ULTRASOUND AS A MEASURE OF BODY COMPOSITION

Real-time ultrasound technology has advanced to the state whereby accurate measurements of several body composition traits can be made on live beef animals. These traits include 12th-13th rib fat thickness, rump fat thickness, ribeye area, and intramuscular fat percentage (marbling). Each of these traits is significant in the determination of quality and red meat yield for individual animals, and each is at least moderately heritable.

Accurate collection and interpretation of ultrasound images is critical to the successful application of ultrasound. Accuracy is highly dependent upon ultrasound technician skill. Only certified, highly skilled technicians should be retained for the collection and interpretation of images.

Before the ultrasound technician arrives to measure your animals, you will need to generate a 'barn sheet' or *Ultrasound Evaluation Form* from the IBBA online registry system for recording appropriate chuteside data.

Instructions for creating a 'Barn Sheet'.
1. After logging into your account, click on **My Animals.**
2. Select an animal category such as: **All Animals**, **Non-parent Bulls**, or **Non-parent Heifers**.
3. When the list of animals comes up, click on the box under the **Ultrasound** column next to each animal that you want included on the 'barn sheet'.
4. After you have selected all the animals to be included on the 'barn sheet', scroll down to the bottom of the page and click on the red button that says **Barn Sheet**.
5. A 'barn sheet' titled **Ultrasound Evaluation Form** will pop up already filled out with member name and membership number. Each animal will be listed with private herd number, registration number, date of birth, sex, and weaning contemporary group number.
6. You can now print your 'barn sheet'.

Ribeye area
Accurate live animal, ultrasound estimation of ribeye area is dependent on three major items: clear and distinct medial and lateral end borders, not being over any portion of 12th or 13th rib, and good transducer-animal contact. The presence of well-defined intercostal muscles under the longissimus dorsi is an indication that the transducer is properly aligned directly between the 12th and 13th ribs for this measurement. Ribeye area is measured by placing the ultrasound transducer at position 2 in the accompanying figure.

12th-13th rib fat thickness
The ultrasound rib fat thickness measurement can be made from the same image (position 2) used to estimate ribeye area. Fat thickness at the 12th-13th rib is measured at a point three fourths of the distance from the medial end of the longissimus dorsi muscle (12-13th rib interface) and perpendicular to the surface of the hanging ribbed carcass. Ultrasound scanning protocol requires the collection of an image made between the 12th-13th ribs using a linear-array transducer and standoff guide that conforms to the curvature of the animal's back.

Rump fat thickness
Rump fat thickness is a fat depot that is highly related to 12th-13th rib fat thickness (genetic correlation exceeding .70). This measurement can be beneficial when scanning very lean animals such as yearling bulls and can be used to improve the overall accuracy of external fat estimation. To collect this image, the ultrasound transducer should be placed at position 3 in the accompanying figure, which is aligned directly between the hooks and pins without a standoff guide.

Percent intramuscular fat
Percent intramuscular fat (%IMF) is a trait that is highly correlated with USDA Marbling Score. It is the most difficult of all ultrasound traits to measure accurately. Equipment calibration, animal preparation, electrical power signal noise, existence of atmospheric radio waves, and transducer-animal contact are some of the factors that can influence measurement accuracy. A minimum of four independent images should be collected and the resulting %IMF predictions averaged for this trait. The %IMF measurement is made from an image that is collected across the 11th-13th ribs (or 12th-13th ribs) at a lateral position from the animal's midline at a point three fourths of the distance from the medial end of the longissimus dorsi muscle (position 1 in the accompanying figure).

Image Scanning Locations on the Live Animal
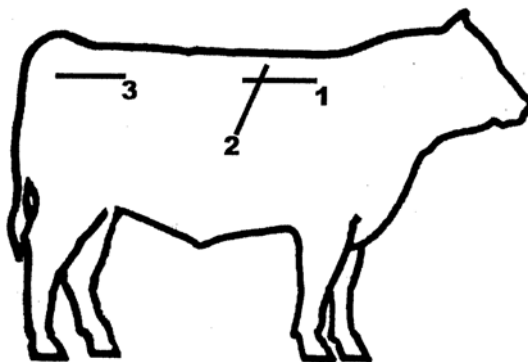
When to scan seedstock

Body composition measures determined from individual animal ultrasound images must be adjusted to a common endpoint for accurate genetic comparisons. The endpoint must have relevance to traits of economic importance in the carcass. Research has shown that yearling bulls and developing replacement heifers can be scanned at approximately 365 days of age to provide a good indication of how sibling steer and heifer mates will perform in the carcass. Each breed association has developed an age at scanning window that must be met in order for the data to be used in national cattle evaluation.

Adjustment factors

Adjusting individual animal ultrasound measures to a common endpoint allows for the fairest comparison among animals within a contemporary group. Factors such as an animal's age, age-of-dam, weight, and weight gain may affect its ultrasound measures. Therefore, a scanning weight should be recorded within 7 days of when cattle are scanned. Gut fill can have a significant impact on an animal's weight when compared to contemporaries, creating a biased measurement and comparison. Therefore, the scanning weight should be an empty body weight taken when the animal has been held off feed over night before scanning. Many adjustment formulas may also use rate of gain to adjust ultrasound measurements to a common endpoint. It is recommended that an additional weight and date be recorded at weaning for seedstock animals being measured at one year of age, and for feedlot animals a weight and date should be recorded when animals go on feed.

Contemporary groups

The development of body composition EPDs requires that scanned animals be associated with a well-defined contemporary group. Animals of the same sex, reared and managed together up until the time of scanning form a contemporary group. Additionally, it is suggested that breeders define only calves that are within a 60-day age window as a contemporary group. Scanning contemporary group definition includes the following: herd code, weaning date or weaning lot date, weaning management group (pasture, creep, non-creep, etc.), scanning date or scanning lot date, and post-weaning management group designation. The lot date is used in lieu of actual measurement date when weaning or scanning of a contemporary group must occur over more than one consecutive day.

For animals scanned at a central test, the contemporary group definition for an animal must include its herd of origin and other birth and weaning contemporary group information.

National cattle evaluation requires that performance records be tied across contemporary groups or herds. The pedigree relationship matrix used in the prediction methodology allows for many indirect ties to be established. However, the best ties are made when sires have progeny represented across contemporary groups, herds, and years. All scanning contemporary groups must have at least two sires represented, and at least one of those sires should be used in another herd that is also participating in scanning for national cattle evaluation.

Facilities and animal preparation

It is the breeder's responsibility in most cases to insure that the cattle handling facilities for scanning are adequate for animal restraint and for safety of the animal handlers, ultrasound technician, and the cattle. A squeeze chute with fold-down side panels is required for scanning beef cattle. The chute should be located under a roof that can block direct sunlight and provide protection from rain or other inclement weather conditions. A clean and grounded power signal (110v) is required chute-side. It is best if the electrical circuit is a dedicated line to the chute, free from the interference of other electrical equipment such as motors.

Most ultrasound equipment does not operate efficiently and accurately when the ambient air temperature falls below 45°F. The breeder should make provisions to keep the facility heated in these situations.

Animals are to be clipped at the scanning sites to enhance contact between the transducer and wave-guide and the hide. Length of hair coat should be no more than ½ inches in the area to be scanned.

Equipment

Currently in the USA, most beef cattle scanning is done with an Aloka 500 V with a 17cm linear array 3.5 MHz transducer or with a Classic Scanner 200 with a 18 cm linear array 3.5 MHz transducer. The type of ultrasound equipment and software used to collect and interpret ultrasound images can have an impact on measurement accuracy.

Image interpretation

As in scanning, accurate interpretation of real-time ultrasound images for external fat thickness, ribeye area, and % IMF requires a high degree of skill by ultrasound technicians. Within the industry, there currently are two methods of processing images. First, technicians are solely responsible for the collection and subsequent interpretation of images. Second, a centralized processing facility may work with field technicians with the primary objective of interpreting images and reporting the data. Each method should strive to provide an accurate and timely assembly of data. There are programs currently recognized within the beef cattle industry that technicians can participate in to obtain training and certification in beef cattle scanning and interpretation.

Technician and equipment proficiency

The Beef Improvement Federation encourages the development and expansion of ultrasound proficiency testing programs. Strict protocol should be followed to insure fair and unbiased testing of technicians, equipment, and software used for the collection and interpretation of images. Technicians should certify with the same ultrasound equipment and interpretation software they would be using to commercially scan cattle in the field.

For certification proficiency testing, a technician should scan approximately 20 animals and then repeat scan the same animals in random order so that repeatability can be evaluated. Although additional statistics and stricter standards may be used for proficiency evaluation, the following requirements should be met.

Trait	Fat Thickness	Ribeye Area	% IMF
Standard Error of Prediction	< 0.10	< 1.20	< 1.20
Standard Error of Repeated Measures	< 0.10	< 1.20	< 1.10
Bias	< 0.10	< 1.20	<.70

Reporting of data

It is recommended that scanning results (data) be electronically transferred, in a standard format, directly by the technician or centralized lab to the respective breed association. Data should include ranch name, membership number, address, and telephone number, technician name and telephone number, ultrasound equipment, and software used. Animal information should include the date measured, association registration number, individual herd identification number, date of birth, association number of sire and dam if registration is not available on the animal, sex, management codes, contemporary group codes, actual measurements for ribeye area, fat thickness, % IMF, rump fat, and weight.

Archiving data and images

Images and data should be archived in central locations at the discretion and direction of the breed association or cattle improvement association involved. This may be a valuable resource as new technology is developed.