SBTS TBTS

TechTalk

June 2013

Understanding EBV Accuracy

An important step when making selection decisions using BREEDPLAN Estimated Breeding Values (EBV) is the consideration of EBV accuracy. The following information provides a guide to understanding and utilising EBV accuracy in 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 (figure 1).

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.

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

Name/ID	Calving Ease Dir (%)	Calving Ease Dtrs (%)	Gestation Length (days)	Birth Wt. (kg)	200 Day Wt. (kg)	400 Day Wt. (kg)	600 Day Wt. (kg)	Mat. Cow Wt. (kg)	Milk (kg)	Scrotal Size (cm)	Days to Calving (days)	Carc Wt. (kg)
NURG368	+1.6	-0.1	-5.4	+5.0	+49	+87	+111	+96	+13	+1.9	-5.2	+6
	48%	41%	69%	78%	73%	72%	69%	59%	44%	75%	37%	61%
Breed Avg												

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

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 BREEDPLAN 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).

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 Trans-Tasman Angus BREEDPLAN 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 ± 8.5 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 +91.5

Table 1. Confidence ranges for EBVs at different levels of accuracy (Angus Example)

	Accuracy										
Trait	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	99%
Gestation Length (days)	2.1	2	1.9	1.8	1.7	1.6	1.4	1.3	1	0.7	0.3
Birth Wt. (kg)	2.1	2	1.9	1.8	1.7	1.6	1.4	1.3	1	0.7	0.3
200 Day Wt. (kg)	8.3	8	7.7	7.3	6.9	6.3	5.8	5.1	4.2	3	1.4
400 Day Wt. (kg)	13.5	13	12.4	11.8	11.1	10.3	9.3	8.2	6.8	4.9	2.2
600 Day Wt. (kg)	16.8	16.2	15.5	14.8	13.9	12.8	11.6	10.2	**8.5**	6.1	2.7
Mature Cow Wt. (kg)	26	25.1	24	22.8	21.4	19.8	18	15.8	13.1	9.4	4.2
Milk (kg)	6.1	5.9	5.6	5.3	5	4.6	4.2	3.7	3.1	2.2	1
Scrotal Size (cm)	1.1	1.1	1	1	0.9	0.9	0.8	0.7	0.6	0.4	0.2
Days to Calving	5.4	5.2	5	4.7	4.4	4.1	3.7	3.3	2.7	1.9	0.9
Carcase Wt. (kg)	13.8	13.3	12.8	12.1	11.4	10.6	9.6	8.4	7	5	2.3
Eye Muscle Area (sq. cm)	2.1	2	2	1.9	1.7	1.6	1.5	1.3	1.1	0.8	0.3
Rib Fat (mm)	1.3	1.2	1.2	1.1	1	1	0.9	0.8	0.6	0.5	0.2
Rump Fat (mm)	1.7	1.7	1.6	1.5	1.4	1.3	1.2	1.1	0.9	0.6	0.3
Retail Beef Yield %	1.3	1.3	1.2	1.2	1.1	1	0.9	0.8	0.7	0.5	0.2
IMF% (Marbling)	0.8	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.4	0.3	0.1

kg to +108.5 kg (i.e.100 ± 8.5kg) 67% of the time; and, within the range of +83 kg to +117 kg (i.e.100 ± (2 X 8.5)kg) 96% of the time.

To assist with the understanding of confidence ranges, a graph has been developed when viewing animals within the EBV Enquiry facility on Internet Solutions. This is available for implementation by Breed Societies that have upgraded to ABRI's new generation of breed registry software known as ILR2.

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 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 many beef producers look at EBV accuracy in relation to an individual animal, it is also worthwhile considering how accurate the EBVs are in describing the genetics of groups of animals within a breeding program.

In conducting a breeding program, it is normal practice for multiple animals to influence the genetics of the breeding herd rather than just an individual. It is therefore important to understand the accuracy of the EBVs describing the breeding value for a group or team of animals.

For example, the EBV accuracy for the team of females being flushed in an embryo transfer program, or the team of bulls being joined. This may be a group of bulls used in a specific joining (e.g. Spring/Summer 2013) or a group of bulls used over subsequent joinings (e.g. all bulls used over last 3 years).

Figure 3 illustrates the EBV accuracy for a group (or team) of animals with an average EBV accuracy of 30% for a trait. While individual bulls within the team may have "low" EBV accuracy, the accuracy of the EBVs describing the breeding value for the entire team of animals will be considerably higher. Put in practical terms, while individually some bulls within the team will perform above expectation, some will perform below expectation and some will perform exactly as expected, across the entire team, the EBVs will describe the breeding value of the team of bulls with considerably higher accuracy.

For example, an individual bull with an EBV of relatively low accuracy of 30% has some level of risk attached as the EBV could change significantly as more information is analysed. If there is a bull team of two, averaging 30% accuracy for the EBV, the EBV accuracy for the bull team is considerably higher at 58% for a team of full sibs, 68% for half sibs and 74% for unrelated bulls.

Similarly, if there is a bull team of ten, averaging 30% accuracy for the EBV, the EBV

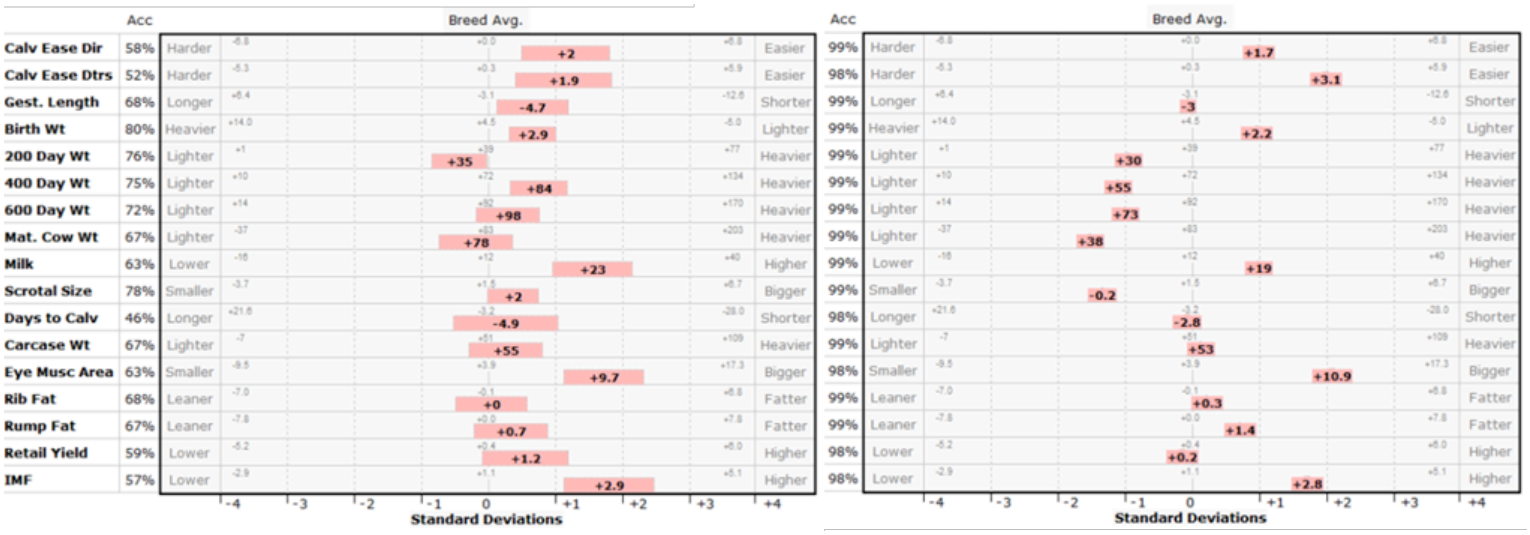

Figure 2 - Example EBV Standard Error graph for a Young Animal (left) and Proven Sire (right)

accuracy for the bull team is 74% for a team of full sibs, 88% for half sibs and 95% for unrelated bulls. For the same situation, but all with 60% accuracy for the EBV, the EBV accuracy for the bull team is 90% for a team of full sibs, 93% for half sibs and 97% for unrelated bulls.

The reason higher bull team EBV accuracy is observed for unrelated bulls, compared to half sib or full sibs, is due to there being less chance of a bias affecting the EBVs for all bulls in the team.

This shows that the risk of using bulls with relatively low individual EBV accuracy (e.g. yearlings) can be overcome by considering them is a bull team context, rather than individuals. This is a result of "*spreading-the-risk*" across the team, rather than "*putting-all-your-eggs-one-basket*" approach. This also suggests that a team of younger "unproven" bulls can be competitive, in terms of EBV accuracy, to an individual "proven" sire.

Consider Accuracy in Selection

Although the accuracy of an EBV should be considered, animals should generally be compared on EBVs regardless of accuracy as they are still the best estimate of an animal's breeding value. In the case where animals have similar EBVs, the animal with the higher accuracy would be preferable because the results can be predicted with more confidence (i.e. less risk).

If seedstock producers prefer to minimise risk through the use of animals with higher accuracy EBVs, consideration could be given to:

- Undertaking a higher level of performance recording across a range of traits and managing their seedstock herd to maximise contemporary group size.
- Sourcing bulls, females and genetics (e.g. semen, embryos) from herds with a history of performance recording.
- Using high accuracy proven sires (e.g. AI sires) or dams.
- Spreading the risk of using younger, lower accuracy animals by utilising the bull "team" approach.

References:

Lohuis, M.M and Smith, C. (1994). Risk associated with teams of bulls. *Proceedings of the 5th World Congress of Genetics Applied to Livestock Production* **18:**298-301

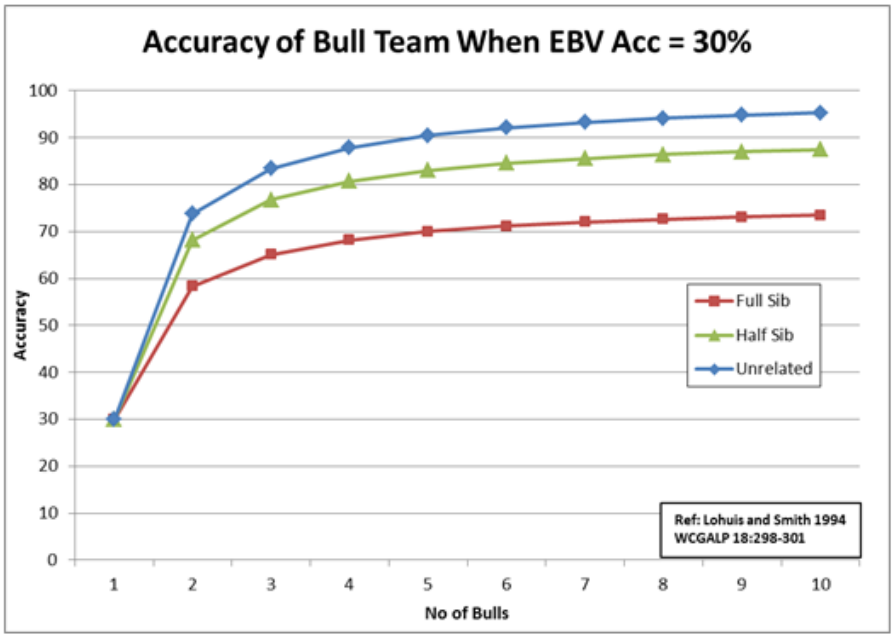

Figure 3 – Accuracy of a Bull Team when EBV Accuracy of Individuals is 30%