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Selection Emphasis for Carcass Traits

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Carcass evaluation for the Angus breed was conceived by Dr. Richard Willham and co-researchers at Iowa State University in 1972 as part of the original sire evaluation program. This very structured program consisted of random mating schemes throughout several commercial herds using the same set of bulls. These sires were later referred to as the original set of reference sires for the Angus breed and served as foundation benchmarks for future evaluation.

This structured sire evaluation program is still in place. While it has been refined and altered by Dr. Doyle Wilson to fit today's needs, the basic principles are still in tact. (Guidelines for structured sire evaluation have appeared in the Angus Journal on a periodic basis and are available from the association upon request.)

When we consider the use of carcass EPD, we must remember that the improvement of livestock is somewhat like mapping out a trip. First, we must know where we are. Secondly, we must determine where we are going, and thirdly, we must plot a route.

Before we are able to make improvements in carcass traits we must establish some knowledge of the genetic merit of the herd for these traits. The time tested means of retrieving carcass data, of course, is through retained ownership of steers from conception to slaughter with cooperating feedlots and packers in order to obtain carcass data on each individual animal slaughtered.

This is relatively easy for large operations; however, it does provide problems for smaller producers with insufficient progeny numbers to make the system work. In this regard, some groups have pooled resources and livestock in order to efficiently retain ownership, feed steers, and recover carcass data.

In measuring carcass merit, we are concerned with those traits which effect carcass value. These are:

1. Age or youthfulness as determined by the color of the bone and the hardness or degree of ossification of the split dorsal processes of the vertebrae. The youngest classification, "A" maturity, is approximately 30 months old or less.
2. SDA yield grade is an attempt to classify carcasses as to cutability or yield of closely trimmed retail cuts from the round, loin, rib and chuck.
   Four characteristics considered in determining yield grade are:
   a. external fat thickness over the 12th rib
   b. percent kidney, heart, and pelvic fat
   c. area of the rib eye muscle at the 12th rib
   d. hot carcass weight
   USDA yield grade 1 is very lean and yield grade 5 is very fat.
3. USDA quality grade is determined by age and marbling. The following pictures and charts (Table 1 and 2) illustrate various quality grades and corresponding marbling scores.

Table 1. Illustration of Marbling Scores.

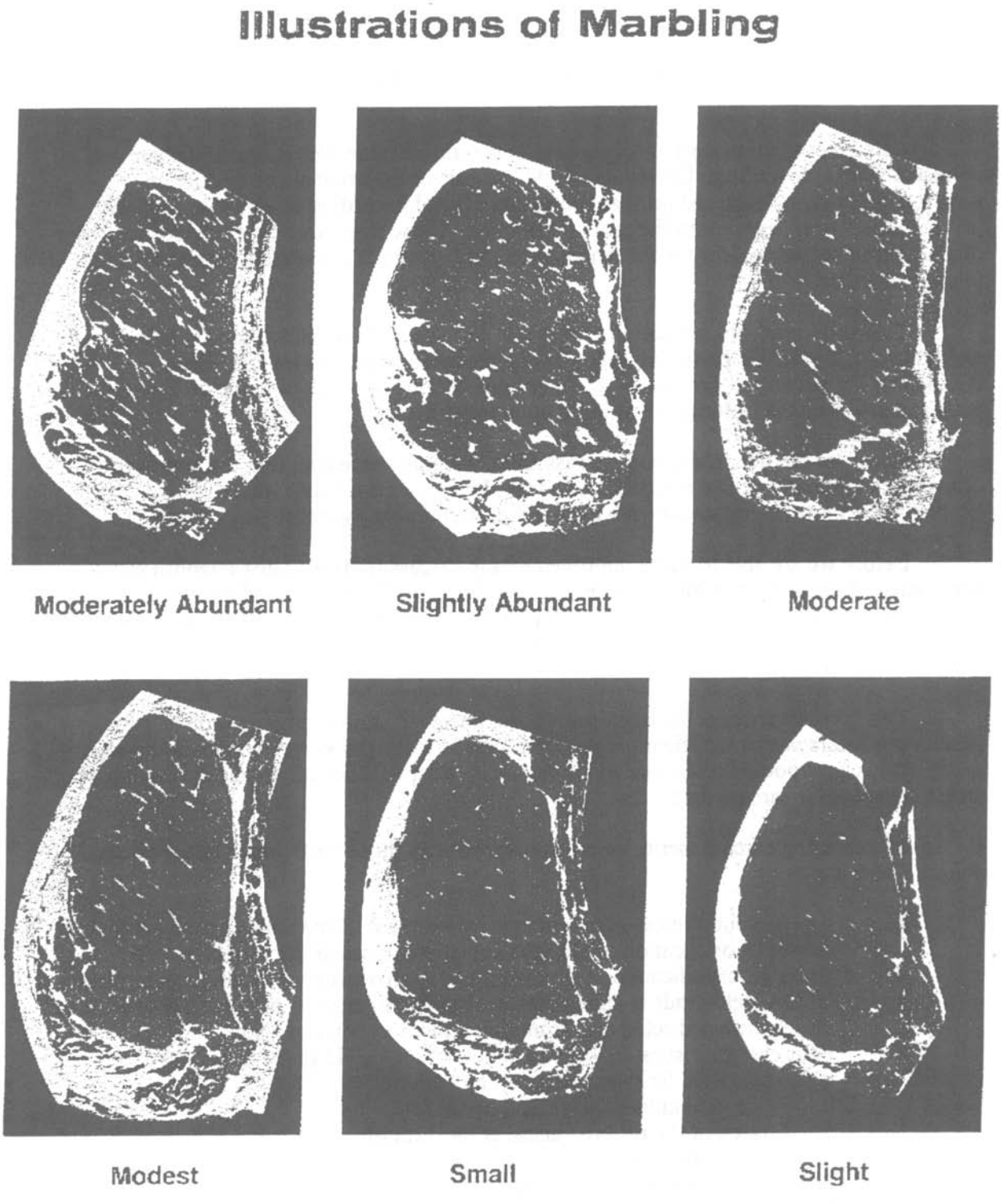

Table 2. USDA Quality Grades & Corresponding Marbling Scores.

QUALITY GRADES		
Degree of Marbling	Numerical Score	USDA Grade "A" Maturity (30 mo. or less)
Slightly Abundant	8.0	Low Prime
Moderate	7.0	High Choice
Modest	6.0	Average Choice
Small	5.0	Low Choice
Slight	4.0	Select
Traces	3.0	Standard
Practically Devoid	2.0	Standard

Since the Angus breed is noted for carcass merit, it is also important to know the adjusted averages for the steers in the carcass data base.

Table 3. Phenotypic Averages for Carcass Traits.

Adjusted[1] carcass weight, lbs.	756
Adjusted fat thickness, in.	.55
Adjusted rib eye area. sq. in.	12.43
Adjusted marbling score	5.81
Percent Retail Product	62.6

[1] Carcasses adjusted to 480 days of age at slaughter.

For carcass weight (756 lbs.) and marbling (Small 81, Low Choice), the average of the Angus breed is excellent. However, from an idealistic standpoint, we should perhaps strive for an average range in fat thickness from .30 to .40 inches and slightly increase average rib eye area. The question is “How can this be accomplished?” The answer is through genetics, over time.

It has been said that most traits expressed by animals are a result of two factors: genetics and environment. Genetic levels controlled by genes regulate portions of traits passed from parents to offspring.

Table 4 illustrates the genetic and phenotypic relationship between carcass traits as well as heritability estimates.

Table 4. Carcass Trait Heritabilities and Correlations. *

	CWT	MS	RA	FT	%RP
Carcass Weight (CWT)	30[1]	-.01[2]	.50	.17	-.16
Marbling Score (MS)	.10[3]	.37	-.06	.00	.02
Ribeye Area (RA)	.40	-.03	.26	-.14	.55
Fat Thickness (FT)	.24	.15	-.10	.25	-.85
% Retail Product (%RP)	-.26	-.16	.53	-.80	.23

*Angus Sire Evaluation Report Fall 1997.
[1]Diagonal elements represent trait heritabilities.
[2] Upper off-diagonals are genetic correlations.
[3] Lower off-diagonals are phenotypic correlations.

Note that the trait heritabilities on the diagonal are .30 for carcass weight, .37 for marbling, .26 for rib eye area, .25 for fat thickness, and .23 for percent retail product. These traits are moderate to highly heritable, which means that we can make rapid progress through proper sire selection.

Also note the genetic correlations expressed above the diagonal. The genetic relationship between marbling and rib eye area at -.06 is slightly negative, but close to zero. The genetic relationship between marbling and fat thickness is even less at .00. This means that each of these traits can be improved independently of the other traits. For example, the Angus data suggests that we can increase marbling, and rib eye area and simultaneously reduce fat thickness through proper selection procedures.

At this juncture, it is important to understand exactly how the four carcass EPDs are defined and what the EPD means:

1. Carcass Weight EPD is the differences in hot carcass weight from breed average of the progeny of sires at 480 days of age. It is expressed in pounds. Like other EPDs, the absolute value is not as important as the differences between the sires. As previously pointed out, the average adjusted carcass weight of the steer progeny in the Angus data base is 756, however; due to differences in environment and the genetic values in commercial cows, the majority or about 70 percent of progeny carcass weights for sires that are 0 or breed average have ranged from approximately 765 to 845 pounds.

2. Rib Eye Area EPD is the differences from breed average of rib eye area of the progeny of sires at 480 days. The measurement is taken at the 12th rib and expressed in sq. inches. At a constant weight end point, rib eye area has shown to account for

significant variation in percent retail product. There is also a high genetic correlation between rib eye area and total retail product. Care should be taken when using the ratio of rib eye area to carcass weight as selection on this index will result in changes in mature size. Generally, the higher the ratio the smaller the mature size. Ranges in rib eye area for the majority of the progeny of sires with zero EPDs are from approximately 11.0 to 14.0 sq. inches with the steer average at 12.43 sq. inches.

3. Marbling EPD is the differences from breed average of the marbling score of the progeny of sires at 480 days. It is expressed as a percent of 1/3 of a marbling score. The average marbling score of the steers in the data base is 5.81 or Small 81 which corresponds to Low Choice 8l; which is very close to average Choice. Sires with zero marbling EPD sired steers the majority of which exhibited marbling scores ranging from 4.80 or Slight 80, which corresponds with High Select, to 6.80, which is Modest 80 is Average Choice. These averages again depend on nutrition, environment and the genetic strength of the cow herd for marbling.

4. Fat Thickness EPD is the differences from breed average of the average external fat thickness of the progeny of sires at 480 days. It is measured over the 12th rib and expressed in inches. Fat thickness has a negative genetic relationship to percent retail product.

5. Percent Retail Product EPD expresses the difference from breed average in percent retail product of a given sire's progeny. This EPD combines the traditional carcass traits used in calculating yield grade and is heavily influenced by external fat thickness.

The following scenario illustrates how carcass EPDs can be effectively applied:

Let's say we run a 200 head cross-bred cow herd, these cows were bred to a bull named Henry VIII who had the following EPD:

Henry VIII

Carcass Weight	Marbling	Rib Eye Area
+.10	+.0	+.0

The steer calves were retained and kept in the same group from birth to slaughter and all processed the same day. A glance at the data revealed the following:

Average Carcass Weight =	700 lbs.
Average Marbling Score =	4.80 (Slight 80)
Average Grade =	Select
Average Rib Eye Area =	12.0 sq. inches

The following year in an effort to increase quality and yield, a bull named Richard II was selected for use. Richard posted the following carcass EPD:

Richard II

Carcass Weight	Marbling	Rib Eye Area
+ 20	+.30	+.30

Assuming that nutrition and environment were the same, the averages of the next calf crop would be expected to be the following:

Average Carcass Weight =	710 lbs.
Average Marbling Score =	5.10 (Small 10)
Average Grade =	Low Choice
Average Rib Eye Area =	12.3 sq. inches

If yield grades of both groups were the same assuming a $4.00 spread/cwt. between the select grade and the choice grade, Richard's steer progeny are worth on the average $28.40 more than Henry's. Multiply this by 100 and we have an increased value of $2,840 for the lot of cattle.

Profit in the beef industry is effected by many factors. From a genetic standpoint, reproduction is by far the most important trait, followed by early growth per unit of feed, and maternal ability. Through proper sire selection, we can keep these traits at optimum levels. These factors combined with acceptable carcass qualities will go a long way toward ensuring the success of the beef industry.