulted in some animals having inflated accuracy values. This error will be fixed and released as part of the 2023 Analysis Enhancements. As a result, there will be an overall reduction in reported accuracy values for the main traits in the Maternal and Terminal analyses. Animals with a genotype will be more impacted by reduced accuracy values compared to non-genotyped animals. Please note that this change will not impact ASBV or index values.

Who is impacted?

Maternal and Terminal breeders

The updating of the reported accuracy value will better reflect the true accuracy of ASBVs. This will result in a degree of reduction in accuracy values for ASBVs for all traits across the Maternal and Terminal analyses. The extent of change will vary between analyses and traits with genotyped animals being more impacted than non-genotyped animals.

Enhancement 6 – New Merino Indexes

Selection indexes combine several important production traits into a single number are an important tool to drive genetic improvement where there are a range of traits of economic or functional importance. MERINOSELECT currently provides standard indexes for three different production systems.

Throughout 2020-21 the Merino indexes underwent review, to ascertain their relevance and usefulness in modern day and future production systems based on industry feedback. The major conclusions from this review process were that the base price and production data underpinning the current Merino indexes needs to be updated. Industry feedback also reported a strong demand for the inclusion of new traits and changing emphasis on existing traits. For this reason, Sheep Genetics will introduce 5 new MERINOSELECT research indexes to better cater to the needs of Merino producers. These indexes will be implemented in the results of the 21st June analysis.

Updates to SHEEPOBJECT software

As part of the review process, it was identified that the software in which indexes are developed, the SHEEPOBJECT software, required updating to an improved bio-economic model that can better incorporate feedback from the industry review.

The updated SHEEPOBJECT bio-economic model has improved flock structure modelling. The updated model now accommodates a multiyear age structure at a flock level, where the economic performance of the system is evaluated over a 12-month period. Modelling includes farm events, inputs, outputs, physiological status of every animal, and the influence of genetics on reproduction throughout the year. This allows for the improved calculation of feed requirements throughout the year, and the incorporation of newer and more complex traits, including condition score and component reproduction, into indexes. This new model also provides the capacity to include important sustainability traits in the future, such as methane and feed efficiency.

New Merino research indexes

The new Merino research indexes will be released with the results of the 21st of June 2023 analysis.

Industry consultation and improving transparency around the core assumptions and goals of these indexes have been a large focus throughout the development of the new Merino research indexes. Sheep Genetics and AGBU have consulted with producers through interviews and

surveys to best capture ‘real-world’ commercial production system and breeding objective data. This process highlighted the diversity of the sheep production industry and brought to light the difficulties in aligning production systems and breeding objectives, and therefore industry indexes.

As with previous indexes, the re-development aims to summarise common production systems to provide more clarity and fair comparison of animals as a first round of selection decisions. The results of the surveys found businesses putting emphasis on two main production systems: wool production, and maternal performance and lamb growth.

The new Merino indexes will be released in a research capacity alongside the existing indexes for a period of 12 months. This will allow for continued industry consultation and ongoing review of the new indexes before they replace the existing indexes in 2024. More detail on final indexes will be made available prior to their release in June.

Who is impacted?

MERINOSELECT breeders

The introduction of the new indexes is driven by an increased industry focus on welfare and sustainability in the sheep industry. These aim to provide more relevant indexes for sheep producers going forward.

Preparing for the 2023 Analysis Enhancements

Below is a check list of tips to help you understand the 2023 Analysis Enhancements

- ✓ Review this booklet on the enhancements that impact the analyses you submit data to
- ✓ Watch the short videos on-line explaining each of the enhancements that impact you
- ✓ Check the percentile bands for indexes and traits to “re-benchmark” yourself
- ✓ Take time to review the results section of the website including reviewing your Data Quality Score Report
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- ✓ ownload a new set of results into your software to ensure that the ASBVs you are looking at reflect the Analysis Enhancements

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