TIPS & TOOLS

Understanding EBV Accuracy

An important consideration when making selection decisions using the TransTasman Angus Cattle Evaluation (TACE) Estimated Breeding Values (EBVs) is the accuracy of the EBV informatoin. The following information provides a guide to understanding EBV accuracy when making selection decisions.

What is EBV Accuracy?

By definition, an EBV is an estimate of an animal's true breeding value. The "accuracy" figure produced with each EBV provides an indication of the amount of information that has been used in the calculation of that EBV. The higher the accuracy, the more likely the EBV is to predict the animal's true breeding value and the lower the likelihood of change in the animal's EBV as more information is analysed for that animal, its progeny or its relatives.

How is Accuracy Reported?

Accuracy figures are reported as a percentage (%) between 0 – 99. In most cases where an EBV is presented, the accuracy of the EBV will be reported in either the column immediately following the EBV or the row beneath the EBV.

Interpreting EBV Accuracy?

The following guide is recommended when interpreting accuracy:

- less than 50% accuracy - the EBVs are preliminary. In this accuracy range the EBVs could change substantially as more direct performance information becomes available on the animal.
- 50-74% accuracy - the EBVs are of medium accuracy. EBVs in this range will usually have been calculated based on the animal's own performance and some pedigree information.
- 75-90% accuracy - the EBVs are of medium-high accuracy. EBVs in this range will usually have been calculated based on the animal's own performance coupled with the performance for a small number of the animal's progeny.
- more than 90% accuracy - the EBVs are a high accuracy estimate of the animal's true breeding value. It is unlikely that EBVs with this accuracy will change considerably with addition of more progeny data.

	Calving Ease Direct	Calving Ease Dtrs	Gestation Length	Birth Weight	200 Day Growth
EBV	+10.2	+6.7	-9.3	+1.9	+36
Acc	60%	55%	81%	73%	68%
Perc	4	12	1	7	87

Figure 1. EBV accuracy figures are reported as a percentage (%) between 0 and 99.

What Influences the Accuracy of an EBV?

A range of factors influence the accuracy of an EBV including:

- The heritability of a trait: Heritability is defined as the proportion of observable differences in a trait between individuals within a population that is due to genetics. The higher the heritability of a trait, the higher the EBV accuracy, all other variables being equal. For example, this is one of the reasons why we generally see higher accuracies for the Weight EBVs (e.g. 400 Day Weight) compared to the Days to Calving EBV.
- The accuracy of the parents: An animal that has sire and/or dam with high EBV accuracy will generally have higher accuracy EBVs compared to an animal with parents of lower accuracy as more information is known about the relatives of the animal.
- The amount of performance information available: EBV accuracies will increase as more performance information is analysed for a specific trait. This includes performance information on the animal itself, as well as progeny records. EBV accuracies of 90% and greater are generally only observed on animals that have had progeny with performance recorded for the specific trait.
- Effectiveness of performance information: Animals that are in large contemporary groups will generally have higher EBV accuracy compared to those in small or single animal contemporary groups.
- Genetic correlation with other measured traits: As TACE uses a multi-trait model, genetic correlations between traits are utilised to calculate EBVs and associated accuracies. For example, recording 200 day weight will also add information to the generation of the 400 Day Weight EBV. Therefore herds that are recording a range of traits (e.g. calving ease, weight, fertility, carcase) will have higher EBV accuracies than a herd that is undertaking limited recording (e.g. 200 day weights only).
- Availability of genomic information: Animals for which genomic information is available will generally have higher EBV accuracies, especially in cases when there is only a minimal amount of pedigree and performance information recorded for the animal (e.g young animals).

EBV Accuracy Confidence Ranges

The maximum likely change to EBVs at different accuracy levels is described by the confidence range (also known in statistical circles as the standard error of estimate). The size of this value decreases as the accuracies increase.

Statistically, there is a 67% chance that an animal's true breeding value will be within 1 standard error of its EBV, and a 96% chance that it will be within 2 standard errors of its EBV. As an example, Table 1 shows the TACE confidence ranges associated with different accuracy levels for various traits.

For example, a 600 Day Wt EBV with an accuracy of 90% will have a confidence range of ± 9.5 kg. If an animal's EBV is +100 then, with the addition of further information (e.g. progeny or sibling records), the EBV would be expected to still fall within the range of +90.5 kg to +109.5 kg (i.e.100 ± 9.5kg) 67% of the time; and, within the range of +81 kg to +119 kg (i.e.100 ± (2 X 9.5)kg) 96% of the time.

		Accuracy														
Trait	Units	***30%***	***35%***	***40%***	***45%***	***50%***	***55%***	***60%***	***65%***	***70%***	***75%***	***80%***	***85%***	***90%***	***95%***	***99%***
Gestation Length	days	3.4	3.4	3.3	3.2	3.1	3.0	2.9	2.7	2.6	2.4	2.2	1.9	1.6	1.1	0.5
Birth Wt.	kg	2.1	2.1	2.0	2.0	1.9	1.8	1.8	1.7	1.6	1.5	1.3	1.2	1.0	0.7	0.3
200 Day Wt.	kg	8.2	8.1	7.9	7.7	7.5	7.2	6.9	6.5	6.1	5.7	5.2	4.5	3.8	2.7	1.2
400 Day Wt.	kg	13.7	13.4	13.1	12.8	12.4	12.0	11.5	10.9	10.2	9.5	8.6	7.5	6.2	4.5	2.0
600 Day Wt.	kg	20.7	20.5	20.0	19.5	18.9	18.2	17.5	16.6	15.6	14.4	13.1	11.5	9.5	6.8	3.1
Mature Cow Wt.	kg	27.8	27.3	26.7	26.0	25.2	24.3	23.3	22.1	20.8	19.3	17.5	15.3	12.7	9.1	4.1
Milk	kg	7.5	7.3	7.2	7.0	6.8	6.5	6.3	5.9	5.6	5.2	4.7	4.1	3.4	2.4	1.1
Scotal Size	cm	1.2	1.2	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.9	0.8	0.7	0.6	0.4	0.2
Days to Calving	days	5.9	5.8	5.7	5.5	5.4	5.2	5.0	4.7	4.4	4.1	3.7	3.3	2.7	1.9	0.9
Carcase Weight	kg	15.4	15.2	14.8	14.4	14.0	13.5	12.9	12.3	11.6	10.7	9.7	8.5	7.1	5.1	2.3
Rib Fat	mm	2.1	2.1	2.0	2.0	1.9	1.8	1.8	1.7	1.6	1.5	1.3	1.2	1.0	0.7	0.3
Rump Fat	mm	2.5	2.4	2.4	2.3	2.2	2.2	2.1	2.0	1.9	1.7	1.6	1.4	1.1	0.8	0.4
Eye Muscle Area	cm^2	3.3	3.3	3.2	3.1	3.0	2.9	2.8	2.7	2.5	2.3	2.1	1.8	1.5	1.1	0.5
Retail Beef Yield	%	1.6	1.6	1.6	1.5	1.5	1.4	1.4	1.3	1.2	1.1	1.0	0.9	0.7	0.5	0.2
Intramuscular Fat	%	1.1	1.1	1.0	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.7	0.6	0.5	0.4	0.2
NFI (Feedlot)	kg/day	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.2	0.1

Table 1. Confidence ranges for EBVs at different levels of accuracy

EBV Standard Error Graphs

To assist with the understanding of confidence ranges, a graph has been developed when viewing animals within the Angus database search on the Angus Australia website.

Known as the EBV Standard Error graph, it depicts in graphical form the possible change in an animal's EBVs for each trait. The horizontal bar for each trait displays one standard error either side of the current EBV value, meaning that statistically, there is a 67% chance that the true breeding value for this trait will be within this range.

Figure 2 shows an example EBV Standard Error graph for a young animal of lower accuracy, compared to a proven sire of higher accuracy.

Considering EBV Accuracy for a Group of Animals

While it is easy to focus on the accuracy of an individual animal's EBVs, the genetic composition of a breeding herd is normally influenced by multiple animals. Consequently, the accuracy of the EBVs in describing the breeding value for multiple animals is an important consideration. For example, how accurate are the average EBVs for the bulls used in either a particular joining, or over subsequent joinings, in describing the genetics that they are delivering to the breeding herd?

In a commercial operation, this may be better considered as the accuracy of the EBVs in describing the genetics for the bulls that have been purchased, either in a single year, or over a number of subsequent years.

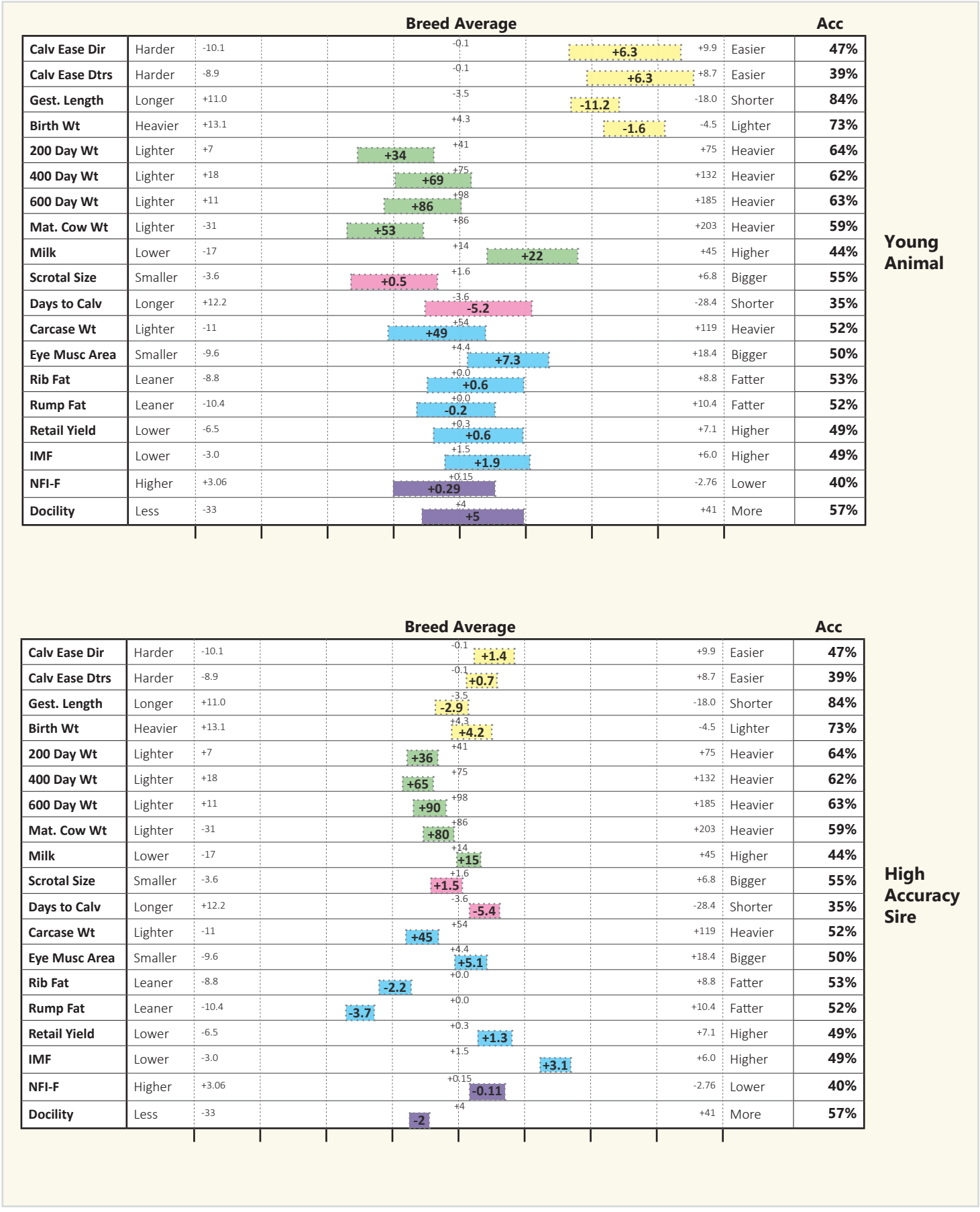

Figure 2. Example EBV Standard Error graph for a Proven Sire and Young Animal

Figure 3 illustrates the EBV accuracy for a group (or team) of animals with an average individual EBV accuracy of 50% for a trait. While each individual bull within the team may have a relatively "low" EBV accuracy for the trait, the combined accuracy of the EBVs for the entire team of animals will be considerably higher.

An individual bull with an EBV of relatively low accuracy of 50% has some level of uncertainty attached and the EBV could change significantly as more information is analysed. If there is a bull team of two however, both with 50% accuracy for the EBV, the combined accuracy of their average EBVs in describing their combined genetic value (i.e. the genetics of the bull team) is considerably higher at 79%. If there are ten bulls in the team, all with 50% accuracy for the EBV, the accuracy of the average EBVs in describing the genetics for the bull team will be 96%.

Individually, some bulls within the team will perform above expectation, some will perform below expectation, and some will perform exactly as expected. However, the average EBVs of the team of bulls will have considerably higher accuracy, and hence be a reliable indicator of the genetics that they are delivering to the breeding herd.

Considering Accuracy in Selection Decisions

Although the accuracy of an EBV should be considered when making selection decisions, animals should generally be compared on EBVs regardless of accuracy. Even at low accuracy, the EBV will take into account all the pedigree, performance and genomic information that is available for the animal and be the most reliable estimate of the animal's genetics for that respective trait.

In the case where animals have similar EBVs, the animal with the higher accuracy may be considered more preferable because the results can be predicted with more confidence (i.e. less risk).

The risk associated with low EBV accuracy can be managed through:

- The use of animals with higher accuracy EBVs. For example, utilisation of proven sires through artificial insemination.
- Spreading the risk of using younger, lower accuracy animals by using multiple bulls within a joining program and/or turning bulls over more regularly.
- Sourcing bulls, females and genetic material (e.g. semen, embryos) from herds with a history of comprehensive performance recording.
- In seedstock herds, conducting a higher level of performance recording across a range of traits, managing the seedstock herd to maximise the effectiveness of the performance information that is collected. (e.g. maximising contemporary group size), and giving consideration to the collection of genomic information.

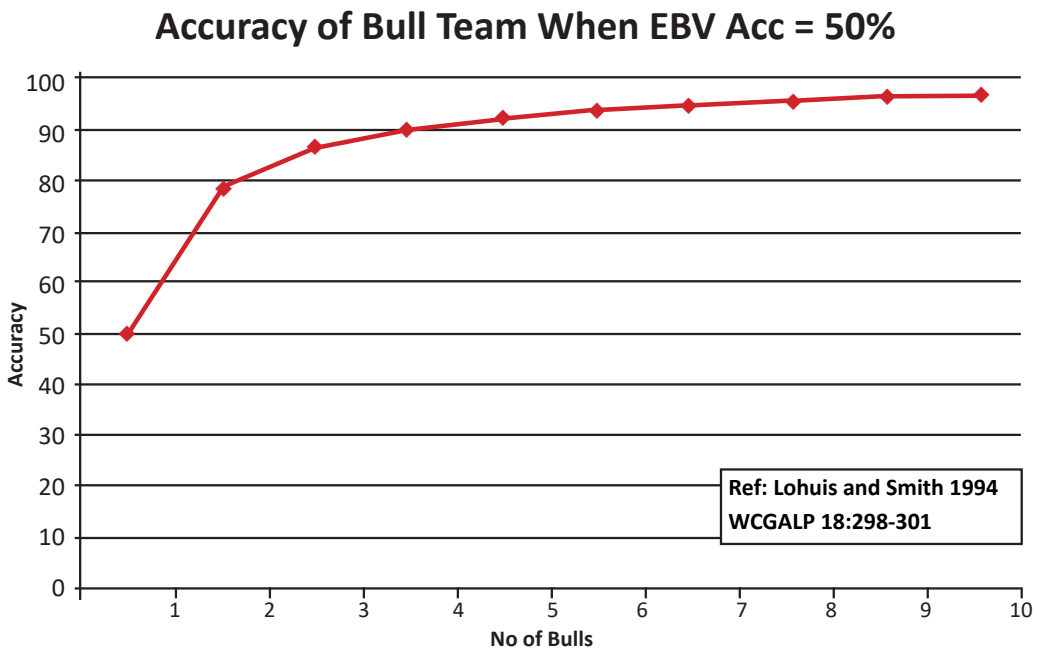

Figure 3. Accuracy of EBVs for a Bull Team when EBV Accuracy of Individuals is 50%. Note: as bulls within the team become related (eg. half sibs), the increase in accuracy decreases.

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