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Carcass Ultrasound 101

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Heterosis of Ultrasound Carcass Traits

The value of heterosis in a structured crossbreeding program has been well documented throughout the beef industry. However, most of the emphasis has been placed on added performance and longevity of offspring. It's important for breeders and bull buyers to understand that heterosis does not have the same impact on all measured or unmeasured traits. Using a particular breed of bull may or may not have a positive impact on one's commercial cow base. Which breed one selects and the genetic merit of the individual sire play a significant role in the realized benefit of crossbreeding. The difficulty lies in balancing the traits one wants to improve, realizing the heritability of each trait (the potential for immediate success), and accounting for other antagonistic traits that work against your selection pressure. This article will focus on the heterosis of carcass traits most often measured on the live animal via real-time ultrasound.

In order for breeders to make changes in any trait, it must first be measured and then inherited by subsequent generations. Heritability is simply a measure of the proportion of variation in a trait attributed to genes rather than environment. Selecting for a highly heritable trait should prove more successful since the genetic effect is essentially a larger portion of what is expressed or measured. As a general rule, traits that are low in heritability estimate receive the most "kick" from heterosis. Reproductive traits like fertility and cow longevity benefit the most from breed complementarity, generally a 20-30% increase over purebred breeding programs. Traits that are highly heritable, like carcass traits (ranging from 45-65% heritable), receive fewer advantages from crossbreeding systems, approximately 0 to 5%. Heterosis is much more difficult to pinpoint in carcass traits since most cattle are marketed at a targeted weight or fat thickness instead of age. In a study of multiple purebred and composite breeds at the Meat Animal Research Center (MARC), realized heterosis levels for carcass traits differed depending on how the cattle were marketed. This does not mean you should crossbreed only to influence fertility and give up on making progress in carcass merit in your crossbreeding program. Ultrasound still has the power to identify elite genetics as well as poor carcass performers. In recent years, commercial producers have made significant progress by scanning replacement heifers and culling those that fall below desired thresholds. This helps eliminate discount cattle on the rail far faster than through bull selection alone. There is an up-front cost to scan the heifers of about \$15/head. However, one Standard carcass or Yield Grade 4 is a discount of \$15/cwt, or roughly \$105 per head.

As a purebred producer, it's relatively easy to select for a trait that is highly heritable. Success is often swift and progress is encouraging. However, some questions need to be asked: Is the trait negatively associated with other traits? Is the trait economically important? Genetic antagonisms should play a significant role in breeding decisions regardless of the breed or breeds involved in your cow herd. Unlimited selection for some carcass traits can have a negative impact in other economically important areas of beef production. Ribeye Area (REA) has a positive genetic correlation with Weaning Weight (0.49), Yearling Weight (0.51), and Cutability (0.45). Selecting for REA via ultrasound can increase performance and Yield Grade but also be detrimental to carcass marbling, since the genetic correlation between the two traits is -0.21 (Gosey, 2003). Most producers are aware of the negative association between quality and yield grade. In addition, MacNeil (1984) found that leaner steers were associated with lower conception rate, increased age at puberty, heavier mature weight, and increased calving difficulty in their half-sib females. Ultrasound REA is not adjusted for weight or frame score; thus, increasing REA can increase the overall size of the beast.

Marbling selection draws a lot of attention with the desire to make more Choice cattle. Fortunately, Dr. Twig Marston suggests that selecting for marbling does not affect age at puberty. In a recent evaluation of Angus sires, there appeared to be mild correlations for lighter birth weights, easier calving, and a positive trend for milk production. Responsible selection for marbling should not impact many of the traits that are important for profitable cow-calf operations. However, crossbreeding helps minimize the reproductive risks by taking advantage of heterosis while also allowing producers to reap the benefits of increased carcass value.

The beauty of a true crossbreeding program lies in the ability to add a new bull breed that best fits the shortcomings of the commercial cow base. Every commercial female in the herd is expected to breed on time, calve unassisted, wean a heavy calf, and do it all over again in 365 days given the environment she calls home. The challenge lies in producing cows that will generate dollars in the vast array of environments across this great land. The perfect cow for the upper elevation grasslands of Wyoming is different than the ideal beast for fescue country of Missouri. Producers should take full advantage of carcass heterosis when deciding which bull best fits the goals of their operation given its environment. Ultrasound-derived carcass EPDs allow buyers to find the carcass ammunition their cow herd needs. In general, breeders can expect a 3% increase in REA and marbling over the average of the sire and dam by using an outcross bull breed (unrelated to the cow's breed base).

Seedstock producers are taking full advantage of the high heritability of carcass traits by making immense progress in REA and marbling over a short number of breeding seasons. Coupled with EPD selection for growth and calving ease, simultaneous change can occur. However, due to the genetic antagonisms covered earlier in the article, progress can be slow. An EPD search for a calving ease bull with excellent growth yet without excessive frame size is difficult. If you also want this bull to generate superior marbling and retail yield, you may drive a number of miles to find him. Prepare to keep raising your buyer's number until the gavel finally hits the auction block; these genetics are in extreme high demand.

Since economics are important when buying a bull, the economic relevance of traits should be kept in mind as well. In a terminal crossbreeding system, ultrasound carcass traits can take precedence, but remember growth and a balanced performance profile are still important. In most cases, bull buyers will be faced with choices that require sacrifice of some traits in favor of

others. If reproductive efficiency is maintained, then profitability will be largely determined by the feeder or fed market. In a tough economy, demand for Choice and Prime beef declines, allowing bull buyers to place more emphasis on growth and retail yield. Since the genetic correlation between Yearling Weight and cutability (Yield Grade) is extremely high at 0.87, one can expect to find more bulls that fit their criteria, potentially driving down the sale price of their next herd sire (Gosey, 2003). The dollars generated from heavier calves should “outweigh” any loss in percentage of offspring grading Choice or better.

Ranchers should crossbreed even if heterosis is zero; the strengths of one breed simply compliment the weaknesses of others. Heterosis enhances good mating decisions and puts a more desirable product on the plate of the meat-eating consumer. The realized heterosis of carcass traits is lower than other measured areas of beef production, but the benefits are much more difficult to measure in traditional marketing systems. Regardless, a broad understanding of heritability, potential antagonisms, and economics can help bull buyers take advantage of carcass heterosis in their program. When used in conjunction with heterosis advantages in growth and reproductive traits, producers can potentially save some money on sale day, avoid unwanted changes to their cow herd, and end up more profitable than their neighbors.