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To the Graduate Council:

I am submitting herewith a thesis written by Delmer F. Lowe entitled "The use of ultrasonic fat measurements of 8mm and 10mm as a marketing guide for feeder heifers." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Science.

James A. Corrick Jr., Major Professor

We have read this thesis and recommend its acceptance:

John D. Smalling, E. R. Lidvall

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by Delmer F. Lowe entitled "The Use of Ultrasonic Fat Measurements of 8mm and 10mm as a Marketing Guide for Feeder Heifers." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Animal Science.

James A. Corrick, Jr.
Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

THE USE OF ULTRASONIC FAT MEASUREMENTS OF 8MM AND 10MM AS A MARKETING GUIDE FOR FEEDER HEIFERS

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee

Delmer F. Lowe

March 1974

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ABSTRACT

One hundred eighty feeder heifers (150 Herford, 29 Angus, and one crossbred) of Choice, Good, and Medium feeder grades were fed to a final back fat thickness of 8mm or 10mm using ultrasonics as the marketing guide. Heifers were purchased at graded feeder calf sales in East Tennessee.

After an adjustment period of three weeks, the heifers were fed corn silage *ad libitum*, treated at the time of ensiling with 10 pounds each of urea and ground limestone plus six pounds of concentrate per head per day, for 110 days, and then full fed a concentrate ration of eight parts ground shelled corn to one part 41 percent cottonseed meal, to finish the heifers at an ultrasonically estimated back fat thickness of 8mm or 10mm.

Heifers that were slaughtered when the ultrasonically estimated fat thickness reached 8mm produced carcasses comparable to those of heifers slaughtered at 10mm fat thickness.

No significant ($P < .05$) differences were found between the two fat levels in carcass grade, yield grade, and percent retail yield. The heifers fed to 8mm subcutaneous fat finished 10 days earlier than the 10mm level heifers, and cost per hundred weight gain overall was in favor of the 8mm level heifers by $0.88. Average return over initial investment and feed cost was in favor of the 8mm heifers by $0.75.

Results of this experiment indicate that the use of ultrasonics does not penalize either feedlot performance or carcass characteristics, and

that using ultrasonics reduces significantly the time the feeder cattle were in the feedlot. Also, that marketing at 8mm fat thickness is just as profitable as marketing at 10mm and shortened the feedlot period by 10 days.

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CHAPTER I

INTRODUCTION

Tennessee has long been a leader in the marketing of feeder cattle through organized, graded feeder calf sales. These sales are designed to provide buyers with large, uniform lots of cattle of various weights and grades. This is accomplished by co-mingling ownership of calves in groups large enough to attract competitive bidding and consequently, yield highest gross returns to the calf producer. It then becomes important to determine the differences in feedlot performance and subsequent carcass characteristics of the grades of feeder cattle. The effects of differences in fatness and/or other measurable or observable differences in feeder cattle on performance and carcass value merits investigation.

Feeder heifers can normally be bought at a lower price per pound than steers of the same weight and grade. The magnitude of this difference is greater in lighter weight cattle. Price differences between slaughter steers and heifers are of lesser magnitude although steers sell for slightly more per pound than do heifers of the same slaughter grade. Since the margin between the purchase price of feeders and the selling price of slaughter cattle is generally more favorable for heifers than steers, it would appear that they offer an opportunity for profit-making to the Tennessee cattleman.

Tennessee has the potential to produce large amounts of corn silage and other roughages. If these roughages are to be marketed for maximum return, marketing those of high quality, particularly corn silage, through finished cattle may be the method of choice.

In the past researchers have fed cattle on a time constant or weight constant basis as opposed to a constant compositional end-point which may account for most of the variation reported in carcass yield of feeder cattle of various weights, grades, and conditions. Due to ever increasing population explosion, the demand for edible beef will rapidly increase. This demand must be met by efficiency in beef production, by management, and increasing technology. The use of ultrasonics as a marketing guide in fat thickness of feeder cattle will help increase this efficiency in beef production.

CHAPTER II

LITERATURE REVIEW

The amount of research dealing with finishing and marketing beef cattle and the carcass characteristics of these cattle is rather large. This review will both subjectively and objectively relate the work and various methods used in the finishing and marketing of feeder cattle.

I. PERFORMANCE OF FEEDER CATTLE OF VARIOUS WEIGHTS, GRADES AND INITIAL CONDITION

The weights, grades, and initial condition of calves being fed for slaughter do not always indicate expected performance and subsequent carcass quality and/or cutability. Minish et al. (1967) reported significantly ($P < .05$) higher average daily gains for Standard grade feeder steers than Choice grade steers. This study involved 128 steers fed four levels of concentrate plus a full-feed of corn silage. Standard grade feeder steers gave a greater ($P < .05$) response to the higher levels of concentrate than did Choice steers.

Harrell (1971) reported feeder grade to have a significant ($P < .05$) effect on the average daily gain of 178 heifers through a 140-day roughage phase combined with a full-feed phase. Estimated initial fat thickness did not affect average daily gain on roughage or overall gain, but did significantly ($P < .05$) affect yield grade and percent retail yield. Medium grade heifers were superior to Choice in average daily gain, but no differences in average daily gain of Good and Choice and of Medium and Good heifers were found.

Corrick and Hobbs (1970) in a study involving 132 Good and Medium grade heifers found no significant ($P > .05$) differences in average daily gains between grades for the roughage phase or total feeding period. Good grade heifers initially averaged 49 pounds heavier than Medium, and 45 pounds heavier at the end of the test. Ribeye area was significantly ($P < .05$) larger for the Good grade heifers than the Medium heifers and was the only carcass characteristics significantly affected by grade.

Anderson, High, and Chapman (1964) found from a three-year study involving 149 heifers and 120 steers of Choice, Good, and Medium feeder grade of varying weights, that steers generally had significantly ($P < .05$) higher average daily gains than heifers. Steers also took longer to finish to market conditions than did heifers, regardless of grade. No significant ($P > .05$) differences were found in average daily gain of the steers regardless of grade and initial weight. Good grade heifers had significantly ($P < .05$) higher average daily gains than Medium grade heifers.

Stonaker, Hazaleus, and Wheeler (1952) individually fed 87 Herefords divided into compressed and conventional types. These workers found compressed cattle gained as fast and efficiently as conventional cattle when fed to give a low Choice slaughter grade. Significant differences in rate of gain and slaughter weights were in favor of the conventional type. There were no differences in efficiency of gains, days on feed, and slaughter age. Carcass composition was the same for both types, and percent of carcass in retail cuts was comparable. Brungardt (1971) obtained similar results when cattle were selected for rate of gain and classified by size. Cattle which were heavier and larger at weaning were superior in rate of gain and feed efficiency when taken to a constant final weight, but that this did not hold true when final slaughter condition was the end point in question. This study involved Angus, Hereford, and Charolais cattle of various sizes and weaning performance within breed. Cattle selected for weaning performance or a high growth rate reached a standard slaughter condition at significantly heavier weights but were not as efficient. The larger breeds also required a longer feeding period to reach slaughter condition.

From a two-year study involving 84 Hereford steers fed rations designed to provide low, intermediate, and high energy levels, and feeding to estimated fat thickness of 3 to 5, 8 to 10, and 13 to 15 mm., respectively, Backus, et al. (1968) reported that the cattle with 3 to 5 mm of fat produced carcasses with comparable eating quality of the fatter cattle with lower feed costs per kilogram gain. The fatter cattle (13 to 15 mm) produced carcasses which were significantly heavier with higher dressing percentages, marbling scores, carcass grades, and weight trimmed retail cuts than the other two fat thickness levels.

Brown et al. (1964) using 45 young bulls reported correlations between performance traits and ultrasonic measurements of fat thickness to be low. However, correlations between ultrasonic estimates and carcass measurements for ribeye area and fat thickness were 0.78 and 0.46, respectively.

Hoornbeek et al. (1962) reported a three year study comparing carcass traits between offspring of four sires. Performance or carcass characteristics were not predicted accurately by type and condition scores. The sires were from four inbred lines. Calves sired by one line excelled in average daily gain and final weight; calves of a second line produced carcasses high in marbling, carcass conformation, and percent fat; bulls of the third line sired calves with higher USDA carcass grade and dressing percent; and calves sired by bulls of the fourth line were inferior in all respects.

Stuedmann et al. (1967) reported the effects of varied nutritional levels from birth to eight months on further growth and development of full-fed beef calves. Sixty Hereford calves subjected to one of five nutritional levels from birth to eight months produced no significant differences in carcass size or composition. Calves on the lower levels early in life required a longer feeding period to reash desired market weight and tended to have greater amount of fat cover.

Brinks, Clark, and Kieffer (1962) reported that post-weaning average daily gain was nearly independent of all carcass traits studied; i.e. ribeye and fat depth at the twelfth rib, and percent lean, fat and bone of the ninth-tenth-eleventh rib cut. Fat thickness estimates appeared more accurate than ribeye area for predicting carcass traits.

Bradley et al. (1966) fed 34 Hereford and 33 Hereford-Red Poll steers and heifers for slaughter in a two year study. Steers had significantly ($P < .05$) higher pre-and post-weaning average daily gains as well as heavier birth, weaning, and final weights. After removal of the differences due to effects of initial weight, differences between steers and heifers in carcass grade, marbling, and ribeye area were small and non-significant.

Brungardt (1971) obtained similar results when cattle were selected for rate of gain and classified by size. Cattle which were heavier and larger at weaning were superior in rate of gain and feed efficiency when taken to a constant final weight, but this superiority did not hold true when taken to a standard slaughter condition. This study involved Angus, Hereford, and Charolais cattle of various sizes and weaning performance within breed. Cattle selected for weaning performance or a higher growth rate reached a standard slaughter condition at significantly heavier weights but were not more efficient. The larger breeds also required a longer feeding period to reach slaughter condition.

II. ULTRASONIC ESTIMATES OF FATNESS

Research dealing with the use of ultrasonics as an evaluation technique for the live animal as a marketing guide is extensive. Stouffer _et al_. (1961) developed an ultrasonic technique for producing cross-sectional outlines of the _longissimus dorsi_ muscle and associated fat layers at the thirteenth rib of live cattle and hogs. Data involving 327 cattle and 42 hogs were reported. A comparison of ultrasonic estimates of _longissimus dorsi_ area with actual areas gave significant but low associations. Problems of measurement in this study were positional variation of _longissimus dorsi_ area and fat thickness between the twelfth and thirteenth ribs, changes in shape and size of the muscle due to slaughtering andhandling, and variability in pressure of the transducer on the hide during ultrasonic measuring.

Hedrick _et al_. (1962) compared ultrasonic measurements to tracings of the _longissimus dorsi_ and actual fat measurements. Correlations ranged from 0.58 to 0.98 ($P<.01$) and 0.11 ($P<.05$) to 0.63 ($P<.01$), respectively, between ultrasonic estimates, actual ribeye area and measured fat thickness on 203 animals. Scribing of the spinous process in slaughtering was thought to cause error in relating live fat thickness to carcass fat thickness.

These workers concluded ". . . The ultrasonic method is a good method for estimating ribeye area and fat thickness in live cattle." In contrast, Sumption _et al_. (1964) reported that correlations between live single point estimates and carcass ribeye area taken at 5, 9, and 13 cm from the midline between the twelfth and thirteenth ribs, were generally too low to be useful predictors. Their correlation ranged from 0.007 to 0.72 on 14 groups of eight to 149 head per group of bulls, steers, and heifers ranging in weight from 700-1570 pounds. Correlations between estimated and actual fat thickness using the average of either two or three measurements were generally no higher than with the single point estimates at 9 cm or 13 cm. Correlations on the 14 groups ranged from 0.41 to 0.80.

Davis _et al_. (1964) obtained high correlations for ultrasonic estimates of ribeye area and fat thickness with corresponding carcass measurements (0.87 and 0.90, respectively).

Shepard (1964) concluded that ultrasonic estimates of fat thickness and longissimus dorsi area are fair indicators of carcass fat thickness and longissimus dorsi area.

Williams (1964) found that ultrasonic estimates of longissimus dorsi and biceps femoris muscle areas and fat over these muscles could be made with a reasonable degree of accuracy.

Ramsey et al. (1965) used 25 beef animals of varying breeding, age, and weight to determine effect of slaughter and chilling treatments on muscle and fat configuration. Ultrasonic estimates were highly associated with the actual values for fat thickness (r = 0.9), longissimus dorsi area (r = 0.9), and biceps femoris area (r = 0.9).

Temple, Ramsey, and Patterson (1965) reported errors in ultrasonic evaluation of live cattle. Decreased accuracy in predicting lean and fat were found to be due to: (1) animal variation; (2) tissue change during slaughter; (3) interpretation; and (4) machine manipulation.

Brown et al. (1964) and Davis, Temple, and McCormick (1966) indicated a reasonable degree of repeatability using ultrasonic measurements. Brown et al. (1964) reported from measurements taken from 45 bulls, that the correlations between independent interpretations of the readings were 0.91 for the ribeye area and 0.94 for fat thickness. Correlations obtained between ultrasonic and carcass measurements for ribeye area and fat thickness were 0.78 and 0.46, respectively. Davis et al. (1966) reported from a study on 27 cattle estimating ribeye area and fat thickness with two similar ultrasonic units and independent operators that simple correlations between operators and units ranged

0.86 to 0.91 for ribeye area and 0.64 to 0.85 for fat thickness. Subsequent correlations between ultrasonic live animal estimates and carcass ribeye area and fat thickness were highly significant, and ranged from 0.84 to 0.82 for ribeye area and from 0.57 to 0.75 for fat thickness.

Brackelsberg, Willhow, and Walters (1967) obtained simple correlations ranging from 0.21 to 0.90 between live carcass measurements of fat thickness between the twelfth and thirteenth ribs on 380 bulls, steers, and heifers. Most of the simple correlations fell between 0.50 and 0.80.

Watkins, Sherritt, and Zeigler (1967) calculated highly significant correlation coefficients between the ultrasonically estimated and actual subcutaneous fat thickness ($r = 0.90$) and between estimated and actual longissimus dorsi ($r = 0.56$).

Backus (1968) found that ultrasonic readings taken on consecutive dates were highly related. Readings taken near the end of the trial were progressively higher in their relationship to carcass fat thickness. The last ultrasonic measurement of fat thickness taken in trial I in a two-year study was highly significant in its relationship to actual fat thickness ($r = 0.88$). The correlation coefficient between the ultrasonic estimate of fatness made on the day prior to slaughter and the actual carcass fat thickness in trial II was 0.84.

McReynolds and Arthand (1970) obtained correlations as high as 0.95 between predicted and actual ribeye area by using 100 acetate drawings of ribeye area of known size and dividing the area by the average of three depth measurements at 5.9 and 13 cm from the midline. This gave a constant that, when multiplied by the average depth of the three readings on the remainder of 270 animals, produced the high correlation between the predicted and actual ribeye area.

Harve and Campbell (1971) found that estimated total muscle in the half carcass of mature steers and calves can be predicted by ultrasonic measurements at cross-sectional areas of the musculi longissimi thoracis et lumborum at different positions. In calves the least standard error of prediction was found when the fifth lumbar position was used. Empty liveweight used in cross-sectional area of the musculi longissimi thoracis et lumborum should give a better estimation of total muscle in the live steers.

III. CARCASS YIELD OF CATTLE OF VARIOUS WEIGHT, GRADE, CONDITION AND METHODS OF PREDICTING YIELD

Much research has been done in an effort to find simple and useful methods to predict the amount of muscling in beef carcasses. However, few researchers have related carcass yield to type or kind of cattle. Most research indicates that when various types of cattle are fed to approximately the same compositional end-point, carcass yield and cutability are similar.

Hedrick et al. (1964b) found significant differences between right and left side measurements on 295 Good and Choice carcasses. When an additional 47 Good and Choice carcasses were chilled without splitting, and wholesale ribs and short loins were removed intact, no significant differences were found between right and left side, l. dorsi and subcutaneous fat measurements at six anatomical locations. Differences between right and left sides were attributed to errors in ribbing or measurement procedures.

Hoornbeek et al. (1962) reported that marbling was not related to percent of fat in the carcass. Percent fat in the carcass, conformation sources, and higher dressing percents were associated with heavier final weights.

Minish et al. (1967) found that Standard grade feeder calves had significantly ($P < .05$) higher estimated percent of boned, trimmed round, rib, loin, chuck, and less fat at the twelfth rib than Choice grade calves. Choice calves were superior to Standard in conformation, marbling, carcass grade, ribeye area, and dressing percent ($P < .05$). Brannon (1957) obtained similar results.

Murphy et al. (1960), Cole, Ramsey, and Epley (1962), Brungardt and Bray (1963), and many other researchers have developed prediction equations for estimating retail yield in beef carcasses. Brungardt and Bray (1963) utilized 14 fat measurements of 33 left sides of steer carcasses. Each measurement was found to be negatively and highly correlated with percent retail yield. These correlations ranged from -.54 to -.90. A single fat measurement at the twelfth rib and percent trimmed round were found to account for 81 percent of the variation in percent retail yield. Cole et al. (1962) developed several equations utilizing measurements from 132 steer carcasses of various breeds. The most valuable equation incorporated only twelfth rib fat thickness and carcass weight, and these variables accounted for over 70 percent of the variation in pounds of separable lean. Murphy et al. (1960) used fat thickness at the twelfth rib, carcass weight, percent carcass kidney fat, and ribeye area to predict percent boneless retail cuts of the round, loin, rib, and chuck.

Lewis, Brungardt, and Bray (1964) indicated differences in distribution patterns of subcutaneous fat as a reason for difference in correlations between percent trimmed round and percent retail yield of 0.57 and 0.83 for heifers and steers, respectively. Comparison of heifer and steer carcasses showed percent kidney and pelvic fat was significantly ($P < 0.1$) higher in heifers.

Crown and Damon (1960) reported the twelfth rib cut to be a useful predictor of carcass yield and meat quality in beef. Correlations were obtained between twelfth rib cut and separable lean, separable fat, and bone of 0.82, 0.96, and 0.75, respectively. In comparison, ninth-tenth-eleventh rib cut yield correlations of 0.94, 0.98, and 0.73 with separable lean, separable fat, and bone, respectively.

Nolan et al. (1965) reported a correlation between percent carcass fat and fat thickness at the twelfth rib of 0.70. A correlation of 0.83 was obtained between percent carcass fat and percent fat from the ninth-tenth-eleventh rib.

Hedrick et al. (1964a) found percent trimmed round and retail yield of the flank were most highly associated with retail yield of the primal cuts and side than were other wholesale cuts.

Thackston et al. (1967) and Powell and Huffman (1968) compared various beef carcass composition prediction equations. Thackston et al.

(1967) compared the USDA Cutability Formula, Wisconsin Method, and the Tennessee Simplified Method. Correlations of 0.69, 0.78, and 0.61 were obtained between estimates and actual retail yield for the U. S. D. A., Wisconsin, and Tennessee methods, respectively. Sex was found to significantly affect the accuracy of the Wisconsin and Tennessee methods. The Tennessee Simplified Method, designed to estimate percent separable lean, was found least desirable in predicting percent retail yield. Powell and Huffman (1968) found the Hankins and Howe formula to be most accurate in predicting beef carcass composition. Methods included in the evaluation were Hankins and Howe Method, Tennessee Method, Wisconsin Method, USDA Yield Grade formula, Illinois and Oklahoma Methods. The USDA Yield Grade and Tennessee Methods were the most practical, and the Yield Grade method was almost as accurate as the Hankins and Howe formula. The Hankins and Howe Method was very impractical and Yield Grade the best method overall.

Hedrick _et al_. (1965) reported from a study involving 1,097 Good and Choice steer carcasses ranging in weight from 350 to 850 points that subcutaneous fat thickness measurements were associated with two to three times as much variation in retail yield as were _l. dorsi_ measurements. Similar results were obtained by Henderson, Goll, and Kline (1966), Brungardt and Bray (1963), Allen, Merkel, and Magee (1966), Gottsch, Merkel, and Mackintosh (1961), Abraham _et al_. (1967), and Ramsey, Cole, and Hobbs (1962). Swiger _et al_. (1964), defining retail products as pounds of retail product divided by carcass weight, reported carcass weight alone accounted for 93 percent of the variation in retail product.

Fat thickness gave no additional accuracy when used in multiple coefficients with live weight.

Henderson *et al.* (1966) reported correlations for percent separable muscle, percent retail yield, yield of four major wholesale cuts, and percent separable muscle of the four major wholesale cuts to be higher for fat thickness generally than for *l. dorsi* area.

Allen *et al.* (1966) reported highly significant ($P > .01$) correlations between fat thickness and percent retail yield ranging from -0.38 to -0.68.

Gottsch *et al.* (1961) reported a correlation of -0.91 between carcass fat and total carcass lean.

Abraham *et al.* (1967) found significant correlations for average fat thickn ss and a single fat thickness with yield of boneless retail cuts of -0.66 and -0.72 respectively.

Ramsey *et al.* (1962) found a single measure of fat thickness to be more closely related to separable lean and fat than carcass grade and yield. Fitzhugh *et al.* (1965) obtained similar results.

CHAPTER III

EXPERIMENTAL PROCEDURE

Data for this study were collected between October 1970 and May 1971 from an experiment conducted at The University of Tennessee, Blount Farm, Knoxville, Tennessee.

I. EXPERIMENTAL ANIMALS

One hundred and eighty feeder heifers purchased through graded feeder calf sales in East Tennessee were used in this experiment. Breeds represented were 150 Hereford, 29 Angus, and one crossbred. Weights of the heifers ranged from 370 to 580 pounds.

II. MANAGEMENT AND FEEDING

Upon arrival at the experimental barn, the heifers were weighed, tagged, and allowed to adjust to the environment and recover from the stress of weaning and sale for three weeks. They were fed *ad libitum* a ration of corn silage treated at time of ensiling with 10 pounds per ton each of urea and ground limestone during the adjustment period.

Following the adjustment period, they were weighed, sonorayed for fat thickness and implanted with 24 mg of diethylstilbestrol. They were graded for type and condition by members of the Animal Husbandry-Veterinary Science Department. The heifers were randomly alloted by grade and weight to ten pens of six heifers each by each of three grades; Choice, Good, and Medium. One-half of the lots within each grade was designed to be removed from the experiment and sent to slaughter when an estimated fat thickness, determined ultrasonically, of either 8mm or 10mm was reached.

The heifers were placed on a ration of corn silage ad libitum treated at ensiling with 10 pounds each of urea and limestone plus six pounds per head per day of concentrate designed to supply adequate protein for a roughage phase of 110 days. All heifers were then full-fed a ration of eight parts ground shelled corn to one part 41 percent cottonseed meal six pounds per head per day, and corn silage ad libitum.

III. SOURCE OF DATA

Heifers were weighed at 14-day intervals for the first 56 days then at 28-day intervals to the end of the roughage phase. In addition, animals were sonorayed for subcutaneous fat thickness at 28-day intervals during the roughage phase. During the full-feed (finishing) phase, animals were weighed and sonorayed at 14-day intervals. The initial, end of roughage phase, and final weights and sonoray measurements were taken at 7:00 a.m. after the heifers had been removed from feed and water the previous night at 8:00 p.m. Feed consumption records were kept daily by pens.

At slaughter, the heifers were re-weighed at the packing plant, hot carcass weight was obtained prior to shrouding, and the remaining carcass measurements taken after the carcass had chilled for 48 hours. Physical measurements included actual fat thickness between the twelfth and thirteenth ribs and ribeye area following the procedures outlined by the American Meat Science Association (Schoonover *et al.*, 1967).

Carcass grade, marbling score, conformation grade, and percent kidney fat were obtained from USDA grader. Calculated measurements included dressing percent, yield grade, and percent retail yield. Dressing percent was calculated using the chilled carcass and the live packer weight. Yield grade and percent retail yield were calculated using the procedure outlined by Murphy *et al.* (1960).

IV. STATISTICAL ANALYSIS

These data were analyzed by using the analysis of variance procedure. An interaction of fat thickness X grade, fat thickness X ration, and grade X ration were found to be non-significant; therefore they were removed and put into error terms in Table I. The following linear additive model was assumed to describe the variation among the individual records.

$$Y = \mu + FT + Gr + R + e$$

Where: Y = Feed lot performance traits

μ = population means

FT = Fat Thickness

Gr = Grade

R = Ration

e = Random error associated with Y

TABLE I

ANALYSIS OF VARIANCE OF FEEDLOT PERFORMANCE TRAITS

Source	df	Mean Squares	F
Total	179	---	---
F. T.	1	0.0292	0.388*
Grade	2	0.0231	0.307*
Ration	4	0.0751	0.997*
Error	172	0.0753	---

$*P < .05$

CRANES CREST

CHAPTER IV

RESULTS AND DISCUSSION

Data from 180 feeder heifers purchased through graded feeder calf sales in East Tennessee formed the basis of this study. They were fed to an ultrasonically estimated fat thickness of either 8mm or 10mm for slaughter. Heifers ranged from 370 to 580 pounds in initial weight, and from one to nine millimeters of initial fat. Overall means and standard deviations are present in Table II.

One-half of the heifers in each feeder grade were removed when they reached an ultrasonically estimated fat thickness of 8mm and the other half were removed at 10mm. The most outstanding differences were in days on feed and the cost per hundred weight gain overall. It required ten days less time to finish the heifers to 8mm final fat thickness (Table III) and cost $.88 per hundred weight or $6.14 per head gain overall compared to the heifers finished at 10mm final back fat thickness. Cost per hundred weight on the 110-day roughage phase for the 8mm heifers was $14.98 compared to $15.28 for the 10mm heifers, a difference of $.30 in favor of the 8mm fat level (Table IV). Cost per hundred weight gain during the full-feed phase for the 8mm heifers was $28.49 compared to $28.12 for the 10mm heifers, a difference of $.37 in favor of the 10mm fat level. The net effect of the overall cost per hundred weight gain was in favor of the 8mm heifers at $18.83 to $19.71 for the 10mm heifers.

TABLE II

OVERALL MEANS AND STANDARD DEVIATIONS FOR SELECTED VARIABLES

Variable	Mean	Standard Deviation
Initial Observations:		
Number of animals	180	
Weight lb.	487	49.8
Fat thickness (mm)	3.34	1.25
Condition grade	8.5	1.32
Performance Measurements:		
Average daily gain, roughage lb.	1.95	0.33
Average daily gain, overall lb.	1.93	0.27
Final weight, lb.	800.0	67.6
Final fat thickness (Sonoray) mm.	9.72	1.50
Final condition grade [a]	11.2	0.92
Days on feed	161.8	16.4
Carcass Characteristics:		
USDA Carcass grade [a]	11.3	1.40
Fat thickness, mm	10.7	2.46
Ribeye area, sq. in.	10.1	1.0
Marbling score [b]	5.0	1.09
Dressing percent	59.6	1.89

[a]Condition Scores: 9 = low good, 10 = average good, 11 = high good and 12 = low choice.

[b]3 = traces, 4 = slight, and 5 = abundant.

TABLE III

NUMBER OF ANIMAL DAYS OF FEEDER HEIFERS WITH 8 MM AND 10 MM OF BACK FAT THICKNESS

	Average by Fat Thickness	
	8mm	10mm
Number of Animals	90	90
Av: Animal Days		
Roughage Phase	110	110
Full Feed Phase	47	57
Total Days	157	167

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TABLE IV

FINANCIAL RETURNS FROM FEEDER HEIFERS WITH 8 MM AND 10 MM OF BACKFAT THICKNESS

	Average by Fat Thickness	
	8mm	10mm
Feed cost per Cwt. Gain.		
Roughage	14.98	15.28
Full feed	28.49	28.12
Overall Av.	18.83	19.17
Av. Feed Cost per Head.	57.30	63.44
Av. Purchase Price per Cwt. $	28.64	28.64
Av. Purchase Price per Head	140.34	138.62
Av. Selling price per Cwt. $	31.81	31.95
Av. Selling price per Head, $	253.21	256.88
Av. Return over Initial and Feed costs, $	55.57	54.82

Average return over initial investment and feed costs was in favor of the 8mm heifers by \$.75 as shown in Table IV. The average return was \$55.57 for the 8mm compared to \$54.82 for the 10mm heifers. Average selling price per head was \$253.21 for the 8mm and \$256.88 for the 10mm heifers and the selling price per hundredweight was \$31.81 for the 8mm and \$31.95 for the 10mm.

There were no differences in the initial measurements between the two back fat levels, but significant ($P < .05$) differences were found in final fat, final condition grade, days on feed, and dressing percent (Table V). The fact that the final fat was measured prior to slaughter and the significant differences were on variables which depend to a large extent on carcass fat measurements could possibly explain these differences. There was no significant ($P > .05$) difference in carcass fat between the two fat levels. The simple correlation between final estimated fat thickness and carcass fat thickness was 0.40. There were no significant ($P > .05$) differences in carcass grade, yield grade, and percent retail yield (Table VI).

Based on the results of this study, it is just as economical for the beef cattle feeder to market his feeder cattle with slightly less external fat cover and consequently, in a shorter period of time.

TABLE V

GRADES AND FAT THICKNESS OF FEEDER HEIFERS WITH 8 MM AND 10 MM OF BACKFAT THICKNESS

	Average by Fat Thickness	
	8mm	10mm
Grade:		
Initial Type	10.5	10.5
Initial Condition [a]	8.6	8.5
Condition, End Roughage [a]	9.3	9.5
Final Condition [a]	11.0	11.4
Average Somascope Reading, MM:		
Initial	3.5	3.5
End Roughage	5.4	5.6
Final	9.0	10.4

[a] 9 = low good, 10 = average good, 11 = high good, and 12 = low choice.

TABLE VI

CARCASS DATA OF FEEDER HEIFERS WITH 8MM AND 10MM OF BACK FAT THICKNESS

	Average by Fat Thickness	
	8mm	10mm
USDA Quality Grade [a]	11.5	11.1
Average Fat Thickness (Ruler), mm	10.4	11.0
Average Dressing %	58.3	60.0
Average Marbling Score [b]	5.1	4.8
Average Ribeye Area, sq. in.	10.0	10.2

[a]9 = low good, 10 = average good, 11 = high good, and 12 = low choice.

[b]3 = traces, 4 = slight, and 5 = abundant.

CRANES CREST

CHAPTER V

SUMMARY

The purpose of this experiment was to determine the effectiveness of the use of ultrasonics as a marketing guide in finishing out feeder heifers to 8mm and 10mm of back fat. Heifers were purchased at graded feeder calf sales in East Tennessee, and consisted of 150 Hereford, 29 Angus, and one crossbred in the Choice, Good, and Medium feeder grades.

After an adjustment period of three weeks, the heifers were fed corn silage <u>ad libitum</u>, treated at the time of ensiling with 10 pounds each of urea and ground limestone plus six pounds of concentrate per head per day, for 110 days, and then full-fed a concentrate ration of eight parts ground shelled corn to one part 41 percent cottonseed meal, to finish the heifers at an ultrasonically estimated back fat thickness of 8mm or 10mm.

Heifers that were slaughtered when the ultrasonically estimated fat thickness reached 8mm produced carcasses comparable to those heifers slaughtered at 10mm fat thickness. There were no significant ($P > .05$) differences between the two fat levels in carcass grade, yield grade, and percent yield. It required 10 days less time to finish the heifers to 8mm final fat thickness, and cost $.88 per hundred weight or $6.14 per head gain overall compared to the heifers finished at 10mm final back fat thickness. Average return over initial investment and feed cost was in favor of the 8mm heifers by $.75. The average return was $55.57 for the 8mm compared to $54.82 for the 10mm heifers. Average selling price

per head was $253.21 for the 8mm and $256.88 for the 10mm heifers.

Results of this experiment indicate that the use of ultrasonics does not penalize either feed lot performance or carcas characteristics and that using ultrasonics cuts down significantly the time the feeder cattle were in the feed lot. Also, that marketing cattle at less back fat thickness can be as profitable as feeding them to a higher back fat thickness.

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