



BREEDPLAN and the bull buyer

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This Agriculture Note introduces BREEDPLAN and outlines how BREEDPLAN can be used as a selection tool when purchasing bulls. It covers interpreting BREEDPLAN figures and includes exercises for producers to practice using the technology.

The bull buyer's dilemma

Buying bulls at a sale can be difficult. How do you tell if that's the best fed animal or the best animal genetically? You can visually check structural soundness and you may have experience with some studs or sire lines. However a better indicator of likely breeding values for growth rates, milking ability, carcase attributes and female fertility levels, would be helpful.

Buying bulls on the property allows better comparison within that herd, but how do you compare these cattle with other herds?

BREEDPLAN can help

BREEDPLAN is an International beef cattle performance recording and evaluation scheme. It has been available since 1985. There are now more than 2300 herds in Australia and over 7100 herds overseas enrolled in BREEDPLAN. Beef cattle breed societies that are currently enrolled in BREEDPLAN are located in Australia, New Zealand, North America, Canada, South America, Southern Africa, Asia and Europe. BREEDPLAN now conducts Trans-Tasman analyses for most temperate breeds. Several breeds are in various stages of planning and implementing international BREEDPLAN evaluations with their overseas counterparts.

Calculation of breeding values

BREEDPLAN is a computer-aided system for estimating the breeding values of cattle. These estimates are called Estimated Breeding Values (EBVs). EBVs are calculated by measuring the performance of individual animals (e.g. for growth, calving ease and carcase attributes) and comparing this with their contemporaries run under the same conditions. That is of course an age-old technique.

What is clever about BREEDPLAN is that sophisticated computers programs are used to incorporate pedigree record information as well. This allows much more than the individual's own performance information to be used. The known performance of relatives (parents, brothers, sisters and their own progeny) are included to improve the accuracy of an EBV.

Information on how traits are correlated with each other is also used. For example, we know that birth weight and weaning weight generally 'go together'. If, for example, a bull calf was not weighed at birth but later weight records were submitted, birth weight EBVs will be calculated taking into consideration the animal's growth EBVs and the performance of its relatives. This EBV is later confirmed, or otherwise, by the performance of relatives, and the EBVs may be further adjusted.

As more information becomes available estimates of breeding values become more accurate. For beef cattle, there are currently EBVs available for 19 traits. Which EBVs are available will depend on what breed you use.

Traits for which EBVs are published

Calving Ease Traits

Gestation Length, Calving Ease Direct (DIR), Calving Ease Daughters (DTRS) and Birth Weight

Fertility Traits

Days to Calving and Scrotal Size

Growth Traits

200-Day Weight, 400-Day Weight and 600-Day Weight

Maternal Traits

Milk and Mature Cow Weight

Carcase Traits

Carcase Weight, Eye Muscle Area, Rump Fat, Rib Fat, Retail Beef Yield % and Intra-Muscular Fat % (Marbling)
Net Feed Intake and Docility

GROUP BREEDPLAN

GROUP BREEDPLAN allows comparison **between** herds, within a breed. Information from common bulls and cows is used to link and compare animals **across** herds. It has rapidly become the most commonly used performance evaluation system. Most of the major Australian breeds are now in GROUP BREEDPLAN. Breeders from 25 Australian beef cattle breed societies submitted performance data in 2004-05.

BREEDPLAN also offers within-herd analysis. Data from cross-bred animals can be recorded through a number of breed databases. New composite herds are using this service, for example.

Publishing EBVs

Nearly all breed societies provide access to EBVs through the internet. They can be accessed either through the individual breed society websites or through the BREEDPLAN website (<http://breedplan.une.edu.au/sireselect.htm>). The web site has user friendly search and select facilities for you to use to find the animal that suits your breeding system.

Sires with sufficient genetic links and records have their EBVs published in a printed Sire Summary by some breed societies. The following examples show the type of information available in sire summaries, sale catalogues and websites.

Interpreting BREEDPLAN figures

Estimated breeding values (EBVs) are set against a zero base that is held constant. For many breeds, the base was set in the 1970s. It is therefore more important to compare EBVs with the current breed average. In the following example, EBVs of 2-year-old bulls for sale in 2005 are being compared against the average EBVs for 2003 born Herefords.

In this example, Bull A is above average for all weights, with average milk and scrotal size compared to 2003 born calves of this breed.

Table 1. GROUP BREEDPLAN EBVs for two Hereford bulls

		GROUP BREEDPLAN EBVs - 2005							
		Birth weight (kg)	200-day Milk (kg)	400-day Weight (kg)	600-day weight (kg)	Scrotal size (cm)	Rump Fat (cm)	EMA (cm)	IMF % (cm)
Bull A	EBV	+8.2	+8	+40	+59	+0.9	+1.7	+0.7	+0.2
	Acc.*	95%	70%	80%	80%	85%	75%	70%	65%
Bull B	EBV	+2.2	+15	+22	+39	+1.4	+1.2	+3.6	0.0
	Acc.	85%	60%	70%	75%	80%	81%	98%	62%
Breed Average (2003 born calves)		+4.0	+8	+34	+49	+0.9	0.2	+1.8	+0.0

*Accuracy figures (expressed as a percentage) are determined by the amount of information that has been provided and are an indication of the 'reliability' of each EBV. EBVs of lower accuracy are more likely to change as more information is collected. There is an equal chance of this change being up or down.

How are the progeny of the two bulls expected to compare?**Birth Weight**

This EBV is the best predictor of the birth weight of a bull's progeny. Bull A is well above breed average. When joined to a random group of cows, he would be expected to produce calves averaging 3kg heavier than bull B (There is a 6kg difference in birth weight EBVs between the bulls. Half of this, the sire's contribution, will be expressed in the calves).

Birth weight is by far the most important genetic influence on calving ease. Gestation length, calf shape, pelvic area and 'calving will' of the cow are also important. Calving Ease EBVs are also available and discussed later. Because of many environmental influences on calving, the calving ease scores have a relatively low heritability. This means that the calving ease EBVs have quite a low accuracy until large amounts of data are collected. They are usually only reported on sires with progeny recorded.

Milk

BREEDPLAN partitions weaning weight into the growth and milk components. The milk EBV predicts milking ability of a bull's daughters in kilograms of extra weaning weight their calves would be expected to have. Bull B is well above breed average and would be expected to sire daughters that milk better. The difference here would obviously only influence a buying decision where the level of milk needs increasing as a high priority. In some situations, high milk is a disadvantage.

400 and 600-Day weight

These EBVs predict weight for age and are most useful for yearling or heavy steer producers. Bull A is ahead in both these areas. He would be expected to produce, on average, calves heavier by 9kg and 10kg as yearlings or steers, respectively. Note: 200-day growth and Mature Cow Weight EBVs are also available, but not used in this example.

Scrotal size

Bull A is breed average for scrotal size. Bull B is above average and would be expected to breed daughters with earlier puberty and shorter calving intervals and sons with earlier puberty and bigger scrotal size. (Some breeds also provide the female fertility EBV, Days to Calving).

Carcase traits

Carcase traits include rump fat, eye muscle area (EMA) and intramuscular fat percentage (IMF%).

Compared to breed average, Bull A is expected to produce earlier finishing or fatter progeny (Rump Fat), with below average muscling (EMA) and above average marbling (IMF).

Note: There are other carcass EBVs available, such as carcass weight, rib fat and retail beef yield.

Example exercises are provided on the following pages.

Bull selection exercises

In all these exercises, assume bulls are sound and fertile. For simplicity, accuracies are not given in the earlier exercises. However, accuracies are used in Exercise IV and discussed in detail in other Agriculture Notes.

Growth EBVs

Exercise 1 – Growth, milk and mature wt GROUP BREEDPLAN EBVs (kg)

Table 2. Breedplan catalogue information to compare growth and milk production EBVs

BULL	Birth weight	200-day milk	200-day growth	400-day weight	600-day weight	Mature cow weight
A	-1	+5	+10	+30	+45	+52
B	+2	+2	+14	+25	+28	+35
C	+5	-8	+16	+40	+50	+60
D	+2	+10	+12	+25	+30	+34
E	+1	0	+10	+28	+40	+36
Breed average for drop	+2	+3	+12	+28	+35	+46

Three producers are selecting from this sire list (Table 2). Which bull should each buyer choose?

- *Buyer 1* - Sells vealers but also breeds replacement heifers. Increasing the level of milk production in this herd would improve profitability.
- *Buyer 2* - Wants to increase yearling and final weights and avoid calving difficulty. The main product is heavy steers. Replacement heifers are retained.
- *Buyer 3* - Is straight breeding in a harsh environment where cows with high EBVs for milk are slower to rebreed. Increased growth rate in two-year-old steers is sought.

(Answers are provided on the last page)

Fertility EBVs

Scrotal size (SS) is an indicator of male fertility. More importantly, bulls with a high scrotal size are known to breed more fertile females. Bulls with high scrotal size EBVs are expected to breed sons with bigger SS and daughters with earlier puberty and a shorter days to calving interval. Scrotal size EBVs are in cm. The female fertility trait Days to Calving (DC) is available for breeds providing the necessary joining and calving information. Days to Calving EBVs are in days and predict

the interval between commencement of joining (or artificial insemination) and calving. Sires with negative Days to Calving EBV's are preferred as they are expected to breed daughters with shorter calving intervals.

Exercise II – Fertility

Table 3. Breedplan catalogue information to compare fertility related EBVs

Bull	400-day weight (kg)	600-day weight (kg)	Scrotal size (cm)	Days-to-calving (Days)
A	+40	+50	+1.2	-9
B	+44	+40	+2.0	-6
C	+34	+40	-0.5	+9
D	+48	+58	-1.0	+12
E	+43	+51	+2.5	-4
Breed average for drop	+36	+43	+0.4	0

(Assume all bulls have adequate Scrotal Size for current mating load)

From this sample catalogue (Table 3), advise each buyer on bull choice.

- *Buyer 1* - Has a commercial purebred herd turning off two-year-old steers and seeks to improve female fertility, while maintaining heavy steer weights.
- *Buyer 2* - Intends to use the bull as a terminal cross over crossbred cows, selling both the heifers and steers as finished yearlings.
- *Buyer 3* - Wishes to increase scrotal size in this stud herd. Yearling bulls are sold and in the past some have been marginal for scrotal size. Clients are predominantly yearling steer breeders.

(Answers are provided on the last page)

Carcase EBVs

Accredited technicians conduct ultrasound scanning on live cattle for submitting data (rib and rump fat depth, eye muscle area and intra muscular fat) into BREEDPLAN. Wherever possible, BREEDPLAN is also collecting abattoir carcass data to contribute to these EBVs. Carcass weight and Retail beef yield percentage EBVs are also produced.

Carcass EBVs are predictions of the differences expected in a 300 kg steer carcass, i.e. at a weight end point.

For a newly imported sire, overseas information in the form of Estimated Progeny Differences (EPDs) may be used as a 'starting value' for the BREEDPLAN EBVs. As Australian progeny records become available the contribution of overseas data to the BREEDPLAN EBV declines, eventually to zero. The contribution of overseas data to carcass EBVs is decreased as differences can exist because the overseas EPDs are expressed on an age constant basis whereas the BREEDPLAN EBVs are expressed on a carcass weight constant basis. These adjustments mean that as more carcass data is collected on Australian progeny, the carcass EBVs will better reflect expected differences between animals for the performance of their progeny measured under Australian conditions.

Exercise III - Carcass traits

Table 4. Breedplan catalogue information to compare carcass EBVs

Bull	400-day weight (kg)	600-day weight (kg)	Rump fat (mm)	EMA (sq cm)	RBV (%)	IMF (%)
Bull A	+56	+83	+2.3	+0.3	-0.2	+0.3
Bull B	+50	+74	-0.2	+2.0	+0.1	-0.1
Bull C	+55	+80	-0.7	+4.1	+0.4	+0.1
Bull D	+58	+78	+0.8	+2.0	+0.1	-0.2
Breed Average for drop	+52	+68	+0.2	+0.6	0.0	0.0

Two producers are selecting from this sire list (Table 4). Which bull should each buyer choose?

- *Buyer 1* - Sells yearling steers to a feedlot which is long-term feeding for Japan and has been advised to increase size and growth to 2 years, reduce fatness and maintain or improve muscularity and improve marbling.
- *Buyer 2* - Breeds yearling steers, from European x Dairy cross cows. They have difficulty in finishing yearling steers and seeks to improve this.

(Answers are provided on the last page)

Calving Ease

Calving Ease EBVs are developed from birth weight, gestation length and calving ease records. Calving ease is scored by the breeder as: **no assistance; light pull; hard pull; caesarean**. The EBVs are reported as differences in the percentage of unassisted calvings. Higher, more positive, calving ease EBVs are more favourable.

Calving Ease (DIR) EBVs are estimates of genetic differences among animals in the ability of their calves from 2 year old heifers to be born unassisted. For example, a bull with an EBV of +5.0% would be expected, on average, to produce 3% fewer 'difficult' calvings from 2-year-old heifers than a bull with an EBV of -1.0% (6% difference between the sires, then halved because they contribute half the genetics). Calving Ease (DTRs) EBVs are estimates of genetic differences among animals in the ability of their 2 year old daughters to calve without assistance.

Exercise IV - Calving ease and accuracy

Table 5. Breedplan catalogue information to compare calving ease EBVs and EBV accuracies

SIRE	Birth weight		400-day Wt		Calving Ease (%)			
	(kg)	Accuracy	(kg)	Accuracy	Direct	Daughters		
A	+2	65%	+6	60%	+10	35%	-6	30%
B	+5	79%	+25	75%	+9	67%	-9	51%
C	+1.3	83%	+21	80%	+1	58%	+5	60%
D	0.7	95%	+18	93%	+8	85%	0	75%
Breed average	+1		+16		0		0	

Advise each buyer on bull choice from this sample catalogue (Table 5).

- *Buyer 1* - Seeks a terminal sire to join with crossbred heifers for yearling production. Calving ease is of moderate importance.
- *Buyer 2* - Is straightbreeding for yearling production and wishes to improve calving ease of the females.
- *Buyer 3* - Is straightbreeding and seeks a sire to join with heifers. Calving ease is of considerable concern to this breeder of grass-finished yearlings.

(See answer below)

Finally

As well as assisting bull buyers, BREEDPLAN has an important role in AI, ET, etc. These techniques quickly spread 'superior' genetics, so it is imperative that only top cattle are used. GROUP BREEDPLAN will greatly assist in identifying cattle with genetics that will suit your cows, the type of country and your target market.

Answers

Exercise I Growth

- Buyer 1
Bull D. The high milk EBV is the deciding factor, while 200 day weight is still average. Mature Weight is also moderate.
- Buyer 2
Bull A. High 400 and 600 day EBVs, with low birth weight EBV and positive milk EBV.
- Buyer 3
Bull E. Adequate 600 day weight and low milk EBV. Neutral birthweight EBV and moderate Mature cow weight EBV.

Exercise II Fertility

- Buyer 1
Bull A. The highest priority is the Negative (fewer) days to calving EBV, and 600 day weight is also good.
- Buyer 2
Bull D. Fertility EBVs relating to progeny are not important for terminal sires, so select highest 400 day weight EBV.
- Buyer 3
Bull E. Has the highest scrotal size EBV and a good 400 day weight EBV.

Exercise III Carcase

- Buyer 1
Bull C. Fat EBV is negative, Eye muscle, retail yield and intramuscular fat % positive, 600 day weight EBV is also high.
- Buyer 2
Bull D or A. Fat EBVs are positive. Best 400 day weight EBVs.

Exercise IV Calving Ease

- Buyer 1
Bull B. Positive calving ease direct EBV with moderate accuracy and good 400 day weight EBV. Note: bull A has a similar, but lower accuracy, calving ease direct EBV; but low 400 day weight EBV.
- Buyer 2
Bull C. Positive calving ease daughters EBV, with acceptable 400 day weight EBV.
- Buyer 3
Bull D. Positive calving ease direct EBV with the highest accuracy, as calving ease is critical. However, 400 day growth is still reasonable.



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