AUSTRALIAN WAGYU ASSOCIATION™

WAGYU TECHNICAL
UPDATE

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TURNING DATA INTO USEABLE INFORMATION

PHENOTYPE ≠ GENOTYPE

The way an animal looks does not equal its genetic merit (the production value of its genes). Animal growth, development and carcase traits like marbling, are heavily impacted by the management conditions that animals are produced under and the health and sickness history of the individual.

Whist the saying "*You can't manage it if you don't measure it*" is certainly true, equally, *just because you measure it, it doesn't mean that you can do anything about managing it!* That is, unless you can turn measurement data into useful information that you can then use to make good decisions.

The key to making genetic improvement in your herd is to turn data into information that can help you make better breeding and selection decisions. Genetic evaluation systems are designed to do this for you by removing the noise in data and determining what the best estimate of genetic merit of an animal is.

> "Just because you can measure it, it doesn't mean you can do anything about managing it , unless you can turn data into useful information that you can use to make good decisions.

Genetic evaluation through Wagyu BREEDPLAN uses pedigree, performance data and genomics. It uses data from several sources to calculate the genetic merit of an animal (the Estimated Breeding Value - EBV). This is done using data for many traits and is collected across many herds.

In doing this, EBVs can account for the noise across a range of production systems and reflect the best estimate of genetic merit of all animals registered with the Australian Wagyu Association.

To demonstrate, three typical scenarios have been prepared to illustrate how data contributes to EBVs under different situations. In preparing these

scenarios, we acknowledge that each individual in Wagyu BREEDPLAN will have its own specific family structure and performance recording history. As such, the scenarios provided are *examples only* and are for the purposes of demonstrating the principles of how different sources of data can contribute to EBVs. The scenarios are:

1. How data contributes to the Marble Score EBV of a sire
2. How data contributes to the 200 Day Weight EBV of a sire
3. How data contribute to the Marble Score EBV of a slaughter steer

This article will not focus on how genomics contributes to EBVs, it will focus on the contributions of performance recording only.

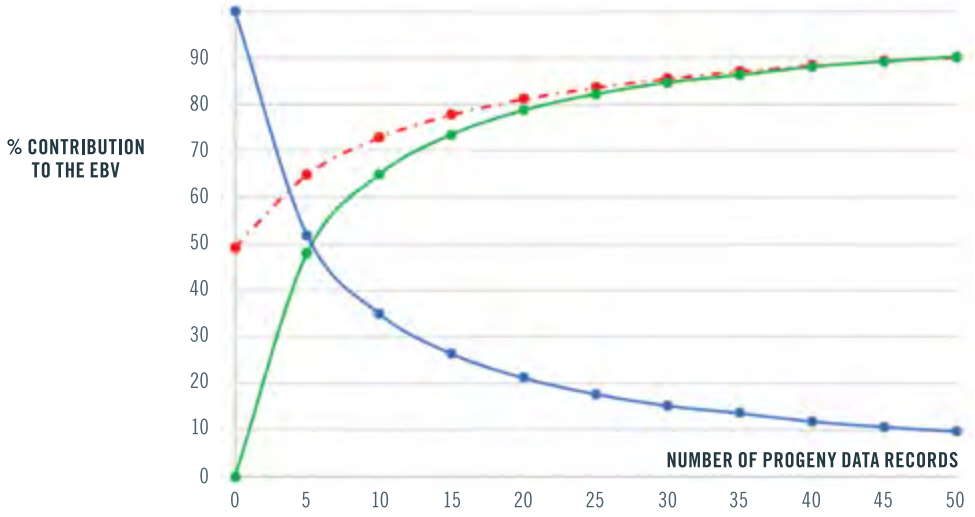


FIGURE 1

How data contributes to the Marble Score EBV of a typical sire.

1. HOW DOES DATA CONTRIBUTE TO THE MARBLE SCORE EBV OF A SIRE?

For a sire, we will never get useable data on his own marbling score, as he will never be slaughtered under standard production practices. We need to estimate his genetic merit using data from his progeny, his relatives and their progeny.

The following example is provided to demonstrate how different sources of data contribute to the Marble Score EBV of a typical sire aptly named 'TYPICAL'.

As with all Wagyu, TYPICAL is part of a family and in his case, he has four full siblings (he was part of an embryo flush with common sire and dam) and 20 half siblings (TYPICAL's sire was used across 20 different cows). The data contributing to TYPICAL's sire and dam EBVs and the performance records for the full siblings and half siblings makes up the pedigree information that contributes to TYPICAL's EBV when he is first registered with the AWA.

As shown in the Blue pedigree line in Figure 1, when TYPICAL has none (0) of his own progeny recorded for Marble Score, all of the information (100%) is coming from the pedigree data and 0% is being contributed from the progeny (green line) of TYPICAL.

Because there is a good amount of data coming from the pedigree of TYPICAL due to the number of other animals in his family and measurements made on them, the EBV accuracy (red dashed line) for TYPICAL is about 50% before any of his own progeny have Marble Score results recorded.

Once TYPICAL begins getting carcase data with Marble Scores submitted for his own progeny, these quickly start to contribute to TYPICAL's EBV. With five progeny records submitted for TYPICAL, progeny data contributes almost 50% of his EBV, with the pedigree data contributing the other 50%. As performance records on TYPICAL are submitted, the accuracy of the EBV increases to 65% as there is now more information being used to calculate the EBV.

As more carcase marble score data for progeny of TYPICAL is submitted to Wagyu BREEDPLAN, the relative weighting on that data continues to rise such that at 50 progeny records, the progeny data contributes 90% of the weighting of the EBV and pedigree information accounts for 10%. EBV accuracy for TYPICAL is then also close to 90% as he is a well recorded sire.

> “ Genetic merit contributes to phenotype, but is only part of the story and explains why the EBVs (genetic merit) don't exactly match the phenotypic difference of slaughter animals.

2. HOW DOES DATA CONTRIBUTE TO THE 200 DAY WEIGHT EBV OF A SIRE?

This example will again use TYPICAL, using the same family structure. The difference in this scenario is that we can measure the 200 Day Weight of TYPICAL himself, giving a 200 Day Weight performance record for TYPICAL as another source of data contributing to his EBV.

In Figure 2, when TYPICAL has none (0) of his own progeny recorded for 200 Day Weight and prior to his own data being recorded for 200 Day Weight, all of the information (100%) contributing to the EBV is coming from the pedigree data (blue line).

Once TYPICAL has his own 200 Day Weight performance record submitted to BREEDPLAN, about 35% of the EBV is contributed by TYPICAL's own 200 Day Weight record (orange line) and about 65% from his pedigree data (blue line).

As progeny of TYPICAL begin to be recorded and start to contribute to TYPICAL's EBV (green line), the relative contribution of pedigree and TYPICAL's own data start to reduce. At 10 progeny records, the relative contribution of progeny data to TYPICAL's EBV is about 55%, with pedigree and TYPICAL's own record accounting for about 29% and 16% respectively.

As with TYPICAL's Marble Score example, as more progeny data for TYPICAL is submitted to Wagyu BREEDPLAN, the relative weighting on that data continues to rise, in this case towards 85% contribution at 50 progeny records. TYPICAL's own performance record continues to contribute a 5% weighting toward the EBV for 200 Day Weight, along with 10% coming from pedigree data.

FIGURE 2

How data contributes to the 200 Day Weight EBV of a sire.

The 200 Day Weight EBV has a higher heritability (0.4) compared to Marble Score (0.3). As a result, the initial accuracy of 200 Day Weight for TYPICAL is higher than that for Marble Score. The addition of TYPICAL's 200 Day Weight performance record also has a large effect on EBV accuracy. By the time 200 Day Weight data is entered for five progeny, the accuracy of TYPICAL's 200 Day Weight EBV is close to 80%. The equivalent accuracy for TYPICAL's Marble Score EBV was 65%.

The point here is that where an animal's own performance record is available, it does contribute strongly to the EBV, but in the case of a Sire, the performance of good numbers of progeny provide the best estimate of that Sires genetic merit and have the greatest influence on the EBV.

3. HOW DOES DATA CONTRIBUTE TO THE MARBLE SCORE EBV OF A SLAUGHTER STEER?

For this example, we can't use TYPICAL as he is now a proven sire. We will use a different animal, called USUAL, from a different family.

USUAL was castrated and fed out for slaughter in a management group with other animals. USUAL does not have the same large family structure as TYPICAL, hence the accuracy of his EBV prior to any data being recorded is low (about 38%) as shown in Figure 3.

USUAL does not have any data from his own progeny that can inform his EBV, hence the green progeny data line is missing from Figure 3. USUAL's Marble Score EBV will be contributed to by his own Marble Score record (orange line) and his pedigree information (blue line). His pedigree data will be added to over time with the addition of siblings that get recorded.

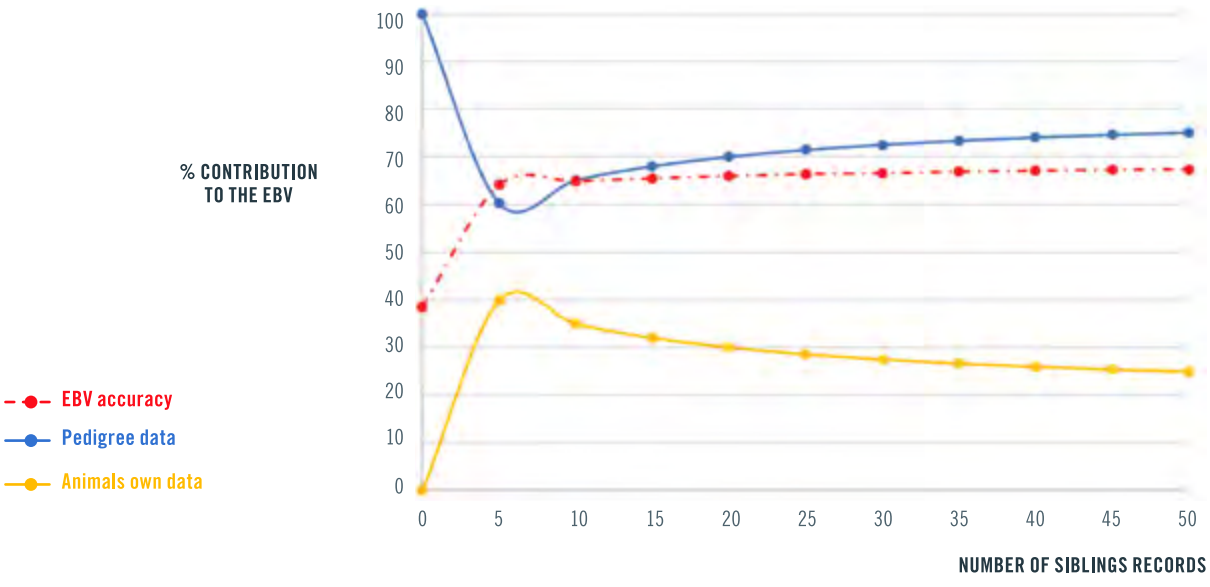
When USUAL was slaughtered, he was slaughtered with other animals in his management group (20 individuals) that included two full siblings and three half siblings. USUAL's Marble Score data and that of his five siblings was submitted to Wagyu BREEDPLAN. USUAL's own Marble score record contributed approximately 40% of the EBV (orange line), with information from the pedigree (including data from the five siblings) accounting for about 60% of the EBV weighting. The Marble Score EBV accuracy for USUAL increased to about 64% based on this performance recording data.

In the example of USUAL, as more half-siblings of USUAL (same sire but different dams) are slaughtered and their data is recorded, this strengthens the contribution of pedigree information to USUAL's Marble Score EBV. Conversely, it reduces the relative weighting placed on USUAL's own data record.

Therefore, genetic merit contributes to phenotype, but is only part of the story and explains why the EBVs (genetic merit) don't exactly match the phenotypic difference of slaughter animals.

FIGURE 3

How data contributes to the Marble Score EBV of a steer.



KEY MESSAGES PHENOTYPE ≠ GENOTYPE

The examples provided in this article are designed to explain the principles of how different sources of data contribute to EBVs under the 3 different scenarios. These examples show the general trends of how data contributes to EBVs and should not be taken to reflect the exact contribution to any specific animal.

- The phenotype of an animal (eg. the performance record for any trait) does not equal the genetic merit of an animal for a trait. Phenotype ≠ Genotype.
- Wagyu BREEDPLAN uses data from many sources and calculates the genetic merit of individuals based on phenotypic data and pedigree. It turns very complex data into useable information in the form of EBVs for a number of traits.
- For a sire, when progeny data is recorded for a trait and submitted to Wagyu BREEDPLAN, this has a large influence on the EBV.
- For a sire, when his own record is available for a trait (eg. 200 Day Weight), this contributes to the EBV, but once progeny data is recorded, progeny data will have a large influence on the EBV.
- For individual animals such as slaughter steers that do not produce their own progeny, EBVs are calculated using pedigree, including data submitted on siblings and performance data of the individual itself. The data from the pedigree and the siblings will have the largest influence on the EBV.
- Wagyu BREEDPLAN takes into account the performance records of an individual in estimating genetic merit in addition to other data. For this reason, the EBV of an individual may not directly reflect the phenotype of the individual. Genetic merit and phenotypic measurements are not the same thing.

MORE INFORMATION
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