



GeneSeek

GGP-LD & GGP-HD

The GeneSeek Genomic Profiler products (GGP-LD & GGP-HD) that are commercially available from the Animal Genetics Laboratory at the University of Queensland are one of several sources of genomic information that are incorporated into Angus BREEDPLAN.

This fact sheet provides technical details regarding the GGP-LD and GGP-HD products, and the associated incorporation of GGP genomic predictions into Angus BREEDPLAN.

Understanding the GeneSeek GGP Products

The GGP products assesses the genetic makeup of black Angus cattle at approximately 20,000 (GGP-LD) or 80,000 locations (GGP-HD) across the animal's genome (known as SNPs or single nucleotide polymorphisms) to obtain a genetic profile for the animal, which is used to calculate a genomic prediction of an animal's genetic merit.

The GGP-LD is a lower density, lower cost version of the GGP-HD product and delivers genomic predictions for the same suite of traits and with comparable accuracy to the GGP-HD.

Traits included in the GeneSeek GGP Products

The GGP-LD and GGP-HD products calculate genomic predictions for over 20 traits, including:

Calving Ease Direct	Carcase Weight
Calving Ease Maternal	Rib Eye Area
Birth Weight	Rib Fat
Weaning Weight	Marbling
Yearling Weight	Docility
Mature Weight	Heifer Pregnancy Rate
Milk	Residual Feed Intake
Scrotal Size	Dry Matter Intake
Yearling Height	Tenderness
Mature Height	Average Daily Gain

Incorporation of GeneSeek GGP Products in Angus BREEDPLAN

As with other genomic tests, the GGP-LD and GGP-HD genomic predictions are best utilised by incorporation into Angus BREEDPLAN, whereby an estimate of an



Fast Facts

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- The GGP product assesses the genetic makeup of black Angus cattle at approximately 20,000 (GGP-LD) or 80,000 locations (GGP-HD) across the animal's genome (known as SNPs or single nucleotide polymorphisms) to obtain a genetic profile for the animal, which is used to calculate a genomic prediction of an animal's genetic merit.
- The GGP-LD is a lower density, lower cost version of the GGP-HD product and delivers genomic predictions for the same suite of traits and with comparable accuracy to the GGP-HD.
- As with other genomic tests, the GGP genomic predictions are best utilised by incorporation into Angus BREEDPLAN, whereby the genomic predictions are combined with pedigree and performance information to calculate EBVs with additional accuracy
- GGP genomic predictions are incorporated into Angus BREEDPLAN for 11 traits

animal's breeding value can be calculated by combining the genomic prediction with the pedigree and performance information that has been collected on the animal and its relatives.

To facilitate the incorporation of the GGP-LD and GGP-HD genomic predictions into Angus BREEDPLAN, the Animal Genetics and Breeding Unit (AGBU) in Armidale has undertaken research to determine the appropriate emphasis that should be placed on the genomic information in the calculation of the BREEDPLAN EBVs.

Given the genomic predictions from the GGP-LD product have comparable accuracy to those from the GGP-HD product, genomic predictions are incorporated in Angus BREEDPLAN for the same traits from both GeneSeek products (ie. GGP-LD & GGP-HD). Likewise, the same emphasis is placed on the GGP-LD and GGP-HD genomic predictions within Angus BREEDPLAN.

Traits to be Incorporated into Angus BREEDPLAN

Based on the results of the research and the subsequent recommendations provided by AGBU, genomic predictions from the GeneSeek GGP-LD and GGP-HD products are incorporated into Angus BREEDPLAN for 11 traits, including:

- | | |
|-----------------------|-------------------|
| Calving Ease Direct | Milk |
| Calving Ease Maternal | Scrotal Size |
| Birth Weight | Carcase Weight |
| Weaning Weight | Eye Muscle Area |
| Yearling Weight | Intramuscular Fat |
| Mature Cow Weight | |

For traits that are not incorporated into BREEDPLAN, there was either an insufficient relationship between the genomic prediction and the available performance information, considerable variation in the relationship between the genomic prediction and the available performance information, insufficient performance information available on which to examine the relationship with the genomic prediction, and/or no equivalent trait within BREEDPLAN.

Emphasis Given to GeneSeek GGP Genomic Predictions When Incorporating in BREEDPLAN

The emphasis given to the GGP-LD and GGP-HD genomic predictions within Angus BREEDPLAN can be described as the accuracy of the EBV that would be generated if the EBV was calculated from only the genomic prediction (i.e. there was no other information recorded with Angus BREEDPLAN).

The accuracy of the EBV that would be generated for each trait from the genomic prediction alone is outlined in Table 1.

Table 1 : Accuracy of BREEDPLAN EBV Calculated from GGP-LD & GGP-HD Genomic Prediction Alone	
Trait	Accuracy
Calving Ease Direct	21 %
Calving Ease Daughters	36 %
Birth Weight	49 %
200 Day Growth	36 %
400 Day Weight	42 %
Mature Cow Weight	32 %
Milk	30 %
Scrotal Size	41 %
Carcase Weight	26 %
Eye Muscle Area	33 %
Intramuscular Fat	35 %



The incorporation of GGP-LD and GGP-HD genomic predictions provides the most additional accuracy to the BREEDPLAN EBV for traits that are particularly difficult or costly to measure, such as carcass traits

Table 2 : Additional Accuracy of BREEDPLAN EBV When GGP-LD & GGP-HD Genomic Predictions Are Incorporated

Trait	Initial EBV Accuracy			
	20 %	40 %	60 %	80 %
Calving Ease Direct	+ 8%	+4 %	+2 %	+0 %
Calving Ease Daughters	+20 %	+10 %	+4 %	+1 %
Birth Weight	+31 %	+18 %	+8 %	+2 %
200 Day Growth	+20 %	+10 %	+4 %	+1 %
400 Day Weight	+25 %	+14 %	+6 %	+2 %
Mature Cow Weight	+17 %	+8 %	+4 %	+1 %
Milk	+15 %	+7 %	+3 %	+1 %
Scrotal Size	+24 %	+13 %	+6 %	+2 %
Carcase Weight	+12 %	+6 %	+2 %	+1 %
Eye Muscle Area	+18 %	+9 %	+4 %	+1 %
Intramuscular Fat	+19 %	+10 %	+4 %	+1 %

* For example, if an animal had a 200 Day Growth EBV with an accuracy of 60%, incorporation of the GGP genomic prediction would increase the accuracy of the EBV to 64%.

Additional Accuracy Provided by Inclusion of GeneSeek GGP for Angus in BREEDPLAN

While Table 1 provides the accuracy of the EBV that will be calculated from the GGP-LD and GGP-HD genomic predictions alone, in practice, the genomic predictions are incorporated with the pedigree and performance information recorded with Angus BREEDPLAN.

The additional accuracy provided by the incorporation of the GGP-LD and GGP-HD genomic predictions at differing levels of existing EBV accuracy is outlined in Table 2.

As is evident from the table, the additional accuracy that is provided by the incorporation of the genomic prediction differs subject to the accuracy of the animal's existing EBV, with the most additional accuracy being provided in situations where an animal's existing EBV has low accuracy. For example:

- When an animal is very young
- For traits that are hard to measure, or traits that cannot be measured prior to an animal entering the breeding herd
- For traits that have a low heritability
- In situations where collecting effective performance information is problematic, such as in small herds, or when an animal has been removed from its contemporary group
- In situations where little information is recorded with Angus BREEDPLAN for the animal, such as recently imported overseas sires

The incorporation of GGP-LD and GGP-HD genomic predictions will add minimal accuracy to the EBVs for animals whose existing EBV has high accuracy.

Analytical Considerations When Incorporating GeneSeek GGP for Angus Genomic Predictions into Angus BREEDPLAN

The analytical process that is used to incorporate GGP-LD and GGP-HD genomic predictions into Angus BREEDPLAN includes:

- The genomic predictions for an animal are only incorporated into the calculation of the EBVs for the individual animal itself. The genomic predictions do not contribute to the EBVs for the animal's relatives (eg. its parents or progeny).
- Likewise, the genomic prediction for a trait is only incorporated into the calculation of the respective BREEDPLAN EBV for that individual trait. The genomic prediction is not incorporated into the calculation of the BREEDPLAN EBV for correlated (or related) traits.
- In situations where animals have been genotyped on multiple occasions with either the GGP-LD or GGP-HD product, or have been genotyped with both the GGP-LD and GGP-HD products, the genomic predictions from the most recent genotype will be incorporated into BREEDPLAN.
- In situations where genomic predictions from multiple genomic companies are available on an animal for an individual trait (e.g. GeneSeek, Zoetis, Beef CRC), the genomic prediction that is given the highest emphasis within BREEDPLAN will be used in the calculation of EBVs for the animal.

Changes to BREEDPLAN EBVs

Changes to the EBVs of an animal are expected when GGP-LD and GGP-HD genomic predictions for the animal are incorporated into BREEDPLAN. The magnitude of the change in EBVs will differ for each

individual animal depending on factors such as the accuracy of the animal's existing EBV, the magnitude of the individual animal's genomic prediction, and the relative emphasis that is used when incorporating the genomic prediction for each respective trait within the BREEDPLAN analysis.

Use of GeneSeek GGP for Red Angus, or Animals on Multibreed Register

Research has shown that the accuracy of a genomic prediction erodes considerably as the relationship between the animal being tested, and the animals on which the genomic prediction was developed decreases.

It is anticipated that the GGP-LD and GGP-HD genomic

predictions have been developed using predominantly black Angus animals, and accordingly, only black Angus animals should be considered for testing with the GGP-LD and GGP-HD genomic predictions.

The accuracy of the GGP-LD and GGP-HD genomic predictions for Red Angus animals, or animals recorded on the Multibreed Register is unknown.

Further Information

To further discuss the GeneSeek GGP-LD and GGP-HD products, please contact staff at Angus Australia. Information is also available by contacting staff at the Animal Genetics Laboratory at the University of Queensland.

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