Ultrasound 101

A Q&A regarding live-animal ultrasound measurements to predict end-product merit

BY JOHN CROUCH

1. What is ultrasound?

Ultrasound technology was developed by the medical profession. It utilizes high-frequency sound waves to measure differences in tissue density in the live animal. The image then reflects the difference between fat tissue and lean tissue.

2. How is ultrasound technology used in the beef industry?

Ultrasonography offers a wide variety of uses in diagnosing certain medical anomalies, as well as pregnancy detection and reproductive disorders. In recent years ultrasound has been further refined and applied to measuring carcass traits in live animals.

3. How does ultrasonography differ from traditional means of carcass evaluation?

Traditional carcass evaluation has served the industry well in recent years; however, it is very expensive and time-consuming.

Ultrasonography offers the seedstock industry a nondestructive alternative to determine end-product merit by measuring intramuscular fat, ribeye area and external fat thickness and predicting percent retail product in live yearling bulls and developing heifers. This also will provide the necessary data for applying the full animal model to the data rather than the sire model currently being used.

4. How do I know these measurements are accurate?

The American Angus Association, in concert with Iowa State University (ISU), recently completed a two-year study designed to gather, analyze and compare ultrasound measurements and traditional carcass measurements taken at the packing plant. This research supported previous research and vividly pointed out that ultrasound detected the same traits in yearling bulls and developing heifers as those exhibited in 16- to 18-month-old steers in the packing plants.

JOHN CROUCH PHOTOS

AAACUP technicians receive classroom and hands-on training as proper technique for real-time ultrasound is explained at a recent training seminar held at the Armstrong Research Center, Atlantic, Iowa. For the most current list of technicians approved to submit scans for AAACUP, call John Crouch, American Angus Association director of performance programs, at (816) 383-5100.

The genetic correlation between ultrasound and carcass expected progeny differences (EPDs) for percent intramuscular fat (marbling), ribeye area and external fat thickness were 0.77, 0.71 and 0.75, respectively. This strongly suggests we are dealing with the same traits.

5. Which traits are measured?

(1) Percent intramuscular fat,
(2) ribeye area,
(3) rib fat (thickness) and
(4) rump fat.

6. What is rump fat?

Subcutaneous rump fat is measured at a point between the hooks and the pins. The measurement is easily taken, highly repeatable and provides additional information about the composition of the animals. Rump fat and rib fat are highly, and positively, correlated.

7. Who does the scanning?

A listing of approved and participating technicians is available in the *Angus Journal*, on the Internet at *www.angus.org* or *www.exnet.iastate.edu/pages/ansci/ ultrasound*, and from the Association office.

8. How do I get started?

In order to participate, your herd must be enrolled in the Angus Herd Improvement Records (AHIR) program. Weaning weights must have been processed on the calves you wish to ultrasound. The necessary forms for 1999-born calves have been or will be included in the envelope containing your weaning summaries. Additional guidelines and instructions are also available upon request.

9. What happens after the technician scans the cattle?

Upon completion of the scan session, the technician sends, overnight, an electronic disk containing the images along with the forms (barn sheets) to the Centralized Ultrasound Processing Laboratory at ISU. The images are then interpreted by a trained technician and sent electronically to the Association office for adjustment. The adjusted measurements and ratios are sent to the breeder. The normal turnaround time is seven working days.

10. How should I use these measurements?

Adjusted measurements, like adjusted weights, are just that. Nothing more,

Scanning into the future

Have you ever wondered how your cattle would fit into a grid-marketing system? Real-time ultrasound uses high-frequency sound waves to "see inside" while the animal is still alive. A sound-emitting probe held snugly on the animal's back bounces sound waves off the boundaries between fat and muscle layers. A cross-sectional image created by the reflected sound appears instantly on the video screen.

What does that mean for you as a cattle producer? Real-time ultrasound enables you to get a fast and objective prediction of the carcass composition of your beef cattle. This tool can help you meet specific market demands and production systems.

In addition, carcass composition information could assist you in the genetic selection and breeding of your cow herd.

What is the accuracy of real-time ultrasound? Certified technicians can measure:
- Ribeye area to within 0.6-0.7 square inches of the actual ribeye area using real-time ultrasound.
- 12th-13th-rib fat and rump fat thickness to within 0.04-0.05 inches of the actual fat thickness using real-time ultrasound.
- Percent intramuscular fat to within 0.8%-0.9% of the actual amount of percent intramuscular fat (see table on page 98).

The benefits of using real-time ultrasound are many:
- Objective prediction of carcass lean and fat in live beef animals.
- A trained evaluator can subjectively determine differences in fat cover and muscling on live cattle. However, it is impossible for a person to evaluate percent intramuscular fat (marbling) of the live animal. Ultrasound gives us the ability to objectively measure marbling in the live animal.
- Evaluation of percent intramuscular fat from the ribeye to determine USDA quality grade.
- Information on body composition eliminates the expense and the time required by progeny testing for carcass merit.
- The full potential of real-time ultrasound will be realized when the data collected can be used to calculate expected progeny differences (EPDs) on a national scale for every breed, working toward improved carcass merit.

— Iowa State University

The reference points (1, 2 and 3) on this drawing represent the areas where ultrasound images are collected, as shown in the photos and scans below.

1 — Marbling

2 — Ribeye

3 — Rump
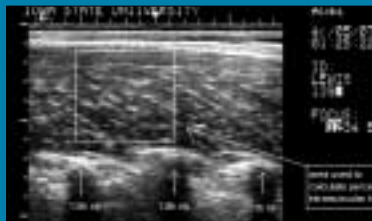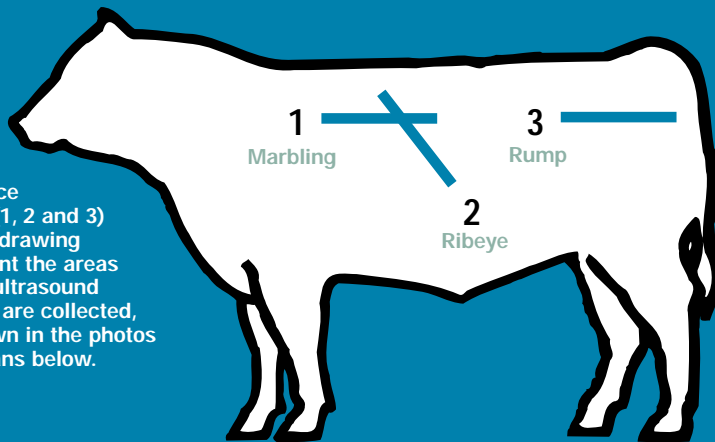
The technician is collecting the image shown above for calculation of percent intramuscular fat (marbling). The real-time ultrasound image is collected across the 11th, 12th and 13th ribs.

The technician is collecting the image shown above for measurement of ribeye area and 12th-13th-rib fat thickness.

The technician is collecting the image shown above for calculation of rump fat thickness.

PHOTOS AND SCANS COURTESY OF IOWA STATE UNIVERSITY

nothing less. Comparisons within contemporary group using adjusted weights are the foundation for all genetic evaluation procedures, which lead to the generation of EPDs.

11. At what age do I have my cattle scanned?

For bulls the age is 320-440 days. Bulls need to be in good flesh, having been fed to gain approximately 3.0 lb./day.

Heifers should be measured at 320-460 days of age and should be in normal pasture condition. It appears developing heifers, due to their physiological makeup, will have enough condition at this age to express variation.

12. How will the cattle be grouped?

Yearling cattle will be sorted back into the groups in which they were weaned. They can, however, be further broken down with respect to management regime. Contemporary grouping provides a more accurate means of evaluating sires for genetic merit.

13. I have a calf sired by a bull with a high ribeye EPD, but the calf's own ultrasound ribeye measurement was below average. Explain.

The answer involves simple genetic variation. The fact that my father was tall does not ensure that all of my brothers will be tall. Cattle are no different. If a sire is highly proven, the average of his progeny will be close to his EPD. However, there will still be variation among his progeny.

14. How should research ultrasound EPDs be used?

The EPDs contained in the preliminary research report were calculated from more than 30,000 records on 2,153 sires. In order for a sire to have been considered, he must have had at least two progeny included in the analysis. In order for a contemporary group to have been considered, it must have consisted of at least three head.

For the present, these EPDs should be considered as research information. Ultrasound EPDs used in promotional information should be labeled as such.

Nearly 60 technicians participated in the AAACUP training seminar held Sept. 20-24 at the Armstrong Research Center, Atlantic, Iowa. Qualifying technicians will participate in collecting images for the program.

PHOTOS COURTESY OF IOWA STATE UNIVERSITY

John Crouch, center, director of performance programs for the American Angus Association, was recognized for his contributions to the development of real-time ultrasound for use in measuring Angus seedstock for carcass traits at the Third Annual Centralized Ultrasound Processing Training and Qualification program. Professors Doyle Wilson (left) and Gene Rouse (right) presented Crouch with an engraved pewter meat platter from the department of animal science at Iowa State University.

Recognized for outstanding achievement as AAACUP technicians were: Volume — Matthew Lane (not pictured), Big Dry Livestock, of Gem, Kan., and Jordan, Mont.; Image quality — Andy Meadows (center, right), Springwood Livestock Management, Buchanan, Va.; and Paperwork proficiency — Jim Pritchard (center, left), West Virginia University Extension, Marlington, W.Va. Also pictured are Rebecca Werner and Craig Hays (left), AAACUP Laboratory, Ames, Iowa.

Table: Conversion from Percent Intramuscular Fat to Marbling Score

% Intramuscular Fat	Quality Grade	Marbling Degree	Marbling Score
2.3 - 3.0	Select⁻	Slight[0-40]	4.0 - 4.4
3.1 - 3.9	Select⁺	Slight[50-90]	4.5 - 4.9
4.0 - 5.7	Choice⁻	Small[0-90]	5.0 - 5.9
5.8 - 7.6	Choice[0]	Modest[0-90]	6.0 - 6.9
7.7 - 9.7	Choice⁺	Moderate[0-90]	7.0 - 7.9
9.9 - 12.1	Prime⁻	Slightly Ab[0-90]	8.0 - 8.9
≥ 12.3	Prime[0]	≥ Moderately Ab[0]	≥ 9.0

Marbling is measured as percent fat. Beef carcasses are traded on the amount of intramuscular fat (marbling) they contain between the 12th and 13th ribs. However, marbling is a subjective score. Real-time ultrasound has the capability to objectively predict the actual percent intramuscular fat in the ribeye, which is what the grader is trying to visually evaluate.