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

BREEDPLAN compares the performance of animals running under different conditions through the use of "genetic linkage".

Genetic linkage can generally be described as "common animals". That is, the 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 mobs 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.
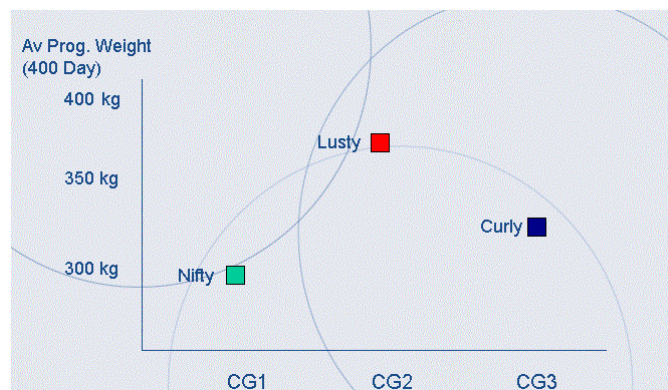
In this example, all of the progeny in each group are by different sires. Nifty is the sire of the progeny in Group 1, Lusty is the sire of the Group 2 progeny and Curly is the sire of the progeny in Group 3. Under such conditions, it is impossible to make valid comparisons about the relative performance 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.
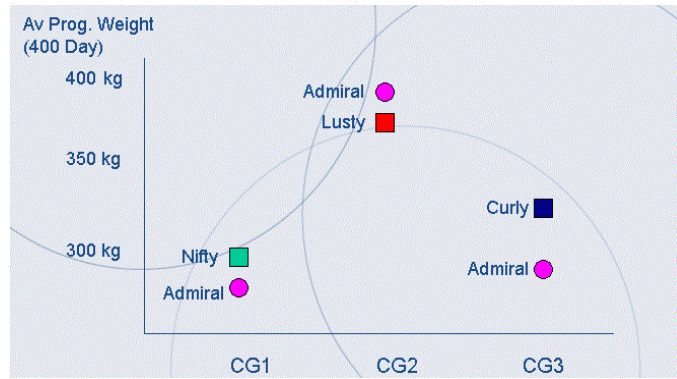
The progeny of the link sire (Admiral) have average adjusted 400-Day weights of 290 kg, 390 kg and 300 kg in their respective contemporary groups. In comparison, the average adjusted 400-Day weights of the progeny of the other sires are: Nifty: 300 kg, Lusty: 380 kg and Curly: 320 kg. For the purposes 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.
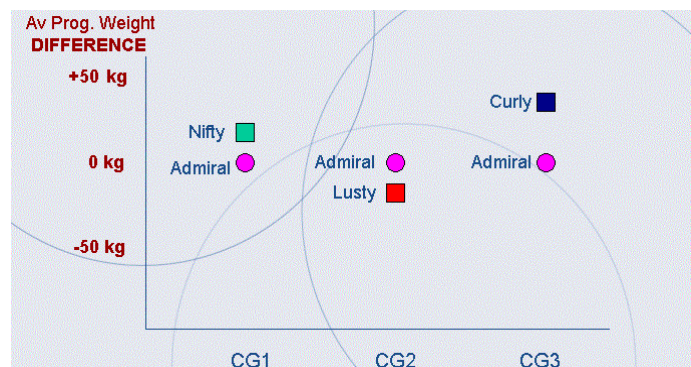
Assuming large progeny numbers (100+) for each sire, the sire EBVs will approach twice the progeny differences. This is because the progeny only receive half of their genes from their respective sires. The other half of their genes comes from the dam.

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

	Nifty	Lusty	Curly	Admiral
EBVs	+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 the use of genetic linkage.