Beef Logic

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Ultrasound measurements vs. traditional carcass data

It is an established and universally accepted fact that currently produced beef carcasses are (on average) too fat, thinly muscled, deficient in marbling and lacking in uniformity. Unfortunately, seedstock producers are doing little about this problem.

Traditional progeny tests for carcass characteristics are time-consuming, expensive, involve too few of the nation's purebred cattle and are of questionable accuracy. Fortunately, sound research data is available that supports the following statement.

The proper collection and use of ultrasound data can be much more effective in improving carcass traits than currently employed progeny tests and can save time and money.

This statement is controversial and requires support. Therefore, a comparison of the two methods follows.

The traits of primary importance in determining carcass value among young cattle are marbling, ribeye area (REA) per unit of weight, fat thickness (FT) at the 12th rib and fat-deposition patterns. Each is worthy of separate discussion.

■ Marbling

Marbling is the major factor that determines quality grade. Marbling refers to flecks and streaks of fat seen in a cross section of ribeye muscle where it is deposited around and between the muscle fibers. As cattle grow and develop, the fat content of the muscle gradually increases from near zero in a baby calf to 8%-10% in a mature, well-nourished animal.

When the fat content of the ribeye reaches approximately 4%, it can be identified visually as marbling. This fat improves the eating qualities of beef by imparting a more desirable flavor; it lubricates the lean-muscle fibers, making them easier to masticate; and it makes cooked beef seem more tender since the heat melts a portion of the fat, leaving the muscle fibers partially separated.

Consumers prefer well-marbled beef and are willing to pay more for it, so the presence of enough marbling to reach the USDA Choice grade is of considerable economic importance.

Marbling score is determined visually. The chilled carcass is "ribbed," or divided into quarters, by cutting between the 12th and 13th ribs. The USDA grader or other technician looks at the cut surface of the ribeye and declares a marbling score, which is an estimate of the fat content of the muscle.

This visual appraisal is subjective and will vary due to the experience, ability and dedication of the observer. It is affected by differences in lighting, humidity, time lapsed after ribbing, temperature of the carcass and even the sharpness of the knife used to rib the carcass.

Marbling score is not a precise measurement of the fat content of beef muscle, which is the evaluator's goal. It is of considerable value because the correlation of marbling score with muscle fat is approximately 0.60.

The ultrasound measurement of marbling in live cattle involves a technique in which high-frequency sound waves are directed into the live animal's body between the 12th and 13th ribs. The interfaces between muscle, fat and bone reflect the sound, and the resulting pattern of sound reflection is processed by a computer to produce a photograph that reveals a map of different tissues. The photo is then further analyzed by a computer that measures the amount of fat in the lean.

The accuracy of this type of measurement has been checked by comparison with chemical analysis of the same ribeye from which the ultrasound measure was made. The correlation between ultrasound fat and chemical fat is about 0.70, which is higher than that for a visual marbling score.

■ Ribeye area

REA is simply an area measurement of a cross section of the ribeye muscle (*longissimus dorsi*) between the 12th and 13th ribs. This measurement taken alone is of no value in evaluating carcass composition. However, REA per unit of weight is of great value in predicting degree of muscling and percent retail product.

This is true because muscles occur in proportion. Therefore, a large REA per unit of weight indicates proportional muscle development throughout the body. Further, a larger REA per unit of weight indicates a lessor amount of fat deposits over the outside of the carcass, between the muscles and inside the body cavity.

REA per pound of carcass is also a part of the formula used to calculate USDA yield grade (YG) or percent retail product and obviously is of great economic importance.

Measurement of the REA in a beef carcass is accomplished by either "grid" or "planimeter." To use the grid, the carcass is ribbed between the 12th and 13th ribs, and the exposed cross-sectional surface of the ribeye muscle is covered by a transparent plastic grid composed of 0.1-square-inch (sq. in.) units. The operator simply counts the squares within the cut surface of the ribeye muscle and divides by 10 to convert to square inches.

Using the planimeter involves tracing the same cut surface of the ribeye and measuring the tracing with a compensating polar planimeter, an instrument used by draftsmen to measure area.

Measurement of the REA by ultrasound uses the same image as that used for determining marbling. The ultrasound "map" of the various tissues allows the measurement of the ribeye muscle.

■ Fat thickness

FT at the 12th and 13th rib is useful in estimating total fatness of cattle and is part of the information used to calculate yield grade and percent retail product. In traditional carcass evaluation, the grader measures or estimates the thickness of fat over the outside of the exposed ribeye. Then the grader adjusts that thickness according to the visual estimate of whether the carcass is trim and lean or has unusually heavy fat deposits in the brisket, plate, flank, cod, rump, pelvic channel or kidney knob.

It is strictly a judgment call. In actual

practice the government grader has about 10 seconds to decide — plus call marbling score, estimate or measure REA, and calculate yield grade. Further, during the slaughtering process, the hide was removed by either a knife or "hide puller," and some fat could have remained on the hide.

In ultrasound evaluation the FT is measured on the same image used for REA and marbling. Then another ultrasound measure of rump fat is used for adjustment if necessary. Researchers agree that ultrasound measures FT even more accurately than it does REA or marbling and is considerably more accurate than a ruler on the carcass, which is subject to damage during slaughtering and handling.

Conclusion: *Live ultrasound measurements are more accurate than traditional measurements taken from the carcass.*

Other advantages

The extensive use of ultrasound measurements in seedstock herds is far superior to traditional progeny tests. Traditionally a bull deemed worthy of a progeny test must be semen collected and entered in a test with other bulls and reference sires. At best, it will be 24 months before carcass data is available. Further, the data will be questionable since each carcass will have come from a commercial cow without any record of performance, carcass excellence or breed background.

On the other hand, breeders using ultrasound measurements would have data, not only on their favorite bulls, but also on all bulls and heifers in each calf crop. And they'd have it as the animals came off postweaning-gain tests at 12-14 months of age. More important, in a few years there would be data on every animal in the entire herd. If the majority of breeders used ultrasound on all yearlings, the database for a breed would mushroom.

For example, the American Angus Association database (the largest of any breed in the world) contains data on approximately 50,000 carcasses collected over the past 26 years. However, since Jan. 1, 2000, the Association had data by ultrasound for marbling and composition on 43,000 head of Angus cattle.

The case for extensive use of ultrasound is overwhelming. When compared to traditional progeny tests for carcass composition, ultrasound is quicker, cheaper and more accurate, and the additional numbers involved make it much more effective as a breed improver.