

# Beef cattle breeding systems

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## Introduction

The basic objective of animal breeding is to continually improve production efficiency and product quality. Breeders must strive for genetic improvement in economically important traits, regardless of their breeding system.

The choice of whether to straight breed or cross breed must consider the ability to match the herd with their environment and intended market.

## Straight breeding

Straight (or pure) breeding produces both replacement females and sale animals. A balanced approach is therefore required for those traits that are antagonistic. Without hybrid vigour from cross breeding, it is important to identify and select genetically superior individuals for continual improvement.

Straight breeding programs are the easiest to manage although bull selection is still important to manage growth, calving ease, maternal and other traits.

### Important points

- BREEDPLAN Estimated Breeding Values (EBVs) and \$indexes are consistent and

relevant for both bulls and cows.

- The simplest breeding option when the same bull can be used over both heifers and cows.
- Herds are self-replacing.
- There are premiums for straight British bred steers, particularly angus and shorthorn, in the feeder steer market.
- Purebred females are often in demand during times of herd rebuilding

**The extra productivity of black baldy breeders must be balanced with the lost price premium of purebred steer progeny**



Photo: Todd Andrews

## Cross breeding

Crossbreeding capitalises on the genetic differences between breeds to produce progeny suitable for a defined market or environment. Complementarity between breeds can be used to achieve a

combination of genes more rapidly than within-breed selection.

Crossbreeding also results in productivity gains due to hybrid vigour, or heterosis, which is defined as the difference between actual and expected performance (based on parental averages). For example, calves exhibiting hybrid vigour have higher growth rates than similar purebred calves.

Heterosis increases for breeds that are less closely related and is maximised when crossing purebred *Bos indicus* and *B. taurus*. Growth (weight for age) and fitness traits (parasite resistance and breeder longevity) are most affected.

**Infusing British breeds with tropically adapted genetics increases productivity in marginal areas such as coastal NSW**



**Photo: Nathan Jennings**

Heterosis should not be relied on for ongoing gains. As in any breeding program, continued improvement from crossbreeding relies on the genetic merit of foundation animals and the selection intensity placed on their progeny.

Crossbreeding allows producers to quickly alter herd characteristics such as targeting a particular market (marbling specifications), increasing production or addressing a breed related disease problem. The main disadvantage is that management is more complex.

**Crossbreeding systems**

Despite large potential gains from crossbreeding, success depends on good planning and using appropriate genetics to achieve the breeding objectives. The following briefly outlines the key 'planned' approaches to crossbreeding.

**Rotational crosses**

Rotational crossing occurs when different sire breeds are used in sequence over breeders. Two, three or even four sire breeds may be used.

In a simple two breed, or criss-cross system, cows of breed A are mated to sire breed B, with the resulting heifers being joined back to sire breed A. In a three breed rotation, the progeny of sire breed A x cow breed B are mated to sire breed C. The female progeny of this cross are mated back to sire breed A for the rest of their breeding lives. The minimum number of joining groups is equal to the number of sire breeds.

All animals in a rotationally crossed herd benefit from heterosis, boosting both growth and maternal traits. As a result, calf weight weaned per cow joined increases by up to 20% in two breed rotations and more in three breed rotations.

In a rotational cross system, each breed contributes genetics equally to the production system over a number of generations. Even so, variability among progeny from radically different sire breeds can make it more difficult to consistently meet market specifications.

All females from a rotational cross system can be used as replacements and

this increases the selection intensity and subsequent opportunities for genetic improvement. Rotational crossbreeding increases management difficulties in that specific breeder groups need to be mated to specific sire breeds.

### **Important points of rotational crosses**

- Generates replacement females.
- Hybrid vigour is retained, increasing weaning weight by at least 10 to 20%.
- Cows can be run in a single herd, apart from separation for sire group joining.
- Good records are required to identify female sire groups and progeny.
- Sale stock may vary in appearance depending on sire breeds used.
- Both maternal and market traits must be considered in female selection.

### **Two-way cross (F1)**

A simple system whereby a bull of one breed is joined to cows of another breed. Hybrid vigour is only generated in the progeny, which are all sold.

Some systems produce F1 females that can be extremely productive and highly sought after as breeders. Other programs can target specialist carcass markets such as Angus x Wagyu feeders.

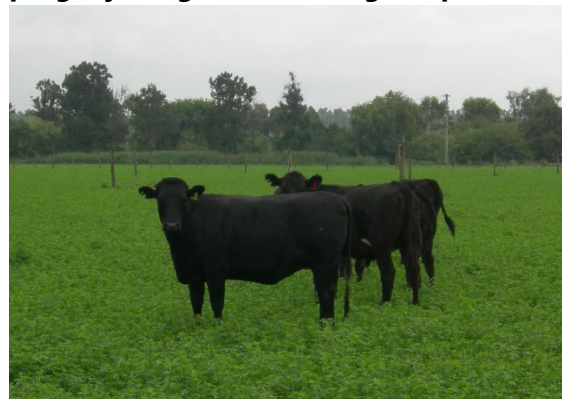
This system does not produce its own replacements, which need to be purchased or bred separately.

### **Important points of two-way crosses**

- There is a 5 to 10% increase in calf weaning weight per cow mated.
- Female replacements must be bred separately or purchased.

- Programs can be aimed at specific lucrative markets.
- Target markets can be changed simply by changing bulls.

### **Crossing Angus with appropriate Wagyu bulls increases marbling potential when progeny are grown out on good pasture**



**Photo: Todd Andrews**

### **Terminal sire joined to first-cross (F1) females**

In this system, a third breed of bull is joined to F1 cows and all progeny are sold. This is the most productive system, as F1 females of the right breed groups can maximise maternal heterosis for fertility, milking ability and longevity. They can also be selected for environmental adaptation and medium size, moderating their feed requirements. Sires can then be selected for growth and carcass traits.

Although F1 females have increased longevity, which means that they don't need replacing as often, the main disadvantage with this system is that replacement females must be sourced outside the system. They can be bred separately, but this requires running a herd of purebred cows, which are often less productive in marginal production areas. Alternatively, F1 females can be both difficult to source and expensive.

Terminal sires are generally European breeds such as Charolais, Limousin and Simmental (and their crosses) because of their extra growth. Note that some bulls chosen for the main breeding herd may not be suitable for use over heifers due to potential calving problems. This requires having additional 'heifer' bulls on hand.

**Hybrid vigour is maximised in calves sired by European (eg Charolais) bulls out of Brahman X British bred cows**



Photo: Todd Andrews

**Important points of terminal crosses**

- Hybrid vigour is expressed in breeders and maximized in calves.
- Up to 50% increase in calf weaning weight per cow mated in marginal environments.
- Replacement females must be sourced from outside the system.
- Heifers may need to be mated to bulls with low calving risk.

**Composites**

An alternative to crossbreeding is to use a composite breed. The development of a composite breed results from the crossing of two or more existing breeds and then selecting from within that population. There are many examples including Santa Gertrudis, Droughtmaster, Brangus and

Charbray. The key advantage is that after the initial crosses are made and the Composite breed is formed, the management requirements are the same as for straight breeding.

This approach provides the opportunity to change long term breeding priorities, as the market or other circumstances dictate, by incorporating breeds with desirable characteristics. Composite breeding allows for the blending of characteristics from a number of breeds into a composite that incorporates any combination of maternal, environmental adaptation and market traits.

The level of hybrid vigour retained depends on the number of breeds used to develop the composite (a four-breed composite will retain 25% more hybrid vigour than a two-breed one).

**The yearling composite bulls pictured (Ultrablack) averaged 20% heavier than the purebreds**



Photo: Todd Andrews

**Important points of using composites**

- A high level of heterosis is retained.
- The herd is self replacing.
- Breeds can be selected to optimize the

mix of traits in the herd.

- Some antagonistic maternal and market traits need to be balanced
- In small herds the management is as simple as running a purebred herd.
- Developing a composite breed requires large base herd to avoid inbreeding.
- Variation in progeny will occur over the first three generations until the composite is stabilised.

### Combination systems within herds

Some producers use a combination of systems within a single herd to produce both replacement heifers and progeny destined for sale.

For example, producers with straight Angus herds might run Angus bulls with breeders for the first four weeks of joining and then swap with Charolais bulls for the remainder of joining. In this system the producer will only select from black heifers as replacements as these have come from the most fertile females while all 'grey' progeny (resulting from the Angus X Charolais cross) that were conceived later in the season are sold.

A similar strategy is to target young or first calf heifers to produce replacement females, as they are generally the hardest to get in calf and therefore female progeny represent the most fertile genetics. Sale progeny eg crossbreds are produced from the remainder of the herd.

This system has the advantage of using the most advanced genetics of the youngest generation, while producing larger crossbred calves in older cows.

A strategy to improve breeder longevity

(due to feet problems for example) in straight bred herds is to join older females to produce replacement females and use younger females for crossbreeding.

All of these systems have the advantage of producing both replacements and crossbred animals from the same herd. The disadvantage is that either separate joining paddocks or additional bulls are required. In this case, having a staggered or separate joining period can reduce these requirements.

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