The benefits of Wagyu genetics in crossbreeding

Well-planned crossbreeding with the Wagyu generates hybrid vigour and complementary traits that are crucial for the commercial breeder.

The aim of crossbreeding is to introduce characteristics of one breed into another to enhance the carcass traits and other desirable traits of these breeds in the crossbred animal.

While Wagyu genetics are traditionally introduced to other breeds to increase marbling and eating quality, several highly successful producers have used Wagyu genetics to increase the fertility and survivability of their animals' progeny.

Hybrid Vigour

Inbreeding depression and hybrid vigour, or heterosis, are two manifestations of the same breeding phenomenon.

- Inbreeding depression
  This is the decrease in the performance of inbred animals, most noticeably in traits such as fertility and survivability. Originally, only 167 black Wagyu and 16 red Wagyu (Akaushi) were brought to the US from Japan. This limited genetic spread and the resultant inbreeding reduces survivability, especially when the animals are young.
  It is thus critical for Wagyu breeders to acquire as much of this limited genetic diversity as possible to maximise the genetic diversification of their herds.
  To achieve this, the inbreeding coefficient should be managed to less than 10%. This is easily determined using the Mating Predictor in Breedplan.

- Hybrid vigour (heterosis)
  This phenomenon, the inverse of inbreeding depression, is visible in the increased performance of hybrids over the performance of purebreds and fullbloods. It is most noticeable in traits such as fertility and survivability, and is manifested in traits such as conception rate and weaning rate.
  Thus, by crossbreeding other breeds with Wagyu, breeders can introduce the marbling and eating quality of the Wagyu in the other breed, while retaining the positive traits of the other breed.

Marbling and Tenderness

The Wagyu is well known for its meat quality traits. Improved meat quality is defined by meat scientists as improved tenderness, juiciness and taste. Juiciness and taste are highly correlated to marbling.

In Wagyu SA's Certified Wagyu Beef programme, nearly 300 carcasses were scanned using a carcass camera. The average marbling score of the F1 (first cross) cattle was slightly over 5%. This showed that a Wagyu bull has a significant effect on the marbling of a crossbred carcass. In addition, the progeny will be marginally enhanced by hybrid vigour.

CROSSBREEDING

The smaller the relationship between two breeds or lines, the greater the hybrid vigour in the crosses between them. Thus,
selecting an unrelated breed with maximum genomic distance from the Wagyu breed will enhance hybrid vigour considerably. A study by the Animal Genetics and Breeding Unit in Australia showed that Wagyu was far removed genetically from both British and European breeds.

**BREED COMPLEMENTARITY**

In practice, breeders should not randomly cross different breeds with each other, but implement a planned programme, taking advantage of the breed complementarity offered by the Wagyu. This can be achieved by crossing, for example, dams with maternal traits such as fertility, milk production, maintenance efficiency and mothering ability with Wagyu sires that are strong in paternal traits such as consistent and proven marbling, carcass yield, growth and size.

Alternatively, a breeder may want to improve the fertility of a herd, and so use Wagyu bulls to enhance the fertility of a herd.

Breed complementarity can also be achieved in terminal sire crossbreeding systems in which maternal-breed dams are mated to paternal-breed sires to produce progeny that are especially desirable for the market, while the cow herd efficiently utilises the current production system.

In this case, daughters of terminal sires are not kept as replacements, but sold along with their male counterparts as slaughter animals.

Individual hybrid vigour depends on the gene combination in the embryo. Paternal and maternal hybrid vigour depends on the gene combinations in individual dams and sires.

For some traits, the cumulative effect of individual, maternal and paternal hybrid vigour can be surprisingly large. This is especially true of traits that combine growth rate, milk production and fertility.

The table demonstrates the substantial value of heterosis on fertility and growth traits. This is particularly important for crossbreeding Wagyu with South African breeds, where a 10% increase in weaning weight, for example, will lead to an immediate economic benefit for the farmer.

**LONG-TERM SUCCESS**

Hybrid vigour for growth is maximised in the F1 of unrelated populations. The Wagyu commercial breeder should understand that the hybrid vigour displayed by a two-breed F1 cross (or backcross, that is, a Wagyu bull on an F1 cow) is halved in the F2 cross. However, the breeder receives the full benefit of the maternal hybrid vigour of milk and fertility.

To sustain acceptable levels of hybrid vigour and complementary traits in a manageable way over the long term requires a well thought-out crossbreeding system. The following six criteria are important:

- Availability and performance of the maternal breed in its environment;
- Selection of Wagyu bulls, availability and performance record;
- Consistency of performance of F1 progeny;
- Simplicity of managing the system;
- Replacement considerations;
- Accuracy of genetic prediction.

The easiest and most common way to manage a system for producing Wagyu F1 calves remains the terminal sire crossbreeding system in which maternal-breed dams are crossed with paternal-breed sires to produce progeny that are especially desirable for the market, while the cow herd efficiently utilises the current production system. In this case, daughters of terminal sires are not kept as replacements, but sold along with their male counterparts as slaughter animals.

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**The percentage improvement of specific traits due to hybrid vigour (HV)**

<table>
<thead>
<tr>
<th>Trait</th>
<th>% HV</th>
<th>% HV (maternal)</th>
<th>% HV (paternal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conception rate</td>
<td>6</td>
<td>X*</td>
<td>6</td>
</tr>
<tr>
<td>Birthweight</td>
<td>3</td>
<td>1.5</td>
<td>X*</td>
</tr>
<tr>
<td>Weaning weight</td>
<td>10</td>
<td>15</td>
<td>6</td>
</tr>
<tr>
<td>Feed conversion</td>
<td>-1**</td>
<td>X*</td>
<td>X*</td>
</tr>
<tr>
<td>Yearling weight</td>
<td>6</td>
<td>2</td>
<td>X*</td>
</tr>
<tr>
<td>Age at puberty</td>
<td>-5**</td>
<td>X*</td>
<td>X*</td>
</tr>
<tr>
<td>Marbling</td>
<td>3</td>
<td>X*</td>
<td>X*</td>
</tr>
</tbody>
</table>

*X STILL NEEDS TO BE DETERMINED.


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