



Evaluation of Beef Carcass Merit With Ultrasound

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Carcass EPDs are becoming common in this era when more economically important traits are being added to national cattle evaluation programs. Traditionally, carcass traits were evaluated solely using progeny tests. One limitation to progeny testing is, of course, cost. Also, for bulls to be evaluated in such a program, he must produce progeny on which carcass data are collected. This is a process that typically requires about two years beginning at the point when a bull is, at a minimum of 13 to 15 months of age. Bulls are typically at least 3 to 4 years of age before carcass data are available from his progeny that can be used for national cattle evaluation. A more efficient method would provide carcass EPD on bulls at younger ages.

Accuracy of Ultrasound:

Real time ultrasound (RTU) has been used in the beef industry for several decades as a non-invasive method to determine body composition, by measuring relevant characteristics such as ribeye area, fat thickness and intramuscular fat percentage (i.e., marbling). Research has shown that RTU can be used to predict carcass data within 0.75 in² for ribeye area, and within 0.10 in for fat thickness. RTU images taken on the live animal as early as weaning can be used to predict carcass traits.

Ultrasound and Genetic Improvement:

Although it has been clearly shown that RTU can be used to predict carcass traits for live animals, taking RTU measurements on steers in the feedlot is insufficient for use in genetic evaluation. To be of use in genetic improvement, RTU measurements from yearling cattle must: 1) have at least moderate heritability (i.e., respond to selection), 2) exhibit adequate genetic variation to allow for change in genetic value, and 3) have sufficient genetic correlation with carcass traits of progeny to be useful as indicator traits.

Heritability of Ultrasound:

There have been numerous studies to estimate the heritability of RTU traits. In one recent review, more than ten heritability estimates were summarized for age-adjusted RTU ribeye area and fat thickness. Most of the estimates ranged from about 0.15 to higher than 0.50. It can be concluded, therefore, that indeed RTU measurements of muscling and fatness from yearling cattle have heritability in the moderate to high range. Fewer studies have estimated heritability for RTU measures of intramuscular fat percentage, because the technology to make these measurements is newer to the industry. The average heritability from four recent studies was 0.31, which is in the moderate range. Traits such as carcass weight, ribeye area, fat thickness and marbling score also have heritability estimates in the moderate to high range.

Genetic Variance of Ultrasound and Carcass Traits:

Equations to predict response in one trait due to selection for an indicator trait involve estimated genetic variance. In effect, traits under selection must have genetic variance in order to respond to selection. This is partially explained by heritability, but traits with similar heritability can have very different estimates of genetic variance. Comparison of RTU traits of yearling cattle with carcass traits of slaughter cattle shows that RTU traits have lower estimates of genetic variance. Simple ratio calculations show that for ribeye area, genetic values for yearling RTU measures are about 75% as variable as genetic values for carcass ribeye area. For fat thickness and marbling score, RTU measures on yearling cattle have only 25 to 35% the genetic variability of carcass traits. However, variances are related to the average, and if variances are adjusted for the average, it can be concluded that RTU and carcass measurements have just about equal relative variability.



Genetic Correlation Between Ultrasound and Carcass Traits:

To be useful as indicator traits, RTU measurements on yearling breeding cattle need to be highly correlated with carcass measurements on their progeny. In practice, the genetic correlation between two traits should be between 0.90 and 1.00 for them to be considered equivalent traits. Most estimates of the genetic correlation between carcass traits and their RTU indicators have been remarkably similar, with values for ribeye area, fat thickness and marbling score ranging between 0.70 and 0.80. This means, as expected, that yearling RTU measurements are not simple proxies for carcass traits. In other words, selection based on ultrasound EPD is not the same as selection for carcass traits. However, the genetic correlations are high and positive, and the recommendation would be to run national cattle evaluations for carcass traits by using RTU measurements on yearling bulls and heifers as separate but correlated traits.

Collecting Ultrasound Data:

One of the advantages of ultrasound is that data collection can be incorporated into the normal management program. A logical time to collect RTU data on bulls and heifers is at yearling. Most research is based on RTU data taken when yearlings are between about 300 and 500 days of age. It is important, however, to note that postweaning management of bulls and heifers is often different. The predictive ability of RTU, especially fat thickness, can be affected by the amount of fat expressed by yearling cattle. Research shows that bull RTU contemporary groups need to have an average of at least 0.15 inches of fat so that variation is expressed and genetic potential for fat deposition can be evaluated. Severely limiting fat deposition in bulls can not only reduce fertility, but also decrease the value of RTU fat measurements. To account for differences between bulls and heifers, some researchers in the U.S., Canada and Australia have opted to treat RTU measurements on bulls and heifers as separate but correlated traits. With this approach, bull RTU, heifer RTU and progeny carcass measurements are used in the genetic evaluation model.

Increasing Accuracy of Evaluation with Ultrasound:

In a traditional progeny test, bulls are evaluated based on carcass data from progeny. These tests are designed to maximize accuracy of sire EPD by production of relatively large half-sib contemporary groups. Increasing the amount of information available on a sire will lead to increased accuracy of EPD. There are several ways to increase accuracy. One direct way to increase accuracy of carcass EPD is to increase the number of progeny per sire with carcass data. But, because RTU data are good indicators of carcass traits, ultrasound data on related animals will also increase the accuracy of carcass EPD. Compared to a progeny test, one study showed that the addition of RTU data on yearling bulls and heifers increased the accuracy of carcass EPD by an average of 75% for ribeye area and 51% for fat thickness. For example, the addition of RTU data increased average accuracy of ribeye area EPD based only on carcass data from 0.32 to 0.56. Other studies have also shown significant increases in expected genetic gains due to adding RTU data to traditional performance data. Current genetic evaluation procedures estimate EPD for all animals related through pedigree. Collecting RTU data on entire yearling contemporary groups not only increases the numbers of animals with data that directly contribute to carcass evaluation, but also decreases selection bias associated with traditional progeny tests. In the few national carcass progeny tests that exist, bulls nominated to the program are generally highly selected, which is to say they are not, generally, a random sample of the breed as a whole. Carcass EPDs are potentially less biased when RTU data are available.

Carcass EPD versus Ultrasound EPD:

It is important to remember that the objective of selection is to improve carcass traits. The potential for carcass EPDs to be improved in some ways by the use of RTU data does not change the breeding objective. In simpler terms, it is not optimal to select for indicator traits (even using EPDs) when EPDs are available for the economic trait of interest. Although it is possible to produce so-called ultrasound EPDs, all of the information of value in the RTU data is incorporated into the carcass EPDs. Some breeds, therefore, do not publish ultrasound EPDs but rather only carcass EPDs that are estimated by inclusion of RTU data. This is a simple matter of remembering which is the economic trait and which is the indicator.

Summary:



Ultrasound offers the opportunity to enhance carcass EPDs so that effective selection and marketing decisions can be made with regard to improving carcass merit. Several breeds have already begun building carcass and ultrasound databases and plan to implement national or even North American carcass evaluation programs. It is important for breeders to understand the benefits of ultrasound data and national cattle evaluation for carcass traits. Producers are encouraged to contact their respective breed associations or beef improvement groups for more information.