

TOOLS OF THE TRADE – Cross Breeding

Planned and well managed crossbreeding systems will deliver significant benefits to beef producers. The main benefits result from:

- 1) Higher performance than expected for a range of traits through hybrid vigour (also known as heterosis).
- 2) Combining the benefits of breeds known as breed complementarity.

Let's look at both benefits in more detail.

Hybrid Vigour - Hybrid vigour is the amount by which crossbred animals exceed (or differ from) the average of the purebred parents used in the cross (figure 1).

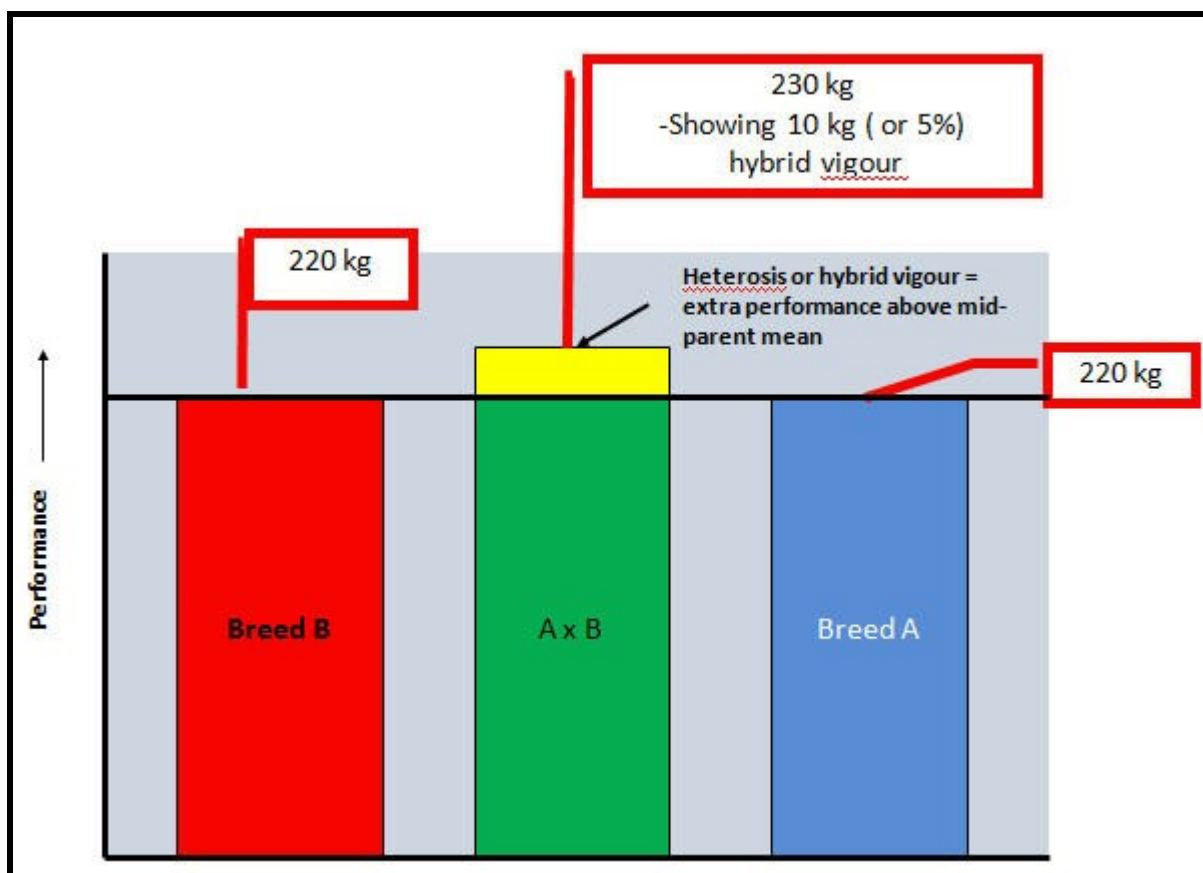


Figure 1 – Example of Heterosis for weaning weight.

A crossbreeding trial undertaken by the Queensland Department of Primary Industries (QDPI now known as DEEDI) 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. 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 calves bred from F1 cows obtaining the additional “boost” from maternal heterosis (Figure 1)

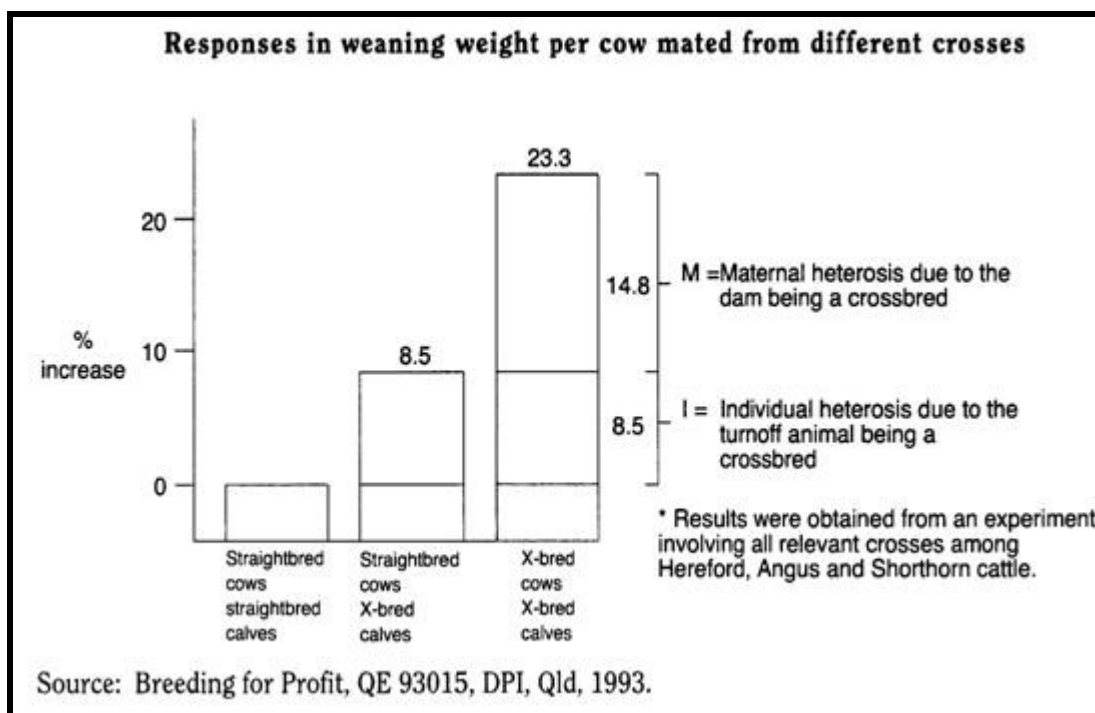


Figure 2. Response in Weaning Weight per Cow Mated from a Structured Cross-Breeding Program

The previous trial shows the benefit of hybrid vigour to weaning weight per cow mated however it will also be expressed in many economically important beef cattle production traits, especially in traits of “low” heritability such as reproduction and adaptability traits. Table 1 illustrates the relationship between heritability and heterosis regarding different categories of beef cattle traits. Reproduction and maternal traits have low heritability and response to selection will generally be slower compared to high heritability traits. At the same time, significant improvement in these traits can be made through programs that maximize heterosis.

Table 1: Heritability and Heterosis comparison

Traits	Heritability	Heterosis
Fertility, Mothering ability, Calf Survival	Low	High
Birth & Weaning weight, milk	Medium	Medium
Carcase	High	Low

The inverse is true with carcass traits. Significant and rapid progress can be made through selection for carcass traits, while crossbreeding has little or no effect. Growth traits are moderate for both heritability and heterosis, making progress possible through 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). The following table 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 (Table 2).

Table 2. Crossbreeding Systems and Estimated Levels of Hybrid Vigour.

System	Individual (%)	Maternal (%)	% WT calf/cow
2 breed cross	100	0	8.5
3 breed cross	100	100	23.3
Rotational cross			
2 breed	33	67	12.7
3 breed	86	86	20
4 breed	93	93	21.7
Composite			
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

To re-iterate, to fully benefit from Hybrid Vigour the cowherd should also be crossbred. Crossbred cows when compared to purebred females will generally have have:

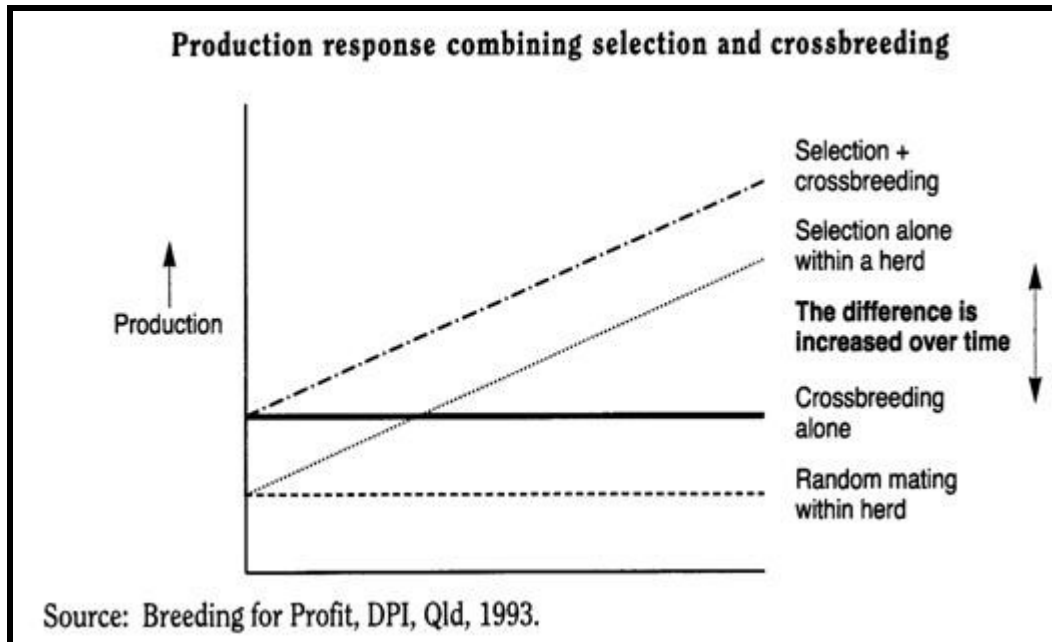
- increased conception rates
- improvement in calving ease
- increase in percentage of calves weaned
- A longer production life (i.e. longevity)

Breed Complementarity results when combining the strong traits of one or more breeds to compensate for the weak traits of another breed. For example Shorthorn and Angus complement each other exceptionally well, particularly in a simple cross breeding system known as criss-crossing. This requires two joining mobs. The daughters of the Angus are joined to the Shorthorn sire(s) and vice versa. This system is relatively easy to manage and generates its own replacement females including maternal hybrid vigour. These breeds both have maternal qualities, and are complementary in carcase and maturity patterns.

Crossbreeding Considerations - There 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 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 but this will depend in individual circumstances.

Selection & Crossbreeding - Crossbreeding should not be seen as an excuse for using “low” performing genetics (i.e bulls). Regardless of hybrid vigour, the performance of the crossbred herd will depend largely on the performance of the parent, the management level and the environment that is used. Figure 3 illustrates the benefits of combining selection with crossbreeding.



Following are several tools that should be utilised in your selection tool kit to ensure the “best” genetics are used in the crossbreeding program.

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 (eg. weight, carcase, 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

BREEDOBJECT 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. Australian Shorthorn has selection Indexes available for the Export Maternal, Heavy Domestic and SB3 Carcase production systems
(Detailed information on these tools can be found at <http://sbts.une.edu.au/>)

Further information on Crossbreeding can be obtained from Christian Duff, Shorthorn SBTS Technical Officer (02 6773 2472 or christian@sbts.une.edu.au)