BREEDPLAN Tips

BREEDPLAN EBVs
"The Traits Explained"

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

Weight	Fertility/Calving	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 Shear Force*	Docility Net Feed Intake* Structural Soundness* Flight Time*

** Trial EBV

The above traits cover several areas of vital importance to both bull breeders and commercial producers. 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 sire's 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 daughters to calve at 2 years of age 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 daughters that have 3% less calving problems when calving at 2 years of age 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. Calf birth weight is the biggest genetic contributing factor causing calving difficulty in heifers.

Birth Weight EBVs are expressed in kilograms (kgs) and are calculated based on weights of calves taken at birth. 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.

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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.

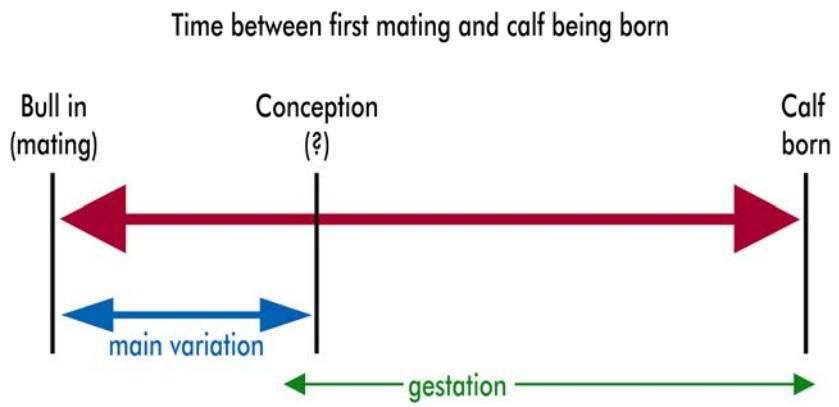
Larger, more positive, Scrotal Size EBVs are generally more favourable. For example, a bull with a Scrotal Size EBV of +4 cm would be expected to produce sons with larger testicles at yearling age and daughters that reach puberty earlier than the progeny of a bull with a Scrotal Size EBV of -4 cm.

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.



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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 seven Carcase EBVs:

- Carcase Weight
- Rib Fat Depth
- Rump Fat Depth
- Eye Muscle Area
- Intramuscular Fat (Marbling)
- Retail Beef Yield
- Shear Force (nb. Trial EBV only)

(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.

(vii) Shear Force

Trial Shear Force EBV^{M}s are estimates of genetic differences between animals in meat tenderness. Trial Shear Force EBV^{M}s are expressed as differences in the kilograms of shear force that are required to pull a mechanical blade through a piece of cooked meat and are calculated from shear force measurements (ie. objective abattoir measures of meat tenderness), gene marker information and flight time records.

Lower, more negative, Trial Shear Force EBV^{M}s are more favourable. That is, lower EBVs indicate that less shear force is required and hence the meat is more tender. For example, a bull with an EBV of -0.90 would be expected to on average produce progeny with meat that required a shear force of 1 kg less than a bull with an EBV of +1.10.

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%.

Net Feed Intake

Feed efficiency is recognised as one of the most economically important production traits, both in grazing enterprises and feedlot operations. Research has shown that large variation exists in feed efficiency between animals, and that a proportion of this variation is due to genetic differences.

BREEDPLAN produces two EBVs relating to feed efficiency - Trial Net Feed Intake (Post Weaning) & Trial Net Feed Intake (Feedlot Finishing). Both EBVs are calculated from information collected in feed efficiency trials or by measuring levels of the blood hormone IGF1. Whilst there is a positive relationship between the two EBVs, some animals do rank differently for feed efficiency in the two different scenarios.

(i) Trial Net Feed Intake (Post Weaning)

Trial NFI-P EBVs are estimates of genetic differences between animals in feed intake at a standard weight and rate of weight gain when animals are in a growing phase. For example, animals placed in a feedlot post weaning. Trial NFI-P EBVs as expressed as kilograms (kg) of feed intake per day.

Lower, or more negative, Trial NFI-P EBVs are 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, are growing at a similar rate, and are in a growing phase).

(ii) Trial Net Feed Intake (Feedlot Finishing)

Trial NFI-F EBVs are estimates of genetic differences between animals in feed intake at a standard weight and rate of weight gain when animals are in a feedlot finishing phase. Trial NFI-F EBVs as expressed as kilograms (kg) of feed intake per day.

Lower, or more negative, Trial NFI-F EBVs are more favourable. For example, a bull with a NFI EBV of –0.6 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 +0.8 kg/day (when the progeny are of similar weight, are growing at a similar rate, and are in a feedlot finishing phase).

Structural Soundness

Since cattle were first domesticated, it has been recognised that animals should conform to certain structural requirements to ensure high levels of production and adaptability to the environment. When structural integrity is not maintained, substantial financial loss can occur. These losses could be due to such things as complete bull breakdown, bulls not being able to cover the allocated cows resulting in lower conception rates, steers being unable to finish a long feeding program, or cows with badly structured udders being unable to rear their calves properly.

Trial Structural Soundness EBVs are provided for five important structural traits:

- Front Feet Angle (FA)
- Front Feet Claw Set (FC)
- Rear Feet Angle (RA)
- Rear Leg Hind View (RH)
- Rear Leg Side View (RS)

Trial Structural Soundness EBVs are reported as an estimate of genetic differences between animals in the percentage of progeny that will have a desirable score for a particular structural trait and are calculated from structural scores recorded on animals by an accredited scorer when the animals are younger than 750 days of age.

Higher Trial Structural Soundness EBVs are more favourable. That is, higher EBVs indicate a greater percentage of progeny with a desirable score for that particular trait. For example, a bull with a Front Feet Angle EBV of +25.3 would be expected to on average

produce 41% more progeny with desirable front feet angle than a bull with an EBV of -56.1 [ie. 25.3 – (-56.1) x ½].

Animals with very low (ie. negative) EBVs for each trait are identified with an additional flag to indicate the nature of their structural fault.

- Front Feet Angle & Rear Feet Angle EBVs are identified with a flag of "ST", indicating increased probability of steep feet angle and "SH", indicating increased probability of shallow feet angle
- Front Feet Claw Set EBVs are identified with a flag of "OD", indicating increased probability of open divergent claws and "SC", indicating increased probability of scissor claws.
- Rear Leg Hind View EBVs are identified with a flag of "BL", indicating increased probability of bow legged rear legs and "CH", indicating increased probability of cow hocked rear legs.
- Rear Leg Side View EBVs are identified with a flag of "SR", indicating increased probability of straight rear legs and "SI", indicating increased probability of sickle hocked rear legs.

Flight Time

Trial Flight Time EBVs are estimates of genetic differences between animals in temperament. Trial Flight Time EBVs are expressed as differences in the number of seconds taken for an animal to travel approximately 2.0 metres after leaving the crush and are calculated from flight time measurements that have been recorded on animals using specialised flight time equipment (see picture below).

Flight time is a simple, cost effective and easy to record objective measurement of temperament. Research has shown that in addition to the obvious benefits for ease of handling and management, animals with longer flight time (ie. superior temperament) also have superior meat tenderness.

Higher (ie. Longer) Trial Flight Time EBVs are more favourable. That is, higher EBVs indicate a longer time taken to exit the crush and hence better temperament. For example, a bull with an EBV of +0.80 would be expected to on average produce progeny that took 0.7 of a second longer to exit the crush than a bull with an EBV of -0.60.

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