ULTRASOUND AND VISUAL APPRAISAL AS METHODS TO ACCOUNT FOR VARIATION IN PERFORMANCE AND CARCASS PARAMETERS IN FEEDLOT STEERS

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Story in Brief

Ninety six yearling steers of various breed types and initial weights (569 to 820 lb) were used to determine the effectiveness of initial ultrasound measurements and live animal evaluation in explaining variation in feedlot performance over 135- and 149-day feeding periods. Experienced evaluators subjectively scored each steer for condition, capacity, muscle, frame and quality. Backfat and ribeye area were determined by ultrasound at the initiation of the feeding trial. Initial weight, breed type, ultrasound and visual appraisal were used to estimate average daily gain, ribeye area, backfat, marbling and yield grade. In general, subjective evaluation accounted for the least variation in measurements of interest, while the combination of breed, initial weight and ultrasound data explained the most. These result suggest that ultrasonic measurements of initial backfat and ribeye can be useful as a tool to improve the capacity to predict several carcass parameters.

(Key Words: Ultrasound, Visual Appraisal, Feedlot Steers.)

Introduction

As the beef industry moves toward production to meet specifications, the need for more accurate prediction of performance and more uniform products from feedlot cattle increases. Accurate estimates of these characteristics would allow producers to sort cattle into outcome groups to feed to reach a desired endpoint, which ultimately would improve feedlot profitability. Ultrasound technology may be a useful sorting tool. Recent Kansas research suggests that sorting incoming feedlot cattle by hip height and ultrasonic backfat measurement permits one to group cattle for uniform feeding and marketing and to reduce time on feed (Houghton, personal

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communication). In this Kansas study, steers had a uniform genetic makeup and origin. By industry standards, uniformity of incoming feedlot steers is the exception rather than the rule. Therefore, the objective of this study was to determine if ultrasonic measurement of back fat and rib eye area could be used to detect differences in feedlot performance and carcass parameters of typical feedlot steers.

Materials and Methods

The 96 yearling steers of various breeds used in this experiment were part of a feeding trial conducted to determine the effects of virginiamycin, a feed-grade antibiotic, on performance and carcass characteristics of feedlot steers (Smith et al., 1989a). Three weight blocks were used for this study with mean initial weights of 600, 730 and 790 lb. Initial back fat thickness and ribeye area were determined for each steer using real-time ultrasound. Steers were scanned between the twelfth and thirteenth rib with an Aloka 210DX equipped with a 3 megahertz probe. After steers were allocated to pen, two trained evaluators visually appraised each animal for the following parameters: frame, muscle, condition, body capacity and quality. Scores for all parameters were on a scale from one to nine; the mean of these two scores was used for analysis. Muscle score was an estimate of thickness and muscle volume (1=thin, 9=heavy), condition was an assessment of fatness (1=thin, 9=fat), and capacity was an evaluation of potential feed consumption. Frame scores represented an estimate of hip height in relation to age. Each evaluator also scored the steers on overall quality of the individual as a feedlot animal. Ultrasound measurements were missed inadvertently on one steer initially and a second steer was removed during the trial due to injury; therefore, performance and carcass measurements were available for 94 head.

The cattle were slaughtered in two groups; therefore, analysis was conducted within slaughter group. Steers in the two heavier weight blocks were fed a total of 135 days (Kill 1) and those in the lightest weight block (600 lb initial weight) were fed for 149 days (Kill 2). General linear models were developed to account for variation in the following parameters: average daily gain (live and carcass basis), marbling, fat thickness, ribeye area and yield grade. Included in the models were: initial weight (W), breed (B), subjective scores (S) and ultrasonic measurements (U) of back fat and ribeye area. Quadratic terms for continuous variables were also included. Interactions were included in all models except for those with subjective variables. Because only a small number of animals were in the second slaughter group, some models for Kill 2 were not valid due to insufficient degrees of freedom associated with the error term and therefore, results are not presented. Regression equations were generated for each parameter in the two slaughter groups using initial weight with either back fat or ribeye area as independent variables.

Results and Discussion

The models developed were able to account for a fair amount of variation in performance traits. Among steers in slaughter group 1, initial weight and breed (WB), ultrasound (U) or subjective (S) measurements used independent of one another accounted for 15, 6, and 11% of the variation in average daily gain (live basis) respectively (Figure 1). However, when initial weight, breed and ultrasound were used together in the model (WBU), 36% of the variation in average daily gain could be explained. When subjective measures were added (WBUS), 44% of the variation could be explained. When evaluating daily gain on a carcass adjusted basis (Figure 2) similar

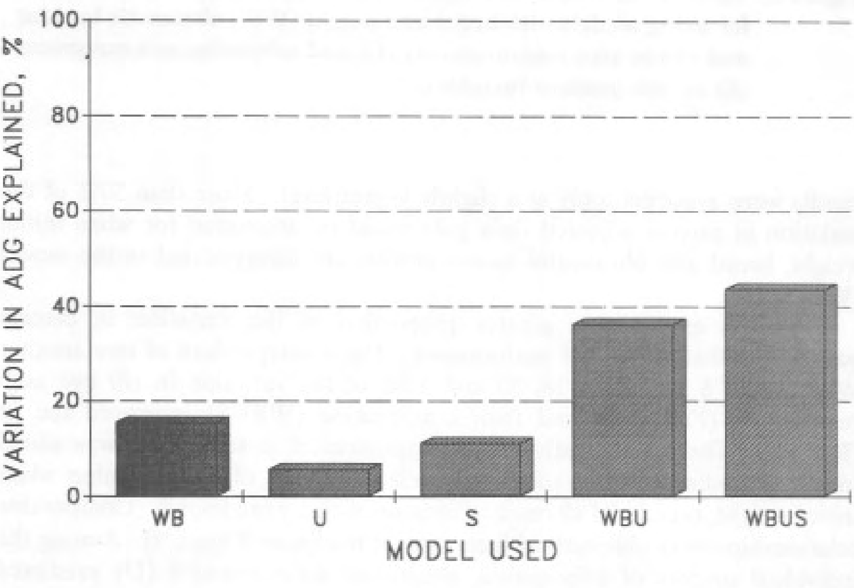

Figure 1. Variation in feedlot average daily gain accounted for using models with breed and weight (WB), ultrasonic backfat and ribeye area measurements (U) and subjective measurements (S) as independent variables.

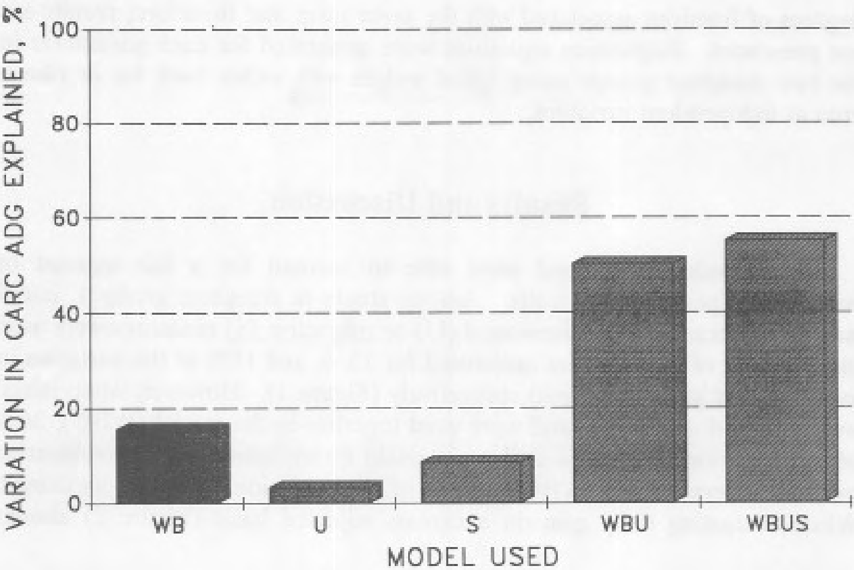

Figure 2. Variation in feedlot average daily gain (carcass basis) accounted for using models with breed and weight (WB), ultrasonic backfat and ribeye area measurements (U) and subjective measurements (S) as independent variables.

results were apparent, only at a slightly higher level. More than 50% of the variation in carcass adjusted daily gain could be accounted for when initial weight, breed and ultrasound measurements are incorporated in the model (WBU).

Models explained a greater proportion of the variation in carcass parameters than in feedlot performance. Used independent of one another WB, U and S explained 28, 30 and 11% of the variation in rib eye area respectively (Figure 3), and their combination (WBUS) improved the fit (R^2=.62). There was relatively little improvement in R^2 when S was added to WBU, indicating that subjective measures were of limited value when initial weight, breed and ultrasound measurements were known. Comparable relationships were observed with carcass fat thickness (Figure 4). Among the individual sources of information, ultrasound measurements (U) predicted carcass fat thickness best (R^2=.45). Similar relationships were observed with numerical yield grade (Figure 5) as fat thickness has the largest impact in estimating cutability. Using all available information (WBUS), 70% of the variation in yield grade was accounted for. Of particular interest is the

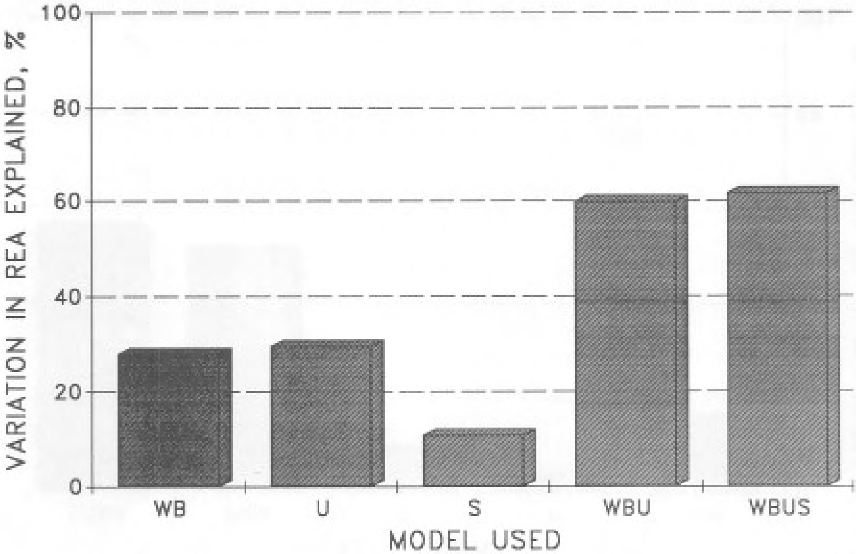

Figure 3. Variation in carcass ribeye area accounted for using models with breed and weight (WB), ultrasonic backfat and ribeye area measurements (U) and subjective measurements (S) as independent variables.

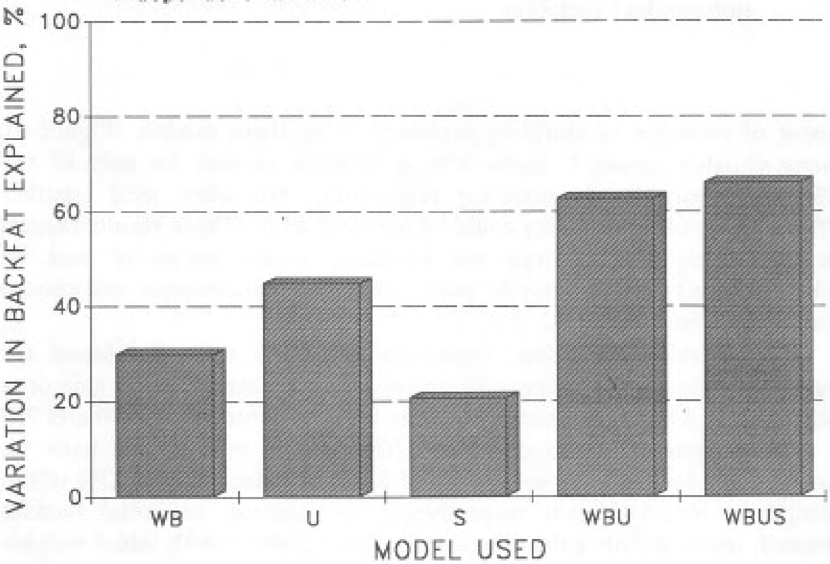

Figure 4. Variation in carcass fat thickness accounted for using models with breed and weight (WB), ultrasonic backfat and ribeye area measurements (U) and subjective measurements (S) as independent variables.

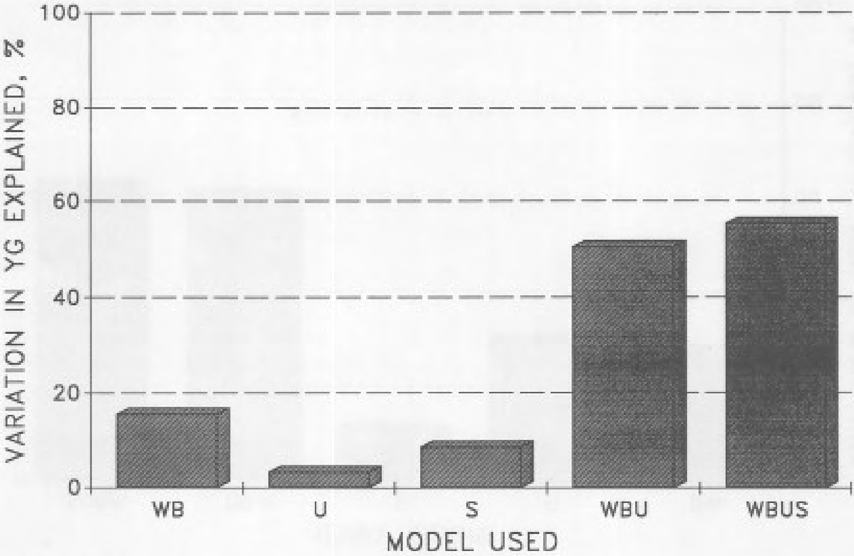

Figure 5. Variation in carcass yield grade accounted for using models with breed and weight (WB), ultrasonic backfat and ribeye area measurements (U) and subjective measurements (S) as independent variables.

amount of variation in marbling explained using these models (Figure 6). Among slaughter group 1 steers, WB or U alone account for only 17 and 14% of the variation in marbling respectively, but when used together (WBU), 58% of the variability could be accounted for. These results suggest that initial weight, breed type and ultrasonic measurements of back fat thickness and ribeye area may be useful to predict performance and carcass parameters of feedlot steers.

To test this assumption, regression equations were developed for parameters of interest. Figure 7 illustrates predicted average daily gain on a carcass adjusted basis for steers with mean initial weights of 600, 730 and 790 lb. These equations were developed from initial weights and back fat measurements for slaughter groups 1 and 2 and explained 15 and 17% of the variation in observed gain respectively. In general, as initial backfat increased, average daily gains decreased. Among steers with initial weights of 600 and 730 lb, cattle with less backfat had higher average gains than fatter animals, suggesting that ultrasonic backfat measurements may be useful in identifying animals with compensatory gain potential or with larger frame size and growth potential.

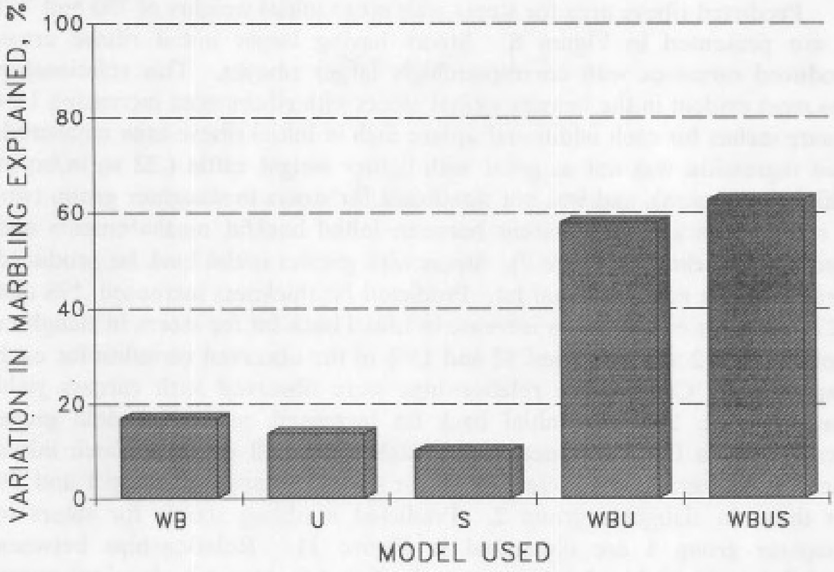

Figure 6. Variation in marbling score accounted for using models with breed and weight (WB), ultrasonic backfat and ribeye area measurements (U) and subjective measurements (S) as independent variables.

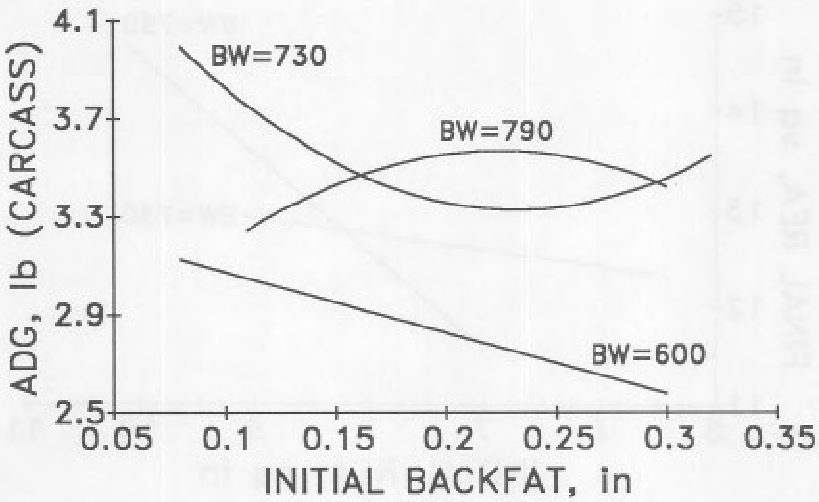

Figure 7. Predicted average daily gain (carcass adjusted basis) versus ultrasonic backfat measurements for steers with mean initial weights of 600, 730 and 790 lb.

Predicted ribeye area for steers with mean initial weights of 730 and 790 lb are presented in Figure 8. Steers having larger initial ribeye areas produced carcasses with correspondingly larger ribeyes. This relationship was most evident in the heavier weight steers with ribeye area increasing 1.04 square inches for each additional square inch in initial ribeye area measured. This regression was not as great with lighter weight cattle (.22 sq in/sq in initial ribeye area), and was not significant for steers in slaughter group two. A relationship also is apparent between initial backfat measurements and carcass fat thickness (Figure 9). Steers with greater initial back fat produced carcasses with more external fat. Predicted fat thickness increased .198 and .127 inches for every .1 inch increase in initial back fat for steers in slaughter groups 1 and 2 and explained 37 and 13% of the observed variation for each respectively. Comparable relationships were observed with carcass yield grade (Figure 10). As initial back fat increased, numerical yield grade increased in a linear manner. With each additional one-tenth inch initial backfat, yield grade was increased .70 for steers in slaughter group 1 and .39 for those in slaughter group 2. Predicted marbling scores for steers in slaughter group 1 are illustrated in Figure 11. Relationships between marbling and initial back fat were not significant for steers in slaughter group 2. In slaughter group 1, however, initial backfat was the only significant variable used in the equation; it accounted for 12% of the variation in

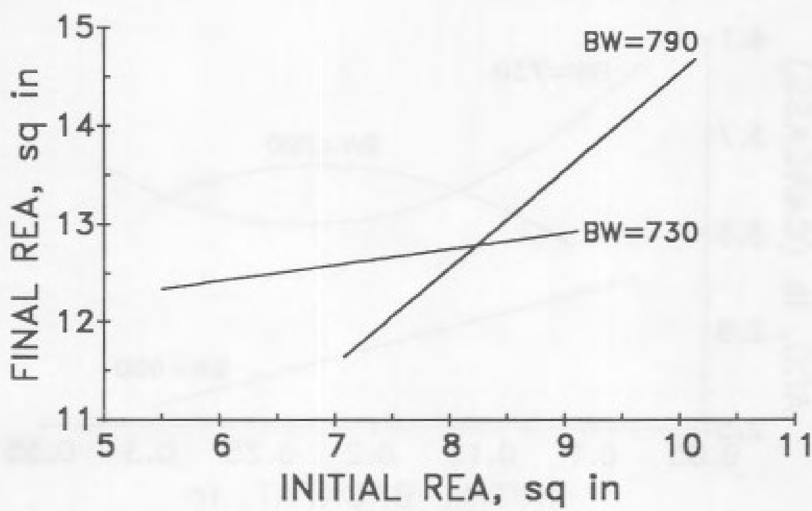

Figure 8. Relationship between predicted carcass ribeye area and ultrasonic ribeye area measurements for steers with mean initial weights of 730 and 790 lb.

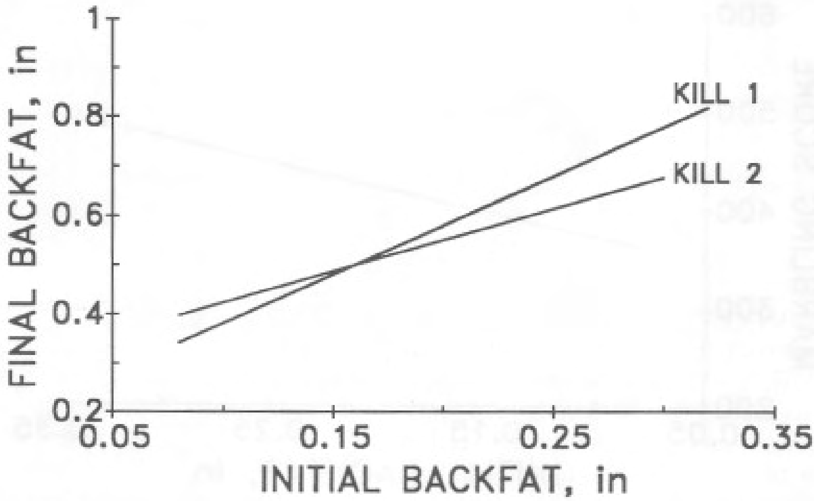

Figure 9. Relationship between predicted carcass fat thickness and ultrasonic backfat measurements for steers fed 135 (Kill 1) and 149 days (Kill 2).

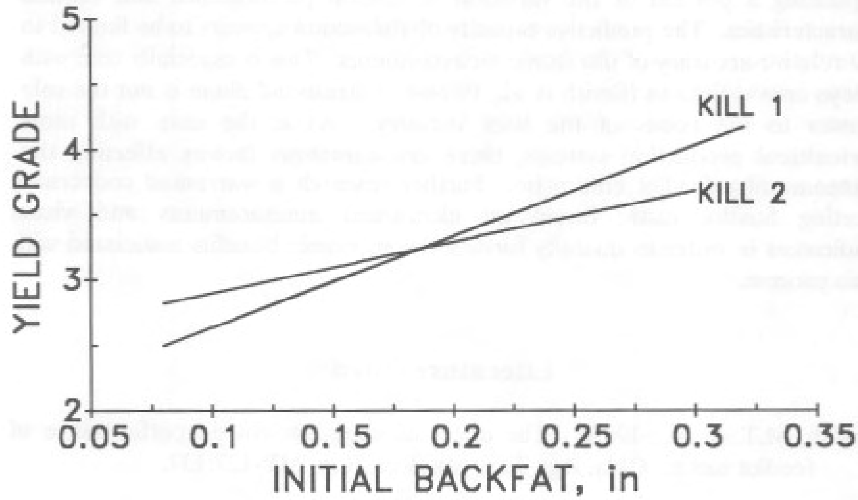

Figure 10. Predicted carcass yield grade versus ultrasonic backfat measuremenfpts for steers fed 135 (Kill 1) and 149 days (Kill 2).

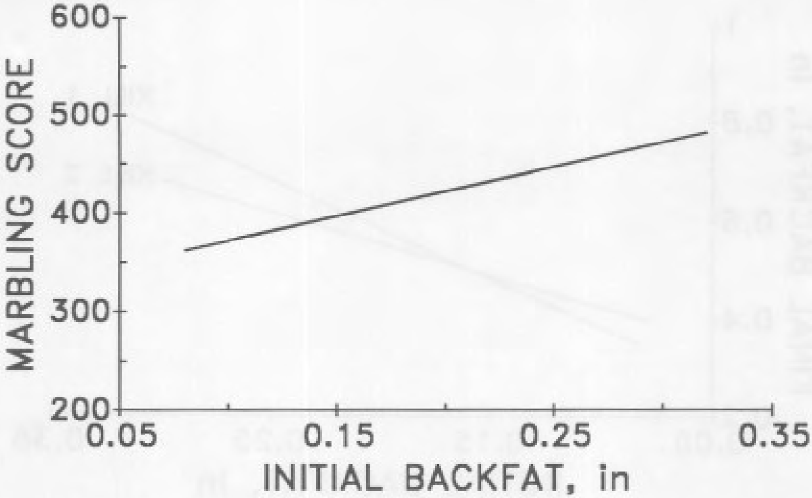

Figure 11. Predicted marbling score versus ultrasonic backfat measurements for steers fed 135 days (Kill 1).

observed marbling score. For this data set, the average steer with greater than .16 of an inch initial backfat graded choice (400 = Small^{00}).

Results of this study demonstrate that ultrasonic measurements of backfat and ribeye area made at the onset of a feeding period are useful in explaining a portion of the variation in several performance and carcass characteristics. The predictive capacity of ultrasound appears to be limited to the relative accuracy of ultrasonic measurements. This is especially true with ribeye area estimates (Smith et al., 1989b). Ultrasound alone is not the sole answer to the needs of the beef industry. As is the case with most agricultural production systems, there are numerous factors effecting the outcome of a feedlot enterprise. Further research is warranted concerning sorting feedlot cattle based on ultrasound measurements and visual indicators in order to quantify further the economic benefits associated with this process.

Literature Cited

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