Cattle Business in Mississippi – February 2012
"Beef Production Strategies" article

Crossbred Cows 101

Jane Parish – Extension Beef Cattle Specialist, Mississippi State University

What is heterosis?

Heterosis, hybrid vigor, free lunch--- whatever it is called, the advantages of crossbreeding in the cow herd can be significant for the operation. Unfortunately, many commercial cow-calf herds are not taking optimal advantage of crossbreeding systems. In many herds, the same breed of bull has been used exclusively or nearly exclusively for many consecutive breeding seasons. In these herds, the commercial cattle are essentially grade straightbred cattle. These and many other herds with less than optimal maternal heterosis would benefit greatly by increasing the heterosis in future calf crops and replacement females.

So what is heterosis? Heterosis is simply the increase in productivity from crossbreeding. With heterosis, calves do not just perform as an average of their parents' performance levels. The calves displaying heterosis perform at a greater level than the average of their parents.

Heterosis is sometimes confused with heritability. Heritability is the additive genetic component of traits. It is a focus of genetic improvement programs, the proportion of differences among cattle due to their genes that transfer to their calves. An animal's genes play a greater role in affecting highly heritable traits (such as carcass traits) compared with less heritable traits (such as reproductive traits). Breeders cannot change the heritability of traits, but they can improve the level of heterosis in their herds through implementation of planned crossbreeding programs.

Heterosis can occur for a wide variety of performance traits. However, it tends to be greatest for traits with low heritability and least for traits with high heritability. Thus, reproductive traits tend to show the largest improvements from crossbreeding systems that increase heterosis. So, even though it is more difficult to improve reproduction than carcass merit in a herd through individual animal selection and culling, it is easier to improve reproduction than carcass merit through crossbreeding.

What is maternal heterosis?

Two types of heterosis are possible: individual (crossbred calf) heterosis and maternal (crossbred cow) heterosis. By using crossbred cows in the breeding herd, producers can take advantage of both types of heterosis. By capitalizing on maternal heterosis through use of crossbred cows, heterosis has its greatest economic impact on the cow-calf operation. The greatest improvements in using crossbred dams rather than straightbred dams involve reproductive traits. Higher reproductive rates, longer productive lives (by more than 1 year), and less frequent replacement need are documented advantages of

crossbred cows over straightbred cows. In addition to having more calves because of improved reproduction, crossbred cows tend to have greater calf survival rates and greater calf weaning weights.

As an example, after several generations a simple 2-breed rotational crossbreeding system results in retained heterosis stabilizing at about 67% of maximum heterosis. A 16% increase in the pounds of calf weaned per cow exposed to breeding is expected above the average of the parent breeds. So, if 500 pounds of calf weaned per cow exposed is the expected average of 2 straightbred breeds, then using those breeds together in a 2-breed rotational crossbreeding system will result in 580 pounds of calf weaned per cow exposed. This is an 80-pound improvement just by taking advantage of heterosis.

Which crossbreeding system is best?

A variety of crossbreeding schemes are available. They vary by number of cattle breeds needed, number of breeding pastures needed, frequency of changing sire breeds, whether or not replacement heifers are retained within the system or purchased from outside the system, and levels of maternal and calf heterosis attained.

Amongst common crossbreeding systems, a terminal cross of F_1 females (first-generation cross of sire breed A and cow breed B) bred to bull breed C offers the greatest advantage from heterosis. It offers maximum maternal heterosis and results in a 24% increase in the pounds of calf weaned per cow exposed above the average of the parent breeds. So, if 500 pounds of calf weaned per cow exposed is the expected average of the 3 straightbred breeds, then using those breeds together in a terminal cross of F_1 females will result in 620 pounds of calf weaned per cow exposed--- a whopping 120-pound improvement from heterosis.

The number of breeds used impacts retained heterosis in the crossbred cow herd. Relative to an F_1 cow with 100% retained heterosis, a 3-breed rotation produces crossbred cows with about 86% retained heterosis. In comparison, a 2-breed rotation produces crossbred cows with about 67% retained heterosis. Therefore, the inclusion of the third breed in the crossbreeding system increased the amount of retained heterosis in the crossbred cows over what it would have been using just 2 breeds.

Similarly, the frequency of bull breed rotation also influences retained heterosis in the crossbred cow herd. Using a 2-breed rotation, bulls of breed A are bred to females of breed B. Then the daughters of this cross are bred to bulls of breed B in the next generation. In following generations, females sired by breed A are bred to bulls of breed B, and vice-versa. Compare this system to a 2-breed rotation where bulls are only rotated every 4 years. Under the 4-year bull rotation system, some females are bred to bulls of the same breed as their sire in some years. Instead of achieving the 67% retained heterosis of the 2-breed rotation described previously, retained heterosis of the 4-year bull rotation system approaches 50%. Thus, because females are sometimes bred to their sire breed, the retained heterosis is less than with the more frequent sire breed rotation.

There are a number of practical considerations in choosing an appropriate crossbreeding system. The number of breeds that could be optimally utilized depends upon herd size and number of breeding pastures available. A 10-cow herd does not need 3 herd sires of different breeds on site at any one time, but a 100-cow herd might want to consider working 3 breeds of bulls into a crossbreeding system. Alternately, a small herd could take advantage of a terminal crossbreeding system by purchasing crossbred females.

Are high-quality breeding stock needed for crossbreeding?

The marketability of the calves produced from the different crossbreeding systems depends in part upon breed selection. It also depends upon the quality of the breeding stock. A well-planned crossbreeding system will not overcome poor bull and semen selection, so consider using quality sires as a critical aspect of crossbreeding.

Heterosis should be an important consideration in replacement female selection and a driving factor in bull breed selection. Well-designed crossbreeding systems deliver proven benefits. Take the time to develop an appropriate crossbreeding system for the operation’s resource base and marketing plan. After all, there are not many free lunches in the cattle business, and a quality crossbred cow herd in a good crossbreeding program using high-quality herd sires is as close to a free lunch as it gets. For more information about beef cattle production, contact an office of the Mississippi State University Extension Service.