Understanding the Ultrasound Info Craze

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Even though ultrasound technology and its application to the beef industry is still in its "calf" stage, the demand for carcass information is growing and maturing rapidly. With each breed association reporting ultrasound data and carcass EPDs independently, comparing the numbers becomes difficult and extremely confusing. In response to countless requests from breeders and buyers alike, a grass-roots explanation of ultrasound data as it is collected "chute-side" is long overdue. A step-by-step description of each image collected is a good method to help beef producers understand the traits measured and how to incorporate them into selection programs, regardless of breed or background, farm or feedlot.

Percent Intramuscular Fat (%IMF) or Marbling

With all of the grid premiums and incentives to raise Choice and Prime cattle, it's easy to see why so much selection pressure has been placed on marbling. The section header implies that the two traits are one in the same. In reality, %IMF is simply an indicator trait for marbling, much like Birth Weight EPD is an indicator of calving ease. With high marbling EPDs and carcass quality genetics demanding top dollar in the sale ring, it is extremely important producers understand what they are buying.

The major difference between %IMF and marbling is that %IMF is a numerical objective measure, whereas marbling is subjective to the eye of the grader. The correlation is usually around +.70 between the two measures. In order to accurately predict USDA marbling score using ultrasound, the same grader would need to be used for every research trial. As a result, a chemical extraction procedure was adopted, using the percentage of intramuscular fat in the ribeye muscle. The collection of %IMF values comes from taking a thin slice of the ribeye in the cooler. External and seam fat are removed from the sample. The steak is then frozen, ground up, and ether extract analysis determines the fat percentage from a sub-sample of the ribeye.

This method captures saturated and unsaturated fat cells, both of which contribute to the eating experience of the consumer. USDA Graders can only measure fat or marbling they can see when assessing quality grade. Typical chain speed in a harvest facility often does not give ample time for some fats to "bloom" or whiten before the carcass is stamped for quality.

Ultrasound machines show intramuscular fat by "hearing" a density change and portraying it on a screen as a grayscale color change. Lean tissue has a different density than fat, thus allowing us to estimate the amount of fat vs. lean on a percentage basis. As a result, the prediction models developed to estimate %IMF in seedstock do just that; they do not attempt to mirror any USDA grader. To classify and compare the actual IMF value is extremely difficult. A bull with a Birth Weight EPD of -1.5 is often termed a "Calving Ease Sire" with little to no argument. However, a bull with a high Marbling or %IMF EPD cannot necessarily be called a "Prime or High Choice Sire," but merely a bull with good carcass quality genetics.

The most confusing element of understanding ultrasound data is deciphering which unit of measure is actually under your nose, especially in the case of marbling vs. %IMF. As one can see in the table (Courtesy of Iowa State University, Department of Animal Science), the number scale for Percent Intramuscular Fat and Numeric Carcass Marbling Score is close, but not one in the same. There is no written law or breed association rule that defines how %IMF or marbling is published in either sale catalogs or advertisements. When data is sent out from The CUP Lab to a breed association or breeder, it is in %IMF form, simply an average value taken from 4-5 images per animal. Complex computer models estimate the percent of intramuscular fat within a box placed by the interpreting technician in a consistent spot between the 12th and 13th ribs in the image, reported to the nearest hundredth. Some breeds express the EPD in %IMF fashion, but others convert the measure to Numeric Marbling Score units in order to prevent confusion.

% IMF	Quality Grade	Marbling Degree	Marbling Score
2.3-3.0	Select -	Slight 00-40	4.0-4.4
3.1-3.9	Select +	Slight 50-90	4.5-4.9
4.0-5.7	Choice -	Small 00-90	5.0-5.9
5.8-7.6	Choice o	Modest 00-90	6.0-6.9

7.7-9.7	Choice +	Moderate 00-90	7.0-7.9
9.8-12.1	Prime -	Slightly Ab 00-90	8.0-8.9
12.2+	Prime o	Mod Ab 00-90	9.0+

When purchasing bulls or heifers, keep in mind that sale catalogs may express marbling or %IMF in any of the columns presented in the table, not to mention additional data for EPDs and Ratios.

Along with this, breeders may also adjust bull ultrasound data to a "steer equivalent." This attempts to give bull buyers information on how they can expect feedlot calves from a particular bull to grade, offsetting the testosterone effect known to be detrimental to a bull's marbling. If all breeders used the same adjustment, data would be easier to compare. Unfortunately, a variety of unpublished math problems get used. Some use a base adjustment, for instance +2.0% IMF, which may overestimate the genetic ability of the poorest bulls to grade and undersell the top-end genetics. Others may multiply the actual %IMF or the age-adjusted values. If you are unclear if the data in front of you has been adjusted and to what extent, consult the breeder for clarification. Remember, the bull sale you attend first may differ from the one just down the road or the one you catch via satellite or video auction. Breed association websites, journals, and sire summaries are often good "rainy day" sources to help eliminate some of the confusion.

Ribeye Area (REA) and Rib Fat

The most difficult image to interpret at The CUP Lab is also the most troubling for technicians to collect on the animal. The margin for error when collecting the REA image is extremely small for both lab and field technician alike, especially when the breeder remembers by heart how big the full sib's ribeye measured a year ago. Consequently, the lab takes more calls from breeders with dissatisfied results, even though the ratios and sire rankings may mirror a year ago. I'm still waiting for my first call complaining about ribeyes that traced too big. Understandably, the only live animal measure of muscle currently available is REA, especially important to breeders marketing terminal sires and retail product genetics. From a lab interpreter's perspective, we only trace what we can see, and guesswork more often underestimates the animal's genetic merit for muscle. As a result, more missing data comes back to the breeder in the REA column than any other, but poor quality images create poor quality results.

At The CUP Lab, highly trained and certified technicians trace every animal's ribeye by hand. A computer mouse is used to trace the boundaries of the *longissmus dorsi*, or ribeye muscle; the computer measures the amount of area within the boundaries drawn, reported to the nearest tenth of a square inch. If the interpreter cannot see the boundaries needed, the image is rejected and no REA is reported, even though Rib Fat can still be measured. Again, data is NOT adjusted as it leaves The CUP Lab; most associations use their own breed-specific age adjustment before sending data on to the breeder. Other associations are still working to compile enough data to develop accurate age adjustments for ultrasound traits. Consult your breed association representative to be sure the data you are receiving has been age adjusted. If the data you are receiving is in its raw form, compare the REA value against the animal's unadjusted scan weight, or in a REA/cwt format. Selecting bulls for muscle using unadjusted or raw REA data could mislead one into choosing the oldest animals instead of the heaviest muscled.

Ribeye Area is not only used for the obvious REA EPD, but also incorporated into corresponding Yield Grade and Percent Retail Product EPDs. Rib Fat has substantially more influence on either of the retail yield EPDs and is also measured on the same image as REA, though much easier to interpret at the lab. Rib Fat is measured in the same location for both ultrasound and carcass data collection, at the 3/4 position (3/4 the distance of the entire ribeye muscle starting from the spine or medial edge) perpendicular to the muscle. A computer mouse is used to measure the distance from the hide-fat interface to the fat-lean interface, reported to the nearest hundredth of an inch. The accuracy of ultrasound rib fat vs. fat measured on the actual carcass has been questioned. However, there is equal argument that ultrasound may actually be more accurate than the carcass measure. Hydraulic hide pullers found in most commercial packing plants often remove external fat with the hide, a source of variation eliminated when using ultrasound.

Breeders must toe a fine line when utilizing fat and retail product EPDs in their selection program, not only from a breeding perspective, but also matching the body composition of their cow herd to their particular management and environmental resources. On the average, Fat EPD in most all breeds has stayed near zero, though significant genetic variation within the population and/or breeds is quite evident. The reason is quite simple; select against fat and you run the risk of indirectly affecting the breeding/re-breeding rate (stayability) and milking ability of your cow herd. Select for increased fat, and you subject your calf crop to potential yield grade discounts and inefficient gains. The optimum combination of quality and yield for your customers may vary from what your cow herd can effectively produce. Mating a beef cow that adequately maintains herself on the feeds and forages you have available with a bull that provides the carcass ammunition desired by your customers is a key element to success.

Rump Fat

Many cattle producers question the usefulness of a rump fat measurement for the simple fact that grids neither pay nor discount for the trait. Besides, the image takes more time to collect and requires additional preparation (clipping/oiling) of the animal. However, the value of the trait is well documented, though not referred to nearly as often as the more traditional measures of carcass cutability.

On the surface, rump fat is extremely easy to collect and highly repeatable. The reference point needed to measure the trait uses the *gluteus medius* and the *biceps femoris*, two muscles easily identified in the ultrasound image taken over the rump. The hook bone is simple to palpate, a landmark used by field technicians to make rump image collection almost effortless. Rump fat depth is measured at The CUP Lab by physically dragging a computer mouse from the hide-fat interface to the reference point between the previously mentioned muscles, reported to the nearest hundredth of an inch.

Agreeably, very few breeders select bulls or replacement heifers based solely on rump fat, but its genetic merit warrants a deeper explanation. Rump fat by nature is an early developing tissue. Early texts of beef cattle anatomy often refer to it as the "breeding pad," a protective fat Mother Nature put in place for mating, making the process more "comfortable" for both bull and cow alike.

Since scanning age windows are open only to cattle near a year of age, an early developing fat tissue helps breeders recognize cattle with more "fat potential." As one might expect, earlier maturing cattle lay down the breeding pad at a younger age. Thus, noticeable differences exist among breeds and biological types, particularly British vs. Continental breeds. Obviously, saying that Charolais cattle average less rump fat than Herefords is not reinventing the wheel, but using growth trends on rump fat vs. rib fat will help producers better understand how to effectively utilize the trait.

On a ration that meets or exceeds nutritional requirements, cattle will naturally have more rump fat than rib fat at yearling. However, on a high-energy diet, like in a feedlot situation, rump fat and rib fat measures come together, and in some cases, the measures actually cross (more rib fat than rump fat) as the animal nears harvest. Seedstock may do the same if being "pushed" to achieve maximum performance.

In the end, British breed associations may find rump fat to be more useful in predicting retail product since more genetic variation is expressed. Continental breeds often find that rump fat is not statistically significant in retail product prediction because the measure more closely mirrors rib fat. Regardless, rump fat may still be used to identify potentially lower maintenance animals within a contemporary group. Similar to rib fat, rump fat needs to be maintained and controlled. Progress can be made in retail yield, but extreme selection pressure could harm reproductive traits. USDA Graders take a quick look at the rump to see if a yield grade adjustment is necessary as the carcass rolls by on the chain. I would suggest breeders do the same when examining their genetics for retail product, especially if heifers are retained in the operation or sold as replacements.

The evolution of ultrasound in the beef cattle industry is a rather short history lesson. Its acceleration into mainstream seedstock and commercial selection programs is a testament to the usefulness of ultrasound data for cattle operations of all sizes and scopes. The science and technology behind ultrasound is not perfect, but it has established itself as the most cost-effective and accurate tool to assess carcass composition in beef cattle without sacrificing the animals themselves. The growth EPDs developed and established in the 80's and 90's helped the beef producer compete in a performance driven market. Ultrasound data is again helping the beef business to compete, domestically and globally, in a value-based market driven by the taste buds of the consumer.