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Not Equal

Hereford provides added heterosis when compared to other British breeds.

by **Dan Moser**, Kansas State University animal scientist

Fewer open cows. Lower death loss. More growth, more milk and more efficiency. In these challenging economic times, the benefits of crossbreeding are more important than ever. While a straightbred commercial herd should expect increased profitability from implementing any crossbreeding system, matching the right breeds can maximize the benefits of heterosis. But not all heterosis is created equal. Added heterosis is a key Hereford advantage, even when crossed on another British breed such as Angus or Red Angus.

Heterosis is defined as the increased performance of a crossbred

animal compared to the average performance of the pure breeds that make up the cross. Heterosis occurs because the desired level of performance — increased fertility, for example — is partially the result of dominant genes.

Beef producers understand that black coat color is dominant to red: that is, when an animal has one black gene and one red gene, the animal is black in color. Similarly, an animal with one gene for more fertility and one for less might be just as fertile as another animal that is homozygous for high fertility. In theory, there are dominant genes that increase not only fertility but survivability, growth and milk production.

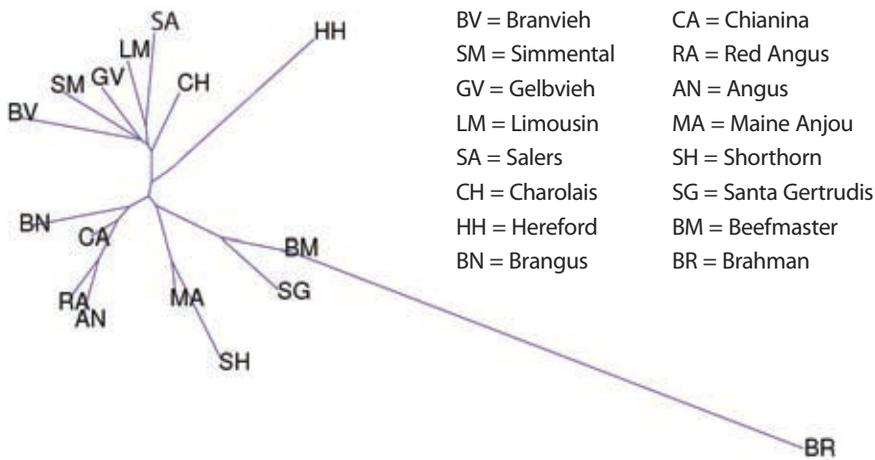
Purebred cattle tend to be more homozygous for some favorable genes and some unfavorable ones. While one breed might be homozygous favorable for one fertility gene but homozygous unfavorable for another, a second breed could be just the opposite. When purebred cattle are crossed with other breeds, the crossbred progeny are more heterozygous and benefit from dominance at many gene locations — increasing fertility, growth and other performance traits.

But not all crosses generate equal heterosis. Greater effects of heterosis occur when the breeds crossed are more different in their genetic makeup. Brahman-cross cattle excel for some traits because of the additional effects of heterosis. These effects occur because Brahman breeds are quite different genetically from British and Continental breeds. The amount of benefit from crossbreeding depends partially on the genetic diversity of the breeds being crossed.

In the past, countries of origin have been used to estimate the

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Figure 1: Breed linkage



degree of similarity between breeds. For example, Angus, Hereford and Shorthorn were all developed in the British Isles, while Simmental, Limousin and Charolais originated from continental Europe. From that information, one might conclude (incorrectly) that all British breeds are more similar to each other than they are to Continental breeds and that British-Continental crosses would yield greater heterosis than British-British or Continental-Continental crosses.

However, with the emergence of tools like as DNA markers, it is now possible to more accurately assess the degree of genetic similarity between breeds. In the last decade, three studies have measured genetic diversity of major beef breeds in this manner, using DNA marker genotype frequencies to measure how similar breeds are genetically and, thus, how much heterosis is gained by crossing those breeds.

While the non-Brahman beef breeds are typically classified as

either British or Continental, the authors of one of the studies found that each of these categories could be subdivided. Continental breeds were divided into Alpine and French breeds. Alpine would include breeds of primarily German or Swiss origin, such as Simmental, Gelbvieh and Braunvieh, while Charolais, Limousin and Salers were grouped together as French breeds.

The researchers found that within those groups, the breeds tended to be more similar genetically but that there were greater differences from one group to the other. Similarly, they found that British breeds could be segregated into two groups. Angus, Red Angus and Shorthorn cattle tended to be more similar to one another and were classified as British group A, but Hereford cattle were more different and were separately classified as British group B. A fifth group of Spanish origin would include Texas Longhorns and other native cattle such as the Corriente. The only

Figure 2: Breed groups

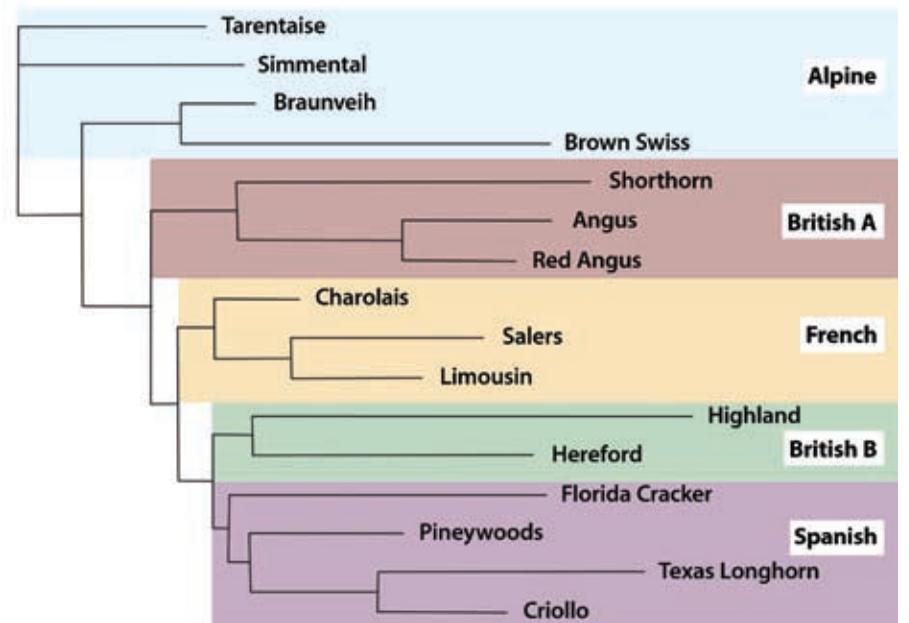


Table 1: Genetic diversity between breed groups

	<u>Alpine</u>	<u>British A</u>	<u>French</u>	<u>British B</u>
British A	0.194			
French	0.134	0.174		
British B	0.185	0.194	0.181	
Spanish	0.156	0.162	0.118	0.188

Figure 2 and Table 1 courtesy of Joe Cassidy, North Carolina State University, and Mike MacNeil, U.S. Department of Agriculture-Animal Research Station (USDA-ARS), Miles City, Mont.

other breed to share a large degree of genetic resemblance to the Hereford was the Highland.

From their results, the authors concluded that heterosis would be less when breeds within the same group, such as Angus × Red Angus, Charolais × Limousin or Simmental × Gelbvieh were crossed. Not surprisingly, the amount of diversity between Angus

and Red Angus was the least of any pair of breeds in the studies. However, the genetic diversity between the two British groups was as great or greater than between either of the British groups compared to a Continental group (Alpine or French). This diversity implies that the heterosis expressed in a black baldie (Angus-Hereford cross) would be as great as or greater than either an Angus or Hereford crossed with a Continental breed. As long as producers cross breeds from two or more breed groups (Angus/Shorthorn, Hereford, Alpine, French, Spanish and Brahman), the genetic diversity between breeds should be more than adequate to allow high levels of heterosis to occur.

This research confirms the widely held opinion that Hereford × Angus is one of the top crosses for commercial beef production in many climates, particularly in terms of cow efficiency. Crossing with Continental breeds, which creates the corresponding increase in cow size and feed costs, is not needed in order to gain maximum heterosis. Commercial cow-calf producers using Hereford bulls on an Angus-based cow herd will produce baldie females with superior fertility, longevity and efficiency while maintaining moderate mature size and lower feed costs. **HW**



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