A Basic Guide to

BREEDPLAN EBVs

INTERNATIONAL BEEF RECORDING SCHEME

BREEDPLAN

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May 2008

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Breedplan - A General Introduction

What is BREEDPLAN?

BREEDPLAN is a modern genetic evaluation system for beef cattle. It offers the potential to accelerate genetic progress, tighten up breeding operations, improve productivity and increase prices for cattle sold for breeding and slaughter.

BREEDPLAN has been implemented as the national beef recording scheme in Australia, New Zealand, Namibia, Thailand and the Philippines, and its use is also increasing in the United States, Canada, United Kingdom, Hungary, South America and South Africa.

BREEDPLAN uses the world's most advanced genetic evaluation system (based on Best Linear Unbiased Prediction (BLUP) technology) to produce Estimated Breeding Values (EBVs) of recorded cattle for a range of important production traits (eg. weight, carcase, fertility).

What is an EBV?

An animal's breeding value can be defined as it's genetic merit for each trait. While it is not possible to determine an animal's true breeding value, it is possible to estimate it. These estimates of an animal's true breeding value are called EBVs (Estimated Breeding Values).

EBVs are expressed as the difference between an individual animal's genetics and the genetic base to which the animal is compared. EBVs are reported in the units in which the measurements are taken (eg. kilograms for the weight EBVs). Thus a value of +12 kg for 400 day weight means the animal is genetically superior by 12 kg at 400 days compared with the genetic base of the relevant cattle population. On average, half of this difference will be passed on to the animal's progeny.

What EBVs are available?

BREEDPLAN produces EBVs for a range of economically important traits. These traits currently include :

Weight	Fertility	Carcase	Other
Birth Weight	Scrotal Size	Eye Muscle Area	Docility
Milk	Days to Calving	Fat Depth	Net Feed Intake**
200-day Growth	Gestation Length	Retail Beef Yield	
400-day Weight	Calving Ease	Intramuscular Fat	
600-day Weight		Carcase Weight	
Mature Cow Weight			

** Trial EBV

It should be noted that EBVs will only be available if sufficient data has been recorded for that trait and as such, the full range of EBVs may not be available for each particular Breed Society/Association.

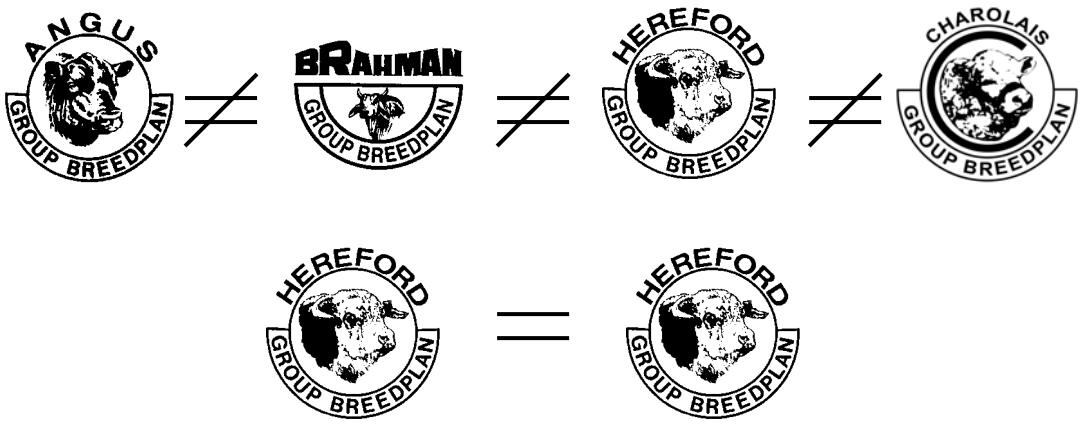
BREEDPLAN Tips

Comparing EBVs Between Different Breeds

One of the common questions asked within the beef industry regards the comparison of EBVs for animals of different breeds. Generally speaking, each breed is currently running a separate BREEDPLAN evaluation and subsequently, only EBVs for animals within a particular breed can be directly compared.

EBVs are expressed as the difference between an individual animal's genetics and the genetic base to which the animal is compared. The "genetic base" can roughly be described as the historical genetic level of that particular breed. For most breeds, their genetic base will have been set in the mid 1980's. Importantly, the genetic base for each breed will be different, so only EBVs for animals within a particular evaluation can be directly compared.

Putting this in practical terms, a 600 day weight EBV of +41 on a Hereford bull is not equivalent to a 600 day weight EBV of +41 on an Angus bull or a 600 day weight EBV of +41 on a Limousin bull.



"Only EBVs for animals within a particular BREEDPLAN analysis can be directly compared"

For more information regarding the comparison of EBVs for animals of different breeds, please contact staff at BREEDPLAN.

BREEDPLAN Tips

Interpreting BREEDPLAN EBVs

You are presented with a detailed set of BREEDPLAN EBVs for a particular animal. How do you assess whether the EBVs are good or not?? This pamphlet provides a simple set of instructions regarding how to interpret this information.

For the purposes of demonstration, please consider the following set of EBVs for an individual animal.

	Gest. Length (Days)	Birth Weight (kg)	Milk (kg)	200D Growth (kg)	400D Growth (kg)	600D Growth (kg)	Mature Weight (kg)
EBV	+0.1	+3.4	+3	+17	+33	+41	+48
ACC	59%	65%	58%	73%	72%	72%	63%

1. What does the EBV mean?

EBVs are expressed as the difference between an individual animal's genetics and the genetic base to which the animal is compared. The "genetic base" can roughly be described as the historical genetic level of that particular breed. For most breeds, their genetic base will have been set in the mid 1980's. **Importantly, the genetic base for each breed will be different, so only EBVs for animals within a particular analysis can be directly compared.**

Therefore, in the above example, a 600 day weight EBV of +41 kg means the animal is 41 kg genetically heavier at 600 days compared with the genetic base of the relevant cattle population. On average, half of this difference will be passed on to the animal's progeny.

2. Compare with the current breed average

As most breeds have experienced significant changes in their genetic merit for most traits since the mid 1980's (ie. their genetic base), the first step when interpreting an EBV should be to compare it to the current breed average EBVs for the breed. This will give you an indication of how the animal compares with the current genetic level for the breed for each trait.

A set of breed average EBVs should be enclosed in all BREEDPLAN reports, sale catalogues etc. and will look similar to the table below.

Breed average EBVs for 2005 drop calves in the 2007 GROUP BREEDPLAN analysis

Gest Length EBV	Birth Weight EBV	Milk EBV	200-Day Growth EBV	400-Day Weight EBV	600-Day Weight EBV	Mature Weight EBV
0.0	+2.2	+3	+13	+20	+30	+31

If we consider the animal in the above example, comparison of it's 600 day weight EBV of +41 with the breed average 600 day weight EBV of +30 indicates that the animal is genetically superior than the current genetic level of the breed for growth to 600 days. Taking this further, it can be calculated that the animal is actually 11 kg (ie. 41 -30) genetically heavier at 600 days compared with the current genetic level of the breed.

3. Compare with the Percentile Bands Table

Comparison with the breed average EBVs allows you to establish whether an animal is above or below the current genetic level of the breed. This can be taken further by comparing the animal's EBVs to the Percentile Bands Table to assess exactly where the animal ranks within the breed for each trait.

As with the breed average EBVs, a Percentile Bands Table should be enclosed in all BREEDPLAN reports, sale catalogues etc. and will look similar to the table below.

Example Percentile Bands Table

	Calving Ease DIR (%)	Calving Ease DTRS (%)	Gestation Length (days)	Birth Weight (kg)	Milk (kg)	200-Day Growth (kg)	400-Day Weight (kg)	600-Day Weight (kg)	Mature Cow Wt. (kg)
Top 5%	+3.6	+0.6	-2.0	-0.2	+7	+24	+37	+54	+57
Top 10%	+2.8	+0.3	-1.5	+0.5	+6	+21	+33	+48	+50
Top 20%	+1.8	-0.1	-0.9	+1.1	+5	+18	+28	+41	+43
Top 30%	+1.1	-0.3	-0.5	+1.5	+4	+16	+25	+37	+38
Top 40%	+0.5	-0.6	-0.2	+1.9	+4	+14	+22	+33	+34
Top 50%	+0.0	-0.8	+0.0	+2.2	+3	+13	+20	+30	+30
Top 60%	-0.6	-1.2	+0.3	+2.6	+3	+11	+17	+26	+26
Top 70%	-1.3	-1.6	+0.5	+3.0	+2	+9	+15	+23	+23
Top 80%	-2.2	-2.2	+0.8	+3.4	+1	+7	+12	+19	+18
Top 90%	-3.4	-3.0	+1.2	+4.1	+0	+5	+9	+14	+13

If we consider the animal in the above example with the 600 day weight EBV of +41, comparison with the Percentile Bands Table indicates that the animal is in fact ranked in the top 20% of the breed for growth to 600 days (see circled information).

4. Compare EBVs to estimate the difference in output from two sires

In the above example, we have determined the animal is ranked in the top 20% of the breed for 600 day weight. But what does that mean in real terms? EBVs can also be used to predict the difference in output that will be observed if 2 different sires are used in a herd.

To demonstrate this, let's compare the animal to another bull. The first bull has a 600 day weight EBV of +41, while the second bull has a 600 day weight EBV of +21. Comparing these animals shows a difference in 600 day weight EBV of 20 kg. As on average half of this difference will be passed on to the progeny of each sire, it can be estimated that calves from the first bull would be on average, 10 kg heavier than those from the second bull at 600 days. Extending this to a single year's drop of 50 calves, this difference equates to a potential production difference of 500 kg in live weight by the time the calves reach 600 days of age.

It is important to note that in the above example we are assuming both bulls are used over dams of similar genetic value/breed and their progeny are run under similar conditions.

5. EBV accuracy

When evaluating any EBV, it is also important to consider the EBV "accuracy". By definition, an EBV is an estimate of an animal's true breeding value. To provide breeders with a measure of the reliability of the estimate, BREEDPLAN produces an "accuracy" figure with each EBV. The "accuracy" provides a measure of the stability of the EBV and gives an indication of the amount of information that has been used in the calculation of that EBV. The higher the accuracy the lower the likelihood of change in the animal's EBV as more information is analysed for that animal, it's progeny or it's relatives.

The following guide may be useful for interpreting accuracy:

less than 50% accuracy - the EBVs are preliminary. EBVs in this range will have been calculated based on very little information. These 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 limited 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 will change considerably with addition of more progeny data

Although the accuracy of an EBV should be considered, animals should be compared on EBVs regardless of accuracy. Where two animals have the same EBV however, the animal with the higher accuracy would normally be used more heavily than the bull with the lower accuracy because the results can be predicted with more confidence.

6. Visual appraisal

Although EBVs provide an estimate of an animal's genetic merit for a wide range of traits, they do not provide information for all the traits that must be considered during the selection of functional cattle. In all situations, EBVs should be used in conjunction with visual assessment for other traits of importance (eg. structural soundness, fertility).

For more information regarding the interpretation of EBVs, please contact staff at BREEDPLAN.

BREEDPLAN EBVs – the Traits Explained

BREEDPLAN currently reports EBVs for up to 19 economically important traits. These traits include:

Weight	Fertility	Carcase	Other
Birth Weight Milk 200-day Growth 400-day Weight 600-day Weight Mature Cow Weight	Scrotal Size Days to Calving Gestation Length Calving Ease	Eye Muscle Area Fat Depth Retail Beef Yield Intramuscular Fat Carcase Weight	Docility Net Feed Intake**

** Trial EBV

The above traits cover three areas of vital importance to both bull breeders and commercial producers - weight, reproduction and carcase. This allows a balanced approach to designing efficient breeding programs for various environments and to target specific markets.

It should be noted that EBVs will only be available if sufficient data has been recorded for that trait and as such, the full range of EBVs may not be available for each particular Breed Society/Association.

The following document explains each EBV is more detail.

Calving Ease

EBVs are provided for calving ease, an important characteristic for cattle. Calving difficulty has an obvious negative impact on the profitability of a herd through increased calf and heifer mortality, slower re-breeding performance and considerable additional labour and veterinary expense. EBVs for traits related to calving ease are calculated from three main sources of information - calving difficulty score, birth weight and gestation length data.

BREEDPLAN produces two calving ease EBVs – Calving Ease Direct & Calving Ease Daughters.

(i) Calving Ease Direct

Calving Ease (DIR) EBVs are estimates of genetic differences in the ability of a sires' calves to be born unassisted from 2 year old heifers. The EBVs are reported as differences in the percentage of unassisted calvings.

Higher, more positive, Calving Ease (DIR) EBVs are more favourable. 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 as they only contribute half the genetics).

(ii) Calving Ease Daughters

Calving Ease (DTRS) EBVs are estimates of genetic differences in the ability of a sire's 2 year old daughters to calve without assistance. The EBVs are also reported as differences in the percentage of unassisted calvings.

Higher, more positive, Calving Ease (DTRS) EBVs are more favourable. For example, a bull with an EBV of +4.0% would be expected to on average produce 2 year old daughters that have 3% less calving problems than the daughters of a bull with an EBV of –2.0%.

Gestation Length

Gestation Length EBVs are estimates of genetic differences between animals in the number of days from the date of conception to the calf birth date. Gestation Length EBVs are expressed in days and are calculated from the joining date and birth date records for calves conceived by either AI or Hand Mating.

Shorter gestation length is generally associated with lighter birth weight, improved calving ease and improved re-breeding performance among dams. In addition, calves born with a shorter gestation length are often heavier at weaning due to more days of growth. Consequently, lower or more negative Gestation Length EBVs are considered to be more favourable. For example, a bull with a Gestation Length EBV of –2 days would be expected to produce calves that are born earlier, and more easily, than a bull with a Gestation Length EBV of +2 days.

Birth Weight

Birth Weight EBVs are estimates of genetic differences between animals in calf birth weight. Birth Weight EBVs are expressed in kilograms (kgs) and are calculated based on weights of calves taken at birth.

Calf birth weight is the biggest genetic contributing factor causing calving difficulty in heifers. In order to minimise the risk of calving difficulty it is recommended that you only use bulls over your heifers that have relatively low birth weights.

Small, or moderate, Birth Weight EBVs are more favourable. For example, a bull with a Birth Weight EBV of +2 kg would be expected to produce lighter calves at birth than a bull with a Birth Weight EBV of +6 kg, with a lower risk of a difficult birth.

Please note, whilst low Birth Weight EBVs are favoured for calving ease they are also generally associated with lower overall growth potential. Consequently, birth weight and growth need to be carefully balanced. Fortunately, animals can be found that have both moderate Birth Weight EBVs and above average EBVs for later growth.

200 Day Milk

200 Day Milk EBVs are estimates an animal's maternal effect on the 200 day weight of its calf. In the case of sires, this estimates the maternal effect that his daughters will have on the 200 day weight of their progeny. The 200 Day Milk EBV is expressed as kilograms (kg) of calf live weight at 200 days (ie. the expected difference in the weight of the calf at 200 days due to the maternal effect (milk) of the cow). The 200 Day Milk EBV is calculated by partitioning the difference in the 200 day weight of calves into growth and milk components.

The optimum level of milk production potential among beef cows is dependent upon the production system and environment in which the cows are run. Selection for increased milk production may be warranted when cows are run under good nutritional conditions and calves are sold as weaners. However, some environments may not support high milking cows.

Larger, more positive, 200 Day Milk EBVs are generally more favourable, depending on the environment. For example, a bull with a 200 Day Milk EBV of +15 kg would be expected to sire daughters with higher milk production than a bull with 200 Day Milk EBV of +5 kg. This higher milk production potential should be reflected through higher weaning weights among the daughter's calves.

Growth

In general, with all other things being equal, higher growth rates will lead to higher profitability. In most economic analyses conducted positive emphasis on growth is warranted. BREEDPLAN calculates three growth EBVs – 200 day Growth, 400 day Weight & 600 day Weight.

These EBVs are the best prediction of the animal's ability to grow to weaning (200-day), yearling (400 day) and later ages (600 day). 200 Day Growth EBVs are therefore important to vealer breeders, 400 Day Weight EBVs for yearling breeders and 600 Day Weight EBVs for breeders of heavy steers. These EBVs are closely linked genetically but there is some scope to select for them individually.

(i) 200 Day Growth

200 Day Growth EBVs are estimates of the genetic differences between animals in live weight at 200 days of age due to their genetics for growth. 200 Day Growth EBVs are expressed in kilograms (kg) and are calculated from the weights of calves taken between 80 and 300 days of age.

This EBV is a measure of an animal's early growth to weaning. It is an important trait for breeders turning off animals as vealers or weaners. Larger, more positive, 200 Day Growth EBVs are generally more favourable. For example, a bull with a 200 Day Growth EBV of +30 kg would be expected to produce heavier calves at 200 days of age (or weaning) compared to a bull with a 200 Day Growth EBV of +10 kg.

(ii) 400 Day Weight

400 Day Weight EBVs are estimates of the genetic differences between animals in live weight at 400 days of age. 400 Day Weight EBVs are expressed in kilograms (kg) and are calculated from the weights of calves taken between 301 and 500 days of age.

This EBV is an important trait for breeders turning off animals as yearlings. Larger, more positive, 400 Day Weight EBVs are generally more favourable. For example, a bull with a 400 Day Wt EBV of +50 kg would be expected to produce heavier calves at 400 days of age (12-14 months) compared to a bull with a 400-Day Wt EBV of +30 kg.

(iii) 600 Day Weight

600 Day Weight EBVs are estimates of the genetic differences between animals in live weight at 600 days of age. 600 Day Weight EBVs are expressed in kilograms (kg) and are calculated from the weights of calves taken between 501 and 900 days of age.

This EBV is an important trait for breeders targeting the production of animals suited for heavy weight grass or grain fed markets. Larger, more positive, 600 Day Weight EBVs are generally more favourable. For example, a bull with a 600 Day Wt EBV of +70 kg would be expected to produce heavier calves at 600 days of age (18-20 months) compared to a bull with a 600-Day Wt EBV of +40 kg.

Mature Cow Weight

Mature Cow Weight EBVs are estimates of the genetic differences between cows in live weight at 5 years of age. Mature Cow Weight EBVs are expressed in kilograms (kg) and are calculated from weights taken on the cow when her calf's 200 day (weaning) weight is being measured.

Mature Cow Weight EBVs are an indicator of:

- Cow Feed Requirements – in general, lighter cows will tend to eat less and consequently have lower feed requirements and be less expensive to maintain.
- Cull Cow Values – the major determinant in the value of cull cows in a commercial herd will be live weight. Consequently, heavier cows may provide higher returns from the sale of cull cows.

A cow with a Mature Cow Weight EBV of +80 kg would be expected to have a higher mature weight than a cow with a Mature Cow Weight EBV of +60 kg.

Scrotal Size

Scrotal Size EBVs are estimates of the genetic differences between animals in scrotal circumference at 400 days of age. Scrotal Size EBVs are expressed in centimetres (cm) and are calculated from scrotal circumference measurements taken on bulls between 300 and 700 days of age.

Increased scrotal circumference is associated with increased semen production in bulls, and earlier age at puberty of bull and heifer progeny. Increased scrotal circumference also has a favourable relationship with days to calving, such that bulls with larger scrotal circumference tend to have daughters with shorter days to calving.

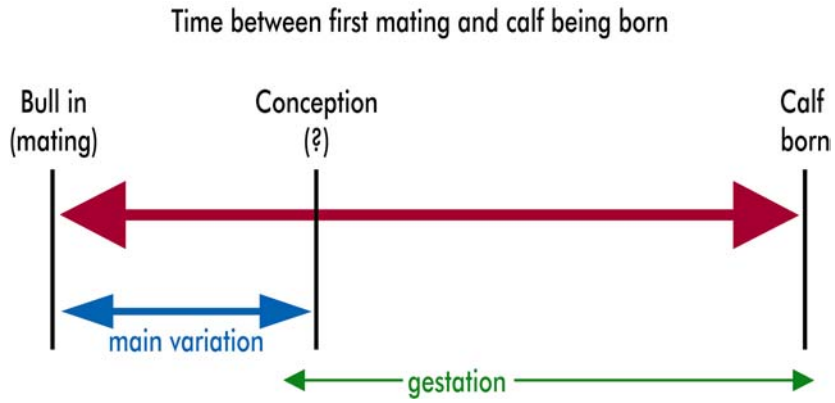
Larger, more positive, Scrotal Size EBVs are generally more favourable. For example, a bull with an Scrotal Size EBV of +4 cm would be expected to produce sons with larger testicles at yearling age and daughters that reach puberty earlier than the progeny of a bull with a Scrotal Size EBV of -4 cm.

Days to Calving

Days to Calving EBVs are estimates of genetic differences between animals in time from the start of the joining period (ie. when the female is introduced to a bull) until subsequent calving. Days to Calving EBVs are expressed in days and are calculated from the joining records submitted for females.

The Days to Calving EBV promotes those cows that calve earlier in the season compared to those that calve later, while penalising those cows that do not calve. Variation in days to calving is mainly due to differences in the time taken for females to conceive after the commencement of the joining period.

Lower, or more negative, Days to Calving EBVs are generally more favourable. For example, a bull with a Days to Calving EBV of -5 days would be expected to produce daughters that conceive earlier in the joining period than the daughters of a bull with a Days to Calving EBV of +5 days. Females with shorter Days to Calving EBVs also tend to be those that show early puberty as heifers and return to oestrous earlier after calving.



Carcase

BREEDPLAN combines both live animal ultrasound scanning information with abattoir chiller carcase data to calculate EBVs that provide information regarding the genetic differences in carcase composition between animals in a standard 300 kg carcase. Selection for increased carcase yield and carcase value should be an important objective for cattle breeders. Carcase EBVs provide a useful tool to assist breeders in targeting animals that meet market requirements.

BREEDPLAN currently produces six Carcase EBVs:

- Carcase Weight
- Rib Fat Depth
- Rump Fat Depth
- Eye Muscle Area
- Intramuscular Fat (Marbling)
- Retail Beef Yield

(i) Carcase Weight

Carcase Weight EBVs are estimates of the genetic differences between animals in hot standard carcase weight (as defined by AusMEAT) at 650 days of age. Carcase Weight EBVs are expressed in kilograms (kg).

Larger, more positive, Carcase Weight EBVs are generally more favourable. For example an animal with a Carcase Weight EBV of +40 kg would be expected to produce progeny with heavier slaughtered carcases at 650 days of age than an animal with a Carcase Weight EBV of +30 kg.

Carcase Weight should not be confused with yield. The Carcase Weight EBV is an indication of the animal's carcase weight and not an indication of the animal's yield percentage.

(ii) Eye Muscle Area (EMA)

Eye Muscle Area EBVs are estimates of the genetic differences between animals in eye muscle area at 12/13th rib site in a 300kg steer carcase. EMA EBVs are expressed in square centimetres (cm^2).

Larger, more positive, EMA EBVs are generally more favourable. For example, a bull with an EMA EBV of +4 cm^2 would be expected to produce steer progeny with a greater degree of muscle expression than a bull with an EMA EBV of +1 cm^2.

(iii) Rib Fat

Rib Fat EBVs are estimates of the genetic differences between animals in fat depth at the 12/13th rib site in a 300kg steer carcase. Rib Fat EBVs are expressed in millimetres (mm).

More positive or more negative Rib Fat EBVs may be more favourable, depending on your breeding goals relating to the finishing ability of your animals. A bull with a Rib Fat EBV of -0.4 mm would be expected to produce leaner calves than a bull with a Rib Fat EBV of +0.4 mm.

(iv) Rump Fat

Rump Fat EBVs are estimates of the genetic differences between animals in fat depth at the P8 rump site in a 300kg steer carcase. Rump Fat EBVs are expressed in millimetres (mm).

More positive or more negative Rump Fat EBVs may be more favourable, depending on your breeding goals relating to the finishing ability of your animals. A bull with a Rump Fat EBV of -0.6 mm would be expected to produce leaner calves than a bull with a Rump Fat EBV of +0.6 mm.

Stock with positive fat EBVs are likely to produce progeny that are fatter, or more earlier maturing, on average than stock with lower or negative fat EBVs. Increasing fat depth leads to a decrease in retail beef yield, however most market specifications require a minimum fat depth. Breeders aiming to breed leaner, higher yielding cattle may select for lower fat EBVs. Breeders wishing to finish their animals earlier may tend to select animals with moderate fat EBVs. Caution should be placed on selecting for extremely low fat EBVs for replacement females as this may indicate females that are more difficult to get in calf.

Differences between Rib Fat EBVs and Rump Fat EBVs can indicate differences in fat distribution among animals.

(v) Retail Beef Yield (RBY)

Retail Beef Yield (RBY) EBVs are estimates of genetic differences between animals in boned out retail beef yield in a 300kg steer carcase. RBY EBVs are reported as differences in percentage (%) yield.

Larger, more positive, RBY EBVs are generally more favourable. For example an animal with a RBY EBV of +0.9% would be expected to produce progeny that would yield higher percentages of saleable beef in a 300 kg carcase than an animal with a RBY EBV of +0.1%.

(vi) Intramuscular Fat (IMF)

Intramuscular Fat (IMF) EBVs are estimates of genetic differences between animals in intramuscular fat (marbling) at the 12/13 rib site in a 300kg carcase. IMF EBVs are reported as differences in percentage (%) IMF.

Larger, more positive, IMF EBVs are generally more favourable. For example an animal with an IMF EBV of +0.8% would be expected to produce progeny that would express more marbling in a 300 kg carcase than an animal with an IMF EBV of +0.1%.

For markets where marbling is important (eg. Japanese B2/B3 market, restaurant trade, etc.), higher IMF EBVs can contribute significantly to carcase value. Recent research would

suggest that 1 marble score is equivalent to approximately 1.5% intra-muscular fat so the variation shown between sires is not that large. This relationship still needs more data to confirm the conversion from marble score to intra-muscular fat.

Docility

Docility EBVs are estimates of genetic differences between animals in temperament. Docility EBVs are expressed as differences in the percentage of progeny that will be scored with acceptable temperament (ie. either "docile" or "restless") and are calculated from temperament scores recorded on animals using either a crush or yard test when the animals are between 60 and 400 days of age (preferably at weaning).

Docility in cattle is the way cattle behave when being handled by humans or put in an unusual environment such as being separated from the mob in a small yard. What we define as poor docility is a survival trait in the wild – fear of anything unusual and the desire to escape. In domesticated cattle it is exhibited as flightiness. Importantly, docility is a highly heritable trait and so can be improved genetically.

Higher, more positive, Docility EBVs are more favourable. For example, a bull with an EBV of +4.0% would be expected to on average produce a greater percentage of progeny that have acceptable temperament than a bull with an EBV of –2.0%.

Trial EBV - Net Feed Intake

Trail EBVs are produced for Net Feed Intake (NFI). NFI EBVs are estimates of genetic differences between animals in feed intake at a standard weight and rate of weight gain. NFI EBVs as expressed as kilograms (kg) of feed intake per day and are calculated from information collected in feed efficiency trials or by measuring levels of the blood hormone IGF1.

Feed efficiency is recognised as one of the most economically important production traits. It particularly affects profitability of feedlots, but is also significant for grazing enterprises.

Lower, or more negative, NFI EBVs are generally more favourable. For example, a bull with a NFI EBV of –0.7 kg/day would be expected to produce progeny that eat less feed per day than the progeny from a bull that has a NFI EBV of +0.5 kg/day (when the progeny are of similar weight and growing at a similar rate).

For more information regarding any of the above EBVs, please contact staff at BREEDPLAN.

Selection Indexes – A General Introduction

What are Selection Indexes?

BREEDPLAN is now calculating Estimated Breeding Values (EBVs) for up to 18 different traits. While this provides cattle producers with a comprehensive range of information regarding the genetic merit of an animal, it can result in a dilemma when trying to select animals for use in a particular breeding program. In an ideal situation, it would be desirable to select animals that excel in all traits, but rarely will an animal be superior in all 18 traits. So which traits should producers put most emphasis on? How much emphasis should be placed on each trait?

BreedObject is a tool that can help solve this dilemma. BreedObject combines the BREEDPLAN EBVs for an animal with an economic weighting (based on costs of production and returns on outputs), to produce a single Selection Index. A separate Selection Index can be produced for any particular production scenario and market.

Selection Indexes enable cattle producers to make "balanced" selection decisions, taking into account the relevant growth, carcase & fertility attributes of each animal to identify the animal that is most profitable for their particular commercial enterprise. Selection Indexes reflect both the short term profit generated by a sire through the sale of his progeny, and the longer term profit generated by his daughters in a self replacing cow herd.

What Selection Indexes are available?

Standard Selection Indexes are now available for most Breed Society/Associations. The standard breed specific Selection Indexes have been designed to cater for the commercial market production systems of general relevance in each particular breed. These Selection Indexes are intended for use by both seedstock & commercial producers.

A general description of the different Selection Indexes that are available for each particular breed are available via the relevant Breed Society/Association website or by contacting staff at BREEDPLAN. Also available should be information regarding the relative emphasis that is being placed on each EBV in the calculation of the different Selection Indexes. This information is also available via the "EBVs Explained" link within the EBV enquiry facility for Breed Societies/Associations that are offering this service.

As well as standard Selection Indexes, it is also possible to develop customised indexes for individual producers using herd-specific production information and marketing goals. Further information regarding the development of customised indexes can be found on the BreedObject website (www.breedobject.com).

Interpreting Selection Indexes

The Selection Index value for an animal is effectively an EBV of the animal's profitability in that particular commercial production scenario and market. Ranking seedstock animals on their Selection Index value sorts them based on their progeny's expected profitability for the targeted production system.

Selection Indexes are expressed as "net profit per cow mated". For example, if we compare a bull with an Index of +$60 with a bull that has an Index of +$30, we can estimate that the difference in net profit from the progeny of the bulls would be :

= ½ x difference in Index
= ½ x (60-30)
= $15 per cow mated

(nb. We need to multiply by ½ because only half the progeny's genes come from the sire)

If the two bulls were joined to 200 cows during their breeding life, this would equate to a difference of (200 x $15) = $3000.

It is important to note that this difference includes profit across the entire production chain from joining to slaughter and also considers the long term profit generated by a sire's daughters (if a self replacing Selection Index).

Using Selection Indexes

As a guide to using Selection Indexes, it is recommended that producers complete the following steps:

(i) Identify the Selection Index of most relevance
(ii) Rank animals on the Selection Index
(iii) Consider the individual EBVs of importance
(iv) Consider other traits of importance

More detailed information regarding each of these steps is included in the Tip Sheet titled "Selecting Animals with Selection Indexes".

For more information regarding Selection Indexes, please contact staff at BREEDPLAN.

Selecting Animals with Selection Indexes

The Selection Index value for an animal is effectively an EBV of the animal's profitability in a defined commercial production system and market. Ranking seedstock animals on their Selection Index value sorts them based on their progeny's expected profitability for the targeted production system.

As a guide to using Selection Indexes, it is recommended that producers complete the following steps:

(i) Identify the Selection Index of most relevance
(ii) Rank animals on the Selection Index
(iii) Consider the individual EBVs of importance
(iv) Consider other traits of importance

1. Identify the Selection Index

As mentioned above, a Selection Index value for an animal is effectively an EBV of the animal's profitability in a particular commercial production scenario and market. Consequently, before using Selection Indexes, producers should identify the index that is of most relevance to their particular production system. For seedstock producers, this may be the production system of their bull buying clients.

In order to identify the most relevant Selection Index for use, it is recommended that producers:

- consider the description of the Selection Index
- take into account the main profit drivers within the production system that the Selection Index is describing
- evaluate the weightings that are being put on each EBV within the Selection Index

Identifying the Selection Index of most relevance to the production system that the animals will be used in is of utmost importance. Using the wrong Selection Index will potentially compromise any subsequent selection decisions that are made.

2. Rank Animals on Selection Index

Once the Selection Index of most relevance has been identified, the animals available for selection should then be ranked on that particular Selection Index.

When ranking animals on the Selection Index, producers should take into account the following points.

- Selection Indexes can not be used to rank animals across breeds. As with EBVs, the Selection Indexes for animals of different breeds are calculated within different BREEDPLAN evaluations. Consequently, Selection Indexes can only be used to compare animals with other animals of the same breed.

- Producers can use Selection Indexes to see where an animal ranks compared to other animals of the same breed by comparing its Selection Index value to the current breed average value and to the percentile table.

Comparing an animal with the current breed average Selection Index will give you an indication of how the animal compares with the current genetic level for the breed in terms of profitability for that particular production system and market scenario.

A set of breed average Selection Index values should be enclosed in all BREEDPLAN reports, sale catalogues etc. and will look similar to the table below.

Breed Average Index Values for 2006 Born Calves		
Supermarket	Long Fed	EU
+46	+46	+51

If we consider an example where an animal has a Supermarket Selection Index value of +52, comparison to the above breed average value indicates that the animal is expected to have genetics that are more profitable than the current genetic level of the breed if the animal is used within this production scenario.

While comparison to the breed average allows us to assess whether an animal is expected to have genetics that are more or less profitable than the current genetic level of the breed, this can be taken further by comparing the animal's Selection Index to the Percentile Table. Comparison to the Percentile Table allows us to assess exactly where the animal ranks within the breed for each particular Selection Index.

If we consider the animal in the above example with the Supermarket Selection Index value of +52, comparison with the Percentile Table below indicates that the animal is in fact ranked in the top 20% of the breed for that particular production scenario and market endpoint (see circled information).

Example Percentile Table

	Supermarket ($)	Long-fed ($)	EU ($)
Top 5%	+58	+64	+68
Top 10%	+55	+59	+64
Top 20%	+52	+54	+59
Top 30%	+49	+51	+56
Top 40%	+48	+48	+54
Top 50%	+46	+46	+51
Top 60%	+44	+44	+49
Top 70%	+43	+42	+47
Top 80%	+41	+39	+44
Top 90%	+38	+36	+41
Top 95%	+36	+34	+38

As with the breed average EBVs, a Percentile Table should be enclosed in all BREEDPLAN reports, sale catalogues etc.

3. Consider Individual EBVs of Importance

While Selection Indexes combine all the available EBV information to provide an indication of an animal's overall genetic merit, it may still be important to pay attention to the animal's individual EBVs for traits of particular importance.

For example, producers may pay attention to:

- Calving Ease EBVs if they are planning to use the bull over heifers
- Milk EBVs if they are looking to turn some calves off as vealers
- IMF EBVs if they are want to specifically improve the marbling in their herd

In order to consider the animal's individual EBVs, it is recommended that producers set maximum/minimum EBV ranges for the individual traits of particular importance. Animals should firstly be ranked on the Selection Index of relevance but then any animals whose individual EBVs fall outside of the acceptable range be excluded from selection.

For example, in the situation stated above where a bull is being selected for use over heifers, animals should be ranked on a particular Selection Index but then any animal that has a Calving Ease Direct EBV below a certain level be excluded from selection. If Calving Ease Direct EBVs are not available, then excluding animals with a Birth Weight EBV above a certain level might be a suitable alternative.

4. Consider Other Traits of Importance

While Selection Indexes take into account all the available performance information on an animal, they do not consider all the traits of functional and economic importance. Consequently, Selection Indexes should be used in association with visual assessment for other traits of importance that may not be accounted for in the EBVs (eg. structural soundness, temperament).

For more information regarding the use of Selection Indexes or simply Selection Indexes in general, please contact staff at BREEDPLAN

BREEDPLAN Bull Selection Exercises

As a practical guide to the use of BREEDPLAN, the following set of bull selection exercises were put together by Brian Sundstrom. Before retirement, Brian was the Cattle Breeding Coordinator with NSW DPI (Agriculture). Part of this role involved technical and advisory work with BREEDPLAN.

Please note, in these exercises:

- All bulls were assumed to be structurally sound and fertile.
- For simplicity, EBV accuracies are not provided in the earlier exercises. They are however used in Exercise IV.
- All EBVs are GROUP BREEDPLAN EBVs for bulls of the same breed.

Answers to the exercises are provided at the back of this document

Exercise I – Growth, Milk and Mature Cow Weight 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	+10	+25	+30	+34
E	+1	0	+10	+28	+40	+36
Breed Av	+2	+3	+12	+28	+35	+46

The following buyers are selecting from this sire list. Which bulls should they choose?

Buyer 1 - Sells vealers but also breeds replacement heifers. Increasing the level of milk production in this herd would benefit 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 straightbreeding in a harsh environment where cows with high EBVs for milk are slower to rebreed. Large mature cow size is also not favoured. Increased growth rate in two year old steers is also sought.

Exercise II – Fertility EBVs

From the following catalogue, advise the clients on their bull choice. Assume all bulls have adequate scrotal circumference for the desired mating load.

BULL	400 DAY WEIGHT	600 DAY WEIGHT	SCROTAL SIZE	DAYS TO CALVING
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 Av	+36	+43	+0.4	0

Buyer 1 - Has a commercial pure bred 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 cross bred 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 SS. Clients are predominantly breeders of yearling steers.

Exercise III – Carcase EBVs

The following is a selection of sires from a British breed catalogue. Which bull should the two clients buy?

BULL	400 DAY WEIGHT	600 DAY WEIGHT	RUMP FAT	EMA	RBY	IMF
A	+58	+83	+1.3	+0.3	- 0.2	+0.3
B	+50	+74	- 0.2	+2.0	+0.1	- 0.1
C	+55	+80	- 0.7	+4.1	+0.4	+0.1
D	+56	+78	+0.8	+2.0	+0.1	- 0.2
Breed Av	+52	+68	+0.2	+1.6	0.0	0.0

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, maintain or improve muscularity and improve marbling.

Buyer 2 - Breeds yearling steers, from European x Dairy cross cows. She has difficulty in finishing yearling steers and seeks to improve this.

Exercise IV – Calving Ease EBVs & Accuracy

BULL	BIRTH WEIGHT		400 DAY WEIGHT		CALVING EASE DIRECT		CALVING EASE DAUGHTERS	
	EBV	*Acc*	EBV	*Acc*	EBV	*Acc*	EBV	*Acc*
A	+0.2	*65%*	+6	*60%*	+10	*35%*	-6	*30%*
B	+0.5	*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 Av	+1.0		+16		0.0		0.0	

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.

Answers

Exercise I

Buyer 1 - Bull D (The high milk EBV is the deciding factor)

Buyer 2 - Bull A (High 400 and 600 day weight EBVs, with low birth and positive milk)

Buyer 3 - Bull E (Adequate 600 day weight and low milk, neutral birth weight and moderate mature cow weight EBVs)

Exercise II

Buyer 1 - Bull A (The highest priority is the negative (short) days to calving EBV, and 600 day weight is also good)

Buyer 2 - Bull D (Fertility EBVs relating to progeny are not important, 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

Buyer 1 - Bull C (Fat EBV is -ve, eye muscle, retail beef yield and IMF EBVs are +ve, 600 day weight EBV is also high)

Buyer 2 - Bull A (Fat EBV is +ve, 400 day weight EBV is the best)

Exercise IV

Buyer 1 - Bull B (Positive calving ease direct EBV with moderate accuracy and with good 400 day weight. Note: bull A has a similar, but lower accuracy calving ease EBV; but low 400 day weight)

Buyer 2 - Bull C (Positive calving ease daughters EBV, with acceptable 400 day weight)

Buyer 3 - Bull D (Positive calving ease direct, with the highest accuracy, as calving ease is so critical)

Who do I Contact for Assistance??

There are a number of people who you can contact if you have queries regarding BREEDPLAN.

BREEDPLAN Office

For specific enquiries regarding BREEDPLAN, please contact staff at the BREEDPLAN office in Armidale.

Specific enquiries may include such things as the collection and submission of BREEDPLAN performance information, the interpretation of EBVs, the reportability of EBVs, the reason for EBV changes, or simply about BREEDPLAN in general.

A designated staff member at the BREEDPLAN office is responsible for providing support to members of each Breed Society/Association. The contact details for the current member of the team responsible for each breed will be circulated regularly. If you are in any doubt as to who to contact for assistance, please contact the BREEDPLAN office.

The contact details for the BREEDPLAN office are :

BREEDPLAN
C/- ABRI
University of New England
ARMIDALE NSW 2351

Ph: (02) 6773 3555
Fax: (02) 6772 5376
Email: breedplan@abri.une.edu.au
Website: http://breedplan.une.edu.au

Breed Society Technical Consultants

In addition to the staff at the BREEDPLAN office, there are a number of technical consultants available to provide assistance in the use and understanding of the different genetic technologies that are available (eg. BREEDPLAN, Selection Indexes, Internet Solutions, TakeStock & Gene Markers).

The contact details of the Technical Consultant responsible for providing assistance to both commercial & seedstock producers of each breed are attached on the next page.

Breed Society Technical Consultants

Technical Consultant	Organisation	Breeds	Phone	Mobile	Email
Andrew Byrne	SBTS	Hereford, Poll Hereford, Murray Grey	(02) 6773 3357	0418 412 042	andrew@sbts.une.edu.au
Craig Croker	TBTS	Belmont Red, Braford, Brahman, Brangus, Charbray, Droughtmaster, Santa Gertrudis, Simbrah	(07) 4927 6066	0427 018 982	craig@tbts.une.edu.au
Bob Dent	Angus Australia	Angus	(02) 6732 5877	0428 811 362	bobdent@angusaustralia.com.au
Christian Duff	SBTS	Blonde d'Aquitaine, Charolais, Devon, Red Angus, Red Poll, Salers, Shorthorn, Simmental, South Devon, Wagyu	(02) 6773 2472	0418 268 158	christian@sbts.une.edu.au
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Further information is also available from:

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