BREEDPLAN basics and their application to industry

Sharon Pettiford and Brian Sundstrom
CRC for Cattle and Beef Quality, CJ Hawkins Homestead, University of New England, Armidale NSW 2351 • Ph: (02) 6773 3501 • Fax: (02) 6773 3500
Email: spettif2@metz.une.edu.au

What is BREEDPLAN

BREEDPLAN is an international beef performance recording and evaluation scheme. BREEDPLAN is a computer-aided model that is used for generating and predicting estimated breeding values of cattle. Estimated Breeding Values (EBVs) are predictions of an animal's genetic merit based on available performance data on an individual animal and its relatives.

How are EBVs measured?

A key step in the calculation of EBVs is the measuring of the performance of individual animals within a contemporary group. Each animal is then compared to the average of other animals in that group. A contemporary group consists of the same sex and age class within a herd, run under the same management conditions and treated equally.

EBVs are calculated for different traits, including the areas of:

- Calving ease
- Fertility traits
- Growth
- Maternal traits
- Carcase attributes

EBVs are calculated from:

- The animal's own performance (eg weights, scrotal size and other factors)
- The performance of relatives (eg parents, relations and progeny in all linked herds)
- Other related measurements (eg yearling and weaning weight for example) that are genetically linked so both weights contribute to estimates of the other trait.

The great benefit of BREEDPLAN for the Australian Beef Industry is that it allows much more than an individual's own performance to be used. The known performances of relatives (eg mum, dad, brothers, sisters and progeny) are added to improve the accuracy of an EBV of a particular animal. The more information that is available for an animal and its relatives, the more accurate the estimated breeding value will be. That is, the more history that is known about the animal the better and more accurate the model is at predicting the animals performance.

Understanding EBVs

EBVs are expressed in the units of measurement for each trait such as kgs for growth traits. They are shown as a positive (+ve) or negative (-ve) difference from the breed base. For example a bull with and EBV of +50kg for 600 day weight is estimated to have a genetic merit 50 kg above the breed base. (Set at zero and held constant.) Since the breed base is set to a historical benchmark. The average EBVs of animals in each year drop usually changes as a result of genetic progress within the herd or the breed. Therefore, it is usually more imporant to know how an animal or a herd compares to current average, rather than the base (refer Table 1).

When using EBVs to assist in selection decisions it is important to achieve a balance between the different groups of traits and to place emphasis on those traits that are imporant to your herd, your markets and your environment. For example if you are selecting a steer for the long--fed feeder steer market you will concentrate more on teh 600 Day weight EBV. Alternatively, if selecting for the domestic market look at the 400 Day weight EBV.

The value of BREEDPLAN in making comparison between animals

When using EBVs to assist in selection decisions it is important to remember that only half the EBV differences between the animals are expressed int heir progeny.

Example One:	600-Day Wt. EBV
Bull A	+40kg
Bull B	+20kg

The expected difference in 600 day weight of calves from Bull A to Bull B

1/2 x (40kg-20kg) = 10kg per calf (at 600 days)

Total extra turnoff weight over two years using Bull A as opposed to Bull B with 10 calves:

10 calves x 2 years x 10kg = 200Kg

This simple exercise can be a useful tool to assist in determining the potential extra money you can expect to gain from using a bull with superior growth EBVs

Accuracy of BREEDPLAN EBVs

EBVs are estimates of the real breeding values of animals. As mentioned earlier EBVs are based on averages and are calculated from varying amounts of data. Individuals are therefore expected to perform within a predictable range around the estimate rather than precisely as estimated.

Table 1. Group BREEDPLAN EBVs - 2002

		GROUP BREEDPLAN EBVs – 2000					
		Birth Weight (kg)	200-Day Milk (kg)	200-Day Growth (kg)	400-Day Weight (kg)	600-Day Weight (kg)	Scrotal Size (cm)
Bull A	EBV	+7 kg	+3 kg	+16 kg	+28 kg	+40 kg	+0.0
	Acc.	95%	70%	85%	80%	80%	85%
Bull B	EBV	+1 kg	+8 kg	+8 kg	+12 kg	+20 kg	+1.3
	Acc.	85%	60%	80%	70%	75%	80%
Breed Av. ('98 born bulls)		+1.8 kg	+3 kg	+10 kg	+16 kg	+24 kg	+0.0

In the table above accuracy figures are expressed as %. This is an indication of how much information has been provided and collected and hence will have some impact on the reliability of the EBV.

The lower the accuracy, the bigger the range within which an EBV is expected to change as more information is collected. The EBV has an equal chance of increasing or decreasing.

The higher the accuracy, the less chance there is for change as more information is collected.

(Refer page 50 Better Bull Buying Book)

<60 %	The EBV should be considered a preliminary estimate, which could change substantially as more performance information becomes available. Most 'non-parent' animals, that is those without progeny will fall within this range.
61-74%	Low accuracy EBV useful for screening "best bet" animals. Still subject to considerable change as progeny records become available for the analysis.
75-89%	Medium accuracy, which includes some progeny information. The EBV is becoming a reliable indicator of the animal's value as a parent but still subject to change.
90-95%	High accuracy EBV and unlikely to change much with the addition of more records.
>95%	Very high estimates of the animal's true breeding value, a case of "what you see is what you get"
Remember	No matter what that accuracy, it is still the best estimate available and equally likely to go up or down as further information comes into BREEDPLAN.

Comparing Cattle on different properties and separating genetics from Environment

(refer page 46 in Better Bull Buying Book)

One of the most difficult concepts for people to grasp and understand with BREEDPLAN is how the model is able to differentiate between the amount of animals' performance that is due to the effect of the environment and that which is due to genetic influence (this is termed the Genotype x Environment interaction). That is, how can animals that are treated very differently be compared to each other. For example how can animals on lush green irrigated pasture in Tasmania be compared to animals that re being grazed on native pasture in western NSW. IT CAN BE DONE…..

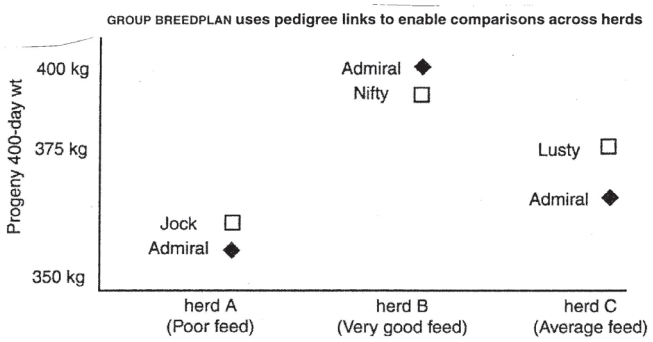
BREEDPLAN is capable of separating genetics from environment in two ways:

1. When recording data on your performance forms it is imperative to note that any individuals or mobs that have been treated differently be put into management groups. For example, if an animal is sick at the time of weighing, this needs to be noted so that it is compared to other sick animals "within" these groups and then linked to others.

2. By having link animals in the various mobs such as a sire on one property with progeny in three mobs or another example is an AI link sire with progeny in three herds.

Example:

Table 2. Group BREEDPLAN Comparison Example



If we have three properties:

- Herd A is on poor feed
- Herd B is on very good feed
- Herd C is on average feed

They all use the same sire (link sire) called Admiral by Artificial insemination and then compare his progeny with those of a different home sire that they each use at their respective properties

- Herd A uses Jock
- Herd B uses Nifty
- Herd C uses Lusty

When comparing Jock, Nifty and Lusty to the link sire (Admiral), for 400 day weight, Jock tested genetically superior to Nifty. This is because Jock's progeny were heavier than Admiral's in poor feed conditions so we would expect him to do even better again once placed on very good feed. Since Admiral is genetically superior to

Nifty we can therefore say that Jock is genetically superior to Nifty. It can be said that Lusty has the greatest genetic potential because of the greater differences in the 400-day weight of the progeny of Admiral and Lusty under the same average feed conditions. Therefore we would expect that Lusty would be superior to Jock and Nifty.

If we now put some actual weight differences on the progeny groups:

Jock vs Admiral = +5kg
Nifty vs Admiral -= -5kg
Lusty vs Admiral = +10kg

The progeny differences are doubled to create EBVs. For example Lusty will pass half of his genes onto his progeny (like all sires and dams). As can be seen above, he has produced progeny 10kg above the link sire Admiral. Therefore to work out his breeding value we double what he has passed onto his progeny (2 x +10kg = +20kg)

So,

Jock	Nifty	Lusty	Admiral
+10kg	-10kg	+20kg	0kg

The above calculations have assumed Admiral as a base animal of 0kg (remember above breed base of 0kg) and sufficient progeny are measure for reliable estimates. With lower progeny numbers and traits of lower heritability, the initial EBVs will be less than double the progeny differences.

Conclusion:

BREEDPLAN is a very useful tool when selecting animals for your breeding herd. It is also important to take into account the survivability and structural soundness of animals too. BREEDPLAN is the best method of generating and predicting an animal's performance. By using and understanding BREEDPLAN correctly you will be increasing the genetic performance and capacity of your herd over time.