PROBLEMS IN ULTRASONIC RESEARCH ON LARGE ANIMALS

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The author of at least one operator's manual for an ultrasonic tissue scanning device states that it is a highly scientific and sensitive instrument. Those who have dealt with ultrasonic measurement of live animals, I think, would concur in this statement.

There are several problems which present themselves when one attempts to evaluate what is under the hide of a live animal by ultrasonic means. From the response to an inquiry about these problems, it would seem that some groups have experienced more difficulties than others.

Some of the major problems in ultrasonic research on large animals are:

1) Interpretation: This would apply to both the Polaroid time exposure picture (Somagram) with "B" scan or to graph interpretation with "A" scan equipment. The area of interpretation is one in which much improvement can be made. More training and experience of operators will help to solve this problem. We lack sufficient knowledge of how various body structures appear on the somagram. Insufficient knowledge is available on how the shape of the muscles may change from the live animal to the carcass. Skinning, hanging, splitting, scribing, fat removal during skinning, etc., may alter the shape and/or position of the muscles. More positive identification of fat, lean, connective tissue, hide, and other structures which may appear in the somagrams is needed.

2) Identification of the end boundaries of the longissimus dorsi: These boundaries quite often are very ill defined and the operator is left to fill in the gaps by guess. Some workers have difficulty in locating the ventral interfaces of the loin-eye also.

3) Location of point of scan on the live animal: It is rather difficult if not impossible to locate the exact spot on the live animal where the carcass will be ribbed. Stouffer (1961) pointed out in this conference the variation in rib-eye size that may be incurred by the position of ribbing. It is also not known how the relative position of the body tissues may change when the animal is changed from a standing (horizontal) position to a hanging (vertical) position. If one attempts to scan the beef round, he will find that, in hanging, certain of the muscles will plump, while others will elongate.

4) Animal variation: Those using "A" scan equipment report difficulties in measuring animals having more than modest degrees of finish. The reason for this is that the marbling within the muscle causes more peaks on the oscilloscope. A fatter animal tends to be overestimated with "B" scan. Wallentine (1960) suggests that this may be due to variation in sonic velocity in fat compared with lean. Some report that it is almost impossible to get a readable somagram of a beef animal which tenses its muscles in the area being
scanned is. One might theorize that the tensing of the muscles, perhaps, affects the velocity of the sound waves. For some unknown reason, some animals are very difficult to measure ultrasonically. This happens perhaps 7 to 10 percent of the time.

5) Magnification of interpretation errors: We must multiply areas by as much as 3 and linear measurements by as much as 3 to convert somagrams back to actual size. Thus, any errors in interpretation are greatly magnified.

6) Calibration of equipment: Our information at present is incomplete on how to calibrate for different species, for differing degrees of finish and other characteristics which may vary from animal to animal. Adjustments for calibration also need to be made finer.

7) Error introduced by the pressure applied to the transducer: The pressure of the transducer undoubtedly affects the configuration of the underlying tissues. These effects will differ between animals because firmness of finish and muscling vary considerably. It may be necessary to vary the pressure placed upon the transducer for varying degrees of firmness.

8) Operator limitations: It is quite often difficult to find an operator who is both a competent animal husbandmen and meats man and an electronics specialist. It is not too difficult to determine that the ultrasonic device may not be giving the desired results, but to understand what may have gone afoul electronically to cause this failure is quite difficult, if not impossible, for most operators. A basic understanding of the electronic workings of the ultrasonic device would, therefore, help to solve some of these problems.

9) Cost and convenience limitations: In the design of ultrasonic equipment the manufacturer must keep in mind the fact that the cost of such an instrument must be within range of its potential users. This may place limitations upon certain features that could be incorporated into the instrument. For use in the field, this instrument should be small enough to be easily portable, which may also place certain limitations upon its design.

A great percentage of the scanning work with ultrasonics has been toward determining the area of the longissimus dorsi muscle. Research by some groups indicates that the area of the rib-eye in cattle is not a good indicator of total carcass lean. Thus, we are faced with the dilemma of perfecting a technique for measuring the rib-eye only to be forced to move to another less easily measured area of the animal which will indicate total carcass lean.
DR. RAMSEY: Thank you, Bill.

Now, to conclude our formal presentation we will have a review of ultrasonic research by our brothers across the big pond. This paper was written by Dr. J. R. Stouffer who is on sabbatical leave at this time from Cornell. He asked me to convey his regards to this group and to tell you that he is certainly sorry that he had to miss the Conference this year. Since he cannot be here, Dr. James McBee of the Beef Carcass Evaluation Committee has graciously consented to read Dr. Stouffer's paper. This paper is entitled "Ultrasonic Research in Great Britain and Europe". Dr. McBee is from West Virginia, and I will say that this paper he is about to read really has some difficult words in it. Good luck, Jim.

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