

Connecting the Cow Herd to the Carcass

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After years of talking about it, value-based marketing of beef has become a reality. As a result, carcass traits are receiving increased emphasis when breeding decisions are made. There is some debate within the beef industry whether too much emphasis is being placed on the end-product. This question is raised because unit cost of production, reproduction, and early growth are still the factors that have the greatest impact on profitability in cow-calf herds. But as the industry moves toward true value-based marketing and more cattle are sold on grids or formulas, traits related to the end-product will likely increase in economic importance.

If the pork industry provides any indication of what may lie ahead, this transition could occur faster than anyone once thought. As recent as 1993, 89% of the nation's hogs were sold on the spot/cash market. Now, it is reported that only 17% are sold on the cash market (Grimes and Meyers, 2001). Those pork producers with a reputation for having the wrong kind of hogs are discovering that no one wants their product at any price.

This transition appears to be moving rapidly in the beef industry as well. It is estimated that when one considers alliances, contracts, grids, packer-

owned cattle, and all other marketing arrangements, nearly 50% of the nation's fed cattle are trading away from the cash market. Some observers predict this could increase to 80% by the end of the decade. The proliferation of new value-added, branded beef products is hastening the transition. In 1998, about 12% of beef products were branded. Industry analysts project this could increase to one-third within five years and 60% by the end of the decade.

Matching the Cow Herd to the Production Environment

Before considering the carcass, it is important to make certain the cow's genotype is compatible with the production environment (feed resources and climate).

The Beef Improvement Federation (BIF) Systems Committee has developed guidelines for matching genetic potential for a number of traits to various production environments (BIF, 1996). Based on these guidelines, Table 1 presents four (by no means all) examples of matching genotypes to different production environments.

Table 1. Examples of matching genotype to production environment^a

Restricted feed resources, arid climate: <i>British X British</i>
Medium feed resources, semi-arid climate: <i>British X Smaller, Moderate-Milking Continental</i>
Abundant feed resources, adequate precipitation: <i>British X Larger, Heavier-Milking Continental</i>
Sub-tropical environment, <i>Bos taurus X Bos indicus</i>

^aBased on guidelines of BIF Systems Committee (BIF, 1996).

An example of how environment can affect the longevity of various genotypes is shown in Table 2, a study conducted in a semi-arid Northern Plains environment. As size and milk production increased from medium/medium to large/high, there was a trend for reduced longevity.

Table 2. Longevity of crossbred cows varying in size and milk production in a semi-arid Northern Plains environment^a

Biological type of F ₁ cows		% in herd after 6 years
Size of sire breed	Milk production	
Medium	Medium	66%
Medium	High	54%
Large	Medium	47%
Large	High	38%

^a Adapted from MacNeil et al. (1994).

Matching the Genotype to the Marketplace

If we are assured that the cow herd fits the production environment, we can then concern ourselves with matching the calf crop to the marketplace. Based upon the National Beef Quality Audit and projections by beef industry marketers, it would appear that there are, and will continue to be, three major market targets for U.S. beef:

□ Mid-Choice and higher beef for the upscale domestic market and export trade; must have superior eating qualities (tenderness, juiciness, and flavor). Future demand for this product will be approximately 30% of the market.

□ Supermarket and midscale restaurant beef that is High Select to Low Choice; must have acceptable eating qualities. This product will make up about 55% of the market.

□ Young, extremely lean beef that has acceptable tenderness; about 15% of the market.

In recent years, a good deal of support has been building for a universal target for U.S. fed cattle. It is called the "70-70-0" target, which means the following: 70% Choice; 70% Yield Grade 1s or 2s; 0% Standards, Yield Grade 4s or 5s, dark cutters, underweights, overweights, or other misfits.

Coincidentally, this universal target comes relatively close to covering the needs of the market targets listed above. The Beef Quality Audit would indicate that the industry as a whole is not yet close to hitting such a target. However, I believe we are making headway. Over the past three years, I have seen a significant number of close-outs on pens of cattle that have met or exceeded these specifications. Table 3 is an example of a recent close-out on a pen of retained ownership calves sold on a grid.

Table 3. Close-out on mixed pen of steer and heifer calves (1/2 Continental X 1/2 British crosses)

No. of calves	165
In wt., lb	614
Out wt., lb	1151
Feed conversion	5.64
Dressing %	64.7
Carcass wt., lb	745
% Choice	70.3
% Yield grade 1s & 2s	76.5
Premium, \$/head	\$ 41.20

Relative Economic Value of Industry Traits

Trenkle and Willham (1977) estimated that the relative economic value (REV) of three categories of beef industry traits were in a ratio of 10:2:1 for reproduction, growth, and product (carcass), respectively. More recently, Melton (1995) calculated the REV ratio of these categories to be approximately 2:1:1 for producers marketing calves at weaning time and 1:1:1.5 for an industry-integrated firm. Based upon an analysis of some 110,000 fed cattle that had been marketed through the Gelbvieh Alliance marketing program, Green et al., (1999) proposed that the REV ratio of these trait categories is approximately 4:2:1. These recent estimates suggest that increased selection emphasis on carcass merit can be justified today compared to previous decades.

Heritability of Traits

Research conducted since the late 1940s has shown that nearly all economically important beef cattle traits are under some degree of genetic control, referred to as heritability, and expressed as a percentage of the total variation in a trait that is due to genetics as opposed to the environment. In general, these studies have shown that selection within a breed population for carcass traits can be relatively effective because these traits are moderately to highly heritable (approximately 35 to 50%). Growth traits tend to be moderately heritable (20 to 35%). Unfortunately, reproductive traits have been reported to be lowly heritable (under 10%). However, recent work at Colorado

State (Evans et al., 1999; Doyle et al., 2000) has shown that heifer fertility may be more highly heritable (20 to 30%) than previously thought. This research has led to the development of a heifer pregnancy EPD, which has been implemented by the Red Angus Association.

Antagonisms Among Economically Important Traits

Extreme selection for certain economically important traits may have an antagonistic effect on other important traits. For example, long-term selection for retail product yield in the carcass could eventually have a negative effect on certain female traits: later sexual maturity, reduced fertility, increased calving difficulty, and increased mature weight (MacNeil et al., 1984; Splan et al., 1998). Research has also revealed that intense selection for marbling may be correlated with increased carcass fatness and decreased percent retail product (Marshall, 1994; Koots et al., 1994). Intense selection for increased muscling and decreased fatness can negatively impact marbling as well as increase ribeye area beyond industry desired specifications (Koots et al., 1994; Dunn et al., 2000). Some of these relationships are not strong, but intense selection over time for certain carcass traits could eventually have negative effects on other economically important traits.

Crossbreeding

In straightbreeding, we have an opportunity to achieve genetic improvement through the use of within-breed EPDs. If we use crossbreeding in

a commercial herd, we not only can rely on the power of EPDs within each breed chosen, but it also provides us with two additional avenues for genetic improvement: 1) breed complementarity and 2) heterosis.

Some commercial producers have abandoned crossbreeding and are resorting to straightbreeding in order to attain more consistency in the calf crop. This is a natural reaction to consumer, retailer, and packer demand for a more consistent beef product. It has also been fostered by the demand and premiums paid for cattle that meet specifications for black-hided branded product programs. However, heterosis is a powerful tool that is difficult to ignore. Compared to the average of the pure breeds in a cross, it can result in increases of from 12 to 25% in pounds of calf weaned per cow exposed, depending upon the system used. Based on current calf prices, this translates into approximately \$50 to \$100 additional income per cow exposed. The goal would be to construct breeding programs that can harvest the benefits of heterosis and still produce a consistent, value-added calf crop that fits the demands of the marketplace.

Choosing Breeds

Based upon research conducted at the U.S. Meat Animal Research Center (Cundiff, 1999, 2000; Gregory et al., 1999) and large databases such as Gelbvieh Alliance (D. Schiefelbein, 1998) and ConAgra (T. Schiefelbein, 2000), it appears that the following breed mixes would come close to hitting the market targets discussed previously.

1. Upscale restaurants and export trade, Mid Choice & higher:

British X British
1/4 Continental X 3/4 British

2. Retail supermarkets and midscale restaurants, High select to Low Choice:

1/2 Continental X 1/2 British
1/4 Bos indicus X 3/4 Bos taurus

3. Young, extremely lean market:

Continental X Continental
3/4 Continental X 1/4 British
3/4 Continental X 1/4 Bos indicus

Table 4 illustrates what one might expect in quality grade and yield grade from a range of Continental and British biotypes, based on studies at U.S. MARC. Obviously, within-breed selection pressure could alter these figures. It is interesting to note that moving from 100% Continental to 75% Continental increased the percent grading Choice by 13% while decreasing the percent YG 1s and 2s by only 6%. Likewise, moving from 100% British to 75% British increased the percent YG 1s and 2s by 14% while decreasing the percent grading Choice by only 4%. A summary of Gelbvieh Alliance and ConAgra data (Table 5) indicates that feed conversion and cost of gain were optimized at the 50-50 and 25-75 levels of Continental and British breeding, respectively.

Table 4. Quality grade and yield grade of various biotypes of fed cattle^a

Biotype	% Choice	% YG 1 & 2
100% Continental	30	89
¼ Continental X ¼ British	43	83
½ Continental X ½ British	56	56
¾ Continental X ¾ British	66	52
100% British	70	38

^aAdapted from U.S. MARC data.

Table 5. Feed conversion and cost of gain of various biotypes of fed cattle

Biotype	Feed Conversion	Cost of gain \$/cwt
100% Continental	6.79	\$ 59.40
¼ Continental X ¼ British	6.71	\$ 60.10
½ Continental X ½ British	6.49	\$ 55.10
¾ Continental X ¾ British	6.55	\$ 54.50
100% British	6.78	\$ 57.50

^aAdapted from ConAgra and Gelbvieh Alliance data.

The trend to case-ready beef, where virtually all fat and bone is left on the packing house floor, will have a major impact on the industry (Mies, 2000; Morgan, 2000). Muscling will play a larger role in determining carcass value because of its impact on dressing percent and red meat yield. Case-ready will increase the demand for YG 2 cattle that quality grade High Select or Low Choice. Demand for Mid-Choice or higher beef will continue at its current level. Carcasses fatter than YG 3.5 will be heavily discounted. Mid to Upper YG 2 may be an ideal target to shoot for, because many of the cattle that are either too lean or too fat would be out of the slaughter mix and replacement heifers would have an adequate degree of condition for efficient reproduction and reasonable maintenance requirements.

Low-cost cow-calf producers will be among the most profitable as they have been in the past. But in the future, it will become increasingly important for producers to have historical information on health practices and how their calves are likely to perform in the feedyard and on the rail for their customers. The future truly will be a "balancing act" in meeting the demands

of both the production environment and the marketplace.

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