

# Tools of the Trade: Cross Breeding

Carefully planned and well managed crossbreeding systems offer the potential to deliver significant benefits to beef producers.

The main benefits result from:

- Additional performance as a result of hybrid vigour (also known as heterosis).
- The ability to combine the benefits of different breeds (also known as breed complementarity).

## HYBRID VIGOUR (OR HETEROSIS)

Hybrid vigour is the amount by which the performance of the crossbred animals exceed (or differ from) the average performance of the purebred parents that are used in the cross. An example of this for weaning weight is demonstrated in Figure 1.

This was further illustrated in a crossbreeding research trial undertaken by the Queensland Department of Primary Industries which highlighted the benefits achieved through a structured crossbreeding program for weaning weight. This trial included crosses of Hereford, Angus and Shorthorn cattle in Southern Queensland.

The results of this trial are demonstrated in Figure 2. Compared to the straight bred calves, the F1 crossbred

calves showed an 8.5% increase on average in weaning weight per cow mated. While significant, a larger increase of 23.3% was observed in the F2 calves, being those calves bred from F1 cows. The additional “boost” was obtained from maternal heterosis.

Importantly, heterosis is not just observed for weaning weight but in many economically important beef cattle production traits, especially in traits of “low” heritability such as reproduction and adaptability traits.

Figure 3 below illustrates the relationship between heritability and heterosis for different categories of beef cattle traits.

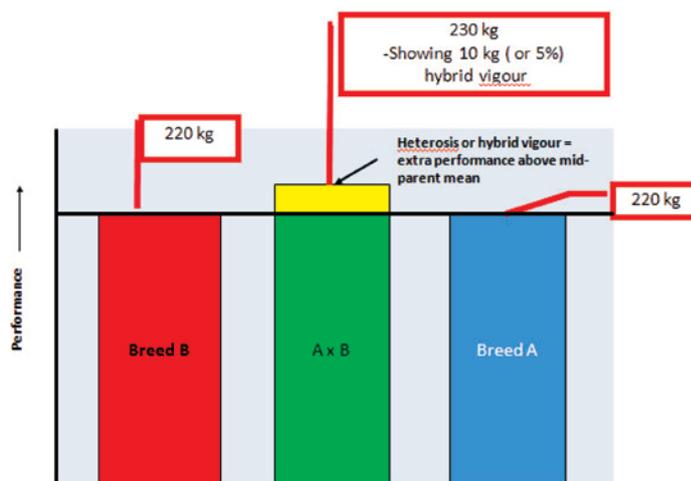


Figure 1. Example of Hybrid Vigour for Weaning

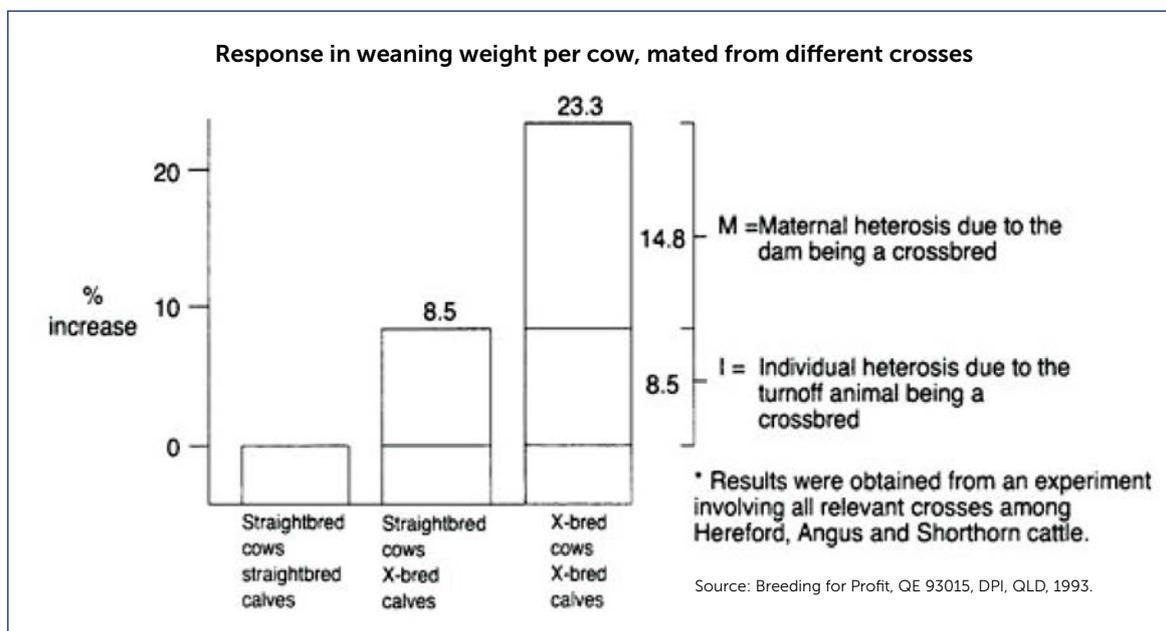


Figure 2. Response in Weaning Weight per Cow Mated

Reproduction and maternal traits have low heritability and the traditional response to selection in breeding programs will generally be slower compared to high heritability traits. At the same time however, significant improvement in these traits can be made through programs that maximize heterosis.

The inverse is true with carcass traits. Significant and rapid progress can be made through selection for carcass traits in a breeding program, while crossbreeding has little or no heterosis effect. Growth traits are moderate for both heritability and heterosis, making progress possible through both selection and crossbreeding.

The amount of hybrid vigour achieved will depend on the type of crossbreeding or composite system implemented. A composite breeding program is a crossbreeding system that is stabilised (inter-mating the crossbreds).

Figure 4 lists the types of crossbreeding systems, the levels hybrid vigour (both individual and maternal) retained and estimates of increases in weaning weight per cow mated.

To re-iterate, to fully benefit from hybrid vigour the cow herd should also be crossbred to also take advantage of maternal heterosis. Crossbred cows when compared to purebred females will generally have:

- increased conception rates
- improved calving ease
- increased percentage of calves weaned
- a longer production life (i.e. longevity)

## BREED COMPLEMENTARITY

Breed Complementarity results when combining the strong traits of one or more breeds to compensate for the weak traits of another breed.

For example, a British breed female (eg. Angus, Hereford, Shorthorn) mated to a European breed sire (eg. Charolais, Simmental, Limousin) complement each other exceptionally well. In general terms, the British breed female contributes early maturity, easy finishing and calving ease while the European breed sire contributes high growth and muscle.

Alternatively, a simple cross breeding system could utilise two different British breeds (eg. Shorthorn/Hereford and Angus genetics). This example requires two joining

Traits	Heritability	Heterosis
Fertility, Mothering Ability, Calf Survival	Low	High
Birth & Weaning Weight, Milk	Medium	Medium
Carcass	High	Low

Figure 3. Comparison of Trait Heritability and Heterosis.

System	Individual (%)	Maternal (%)	% WT Calf/Cow
2 breed cross	100	0	8.5
3 breed cross	100	100	23.3
<b>Rotational Cross</b>			
2 breed	33	67	12.7
3 breed	86	86	20
4 breed	93	93	21.7
<b>Composite</b>			
2 breed	50	50	11.6
3 breed	67	67	15.6
4 breed	75	75	17.5
5 breed	80	80	18.6
6 breed	83	83	19.3

Figure 4. Crossbreeding Systems and Estimated Levels of Hybrid Vigour.

mobs, with the daughters of the Angus sires being joined to the Shorthorn/Hereford sire and vice versa (known as a criss-cross mating system). These breeds work in this system as they both have maternal qualities, and are complementary in carcass and maturity patterns. In addition, the system is relatively easy to manage, generates its own replacement females, which in turn provide the benefits from the maternal hybrid vigour that will be expressed.

## CROSSBREEDING CONSIDERATIONS

There are some considerations that need to be taken into account regarding the implementation of a crossbreeding program.

These include:

- Managing and/or sourcing replacement females (depending on crossbreeding system implemented).
- Crossbreeding programs may require more joining groups than a purebred system. This could be eased by purchasing replacement heifers although locating

a source of heifers available on a regular basis with suitable health status and known breeding may be difficult.

- Hybrid vigour may result in higher birth weights when sires of a high growth rate breed are joined to heifers of a smaller breed. Selection of suitable genetics is essential to counteract this negative.
- Crossbred females may be larger and therefore consume more feed than purebred females. Research has indicated that productivity per hectare still favours the crossbred female.

## SELECTION & CROSSBREEDING

Crossbreeding should not be seen as an excuse for using “low” performing genetics (i.e. bulls) within a breeding program. Regardless of hybrid vigour, the performance of the crossbred herd will depend largely on the genetics of the parent, the management level and the environment that is used.

Figure 5 illustrates the benefits of combining selection with crossbreeding.

Several tools should be utilised within the beef producer’s tool kit to ensure the “best” genetics are used in the crossbreeding program, including:

### 1. BREEDPLAN EBVs

BREEDPLAN is a genetic evaluation system for beef cattle breeders offering the potential to accelerate

genetic progress in their herds, and to provide objective information on stock they sell to commercial breeders.

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 (e.g. weight, carcass, fertility). Included in the calculation of EBVs are the animal’s own performance, the performance of known relatives, the heritability of each trait and the relationship between the different traits.

### 2. BreedObject Selection Indexes

Selection Indexes enable cattle producers to make “balanced” selection decisions, taking into account the relevant growth, carcass & 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.

Utilising both selection and cross breeding will result in maximum benefit within a breeding program.

To further discuss the application of cross breeding, please contact staff at Southern Beef Technology Services (SBTS) or Tropical Beef Technology Services (TBTS).

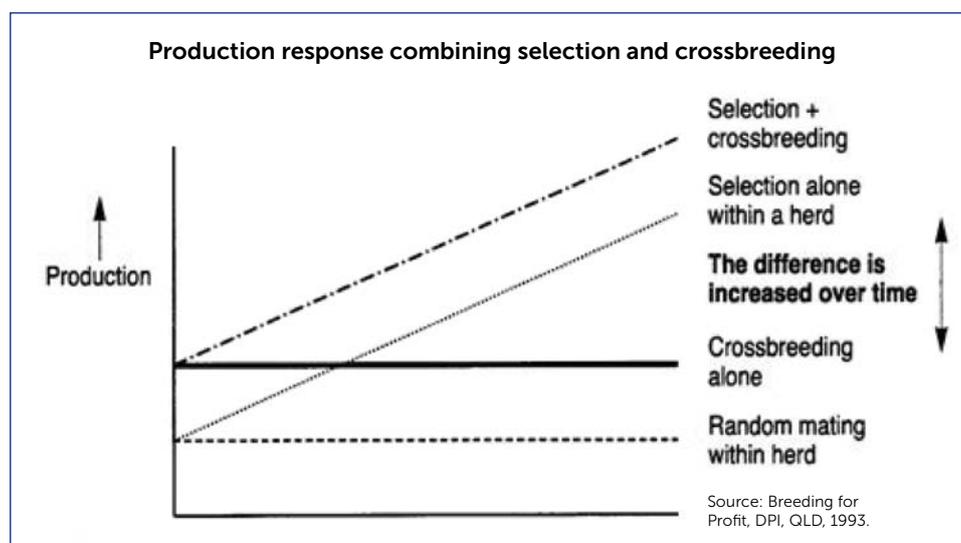


Figure 5. Maximum benefit is achieved when the benefits of crossbreeding and selection are combined.