Carcass Merit

Questions Needing Answers

by Ronnie D. Green
Texas Tech University

The definition of "ideal" carcass merit is somewhat elusive under our current yield and grading system. Rex Butterfield summed up our objective well when he said:

"The ideal carcass is one which yields a maximum percentage of muscle, a minimum percentage of bone and enough fat to meet the minimum quality requirements of the marketplace. It must be produced economically within the limits of functionally efficient cattle."

Recent trends in the beef cattle industry have dictated that we clean up our act in terms of excess fat production. This has resulted in a call from witbin the industry to put into place a system which will encourage the breeding and feeding of cattle which will yield leaner, yet palatable carcasses. Even though this system currently does not exist, there is little doubt in the minds of most industry leaders that it will come in the not too distant future.

Therefore, it is our challenge to devise tools for our breeders to use to aim at the objective of improved carcass merit. This objective coincides with the fact that we know that our consumer preferences are in the words of Gary Smith "to keep the taste fat and get rid of the waste fat."

Fortunately, we know from collective research results over the past 25 years that a great deal of genetic variation exists both between and within breeds for measures of carcass merit. Levels of additive genetic variability for measures of retail yield and palatability are all in excess of what we generally observe for growth traits such as weaning weight (see Table 1). This indicates that we should be able to make fairly rapid genetic improvement from selection within breeds for these measures.

Larry Cundiff and co-workers at the Roman L. Hruska U.S. Meat Animal Research Center have also reported in past Beef Improvement Federation (BIF) meetings that the magnitude of genetic variability between breeds is roughly

equivalent to that within breeds (see Table 2). This infers that we should also be able to make improvement in carcass desirability of slaughter cattle through proper breed selection implemented in designed crossbreeding programs.

Collectively, these facts lead us to the conclusion that we have the opportunity in our current cattle population to produce the kind of cattle desired at the end product level. Terminal sire lines selected for carcass merit, matched with maternal dam lines where emphasis is placed on reproductive efficiency, and matching of production potential to environmental resources offer the means to this end.

However, for this type of system to be effective, carcass merit EPDs must be implemented in national cattle evaluation programs.

Table 1. Heritability Estimates of Carcass Traits in Beef Cattle

Trait	No. Studies	Avg. h2
Retail yield (%)	7	.42
Retail weight (lb.)	6	.53
Carcass weight (lb.)	7	.48
Ribeye area (in2)	10	.40
12th rib fat (in.)	10	.43
Marbling (or QG)	9	.38

(Weightedaverageofliteratureestimates)

Table 2. Relativity of Variation Within and Between Breeds for Carcass Parameters in Beef Cattle

Trait	Number of Additive Genetic Std. Deviations Between Most Divergent Breeds
Retail product (%)	5.8
Retail product weight (458 days)	6.2
Marbling score	5.3

(Adapted from Cundiff et al. (1990)

Past BIF meetings have featured speakers which have concluded that real-time linear array ultrasonic imaging offers great potential for moving toward carcass merit EPDs. As a prelude to this year's BIF meeting, a group of researchers working in the live animal prediction of carcass merit utlilizing ultrasound technology met for a discussion of where we are currently. It is the intent of this report to summarize some of that discussion and to specifically make some recommendations regarding ultrasound technician certification programs.

The first question that must be addressed in reference to collection of ultrasound carcass data is that of which traits should be measured. It has become

quite standard for ultrasound measurements to consist of estimates of fat thickness and area of the 12/13th rib juncture. These measurements, emphasized largely because of their importance in the USDA yield grade equation, have become fairly refined and are relatively easy to obtain; therefore, they will most likely be a part of any collection of this kind of peformance data in the future. However, there may be other measures which could be better predictors of yield than these two.

Since intermuscular fat (i.e. "seam" fat) makes up 50 percent or more of total carcass fatness, an ultrasonic predictor of this fat deposit would be very useful for selection for improved retail yield. Researchers at Iowa State and Texas Tech are attempting to define such measures in locations like the round, forearm, shoulder, brisket, 4/5th rib juncture, 8th rib and others.

The real goal here is to alter the relative proportions of inter- and intra-muscular fat deposits. This requires that we be able to predict with some degree of accuracy intramuscular fatness (i.e. "marbling"). There has been much debate about the validity of marbling as the primary determinant of palatability in our current grading system. As long as that is our system and "insurance policy" against a bad-eating piece of product, we need to predict it on the live animal. The point must be clear, however, that any prediction of marbling using ultrasound needs to be totally free of human subjectivity.

There's a need for some joint effort by researchers working on these "new" measures to develop some standard protocols. One suggestion was a scanning workshop amongst these groups to go over all of these sites and techniques of measurement with the ultimate goal being the development of an anatomical "scanning guide." Plans are underway for the possibility of such a workshop either around the American Society of Animal Science meetings in August or the NC-196 meeting in September.

There also exists a variety of different types of ultrasound units currently being used for carcass imaging. Doyle Wilson and his group at Iowa State pointed out in last year's BIF proceedings the different units available and their capbilities. There is no doubt that this technology will continue to improve and evolve with increased use. This raises the question of how technicians will be evaluated given the use of different equipment. Some discussion has been given to a "phantom modeling" approach

which would perhaps allow estimation of the differences between the various types of units.

Much of the discussion in the past year regarding evolving equipment has centered around the effectiveness of the new Aloka 500V and 633 units (Corometrics, North Wallingford, CT). When reviewing the literature on accuracy of ultrasonic measures of backfat and ribeye area using equipment prior to the two newer units, the weighted average correlation of a number of studies between actual carcass and live ultrasonic measures is .79 and .69 for backfat and ribeye area, respectively. When this is compared to the results of studies thus far, utilizing the newer Aloka units, these correlations have increased to .87 and .78 for the two measures. The same result has been observed by workers in Australia for ribeye area measurements with the newer equipment but they have observed a slight decrease in accuracy for backfat thickness. It appears that the newer generation equipment does in fact perform more accurately, particularly for measurement of ribeye area, when used by trained technicians.

Accuracy of measurements taken ultrasonically has traditionally been assessed using correlation coefficients. Many have been led to believe that backfat thickness estimates are more accurate and more precise than are those for ribeye area. Precision is determined by the size of the deviation between the ultrasonic live and carcass measure. When expressed relative to the average, fat thickness is roughly twice as imprecise as is ribeye area (20.6 percent vs 9.4 percent error rates, respectively) in recent data collected in our program. This fact has been repeatedly shown in most research studies where these two traits have been evaluated.

Past ultrasonic estimates of marbling have had two primary problems. They have been of insufficient accuracy to be of use and have been made in such a way that they are too prone to human subjectivity. More recent attempts to use ultrasound to predict marbling differences have relied on the distribution of pixel counts corresponding to the 64 shades of grey in the ultrasound image.

Only now are we beginning to understand how these types of image analysis results can be used to predict this trait. In a recent study in our program, image analysis pixel distributions of the ribeye area were analyzed with discriminant analysis techniques to quantify marbling in 36 feedlot steers. In that set of animals using images from two separate technicians, we were able to classify animals into the correct quality grade with 100 percent accuracy from one technician and 97 percent accuracy for the other technician.

Factors which have been identified which affect accuracy and precision of ultrasonic estimates include level of fatness and muscling, sex of animal, age of animal, technician, equipment and technique, changes in tissue character postmortem, removal of hide and effects of hanging carcass versus standing animals. Many of these factors have been evaluated in designed research. There are several unanswered questions remaining, however.

Several research programs around the country are currently evaluating the effects of age, weight, nutritional regimen and biological type on ultrasonic estimates of carcass merit. Intensive work

Continued on Page 478

Continued from Page 475

is being done in attempting to find not only how accurate different measures are relative to the same measures on the carcass, but also how well the measures predict retail yield and grade. Research in this area is proceeding at a rapid pace.

Perhaps the biggest unanswered question in relation to use of ultrasound for developing carcass merit EPDs is how well measurements on young bulls genetically predict performance of their future feedlot steer and heifer progeny. The possibility certainly exists that we are attempting to measure traits in young bulls that are physiologically quite different than the same types of measures in feedlot animals. The research data base of measurements on breeding bulls and heifers is growing rapidly, but we must know the answer to how well these measures translate into carcass merit of feedlot progeny. This question will be addressed over the next year in studies at Texas A&M, Iowa State and Texas Tech.

Approval has just been given for the first phase of funding for a project involving research groups at Iowa State University, the University of Georgia and Cornell University in the carcass merit area. We all need to recognize and support these efforts wholeheartedly for the potential that they offer.

Ultrasound Technician Certification

The Live Animal and Carcass Evaluation Committee (LACE) under the leadership of John Crouch has been looking at how to "certify" ultrasound technicians who are collecting this kind of performance data. This process started at the 1988 BIF meeting when an ad hoc committee was formed to proceed in this area. Following that meeting two workshops were held, one at Cornell and one at Texas A&M. In January of 1989 the first BIF ultrasound proficiency examination was hosted by Bill Turner and colleagues at Texas A&M which resulted in certification by those standards of seven technicians.

At the 1989 BIF meeting in Nashville, guidelines for certification programs were presented to the LACE committee along with a summary of the first exam at Texas A&M. In February of 1990, a second proficiency examination was hosted by John Hough and colleagues at Auburn University which resulted in the certification of an additional six technicians.

Many folks have argued that the most appropriate way to evaluate technician competency would be in the form of their variance rather than correlation. We know that correlations can be affected by the variability of the particular sample of animals being evaluated. A more appropriate method would be to look at a measure similar to that used by the Australians of a mean squared deviation.

Not only is there much debate about what the proper statistic for evaluation is, but we also have not put into place any method for determining what is an acceptable level of that criterion. We can't afford to be comfortable choosing an arbitrary level of whatever statistic is utilized. This must be answered through some logical evaluation of past research along with some modeling of the effects of imperfect accuracy and repeatability on our breeding value rankings of animals.

Should BIF be performing the duty of certifying ultrasound technicians or would that be more appropriate for breed associations or other groups? The overwhelming opinion of our group was that BIF should continue providing this service to the industry.

With all of the changes occurring in this area at the current time, there are many factors which need to be integrated into this certification process. In many ways, in terms of ultrasound technician certification, we really are attempting to shoot at a moving target. Questions exist regarding: a) what is the most acceptable method and criteria to evaluate technician competency? b) how do we go about setting the minimum levels of these criteria? c) how should we handle equipment differences? d) how do we integrate new and perhaps more meaningful measures as they become defined? e) should all sexes be measured including breeding animals? f) should we expect technicians to also be versed in how these measures should be adjusted and used? and finally g) what is the most efficient location/frequency/protocol for proficiency evaluations?

No doubt, we are at a crossroads in the development of this technology. Judging from the points discussed at the 1991 BIF meeting, we need to stop and take a very close look at all of these questions before we proceed further.