

## Back to the Basics-Emphasizing the Economically Important Traits

J.W. Turner  
Beef Cattle Science Section  
Department of Animal Science  
Texas A & M University

### Introduction

The Overview for this 1988 National Beef Cattle Conference printed on the advertised program clearly identified the questions needing an answer:

1. Has recent emphasis on frame and single trait selection resulted in purebred cattle that are genetically not the kind of cattle needed in the commercial beef industry?
2. What are the important issues and economically important traits to emphasize in selection of seedstock and how should breeders change selection emphasis to produce more profitable cattle?

### Traits to Emphasize

Selection decisions in breeding purebred cattle are still largely subjective even though we use objective measurements more in making selection decisions. The herd owner is the authority who establishes priority among the traits and actually culls cattle to create genetic change. Normally, breeders produce what they feel can be easily and effectively sold. Commercial cattlemen frequently state that purebred breeders breed for breed "standards" and do not reflect upon and consider the commercial cattleman. In fact, most purebred cattlemen are believed to have a rather limited exposure to the commercial industry and may not understand nor fully appreciate the real economic impact that the genetics of their breed is making in the beef industry. We all talk commercial beef production but few truly live and work in full appreciation of the problems. We tend to be breed oriented and totally committed to breed promotion. All breeds should not be the same and purebred breeders must be aware of where and how their breed and the genetics in their herd fits into the commercial industry. There should be a common breed utility and production objectives for purebred and commercial cattlemen or the breed(s) will not remain viable and be used commercially. There are sufficient breeds to allow for selection among similar breeds for use in the commercial industry. Breeds not acceptable or accountable will not be used nor remain a significant factor in the national breeding herd.

On a national basis we have seen emphasis on frame score (growth rate) that has been consistently stressed in nearly all of the beef breeds. Since beef production encompasses use of a mammal supported mainly on native forages in widely variable environments, there are several important aspects (traits) that become critical to profitable performance that may be specific to the environmental conditions. This

cannot and must not be overlooked by cattlemen as they design and manage beef cattle enterprises. Taylor (1980) prepared an excellent summary table to identify traits of importance within the various segments of the beef industry.

**Table 1. Identification of traits important to various segments in the beef industry.**

SEGMENT	CHARACTERISTICS OF BEEF THAT AFFECT NET RETURN OR DESIRABILITY
Purebred breeder	All the characteristics listed for the other segments (must meet the needs of entire industry).
Commercial cow-calf producer	Reproductive efficiency Weaning weight Weaning conformation
Feeder	Rate of gain Feed efficiency Live or carcass grade
Packer	Carcass grade Carcass weight Carcass cutability
Retailer	Carcass grade Carcass cutability Product appeal and shelf life
Consumer	Lean-fat ratio Lean-bone ratio Tenderness, flavor, and juiciness Consistency of product

Adapted from Taylor (1980)

Secondly, Taylor (1980) identified the goals of purebred beef breeders in terms of the needed performance levels for some of the important traits (Table 2).

**Table 2. Desired levels of productivity for the economically important traits of beef cattle raised under intensive management systems.**

Trait	Desired level of Productivity
Calf-crop percentage (weaned)	95 percent and higher
Seven-month weaning weight	225 kg (500lb) and higher
Yearling weight (after going directly into feedlot at weaning)	455 kg (1000lb) and higher
Feed: gain ratio	6:1 and lower
Carcass quality grade	Minimum, low choice
Yield or cutability grade	YG 2 (50 percent of the carcass weight in closely trimmed, boneless, retail cuts from the round, loin, rib and chuck)

Adapted from Taylor (1980)

Koch (1980) identified the important traits into classes as:

1. Reproductive performance
2. Preweaning growth
3. Postweaning growth
4. Efficiency of gain
5. Carcass merit
6. Conformation
7. Longevity
8. Disease resistance or defects in function.

Pollak (1980) presented an interesting methodology to determine the relative importance of beef production traits by citing earlier work of Lindholm and Stonaker (1957). He compared the correlation of net return to a single trait and squared the correlation coefficient to obtain the coefficient of determination or a percentage expression. By multiplying this value times the heritability of the trait he arrived at an index of importance of a beef trait based on the association to net return and the amount of genetic variation (heritability). This is identified as the index of importance in table 4. Heritability is important because it identifies those traits that will respond to selection or lets breeders know which traits can be controlled better with genetic methods. Weaning weight is one trait that is associated with net return

and under good genetic control. Percent calf crop is extremely important but because of its low heritability, selection change will be slow. Selection of cow breeds and crossbred females offers a much faster and effective means of improvement rather than selection within a breed. Size of dam, average daily gain (growth rate) and days to finish are similar in the index of importance. Lastly, carcass cut-out value is also comparable. While this presents an early attempt to classify the more important traits, it does not correctly reflect on all aspects.

**Table 4. Estimated ranking of importance of single traits to the breeder based on economic worth and heritability. (From Lindholm and Stonaker, 1957)**

Traits	Relative Economic Worth ( $r^2$ ) <sup>a</sup>	Heritability ( $h^2$ )	Index of Importance ( $r^2 \times h^2$ )
Weaning weight	0.64	0.30	0.19
Size of dam	0.10	0.70	0.07
Daily gain	0.14	0.45	0.06
Days to finish	0.21	0.25	0.05
Percent of calf crop	0.64	0.07	0.04 <sup>b</sup>
Feed per pound of gain	0.04	0.39	0.01
Carcass cut-out value	0.08 <sup>b</sup>	0.25 - 0.50	0.02 - 0.04 <sup>b</sup>
Slaughter grade	0.21	0.00	0.00

<sup>a</sup>squared correlation coefficient between trait and net income.

<sup>b</sup>Estimated.

Pollack (1980)

All of these references were used to provide a concept of needed traits. The relative value determination is generally left to the breeders. Simply stated, acceptable performance must be realized for all traits or a breed or herd will not survive as an economic unit. Breed roles are becoming more important because we are not just evaluating on a general purpose basis. Terminal sire breeds and maternal breeds are now common terminology and have a defined role in the commercial beef industry with the observed advantages of beef cattle crossbreeding. Stated differently, some breeds have a utility in crossbreeding that is not related to their performance as a straightbred. The Brahman breed is an example in that the purebred animal is a relatively poor beef animal based on performance traits but is uniquely identified and appreciated by some as an outstanding breed for crossbreeding. It has a niche that is founded upon the documented

question that they can be too large and demand more nutritionally than the natural environment can provide. Fitness is immediately reduced. Frame has been overemphasized because it is easily measured and new, uniformed purebred breeders feel comfortable with it because they can see animal differences. Evidence from feedlot performance of yearling steers cited by Neumann and Lusby (1986) showed yearlings steers above 51 inches in height were not as profitable as steers of more moderate frame. Larger framed steers gained more but did not grade as well which resulted in lower profit or return.

The importance of carcass traits is now being stressed because they reflect unit value for the weight of beef produced. No one can deny the importance of USDA Choice grade as the standard value reference. Cundiff (1987) expressed concern over the antagonism between marbling and muscling (retail product yield) and the different approaches required to address the problem between the purebred breeder and the commercial cattlemen. General purpose beef breeds will be changed by breeders only to the extent that they can locate and select individuals within the breed to qualify as a complete beef animal. Commercial breeders using crossbreeding have a more accurate and effective means of meeting performance goals. Breeds selected for use in crossbreeding programs can stress those traits that lead to the merits of the crossbred progeny. These breeds may well be out of balance genetically as a straightbred beef animal.

Recently the emphasis to improve lean yield and reduce fat has moved from trimming the retail cuts to the possibility of hot fat trimming on the kill floor. The question now being asked is: Why not do this genetically? High lean yield (minimum fat thickness or content) and high eating quality (marbling) are going to be difficult to obtain in a single animal based on the observed genetic antagonism but it is not an impossible assignment. The promotion of beef to strengthen demand is stressing a healthful, low fat product that is flavorful, juicy and tender. Carcass traits are highly heritable and will respond to selection. The problem is that they are difficult and expensive to measure. The industry is moving to collect the necessary data and provide an opportunity for breeders to utilize carcass traits in their selection. However, we must realize that we can and should manage cattle of various genetic potentials to best utilize their capabilities. Overfattening to produce USDA Choice quality grade is not the answer and the current concern introduced by Excel simply reflects an effort to identify what is wanted by our packing and retail industry. They cannot assume to dictate the genetics required in the national cow herd, but hopefully give breeders an opinion of the carcass aspects desired.

Berg and Walters (1983) in a review paper addressing the changes and challenges concerning our meat animals also reflected that maturity in meat animals results in a decrease in the portion of muscles in the high priced regions and an increase of those muscles in the less valued regions. Cundiff (1987) cited results of sensory panel evaluations on various breed crossbreds fed and managed alike to slaughter at 14 to 16 months of age. Taste panel differences were small and a minimum of fat content of 3 percent in rib and loin steaks was identified as acceptable. This equated to a degree of marbling similar to USDA Select

performance of the crossbred cow with Brahman inheritance. Research results generated from the Germ Plasm project at the Roman L. Hruska Meat Animal Research Center, Clay Center, Nebraska published by Cundiff et al. (1983) and Cundiff et al. (1987a,b) have clearly established that we are limited in our ability to make our breeds the same genetically and we should follow breeding policies and selection goals to create breeds and cattle within breeds that will effectively match the natural environment. Breed differences are important but breeders must carefully identify the selection goals within a herd. Commercial cattlemen need to be able to purchase predictable genetics (breeding value) both among and within the breed genetics he chooses to use. Mr. Burke Healey probably prepared one of the better articles referencing these points and the use of frame scores in breeding purebred cattle (Healey, 1987). Frame scores were cited as a tool but not the total or final answer. In fact, he reflected that "They're about to lead many breeders from the pinnacle of success right on over the cliff into oblivion and ruin. Always bigger can't continue to be always better." So what are the answers need today?

### Discussion

The national cow herd must be one that reflects high fertility or fitness for the environment under consideration. Maternal ability must include calving ease, survival of newborn calves, milking ability that supports calf growth and allows the cow to rebreed to continue calving on a yearly basis. Cow size and body condition scores are measures that are descriptive of how the cows are responding to the level of management and natural environment. The use of a herd index measure is recommended that measures the pounds of calf weaned per cow exposed to breeding. It is calf crop percentage weaned times the average weaning weight. Herd owners should use this statistic to describe herd production to prospective buyers. It is not a statistic that can be measured on a single animal. Selection for weaning weight should relate to selection for better milking cows and for genetic growth potential that is transmitted by both the cow and the bull. This is why we need direct genetic and maternal or milk EPD values calculated in our sire summaries.

Weaning weight is an important performance trait that requires selection attention along with fitness (reproductive performance). Calves with heavy weaning weights are important in that they attain more weight early in life and this affords the opportunity to shorten the time from birth to slaughter (length of the food chain). Gains made early in life are more efficient. Postweaning growth rate is positively correlated with mature size and frame score used here is a good indicator of expected growth and estimated slaughter weight. Large scale breeds are favored for efficient gains and lean tissue yield but they lack the ability to grade (marble) at comparable slaughter weights to smaller mature size breeds that fatten earlier. The need is to define a weight and composition of slaughter animal to balance the need for yield of retail lean and marbling for eating quality. We can answer the original question concerning frame score by noting that increased mature size in our breeding cattle has led to increased birth weights and calving problems. As more large cows are studied there is not

quality grade (slight degree of marbling). However, Berg and Walters (1983) felt the quality of beef (meat) would be more dependent upon technology (pre and post - slaughter) in the future and less dependent on production factors. The role of the beef producer was stated as increasingly one of producing lean meat as efficiently as possible. Technology was felt to assume a greater role in assuring consumer acceptance of the final product.

Smith (1987) considered the available "target" markets for beef and identified that not all beef markets require high quality or marbling.

It seems logical to assume that breeders need to take time to review their breeding programs and clearly define selection and performance goals that are realistic and profitable. All breeds will not be placed into a single category and evaluated solely on carcass aspects. In fact, the priority rank of traits should be:

1. Reproduction
2. Maternal
3. Growth (weaning weight)
4. Carcass (optimum size and fatness)  
    Retail yield  
    Marbling

The first three areas are capable of change genetically via selection and crossbreeding (heterosis) and must be evaluated relative to a defined production environment. Carcass traits are moderate to highly heritable and should respond to selection. It will be difficult and expensive to collect carcass data but general purpose breeds will need to do so to make the correct selection decisions. Specialty breeds will not be required to do this but they must clearly identify the crossbred types that will work.

#### How to Change

Single trait selection has never been advocated as the "best" method. Multiple trait selection methods have consistently been taught and advocated. Such procedures are not easily employed. With the use of computers, we are increasingly obtaining a more effective approach. I believe the use of independent culling levels represent the easiest approach to managing multiple trait selection. This simply says cull the herd as the traits are expressed and keep the number of traits under selection to a minimum number.

Young heifers should be selected on weaning weight and reproduction (palpated pregnant to calve at two-years of age for a general purpose beef breed). Cows should be culled for calf survival and nursing problems related to the cow, poor milking ability and failure to reproduce as required. Herd bulls should come from cows with established maternal performance.

Selection of bulls should include emphasis on weaning weight, postweaning growth, early puberty and carcass traits. Scrotal

circumference is a measure that should be used. A knowledge of fat thickness may have merit but this should best be determined by carcass evaluation of progeny or predicted EPD carcass values.

### Summary

Breeding purebred cattle is not an easy task. The extremes of size, large and small, will not be the answer. What really will be true is that several breeds, crosses and body types will find advantage according to the natural environment. Breeders must recognize the utility of their breed and clearly define how it is best used commercially. The answer is simply to stress those traits in selection that are basic to commercial productivity. All cattle must be reproductively fit, cows must provide a maternal environment beneficial to their calves and genetically transmit growth and carcass potential. Breeding bulls should come from proven productive cows and selection for growth, milk and carcass traits is recommended in general purpose breeds. Specialty breeds will not have to contend with all the traits identified but must be reproductively sound and selected for merit as measured in their hybrid progeny. Sire breeds will represent only a small segment of the beef cattle herd. Maternal breeds will be those in greatest numbers. Crossbreeding will remain the most effective breeding policy for the commercial producer and this will create a need and demand for sound, productive purebred cattle.



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