

## **How does BREEDPLAN compare animals running under different conditions ??**

The process by which BREEDPLAN compares animals running in different herds and in different environments can be broken down into two main steps :

- (i) Firstly, the performance recorded for an animal is directly compared with the performance of other animals that have had an equal opportunity to perform (ie. animals within their contemporary group).
- (ii) Secondly, BREEDPLAN uses “genetic linkage” to compare animals across the different contemporary groups both within the herd, across herds & across countries.

<b>Comparison within Contemporary Groups</b>
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BREEDPLAN analyses cattle in contemporary groups to take out the influence of as many of the non-genetic effects as possible (eg. feeding, years, seasons). The underlying principle is that only animals that have had an equal opportunity to perform are directly compared together within each contemporary group.

BREEDPLAN automatically creates the contemporary groups of animals for comparison based on the criteria outlined below.

**Table 1 : Aspects of the Division of Data in BREEDPLAN**

AUTOMATIC	AUTOMATIC, BUT CAN BE BREEDER INFLUENCED	BREEDER SUPPLIED
1. Herd	7. Breed	10. Breeder Defined Management Groups
2. Calving Year	8. Weight Date	- birth
3. Sex of Calf	9. Calf Age (Slicing)	- post-birth
4. Twins/Single		
5. Birth Status (ET)		
6. Dam Age		

The following section provides more detail regarding each of these criteria.

### **1. Herd**

Only calves bred and weighed in the same herd will be directly compared in the same contemporary group.

This herd definition can be extended to include “associated herds” which have calves bred and managed as part of a larger herd. The most common example is where members of a family (eg. children) have a small number of animals registered in their own name that run as part of the main herd on the property.



## **2. Calving Year**

Only animals born in the same “calving year” will be compared together in the same contemporary group.

Usually the calving year is the same as the year of birth of the calf. However, for herds whose calving period runs into the next calendar year (eg. from November through to March), "calving year" can be specified to span the period running across two different calendar years. This may be applicable to herds in northern Australia that calve over the summer months. In these cases, a financial year is more appropriately used as the “calving year”.

## **3. Sex of Calf**

Only calves of the same sex at measurement will be directly compared in the same contemporary group (ie. bulls with bulls, heifers with heifers, steers with steers).

Note that males that are weighed initially as bulls and then castrated will have their first weight compared with all the other males and their second weight only with the steers.

## **4. Number in Birth (Singles/Twins)**

Only calves of the same birth number will be compared together in the same contemporary group. In other words, single calves will not be compared with twins.

While twins can potentially be compared with other twins, the low occurrence of twin births generally means that very little performance information from twins is used in the BREEDPLAN analysis.

## **5. Birth Status (ET/Natural)**

Calves conceived naturally or by AI will be directly compared together in the same contemporary group but they will not be compared with embryo transfer (ET) calves. In other words, ET calves will be analysed in a separate contemporary group.

Furthermore, the amount of information available on the recipient dam will then determine the formation of the contemporary group for ET calves. More specifically, ET calves will only be directly compared with other ET calves that have been reared by recipient dams of the same breed (and the recipient dam information has been recorded with the Breed Society/Association).

## **6. Dam Age (Parity)**

The birth performance records for calves out of first calf heifers (up to 3.5 years of age) are not compared with birth performance records for calves out of other cows.

NOTE - This heifer/cow distinction is only used for birth performance traits (ie. birth weight, gestation length, days to calving).

## **7. Breed**

In some BREEDPLAN analyses, only the performance records for calves of the same breed will be compared together in the same contemporary group.

NOTE - The breed of an animal is only used in the formation of contemporary groups in some BREEDPLAN analyses. In other BREEDPLAN analyses, either a) only the performance for pure bred animals is included or b) the performance from cross bred animals is included in the same contemporary group and adjustments for heterosis are made.

## **8. Weight Date**

Only animals weighed on the same date will be compared together in the same contemporary group. In addition, only animals with the same weighing history will be directly compared.

For example, the 400 day weight performance for two animals will only potentially be directly compared if :

- both the 400 day weights were recorded on the same day
- any weights previously submitted to BREEDPLAN for these animals (eg.200 day weights) had also been recorded on the same day.

## **9. Calf Age**

Only animals of similar age will be directly compared in the same contemporary group.

When all the other criteria have been used to place animals into a contemporary group, the group is divided (sliced) into animals of similar ages. “Slicing” is done to ensure that the calves being compared have been run under comparable seasonal conditions.

For example, if the age slicing for 200 day weight is 45 days. The first calf born in the group is the start and the contemporary group will include all animals born in the next 45 days. After this the next calf is found and this becomes the start of the next contemporary group.

NOTE – This age slicing varies depending on the trait being analysed. In addition, the age slices used may vary from breed to breed. The following table provides an indication of the standard age slices used by BREEDPLAN.

**Table 2: Standard Age Slicing and Ages for BREEDPLAN Traits**

Trait	Age Range (days)	Standard Age (days) #	Slicing
+ Gestation Length	520-(20yrs)	-	6 months
Birth Weight	0	-	45 days
⊕ 200 Day Milk	760 days -(20 yrs)	-	-
200 Day Weight	80-300	200	45 days
400 Day Weight	301-500	400	60 days
600 Day Weight	501-900*	600	60 days
Scrotal Size	300-700	400	60 days
+ Days to Calving	600-3650	-	6 months
Scan Fat	300-800	500	60 days
Scan EMA	300-800	500	60 days
+ Calving Ease	600-(5 yrs)⊗	-	4 months

- # Each trait is adjusted to a standard age before comparisons are done.
- + These are measures on the cow when the calf is born.
- ⊗ For calving ease, all cows older than 1900 days are treated as “mature cows”.
- ⊕ The 200 day milk EBV of the cow is estimated from the 200 day weight of the calf. Cows older than 12 years are treated as mature cows.

**10. Breeder Defined Management Group**

Only animals in the same breeder defined “management group” will be directly compared in the same contemporary group.

There are two different forms of breeder defined management group.

a) the “Birth Management Group” allows breeders to describe different treatments of the cows prior to the birth of the calf. For example, where one group of cows have had different feed availability that may affect the birth weight and/or calving ease and/or gestation length when the calf is born.

b) the “Post Birth Management Group” allows breeders to identify animals that have received different treatment or management following birth that has influenced their performance. This treatment may be deliberate (eg when some of your young bulls receive supplementary feeding and others do not) or accidental (eg if a calf is sick).

Providing BREEDPLAN with management group information is the responsibility of the breeder. By assigning animals into management groups, breeders are acting as “eyes” for the BREEDPLAN evaluation.

<b><u>Comparison between Contemporary Groups</u></b>
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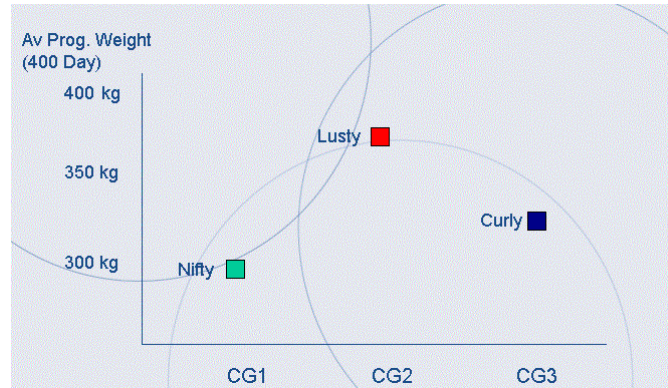
Once BREEDPLAN has formed contemporary groups of similar animals, each contemporary group is then compared through the use of “genetic linkage”.

Genetic linkage can generally be described as “common animals”. That is, for BREEDPLAN to compare animals from different environments, herds must have some performance recorded progeny from common animals (typically common sires) so that the performance recorded animals in each herd are genetically related.



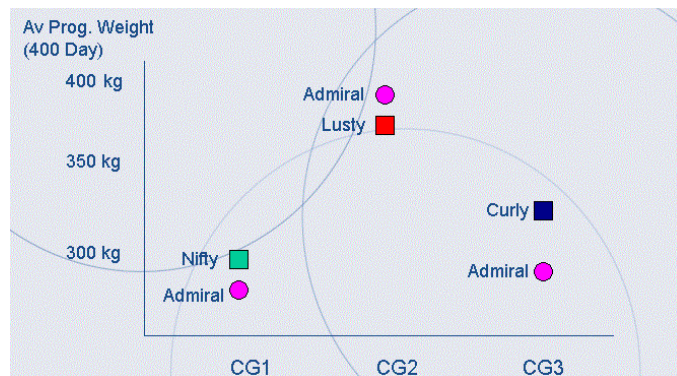


As an example of genetic linkage, please consider a situation where 3 different contemporary groups of calves (either on the same property or different properties) are compared. There are environmental differences between the Groups - Contemporary Group 1 (CG1) has relatively poor nutrition, Contemporary Group 3 (CG3) average and Contemporary Group 2 (CG2) relatively good. The figure below reflects the relative average performance of progeny in each of these contemporary groups.



In this example, all of the progeny in each group are by different sires. Nifty is the sire of the progeny in Group 1, Lusty is the sire of the Group 2 progeny and Curly is the sire of the progeny in Group 3. Under such conditions, it is impossible to make valid comparisons about the relative performance of the animals in the different contemporary groups, as there are no “links” between the groups and the groups have been running under different conditions.

If however, progeny from a common link sire existed in each contemporary group (for example, an AI sire) then it becomes possible to compare the progeny of the different sires represented in each group. This is illustrated in the figure below where Admiral is the link (or common) sire.

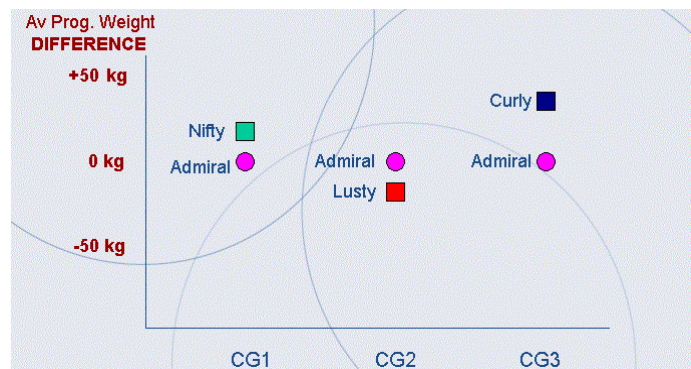


The progeny of the link sire (Admiral) have average adjusted 400-Day weights of 290 kg, 390 kg and 300 kg in their respective contemporary groups. In comparison, the average adjusted 400-Day weights of the progeny of the other sires are: Nifty: 300 kg, Lusty: 380 kg and Curly: 320 kg. For the purposes of this example, we assume that all sires are joined to cows of equal merit.

When compared to the link sire Admiral, Nifty tested in Contemporary Group 1 is superior to Lusty from Group 2. Curly from Group 3 has the highest average 400 day weight performance. These differences are represented in the following table.

Direct comparisons	Indirect comparisons
Nifty vs Admiral = +10kg	Nifty vs Lusty (+10kg +10kg) = +20kg
Lusty vs Admiral = -10kg	Nifty vs Curly (+10kg -20kg) = -10kg
Curly vs Admiral = +20kg	Lusty vs Curly (-10kg -20kg) = -30kg

Graphically, these differences are shown in the following figure.



Assuming large progeny numbers (100+) for each sire, the sire EBVs will approach twice the progeny differences. This is because the progeny only receive half of their genes from their respective sires. The other half of their genes comes from the dam.

In accordance with this, the resultant EBVs of these sires (twice the progeny differences) will be :

	Nifty	Lusty	Curly	Admiral
<b>EBVs</b>	+20 kg	-20 kg	+40 kg	0 kg

The above EBVs assume that Admiral has a base 0 EBV, that reasonable numbers of progeny were measured and that the cows are of equal performance. Adjustments are made if cows are known to differ in BREEDPLAN.

In addition, if the progeny numbers are not large, the sire EBVs will be less than double the progeny differences, as BREEDPLAN makes “conservative predictions”. The “scaling factor” depends on the number of progeny of home sire and link sire and the heritability of the trait in question.

*Please contact staff at BREEDPLAN should you have any further queries regarding how BREEDPLAN compares animals running under different conditions.*