

The Merits of Angus Carcass Evaluation

BY JOHN CROUCH

In the earliest recorded history of the Angus breed, references are made to the wonderful eating quality of the Angus bullock. Early 18th century breeders, such as Robert Bakewell of the mother country Scotland, endeavored to produce high quality beef by using the concept "Like Begets Like."

In the 75-year history of the famed International Livestock Exposition in Chicago, Angus were declared winners of the coveted carcass contest in all but three years, and two of these were won by Angus crosses.

In an effort to perpetuate these excellent meat qualities, the American Angus Association engaged in a project designed to identify superior genetics for carcass merit. The year was 1972 and the project was called Angus Sire Evaluation. While most people assume that carcass evaluation is relatively new, it's noteworthy that expected progeny differences (EPDs) for carcass traits have been a part of the Angus Sire Evaluation Report since 1974.

Basically there are two ways to obtain a fair genetic evaluation. The first, as in the animal model, is to account for the genetic contribution of each mate, partition out this effect, and hence we have fairly evaluated both mates. The second way is to randomly mate test sires and proven reference sires in a population of females, treat all progeny in the same manner, weigh, measure, analyze and compare the data.

Since in carcass evaluation we are primarily dealing with commercial females with unknown genetic merit, we must use the second method of random mating schemes. This is called designed sire evaluation.

Generally speaking, enough cows are randomly mated through artificial insemination (AI) to ensure the evaluation of approximately 25 steer progeny from the sire to be tested and the same number of reference sire progeny through slaughter. A reference sire is defined as a sire with proven carcass performance. This data is then included in the Angus database and carcass EPDs are generated through National Cattle Evaluation (NCE) procedures.

Carcass evaluation is divided into the following four categories:

- 1. Carcass Weight EPD** is expressed in pounds. It's a predictor of the difference in pounds of the average hot carcass weight of the progeny of sires at a given end point. Generally, carcass weight is not a good predictor of percent retail product; however, it's a good predictor of total retail product.
- 2. Marbling Score EPD** is expressed as a fraction of a U.S. Department of Agriculture marbling (intermuscular fat)

score. It's a prediction of the average difference in marbling score of the progeny of sires at a given end point. The higher the marbling score, the higher the amount of intermuscular fat in the ribeye muscle. Marbling is associated with taste, juiciness, tenderness and the overall palatability of beef.

- 3. Ribeye Area EPD** is expressed in square inches. It's a predictor of the average difference in ribeye area of the progeny of sires at a given end point. Ribeye area is measured at a cross sectional area of the ribeye muscle between the 12th and 13th rib. It has been shown to account for a significant amount of variation in percent retail product at a constant carcass weight. A high genetic correlation also exists between ribeye area and total retail product.
- 4. Fat Thickness EPD** is expressed in inches. It's a predictor of the average difference in external fat thickness over the 12th rib in the progeny of sires at a given point.

Table 1 lists the estimated heritabilities used in the 1995 Angus Carcass Analysis, along with the genetic and phenotypic correlations.

Table 1. Carcass Trait Heritabilities & Correlations

	CWT	MS	RA	FT
Carcass weight (CWT)	.32	-.00	.52	.30
Marbling score (MS)	.10	.32	-.04	-.05
Ribeye area (RA)	.42	-.02	.29	-.05
Fat thickness (FT)	.25	.13	-.00	.26

¹ Diagonal elements represent trait heritabilities

² Upper off-diagonals are genetic correlations.

³ Lower off-diagonals are phenotypic correlations

Heritability estimates for carcass traits are found to be slightly higher than those used to analyze growth traits. Marbling at .32 and ribeye area at .29 are good examples.

It's interesting to note the genetic correlations between marbling and ribeye area, and also between marbling and fat thickness, are close to zero. This means that each trait can be improved independently of the other two traits.

Increased interest in high quality beef in recent years has been evident; hence, marbling and muscling are desirable traits.

Beef quality is dependent upon two factors – age and marbling. For cattle 30 months of age and less the following table illustrates the relationship of marbling to USDA grade.

Table 2. USDA Quality Grading System & Marbling Score

Quality Grade	Amount of Marbling	Numerical Score
Prime +	Abundant	10.0-10.9
Prime	Moderately Abundant	9.0-9.9
Prime-	Slightly Abundant	8.0-8.9
Choice+	Moderate	7.0-7.9
Choice	Modest	6.0-6.9
Choice-	Small	5.0-5.9
Select	Slight	4.0-4.9
Standard	Traces	3.0-3.9
Standard	Practically devoid	2.0-2.9
Utility	Devoid	1.0-1.9

It's interesting to note the phenotypic averages of the American Angus database in Table 3.

Table 3. Phenotypic Averages of Steer Carcasses In the Angus Database

14,768 observations

Average age at slaughter, days	470
Adjusted carcass weight, lbs.	714
Adjusted fat thickness, in.	.52
Adjusted ribeye area, sq. in	12.03
Adjusted marbling score	5.34

† Carcasses adjusted to 480 days of age at slaughter

It's further noteworthy to observe the average Angus marbling score to be 5.34, or Small 34, well into the Low Choice grade.

Some years ago a well-known American cattleman was reported to have remarked, "I never sold a bull because of his carcass merit." Today this simply is not true. Interest in carcass evaluation is at an all-time high. This is evidenced by the fact that 33 of the top 50 Angus sires in numbers of calves recorded last year have been evaluated. These 36 bulls sired more than 40,828 calves last year.

Increases in Angus carcass data provided the means to analyze and generate Interim Carcass EPDs for young cattle in 1993, and yielded another avenue for increasing carcass acceptability.

Basic application of carcass EPDs are the same as applying

any other EPD; however, it certainly helps to know the general level of carcass merit first.

A common question goes something like this. "If I use a bull that is +.30 or marbling, what percentage of my calves will grade USDA Choice?"

The answer, of course, is that nobody knows. It depends upon the average marbling ability of your cow herd, and how the +.30 bull compares with the bull you used before.

So let's put the question another way. Suppose you have been using a bull named Henry Fonda who is +.0 for marbling. Fonda's steer calves have averaged a marbling score of 4.8 (Slight 80). This is 80 points into the Select grade (a marbling score of 5 would be Low Choice).

Now suppose you like the bull Clark Gable who has a marbling score of +.30. If you breed Clark Gable to the same cows that were mated to Fonda, the Gable sired steers should have an average marbling score of 5.10, which is .10 into the small marbling range or Low Choice.

In other words, by using Gable rather than Fonda, you should be able to move the average marbling score of your herd by .30 of a marbling grade from 4.8 to 5.10 or from Select to Low Choice. In today's market each 700-pound carcass that grades Choice rather than Select is worth about \$21 more.

For cattle producers with a crossbred cow herd, all that may be necessary to dramatically improve marbling might be to simply select Angus bulls with positive marbling EPDs. In a two-year Nebraska study, Angus bulls with high and low marbling EPDs were bred to cows that were one-quarter each Hereford, Simmental, Gelbvieh and Angus breeding. The results, over two years, showed that more than 70 percent of the 120 carcasses sired by high-marbling bulls graded USDA Choice. Only 50 percent of the steers sired by low-marbling bulls graded USDA Choice.

University of Florida studies have shown similar results. Research conducted at the University of Georgia some time back found that cattle sired by high marbling EPD sires were worth \$43 per head more as carcasses than steers sired by low marbling bulls.

What's more, the Nebraska studies showed that differences between low and high marbling EPD bulls were even greater than would have been predicted by the EPD figures. This could mean heritability for marbling may be higher than once thought. If so, progress would be even easier to achieve.

We're proud of the progress we have made; however, technology does not stand still. Other means of measuring muscle, fat cover and marbling in live cattle throughout real time ultrasound is fast gaining acceptance and will be used to an even greater extent in the future evaluation procedures.

Our future is exciting and will continue to be if we ensure that our cattle are reproductively sound, have great maternal characteristics, and have superior end product merit.

Editor's note: This article was presented by John Crouch, director of performance programs for the Association, at the Technical Meeting of the World Angus Secretariat April 3 in South Africa.

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