EVALUATION OF EARLY MEASURES OF BODY COMPOSITION AS RELATED TO BEEF CARCASS TRAITS

A Thesis

by

RICHARD PAUL MAULSBY

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of requirements for the degree of

MASTER OF SCIENCE

December 2009

Major Subject: Animal Science

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ABSTRACT

Evaluation of Early Measures of Body Composition as Related to Beef Carcass Traits.

(December 2009)

Richard Paul Maulsby B.S., Oklahoma State University

Co-Chairs of Advisory Committee: Dr. Chris L. Skaggs
Dr. Andy D. Herring

Two similarly managed trials were conducted to investigate serial ultrasound measures of body composition (longissimus muscle area (ULMA), 12^{th} – rib fat thickness (UFAT), and percentage of intramuscular fat (UIMF)) early in the lives of feeder calves as they compared to carcass traits. Group 1 cattle were Charolais-sired by Brahman-British crossbred dams whereas Group 2 cattle were purebred Beefmaster. Both groups were fed at the same commercial feedlot (Graham Land and Cattle Co.) in Gonzales, Texas. In both data sets classifications were developed for ribeye area of Lower (less than 70.95 cm^2, Middle (between 70.95 cm^2 and 90.3 cm^2) and Upper (over 90.3 cm^2) based on a range that fit within the ribeye specifications of such branded beef programs as Certified Angus Beef and Nolan Ryan's Tender Aged Beef. Differences among ribeye area and quality grade (Choice vs. Select) categories were evaluated for ultrasound and carcass traits. As reported previously, correlations between ultrasound measures and carcass traits became larger at times closer to harvest. In both sets of cattle, there were no differences in fat thickness or intramuscular fat at the ultrasound scan sessions or in these carcass traits due to ribeye area category. The same trend for quality grade classification was not seen across both groups of cattle however. In Group 1, there were no differences in early measures of body composition between carcass quality grade classes except for ultrasound fat thickness at weaning. However, in Group 2 cattle there were differences in ultrasound fat at times 1 and 2, IMF at time 1, and ribeye area at time 2 between cattle that graded choice verses those that graded select. Correlations between ultrasound measures of REA (r of .26 to .50) and ultrasound REA and carcass REA (r of .16 to .81) appeared to be lower in Group 1 vs. Group 2 (r of .55, and .64 to 81 respectively). Results from this project imply that changes in ribeye area will not automatically result in changes of marbling and vice versa. Furthermore, these results also show that ultrasound is useful to help predict beef carcass traits, but that early measures of body composition used alone do not explain a large portion of the variation in the carcass measures and specific methods should be developed by different biological cattle types.

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With all of the successes, challenges and unexpected events in my life the one constant has been the support and love of my Mom, Dad and sisters. Thanks for believing in me and always knowing what to say, when to say it and how to bring out the best in me. I would also like to thank all of my graduate student friends and student workers at the TAMU Beef Center throughout the years. Without you, I would not be able to accomplish the tasks of graduate school and work.

The reason for everything that I do are my daughters Anna and Sydney. They give me the incentive to accomplish everything I do, and I hope I make a positive example for them.   I thank God everyday for blessing me with them.

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INTRODUCTION

The application of real-time ultrasonography (RTU) has been used as a tool to study carcass characteristics, growth and development traits and has proven to revolutionize the cattle industry. RTU has been used extensively in beef cattle enterprises for the past decade and it continues to be a key source of selection and prediction of potential carcass merit in cattle. It is a tool that is predominately used in the purebred sector; however the use of RTU in feedyards and commercial beef cattle programs has seen use, although it has been limited. Feedlot producers are reluctant to use RTU due to the added labor and stress subjected to the animals, but nevertheless, ultrasound in the feedlot is not considered a new application.

Brethour (2000) assessed marbling and backfat deposition in beef cattle at several stages of growth and it was established that carcass composition could be accurately predicted for pre-slaughter but the use in calves proved to have variability and inaccurate due to the differences in pre-weaning environment. Brethour (2000) used similar technology to predict carcass composition at various points prior to harvest and they found ultrasound use just prior to slaughter was feasible, however if utilized for extended periods before harvest would require a more appropriate model.

The objective of this study was to determine if utilizing ultrasound and computer technology at weaning and throughout the feeding period could aid in making selection

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This thesis follows the style of the Journal of Animal Science.

decisions based on choice and select quality grade differences, as well as ribeye area parameters in cattle.

The cattle utilized in the study are represented by two similar but separate groups of cattle. Group1 cattle derived from the Texas A&M University Beef Center and Group 2 cattle originated from the 2006 Beefmaster Breeders United Steer Feedout program. Both groups were received, fed and managed at Graham Land and Cattle Company in Gonzales, Texas.

The results of the analyses are compared to previous reports of predicting body composition in cattle at various stages of growth through the use of real time ultrasound.

LITERATURE REVIEW

The question presented is, can enough pertinent carcass information be obtained early in life and throughout various stages of feeding to identify if particular groupings of calves should be managed and marketed differently to maximize profits. If a producer was able to determine the potential carcass merit of a calf at the beginning or during the early stages of a feeding period, this could aid in feeding and marketing strategies of particular groupings of calves within a larger population. This could potentially affect the days on feed for a particular group or change the grid or branded beef program that individual cattle are best suited for when marketed. In order to accomplish this task the use of technology complemented with practical knowledge could prove to be instrumental in marketing decisions.

Targeting the producers' customers

The marketing strategies and opportunities for today's cattle producers have changed considerably. Perhaps the most noted is that the mind set of the producer has now become much more focused on end-product value. More producers are implementing the practice of retained ownership and are targeting specific branded beef programs as marketing possibilities and therefore should receive premiums for their genetic decisions and management practices. Cattle that meet specifications for branded programs get rewarded in terms of premiums paid on a negotiated grid, while cattle that do not meet specifications get discounted. Those premiums and discounts from different grids serve as a signal to help one know what target to hit and improve end-product value.

There have always been producers who have used selection criteria to produce a beef animal that was in demand. However, the selection pressures imposed by today's producer, continues to evolve due to the understanding that the production of beef cattle is ultimately the production of a food source. There are consumers with concerns about dietary aspects of red meat, and the financial waste associated with excess fat in market animals and thus it has forced producers of red meat and allied industries to seek ways of improving the end product (Wilson, 1992). One method of improvement is through genetic selection aided by expected progeny differences, and in recent times the availability of ultrasound. It is not only one practice or trait that determines profitability in cattle production. Each sector requires multiple factors, and today's cattle producers and feeders have to recognize the end-point is red meat that is intended for the consumer.

<u>Branded beef programs</u>

In recent years the identification of various branded beef products has allowed producers to merchandise beef that targets specific consumer groups. There is diversity among consumers beyond the cost of a product, and, therefore the needs and demand for some variation in product is required. Value-based markets pay premiums to producers who can deliver a specific product, but discount those who cannot. Ultrasound in feedlots may offer a unique opportunity; it can help the producer recognize which grid program offers the most profit potential based on the type of cattle being fed. More importantly, scanning feedlot cattle at an extended period before slaughter still allows sufficient time to make crucial management decisions and decrease carcass discounts (Wall et al., 2004). As the market changes and more branded beef programs are added feeding strategies and target points of the cattle being sold become even more important. The use of ultrasound as a tool to sort cattle during the feedlot phase will allow a manager to target the cattle to specific points or branded beef programs and thus be more efficient and profitable.

The use of technology

Perhaps the most widely practiced and accepted source of technology used to evaluate cattle from both a yield and quality grade aspect prior to harvest is the use of ultrasound. The use of ultrasound allows producers to determine fat thickness, muscle development and a degree of intramuscular fat in the live animal. Numerous studies have shown that ultrasound provides an accurate measurement of live animal fat thickness and longissimus muscle area (Perry et al., 1989). Ultrasound also has possibilities of predicting carcass composition (Hamlin et al., 1995). The ability to use ultrasound to precisely and accurately estimate carcass measurements in live animals should benefit the beef industry and will continue to allow the industry to move away from the practice of pricing cattle on pen averages to marketing on a value based system. Additionally, serial ultrasound measurements could replace the need for costly serial slaughter designs frequently used in growth studies (Smith et al., 1991). With continued improvement in ultrasound technology, it may be possible to implement ultrasound evaluation at key points along the marketing chain (May et al., 2000). Insight into when a producer should ultrasound an animal to aid in management decisions could prove to be vital. If the use of ultrasound technology could be utilized at the onset of weaning or soon after, feeding and marketing strategies could be designed for each particular grouping of calves.

Utilization of ultrasound

The use of ultrasound was initially designed to measure ultrasonic techniques that would allow for a nondestructive and humane means of quantifying muscle and fatty tissues in live animals (Houghton et al., 1990). With the use of ultrasound, one was able to better estimate carcass indicators beyond visual appraisal. Ultrasound technology has been a vital tool used to collect carcass data on live animals and could be time and cost effective when compared to traditional methods, which typically takes a minimum of 3 to 5 yr and up to $5000.00 to “prove” a sire’s genetics through progeny testing. By using ultrasound technology to collect carcass data, progeny testing can be completed in less than 2 yr at a cost of approximately $450.00 per sire (Williams, 2002).

It would prove to be vital if one could predict the amount of intramuscular fat in the longissimus muscle which is the most important element in determining quality grade in the U.S. system and putatively is associated with both beef palatability and product consistency (Brethour, 1994). Many involved in the beef cattle industry view the use of ultrasound as a vital part of becoming closer to a value-based marketing system that potentially would allow them to capture the profit of improved genetics implemented into their programs, as well as targeting consumer niches.

Prior to the use of ultrasound, the only source of prediction of carcass merit was through visual appraisal. It is recognized that skilled individuals can make assessments of carcass end points fairly effectively. Previous studies have indicated that visual appraisal is an effective method for estimating carcass fatness (Daley et al., 1983). However, this system is often criticized for being too subjective and could perhaps be inconsistent across evaluators (May et al., 2000). The margin for human error and the variation between individuals may vary but there are those who are trained in estimating carcass indicators through the differences amongst weight, breed type and degree of fat thickness for an individual animal that can make fairly accurate estimations in determining both a final yield and quality grade. Brethour (1994) stated visual assessment of marbling in the live animal is virtually impossible, so cattle often are overfed to assure acceptable marbling thus resulting in excessively fat cattle. If a producer or the entity that owns the cattle being fed were able to collect carcass information as an aid in ensuring cattle are not overfed then a combination of visual appraisal, and ultrasound should prove to be a plausible solution to help generate profit. Regardless of one's view point on the accuracy of visual assessment it stands to reason that the use of ultrasound complemented with visual evaluation would serve as an effective system for making management decisions.

Practical application of ultrasound

As the use of ultrasound technology becomes more widely used and more economically efficient for the use within the various sectors of the cattle production system it will prove to be an aid in the decision making process of cattle management. It is the practical application that could prove to be the most beneficial.

Using ultrasound technology to sort and select cattle for carcass merit has the potential to return substantial net income on a per animal basis. Ultrasound technology is used in two basic categories: 1.) sorting and selecting seedstock, and 2.) sorting feedlot cattle at reimplant for optimal carcass quality and yield grade endpoints (Williams, 2002). It will also be important to add the category of sorting for the selection of young feeder calves. By identifying calves at an early age for carcass potential through the use of ultrasound, a feeding and management strategy could be designed for groupings of calves with similar traits.

A decision support system within an ultrasound cattle-sorting system (KSU/CPEC) was developed and used to sort feeder cattle at reimplant for prediction of optimal endpoints (Brethour,1989, 1994). The KSU/CPEC system uses carcass development models to make sorting decisions by projecting additional days on feed to obtain maximal profitability. It is a scholastic model that estimates the future likelihood for an animal's carcass to be placed in the cells of a typical three-dimensional (quality grade, yield grade, carcass weight) price grid. These probabilities are multiplied by corresponding premiums and discounts to determine an estimate of future carcass value (Williams, 2002). Data from William's project determined the KSU-sorted steers gained faster, had increased carcass quality and were overall more profitable, with the use of the system profitability increased by $15.22 per steer in one feedlot and by $27.67 per steer in another.

Ultrasound technology continues to advance and the wide spread use of it is increasing through all phases of cattle production It will continue to advance the ability to accurately select seedstock and aid in management decisions throughout the feeding periods. Most importantly, it will become a practical tool in making profitable decisions in cattle management.

Use of ultrasound by feedlots

Although ultrasound has predominantly been used to aid in management decisions within seedstock production, it is beginning to be used within the feedlot industry. The use of more precise information is needed to efficiently manage and market feedlot cattle for specific carcass programs. Many people feel certain types of cattle should not be produced because they don't fit certain carcass programs. The large inefficiency in the beef cattle industry occurs when cattle of various genetic and management backgrounds are all managed the same for the same target market, or do not have to target a market until after they are killed. With the use of live evaluation as well as ultrasound an individual owner of fed cattle can potentially utilize the collected data to make management decisions that will allow specific cattle to fit the most profitable grid system. Houghton et al., (1990) stated the ability to identify and market groups of cattle that will consistently produce carcasses of similar weight with acceptable yield and quality grades is the primary interest of feedlot managers. As the demands of the consumer are evaluated, it is understood that there is a need for consistency in the product. Before technology is implemented by feedlot managers as common practice, all variables must be evaluated to ensure profitability and efficiency for those represented in the feeding stages of production. It is vital for the feeder and packer to have a trusted system for accessing carcass merit before slaughter (May et al., 2000). Although the feedlot managers most likely recognize the potential benefits gained through ultrasound data, they are reluctant to subject animals to added stress. Scanning takes considerably more time to handle the cattle than the typical 90-animal/hr rate in most commercial feedlots (Wall et al., 2004). The use of ultrasound information has proven to be a major consideration in many seedstock cattle breeding programs, but it is inevitable the practice could perhaps become more widely used in the industry throughout various stages of feeding. The concept and need for such information is supported by the trends seen in value-based marketing, which has made producers become more aware of the value of a carcass as compared solely to the value of live animals at given points throughout production. If producers are better informed about potential performance of their cattle, they can tailor their management and marketing more efficiently. Ultrasound has been used for several years now to estimate carcass composition in live animals for marketing of feedlot cattle as well as collecting data for breed performance programs and expected progeny differences. As ultrasound data are collected closer to time of slaughter, it is closely related to the actual carcass traits (Herring et al, 2006).

As production and marketing have evolved over time, today's producer must aspire to generate a product that targets consumers' preferences and conveniences, as the consumer is the target audience of merchandising at all stages of cattle production. With this being understood, the implementation of ultrasound in the feedlot and throughout prior feeding phases should prove to be met with greater acceptance and need.

<u>Stages ultrasound should be implemented</u>

Ultrasound has become more widely used by producers as an added tool to make management decisions. Studies have shown that ultrasound measures of fat thickness and ribeye area (Perkins et al., 1992), and intramuscular fat percentage are accurate predictors of their corresponding carcass traits in fed slaughter cattle (Sapp et al., 2002). If ultrasound is used as a predictor of potential carcass merit on young cattle to aid in feeding strategies then one must assess the most optimum age and time to ultrasound. Further studies have shown ultrasonic measurements of carcass traits can be used to sort steers prior to the finishing phase and to predict optimal slaughter end-points. Estimation of carcass characteristics in live animals potentially allows for sorting and selecting cattle for carcass merit. Collectively, current and future application of ultrasound holds tremendous potential to enhance management for improved carcass production efficiency in beef cattle.

A large majority of research done in determining the optimum time for the use of ultrasound targets the needs of the seed-stock producer. In order to maximize genetic response to selection, ultrasound data should be collected at the earliest and most useful time. However, literature that relates changes in genetic parameter estimates for ultrasound traits to a wide rage of ages at measurement does not exist (Hassen et al., 2004). With the emphasis on all phases of cattle production being end-point driven, the importance of information at every stage of the cattle cycle is imperative to success. As the use of ultrasound is more diversely used among the sectors of cattle production the timing of data collection becomes an important consideration.

When considering the earliest age to collect ultrasound information, body composition as related to endpoint carcass composition should be taken into consideration. Carcass composition is affected by sex, age, genetic background, plane of nutrition and weight. Preston (1971) stated the variable with the greatest effect on composition is weight, and that the growth and distribution of fat is important when quantifying growth. As an animal grows and approaches market weight, fattening occurs as a normal part of growth. Additionally it is recognized that the common sequence of growth is the development of the skeleton then muscle and followed by fat. The order of deposition of different fat depots has been determined to be in the following order: internal, intermuscular, subcutaneous and intramuscular. Marbling increases in a quadratic fashion relative to time, increasing at a decreasing rate with increasing days on feed. Research has not clearly defined the accumulation of marbling relative to carcass composition and weight, nor has the deceleration concept of maturing tissue been quantified for marbling in relation to growth (Bruns et al., 2004). The study conducted by Bruns et al., (2004) utilized purebred Angus steers, and concluded there was an increase in marbling in a linear pattern and it was relative to carcass weight.

Pilot studies have indicated that ultrasound estimates of marbling taken on calves at weaning might predict USDA quality grade 10 mo later (Brethour, 1992). The ability to predict potential quality grade of calves at weaning might enable clustering cattle into groups with similar carcass characteristics, which might facilitate more appropriate management and marketing strategies (Brethour, 2000).

Brethour (1992) stated that correlation coefficients are used commonly to evaluate the accuracy of technologies that predict attributes. However, correlation coefficients are biased by sample variability and do not provide quantitative information that allows economic interpretations. In addition, a user might be more interested in categorization and whether ultrasound technology simply will predict whether an animal will grade USDA choice.

The majority of research conducted concerning age of scanning has targeted animals identified as potential breeding animals and not as a predictor of potential quality grade at an animal’s terminal end-point. In analysis done by Waldner et al. (1992) a study was performed evaluating the validation of real-time ultrasound technology for predicting carcass traits in Brangus bulls ranging in age from four months old to two-years. When estimating fat thickness for the actual differences between scanned and actual FT, significant differences were found among the four scanning periods. The bulls were scanned every four months from the time they were four months until two-years of age and 10 bulls from each group were selected to eventually be harvested in order to gather carcass information.

In the analysis of actual differences between scanned and actual FT, there were significant differences among the selected groups of bulls. Estimation of FT was most accurate (*P* < .05) at 16 mo., followed by mo 12, 20 and 24. Month 16 was the only month in which the mean difference of the scanned vs actual carcass measurements was not significantly different from zero (*P* = .09). Their data showed that as FT increased above 1.0 cm, it was increasingly underestimated. Their findings agreed with those of Parrett et al. (1987) and Smith et al. (1990), both using similar real time ultrasound equipment on cattle, who observed that, as FT increased, accuracy of the measurements decreased. In addition, there was a tendency to overestimate thin cattle and underestimate fat cattle (Waldner et al., 1992). They further estimated when the absolute differences between the scanned and actual carcass measurements for FT were taken into account, all months were significantly different from zero. These data point out that, although real-time ultrasound can be used to estimate accurately the average fat thickness at 16 mo. for a group of bulls, the measurement for any one bull can be inaccurate.

Brethour has performed considerable research on the use of real-time ultrasound in young cattle. In a particular project utilizing young calves, the use of ultrasound at early stages of development were supported by a modified power function (r = .315, *P* < 0.001) was better (*P* < .05) than a linear model (r = .296, *P* < 0.001) in expressing the relationship of carcass marbling to initial ultrasound estimates. The relationship for marbling estimates for the calves in the project were taken at an average age of 219 d. A second measurement was taken at 252 d in order to compare the two ultrasound evaluations. An exponential model was numerically lower the power function (r = .308). The nonlinear models corroborate with previous observations that the rate of marbling increase during feeding is higher among cattle with higher initial marbling levels. The exponential model proved to account for more variation than the linear model.   Analysis further indicated that the intramuscular fat estimates were 78 $\pm$ 4% accurate in classifying future quality grade and predicting whether an animal would grade USDA Choice. It typically requires an additional $150 per animal to develop a calf from weaning to yearling age, the ability to obtain accurate measurements at weaning could be economically beneficial.

The supporting data serve as a source that potentially the use of ultrasound could be used as a prediction of future quality grades and thus if implemented during phases of feeding decisions on feeding regimes and target end-points could be adjusted depending on the differences in cattle groups.

Three major components of error exist in predicting future quality grade. One is the accuracy of ultrasound technology to measure a present value of marbling in the live calf. In one study the average amount of marbling at evaluation was 4.0 (slight00, SD=.47) which is approximately equivalent to 3% ether extract. Herring et al. (1998) reported that the most precise ultrasound systems currently used for measuring marbling have standard errors of prediction ranging from .7 to.9 marbling score units, although the range of marbling scores were wider in their study. Differences among animals, as well as effects of environment and health, may affect the rate of marbling increase during the feeding period. Also, the determination of carcass marbling is subjective and varies among graders, carcass temperatures, lighting, bloom time, and ribbing technique.

In further studies concerned with utilizing ultrasound to predict future quality grades Brethour utilized ROC analysis. ROC analysis was created to determine potential quality grades in cattle through the use of ultrasound. The ROC analysis provided a method of choosing a critical operating point to attain a desired proportion of Choice or premium choice in a particular outcome group. The value that is derived from the ROC depends on an estimate of the percentage choice or premium choice in a population. For example, in a set of calves that should grade 70 % choice based on past performance, a critical operating point of approximately 3.7 marbling score units would enable selecting a set expected to grade 50% choice, then that critical point must be increased to nearly 4.2 to accomplish the expectation of an outcome group that would grade 80% choice. An important consequence is that the likelihood of a calf with a specific marbling score attaining choice is dependent on an *a priori* estimate of choice prevalence in the herd (Brethour, 2000).

Application of ultrasound technology to sort calves at young ages for future quality grade will prove to be challenging. Many factors affect ultrasound estimates of marbling in the live animal, including technician competency and experience, algorithms for image analysis, conditions at insonation, and different ultrasound systems. Brethour (2000) concluded that the use of ultrasound technology on young cattle to predict future quality grade does seem feasible. However, the relative accuracy of 76% to 78% in predicting carcass grade categories may not be high enough to affect substantial monetary benefits from the procedure.

Summary

Recognizing the importance of economic efficiency in any enterprise is important in creating success, and the cattle industry is no different. As the industry evolves the necessity to implement the appropriate management decisions and strategies will prove to be a deciding factor on determining which programs create a profit. The use of actual performance, expected progeny differences, genetics and ultrasound are the tools needed to produce successful breeding programs. Today's producer are recognizing that in order to meet the consumers needs these same tools will need to be utilized for producers feeding cattle for end-point. If the use of ultrasound combined with visual appraisal will allow the producer to cluster or streamline groupings of cattle that should be fed and marketed different from their contemporaries. The subsequent choices made in managing the cattle should prove to be profitable ones. As a result, this project will evaluate use of early measures of ultrasound in two distinct sets of cattle to ascertain correspondence to actual carcass measurements.

MATERIALS AND METHODS

Data for this thesis were collected on calves from two different trials that involved investigation of ultrasound measures of body composition evaluated early in the growing programs. Although the two subsets of cattle were of different genetic bases and fed at different times, they were managed similarly, and both groups were fed at the same commercial feedlot (Graham Land and Cattle Co.) in Gonzales, Texas. In both data sets classifications were developed for ribeye area and quality specifications. For both Group 1 (TAMU) cattle and Group 2 (BBU) cattle ribeye area classifications were formed based on carcasses having less than 70.95 cm^2 (referred to as Lower), between 70.95 cm^2 and 90.3 cm^2 (referred to as Middle), and over 90.30 cm^2 (referred to as Upper). This range was utilized based on industry preferred REA size. For quality grade, cattle from both groups were classified as either USDA Choice or Select and derived from the final carcass quality grade estimates. The two data sets were analyzed separately and are explained in detail below.

<u>Group 1</u>

Animals, Feeding Management and Marketing

Group 1 consisted of 40 Charolais-sired calves and out of *Bos indicus* influenced dams. The group of calves was comprised of 23 and 17 steers born predominantly in February and March of 2003. The calves were weaned at an average age of 210 d and managed under the protocol of the Value Added Calf-45 (VAC-45) program guidelines. The calves did not receive pre-weaning vaccinations, therefore, the initial vaccination incurred at the day of weaning. The calves were administered Cattle Master 4, an 8-way clostridia booster, and de-wormed with Ivermectin per label. The calves were monitored for potential health problems and the few that did exhibit problems were administered Naxcel. Over the course of the feeding period, from beginning to end, no death loss occurred.

During the 45 day preconditioning period the calves were fed a 15% CP (min) ration that contained 3.05 % C-Fat (min), 13.75% C-Fiber (max), .05 % Ca (min) and 1.25% Ca (max). Free choice hay that contained 15% CP was also made available. Upon the completion of the 45 day feeding period calves were implanted with Synovex S (steers) or Synovex H (heifers). The cattle were managed and fed as a one group, and upon completion of the (VAC-45) program they were turned out onto Bermuda grass pastures with supplement for 65 d prior to entry into the feed-yard.

When Group 1 (TAMU) cattle began the feeding period they were fed a starter ration of 32.23% corn for 14 days, a set-up ration of 42.73% corn for 45 days, and a finishing ration of 59.48% corn fed for the remainder of the feeding period. The cattle were fed in the feed yard a total of 155 days. The length of the feeding period was not pre-determined, therefore the cattle were fed and marketed according to the feed yard manager's typical marketing protocol.

The guidelines of the major marketing outlet specified that no animal could qualify for the marketing program if it has received a growth enhancing hormone within 100 d prior to slaughter. Therefore, the initial implant upon the receiving period to the feed yard was the only growth promo tent that was administered. Group 1 cattle were harvested on September 3rd 2004 at Sam Kane Beef Processors in Corpus Christi, Texas.

Data Collection

Group 1 cattle were scanned on day one (Scan 1) of the (VAC-45) program, as well as day forty-four (Scan 2) which would have been the concluding day of the VAC- 45 period. The final ultrasound data (Scan 3) was collected on day l20 of the feedlot feeding period. All cattle in Group 1 were evaluated for live compositional measurements by a certified ultrasound technician using an Aloka 500V ultrasound machine and a 17cm 3.5GHz probe. Measurements collected were 12th rib fat thickness (UFAT), longissimus muscle area between the 12th and 13th ribs (UREA), and intramuscular fat percentages between the 12th and 13th ribs (UIMF). Live weights (LW) were taken at each scanning session. The cattle in Group 1 were designated to be harvested when the feed-yard manager designated the most optimum time for profitability.

Following a 48 hour chill period, carcass measurements were taken as well as the Smart Vision BeefCam. Measurements collected by the Smart Vision Beef Cam were REA, CWT, FAT, BeefCam Score (BCSCORE), and Nolan Ryan Tender Aged Beef Certification approval (NRCERT). BCSCORE measured each carcass for ribeye area, fat thickness, and pH. The carcass data on each steer was used to calculate Yield Grade (YG) with the following equation:

YG = 2.5 + (2.5^{x} Adjusted Fat Thickness) + (0.2^{x} Kidney Pelvic Heart Fat Percentage) + (0.0038^{x} CWT) – (0.32^{x} REA).

Statistical Analyses

Ultrasound measurements and carcass data were evaluated through analyses of variance (PROC GLM; SAS Institute, Cary, NC) with ribeye area classification (Lower, Middle, Upper) and USDA quality grade (choice vs. select) included as fixed effects. Dependent variables included ultrasound measurements of ribeye area (REA), fat thickness (FT), percent intramuscular fat (%IMF) at each scan session, live weight (LW), hot carcass weight (HCW), carcass ribeye area (FREA) and carcass fat thickness (FFT). Least squares means were calculated for all traits, but only compared when a significant F-test was present. Correlation coefficients were also investigated to evaluate relationships among body composition traits across times and carcass traits.

Group 2

Animals, Feeding Management and Marketing

Group 2 calves were comprised of Beefmaster steers that originated from three different producers. A total of 71 steers were delivered to Graham Land and Cattle Co. in Gonzales, Texas on January 16, 2006. The steers were sired by 14 registered BBU bulls and fed and managed under the guidelines of the Nolan Ryan Tender Aged Beef Program.

Group 2 cattle began the feeding phase by being introduced to a starter ration of 32.23% corn for 14 days, followed by a set-up ration of 42.73% corn for 45 days, and transitioned into a finishing ration of 59.48% corn. The cattle were fed the finishing ration for the remainder of the feeding period. The cattle were fed in the feed yard a total of 190 days and the length of the feeding period were not pre-set, therefore the cattle were fed and marketed according to the feed yard manager's typical marketing protocol.

Cattle were harvested on August 14, 2006 at Sam Kane's Beef Processors in Corpus Christi, Texas and carcasses were graded on August 16, 2006 by TAMU trained personnel.

Data Collection

Group 2 cattle measurements collected were 12^{th} rib fat thickness (UFAT), longissimus muscle area between the 12^{th} and 13^{th} rib (UREA), and intramuscular fat percentages between the 12^{th} and 13^{th} ribs (UIMF) and live weights (LW). Ultrasound data collected included ribeye area, percent intramuscular fat, 12^{th} rib fat thickness, rump fat thickness, and gluteus medius depth. Cattle in Group 2 were evaluated for live compositional measurements by a certified ultrasound technician using an Aloka 500V ultrasound machine and a 17cm 3.5GHz probe on March 10, 2006 (Scan 1, 63d) and May 11^{th} (Scan 2, 119d).

The carcass data collected on each steer were used to calculate Yield Grade (YG) with the following equation:

YG = 2.5 + (2.5^x Adjusted Fat Thickness) + (0.2^x Kidney Pelvic Heart Fat Percentage) + (0.0038^x CWT) – (0.32^x REA).

Statistical Analyses

Ultrasound measurements and carcass data were evaluated through analyses of variance (PROC GLM; SAS Institute, Cary, NC) with ribeye area classifications, and USDA quality grade differences among choice and select, as well as, carcass information based on live and harvested data included as fixed effects. Dependent variables included ultrasound measurements for ribeye area (REA), fat thickness (FT), percent intramuscular fat (%IMF) at the different scan sessions, and carcass traits of percent kidney heart and pelvic fat (% KPH), marbling (MARB), yield grade (YG), live weight (LW), hot carcass weight (HCW), ribeye area (FREA) and fat thickness (FFT). When significant F-test was observed, least squares means were calculated and separated by t-tests. Correlation coefficients were also evaluated to determine relationships among body composition traits across times and carcass traits.

RESULTS AND DISCUSSION

Simple statistics for live animal measurements and carcass data for both Group 1 and 2 are listed in Table 1. Weights were taken at each session and increased as expected. The initial weight (weight 1) for Group 1 (TAMU) occurred at d1 of weaning and ranged from 172.41 to 353.90 kg, with a mean of 259.68 kg; weights were taken at each session of scanning, with carcass weight representing the final weight measurement. At weight 2 which was taken 44 d after the initial scanning session the cattle ranged from 190.56 kg to 361.160 kg with a mean of 265.85 kg; at the third and final scan, the cattle ranged in weight from 239.56 kg to 405.62 kg with a mean of 239.56 kg. The HCW ranged from 276.77 kg – 451.90 kg with a mean of 359.70 kg.

Group 2 (BBU) weights were represented by weight 1 which was taken at d 63 and weight 2 which occurred at d 119. Weight 1 ranged from 222.32 kg to 340.74 kg with a mean of 281.27 kg. The final HCW for Group 2 ranged from 303.08 kg to 434.66 kg and had a mean of 370.28 kg.

At each scan session rib eye area measurements were taken utilizing RTU to access the change in REA at each stage of development. At the initial scan session (scan 1) the mean for REA was 45.08 cm^2 and ranged from 32.89 cm^2 to 58.69 cm^2. At the second scan session (scan 2) Group 1 (TAMU) cattle increased in REA size at all ranges. The minimum REA at scan 2 was 34.05 cm^2 with a mean of 48.95 cm^2, respectively. The most noticeable change at scan 2 was observed at the maximum range with an REA measurement of 66.82 cm^2. The time period between scan1 and 2 was 44 d.

Table 1. Simple statistics for live animal measurements and carcass data collected from Group 1 (TAMU) and Group 2 (BBU) populations

Measure	Mean	Standard Deviation	Minimum	Maximum
Group 1[a]				
Live animal measurements[c]				
WW,kg	259.68	37.78	172.41	353.90
Scan 1 REA, cm^2	45.08	2.40	32.89	58.69
Scan 1 FT, cm	0.30	0.10	0.20	0.40
Scan 1 IMF, %	1.61	0.40	0.97	2.59
Scan 2 W, kg	265.85	39.33	190.56	361.16
Scan 2 REA, cm^2	48.95	2.90	34.05	66.82
Scan 2 FT, cm	0.20	0.10	0.20	0.40
Scan 2 IMF, %	1.85	0.42	0.97	2.66
Scan 3 W, kg	314.13	40.75	239.56	405.62
Scan 3 REA, cm^2	88.81	3.80	69.01	106.43
Scan 3 FT, cm	0.40	0.20	0.30	1.0
Scan 3 IMF, %	1.97	0.47	1.11	2.88
Carcass measurements[d]				
Final HCW, kg	359.70	38.68	276.77	451.90
Final REA, cm^2	103.32	3.80	82.56	123.84
Final FT, cm	0.70	0.30	0.40	1.70
Group 2[b]				
Live animal measurements[c]				
WW, kg	281.27	25.51	222.32	340.74
Scan 1 REA, cm^2	50.57	2.50	34.83	62.56
Scan 1 FT, cm	0.30	0.10	0.20	0.60
Scan 1 IMF , %	1.43	0.49	0.68	2.92
Scan 2 REA, cm^2	66.76	3.20	46.44	83.20
Scan 2 FT, cm	0.40	0.10	0.30	0.80
Scan 2 IMF, %	1.66	0.54	0.92	3.20
Carcass measurement[d]				
MARB	365.92	38.82	290.00	480.00
Final HCW, kg	370.28	30.95	303.08	434.66
Final REA, cm^2	80.63	3.80	58.69	106.43
Final FT, cm	1.10	0.04	0.40	2.30

[a]Group 1= Cattle from Texas A&M University Beef Center
[b]Group 2 = Cattle from Beefmaster Breeders United
[c]Weaning weight = BW at ultrasound; scan 1, 2, 3 = ultrasound scan session;
REA = of rib eye area at the 12^{th} and 13^{th} rib; scan 1, 2, 3 = ultrasound scan session
FT = ultrasound of 12^{th} and 13^{th} fat thickness; scan 1, 2, 3 = ultrasound scan session
IMF = ultrasound predicted percent intramuscular fat; scan 1, 2, 3 = ultrasound scan session
[d]Final HCW = hot carcass weight at harvest; Final REA = Carcass rib eye area at the 12^{th} rib; Final FT = Carcass 12^{th} rib fat thickness; MARB = marbling score = carcass numeric marbling score where 300-399 is Slight 00 to Slight 99 (Select), 400 -499 is Small 00 to Small 99 (low Choice)

At the third and final scan which was mid way through the feedlot phase and prior to harvest, the minimum REA was 69.01 cm^2 and the maximum was 106.43 cm^2, with a mean of 88.01 cm^2, respectively.

Group 2 (BBU) cattle had two scan sessions performed and were represented as scan 1 and 2 REA. Scan 1 showed a minimum REA of 34.83 cm^2 and a maximum of 62.56 cm^2 with a mean of 50.57 cm^2. Scan 2 ranged from 18.30 cm^2 to 32.80 cm^2 with a means of 26.30 cm^2. The final REA measurement was taken from the carcasses and had a minimum REA of 58.69 cm^2 and a maximum of 106.43 cm^2 with a mean of 80.63 cm^2. As expected growth traits such as weight and REA increased throughout all phases of feeding and measurements for both Group 1 and 2, respectively.

Fat thickness (FT) was measured at all scanning sessions; with values at scan 1 and 2 of Group 1 (TAMU) calves remained fairly constant. Scan 1 was measured at d1 of weaning and Scan 2 was measured at d44 of the VAC-45 back-grounding program. Scan 1 FT measurements were represented by a minimum measurement of .20 cm and a maximum of .40 cm. Scan 2 measurements represented the leanest animal at .20 cm and the fattest animal at 0.40 cm, therefore little variation from the leanest to the fattest animal was observed at scan 1 and 2. The calves did not gain any body fat during the 44d feeding period, in fact when looking at the differences in mean at both scan sessions they regressed in back fat as evidenced by scan1 measurement of .30 cm and .20 cm at scan 2. At scan 3, which was evaluated during the feedlot phase, a slight increase in FT was observed when evaluating the means as compared to scan 1 and 2 mean with a gradual progression of .30 cm, .20 cm and .40 cm, respectively. A considerable difference was seen at scan 3 when comparing the leanest animal at .30 cm and the fattest animal measuring 1.0 cm.

The final measurement for (FT) of Group 1 (TAMU) was collected as an actual fat measurement opposite the REA at the 12th and 13th rib. The actual measurements showed the leanest carcass to be .40 cm and the fattest to be 1.70 cm with a mean of .70 cm.

Similar to the FT results found in Group 1 (TAMU) cattle, Group 2 (BBU) cattle saw a steady progression in FT at each session with a mean of scan 1 FT of .30 cm and scan 2 FT of .40 cm. A considerable change in FT was observed when looking at the leanest and fattest animals at these scan sessions. At scan 1 the minimum fat is .20 cm and the fattest animal is .60 cm and at scan 2 the leanest animal is .30 cm and the fattest is .80 cm. The final fat estimates taken from the carcass opposite the REA at the 12th and 13th rib showed a considerable difference between the fattest and leanest animals which is similar to those observed in scans 1 and 2. The leanest carcass measured a fat thickness of .40 cm and the fattest carcass measured 2.30 cm.

A value that is widely utilized in RTU is the use of % IMF. When evaluating the mean at each session a steady increase in % IMF is recognized, and would be expected. The means at, scan 1, 2 and 3 were 1.61, 1.85, and 1.97, respectively. The standard deviation at each measurement was represented with 0.40 at scan 1, 0.42 at scan 2 and 0.47 at scan 3.

When evaluating the range from minimum to maximum values at each scan sessions, considerable differences were noted, at the time of scan 1, Group 1 (TAMU) cattle had a minimum % IMF measurement of .97 and a maximum of 2.59, scan 2 ranged from .97 to 2.66 and scan 3 values ranged from 1.11 to 2.88. When evaluating the maximum or minimum values among scan sessions, a noticeable difference was observed as indicated by scan 1 maximum of 2.59, scan 2 maximum of 2.66 and scan 3 2.88. This same trend prevailed when comparing all of the minimum values at each scan session.

Group 2 (BBU) cattle showed a similar trend with the lowest measurement of % IMF at Scan 1 being .68 and the highest being 2.92. Marbling (MARB) was estimated for Group 2 (BBU) cattle and the means for MARB was measured at 365.92 which correlates to the Select quality grade, the highest MARB measured at 480.00, which is estimated as a Choice quality grade.

Table 2. Summary statistics for Group 1 (TAMU) Choice and Select quality grades

Measure	Mean	Standard Deviation	Minimum	Maximum
Choice Quality Grade[a]				
Live animal measurments[c]				
WW, kg	265.61	33.11	204.17	322.14
Scan 1 REA, cm^2	46.31	2.10	38.05	56.11
Scan 1 FT, cm	0.30	0.10	0.20	0.40
Scan 1 IMF, %	1.68	0.41	1.03	2.59
Scan 2 WW, kg	268.45	36.52	206.90	323.05
Scan 2 REA, cm^2	48.11	2.00	41.15	58.31
Scan 2 FT, cm	0.20	0.10	0.20	0.40
Scan 2 IMF, %	1.88	0.40	1.13	2.66
Scan 3 WW, kg	317.38	38.35	253.18	377.50
Scan 3 REA, cm^2	84.82	1.28	70.31	97.39
Scan 3 FT, cm	0.50	0.10	0.20	1.00
Scan 3 IMF, %	2.05	0.49	1.21	2.88
Carcass measurements				
Final HCW , kg	362.91	31.42	301.27	443.74
Final REA, cm^2	97.13	2.80	87.07	110.94
Final FT, cm	0.80	0.40	0.30	1.70
Select Quality Grade[b]				
Live animal measurements[d]				
WW, kg	253.46	42.14	172.41	353.90
Scan 1 REA, cm^2	45.08	2.70	32.89	58.69
Scan 1 FT, cm	0.30	0.02	0.20	0.40
Scan 1 IMF ,%	1.55	0.38	0.97	2.36
Scan 2 WW, kg	263.08	42.92	190.56	361.16
Scan 2 REA.cm^2	48.95	3.80	34.05	66.82
Scan 2 FT, cm	0.20	0.10	0.20	0.30
Scan 2 IMF ,%	1.81	0.45	0.97	2.54
Scan 3 WW	311.13	43.95	239.56	405.63
Scan 3 REA, cm^2	88.82	4.20	69.01	106.43
Scan 3 FT, cm	0.40	0.20	0.20	0.80
Scan 3 IMF, %	1.89	0.44	1.11	2.87
Carcass measurements				
Final HCW,kg	356.34	45.74	276.77	451.91
Final REA, cm^2	103.33	4.40	82.56	123.84
Final FT, cm	0.60	0.20	0.30	1.10

[a] Cattle USDA choice quality grade

[b] Cattle USDA select quality grade

[c] Weaning weight = BW at ultrasound; scan 1, 2, 3 = ultrasound scan session; REA = of rib eye area at the 12th and 13th rib; scan 1, 2, 3 = ultrasound scan session; FT = ultrasound of 12th and 13th fat thickness; scan1, 2, 3 = ultrasound scan session
IMF = ultrasound predicted percent intramuscular fat; scan1, 2, 3 = ultrasound scan session

[d] Final HCW = hot carcass weight at harvest; Final REA = Carcass rib eye area at the 12th rib; Final FT = Carcass 12th rib fat thickness.

<u>Quality grade specifications</u>

One objective of this project was to evaluate live animal measurements and carcass traits of cattle with carcasses grading Choice vs. Select. Simple statistics of live animal and carcass traits fro choice vs. select are represented in Table 2 for Group 1 (TAMU) cattle and Table 6 for Group 2 (BBU) cattle. The traits analyzed in Tables 2 and 6 are also the same traits presented in Table 1, including measurements of ribeye area, fat thickness, percent intramuscular fat, and weight at the various scan sessions. However, the data presented in Table 2 and 6 shows the traits of animals whose carcasses were graded either choice or select at every state of scanning and at the eventual end-point.

Group1

Among Group 1 cattle, no significant differences were noted in weight of choice and select carcasses. However, differences in ribeye area (*P* = 0.04) and fat thickness (*P* = 0.01) did exist across quality grades, as depicted in Table 3. Choice carcasses weighed 362.80 kg ± 8.7 kg and select carcasses weighted 356.23 kg ± 8.9 kg. Choice carcasses weighed 6.57 kg more than select carcasses, and choice carcasses had 0.26 cm more fat than select carcasses. The least squares mean for carcass traits across quality grades are presented in Table 5.

Table 3. Summary of carcass trait ANOVA for Group 1 (TAMU) cattle based on quality grade classification

Trait	FHCW	FREA	FFT
Quality grade P-value	0.6	0.04	0.01
Means square error	7408.8	2.11	0.01
R-Square	0.007	0.10	0.16
CV	10.9	9.36	42.69

Final HCW = hot carcass weight at harvest;
Final REA = Carcass rib eye area at the 12th rib
Final FT = Carcass 12th rib fat thickness

In Table 4 summary of ultrasound trait ANOVA across quality grade Group 1 cattle for ultrasound traits showed no considerable differences in weight, ribeye area or percent intramuscular fat among scan 1, 2 or 3, across quality grades. The one trait that did express difference between quality grades was fat at scan 1 (*P* = 0.06), however there were no differences observed in fat at scan 2 or 3. At scan session 1, choice carcasses averaged 0.31 cm of fat and select carcasses averaged 0.28 cm of fat. The least squares means for ultrasound traits across quality grades for Group 1(TAMU) cattle are presented in Table 5.

Table 4. Summary of ultrasound trait ANOVA Group 1 (TAMU) cattle based on quality grade classification

Trait	Quality grade P- value	Mean square error	R-square	CV
Weaning weight	0.33	6931.1	0.027	14.55
Scan 1 Ribeye area	0.55	0.906	0.009	13.43
Scan 1 Fat thickness	0.06	0.0003	0.086	16.84
Scan 1 IMF	0.29	0.157	0.029	24.52
Scan 2 Weight	0.68	7679.6	0.004	14.96
Scan 2 Ribeye area	0.71	1.379	0.004	15.60
Scan 2 Fat thickness	0.87	0.0003	0.0007	24.13
Scan 2 IMF	0.62	0.01	0.157	0.159
Scan 3 Weight	0.64	8233.91	0.006	13.09
Scan 3 Ribeye area	0.19	2.17	0.046	10.95
Scan 3 Fat thickness	0.14	0.008	0.056	52.72
Scan 3 IMF	0.30	0.219	0.028	23.69

Weaning weight = BW at ultrasound; scan1, 2, 3 = ultrasound scan session
REA = of rib eye area at the 12th and 13th rib; scan 1, 2, 3 = ultrasound scan session
FT = ultrasound of 12th and 13th fat thickness; scan 1, 2, 3= ultrasound scan session
IMF = ultrasound predicted percent intramuscular fat; scan 1, 2, 3= ultrasound scan session

Table 5. Least squares means for ultrasound and carcass measurements for choice and select quality grade levels Group 1 (TAMU) cattle

	Choice	Select
Live animal measurements		
WW, kg	265.50 ± 8.4	253.39 ± 8.7
SC1REA, cm^2	46.25 ± 1.4	45.09 ± 1.4
SC1FT, cm	0.31 ± 0.0	0.28 ± 0.0
SC1IMF,%	1.6 ± 0.1	1.6 ± 0.1
SC2WT, kg	268.39 ± 18.8	263.01 ± 9.1
SC2REA, cm^2	48.05 ± 1.7	48.76 ± 1.7
SC2FT , cm	0.2 ± 0.0	0.2 ± 0.0
SC2IMF ,%	1.8 ± 0.1	1.8 ± 0.1
SC3WT,kg	317.28 ± 9.2	311.04 ± 9.4
SC3REA,cm^2	84.82 ± 2.13	88.81 ± 2.13
SC3FT, cm	0.46 ± 0.0	0.36 ± 0.0
SC3IMF ,%	2.05 ± 0.1	1.89 ± 0.1
Carcass measurements		
FHCW, kg	362.80 ± 8.7	356.23 ± 8.9
FREA, cm^2	15.06 ± 0.3	16.02 ± 0.3
FFT, cm	0.84 ± 0.1	0.58 ± 0.1

Weaning weight = BW at ultrasound; scan1, 2, 3 = ultrasound scan session
REA = of rib eye area at the 12th and 13th rib; scan1, 2, 3 = ultrasound scan session
FT = ultrasound of 12th and 13th fat thickness; scan1, 2, 3 = ultrasound scan session
IMF = ultrasound predicted percent intramuscular fat; scan1, 2, 3 = ultrasound scan session
Final HCW = hot carcass weight at harvest;
Final REA = Carcass rib eye area at the 12th rib
Final FT = Carcass 12th rib fat thickness

Table 6. Summary statistics for Group 2 (BBU) Choice and Select quality grade classes

Measure	Mean	Standard Deviation	Minimum	Maximum
Choice Quality Grades[a]				
Carcass measurements[c]				
HCW , kg	378.40	27.97	332.57	432.85
FT, cm	1.30	0.50	0.60	1.90
AFT , cm	1.40	0.50	0.80	2.00
REA, cm^2	80.11	3.33	58.69	94.17
KPH, %	2.43	0.33	2.00	3.00
MARB	425.71	30.81	400.00	480.00
Yield Grade	3.53	0.71	2.40	5.10
Live animal measurements[d]				
UFAT 1, cm	0.30	0.10	0.30	0.60
UREA 1, cm^2	51.21	2.50	36.76	59.34
UIMF 1 , %	1.59	0.50	0.30	2.70
UFAT 2 ,cm	0.50	0.10	0.30	0.80
UREA 2 ,cm^2	68.82	3.20	50.95	80.62
UIMF 2 ,%	1.95	0.51	1.04	3.21
Select Quality Grades[b]				
Carcass measurements[c]				
HCW, kg	367.51	31.42	303.09	434.66
FT, cm	1.00	0.40	0.40	2.30
AFT , cm	1.10	0.50	0.30	2.20
REA, cm^2	81.08	3.90	58.69	106.43
KPH, %	2.22	0.44	1.00	3.50
MARB	353.45	20.66	300.00	380.00
Yield Grade	3.09	0.75	1.30	4.40
Live animal measurements[d]				
UFAT 1 ,cm	0.30	0.10	0.20	0.60
UREA 1 ,cm^2	50.18	2.50	34.83	62.57
UIMF 1,%	1.40	0.49	0.68	2.92
UFAT 2 ,cm	0.40	0.10	0.30	0.70
UREA 2 ,cm^2	65.59	3.10	46.44	78.69
UIMF 2 ,%	1.60	0.52	0.92	2.94

:[a] Cattle USDA choice quality grade

[b] Cattle USDA select quality grade

[c] HCW = hot carcass weight at harvest;; FT = ultrasound of 12th and 13th fat thickness; AFT = actual fat thickness at the 12th rib; REA = of rib eye area at the 12th and 13th rib; KPH = percent kidney, heart, and pelvic fat; MARB = marbling score = carcass numeric marbling score where 300-399 is Slight 00 to Slight 99 (Select), 400 -499 is Small 00 to Small 99 (low Choice)

[b] UFAT = ultrasound of the 12th and 13th fat thickness scan 1, 2; UREA = ultrasound of the rib eye area at the 12th rib scan 1, 2; UIMF = ultrasound predicted percent intramuscular fat scan 1, 2.

Group 2

In Table 7, the change among carcass traits of fat, percent intramuscular fat and ribeye area are presented. These factors represent the change between the two scan sessions for the given trait across quality grades choice and select. There were no differences in scan sessions for fat and percent intramuscular fat change, however there was a slight difference between choice and select carcasses when looking at the change among ribeye area for scan sessions (*P* = 0.09). Choice carcass ribeye changed among scan sessions 18.13 $cm^2 \pm 1.29$ compared to select carcass ribeye 15.35 $cm^2 \pm 0.8$. As seen in Table 9 which provides the least squares means across quality grade for Group 2 (BBU) cattle.

Table 7. Summary of change in scan sessions for carcass trait ANOVA Group 2 (BBU) cattle based on quality grade classifications

Trait	FATchng	IMFchng	REAchng
Quality grade P-value	0.66	0.68	0.09
Means Square error	0.001	0.141	0.502
R- Square	0.36	0.03	0.24
CV	64.14	157.52	28.19

FATchng = change in ultrasound fat thickness at the 12th and 13th between scan 1 and 2
IMFchng = change in ultrasound percent intramuscular fat between scan 1 and 2
REAchng = change in ultrasound ribeye area at the 12th rib between scan 1 and 2

Table 8 summarizes ultrasound traits across quality grades for Group 2 (BBU) cattle. There were differences in fat, percent intramuscular fat and ribeye area for either one scan session or even both for some traits. Fat showed a difference at scan 1 (*P* = 0.04), as choice carcasses measured 0.36 cm of fat compared to select carcasses that measured .30 cm. There was no difference in percent intramuscular fat at scan 2 between choice and select carcasses, however at scan 1 slight differences were seen (*P* = 0.09) where, choice carcasses at scan 1 measuring 0.26 % more than select carcasses. Differences were also seen in ribeye area at scan 2 (*P* = 0.04), however there were no differences in ribeye area at scan 1. Choice carcass ribeye area was 4.83 cm^2 more than select carcasses at scan session 2. The least squares mean for carcass traits across quality grades for Group 2 are presented in Table 9.

Table 8. Summary of ultrasound trait ANOVA Group 2 (BBU) cattle based on quality grade classifications

Effect	FAT1	IMF1	REA1	FAT2	IMF2	REA2
Quality grade P-value	0.04	0.09	0.26	0.08	0.15	0.04
Means Square error	0.0005	0.19	0.55	0.001	0.19	0.96
R-Square	0.59	0.42	0.54	0.38	0.48	0.52
CV	18.85	30.19	9.47	21.77	26.20	9.51

FAT = ultrasound of the 12^{th} and 13^{th} fat thickness scan 1, 2
REA = ultrasound of the rib eye area at the 12^{th} rib scan 1, 2
IMF = ultrasound predicted percent intramuscular fat scan 1, 2.

Table 9. Least squares means for ultrasound and carcass measurements in Group 2 (BBU) cattle for quality grade classifications

	Choice	Select
Change in ultrasound measurement		
FATchng, cm	0.13 ± 0.0	0.10 ± 0.0
IMFchng. %	0.4 ± 0.1	0.2 ± 0.1
REAchng, cm^2	18.13 ± 1.29	15.35 ± 0.8
Live animal measurements		
WT1, kg	286.09 ± 26.5	279.41 ± 24.33
FAT1,cm	0.36 ± 0.0	0.30 ± 0.0
IMF1 ,%	1.74 ± 0.1	1.48 ± 0.1
REA1,cm^2	51.79 ± 1.5	49.92 ± 0.8
FAT2 ,cm	0.48 ± 0.0	0.43 ± 0.0
IMF2 ,%	1.92 ± 0.1	1.69 ± 0.1
REA2, cm^2	69.91 ± 1.9	65.08 ± 1.1

FATchng = change in ultrasound fat thickness at the 12^{th} and 13^{th} between scan 1 and 2
IMFchng = change in ultrasound percent intramuscular fat between scan 1 and 2
REAchng = change in ultrasound ribeye area at the 12^{th} rib between scan 1 and 2
FAT = ultrasound of the 12^{th} and 13^{th} fat thickness scan 1, 2
REA = ultrasound of the rib eye area at the 12^{th} rib scan 1, 2
IMF = ultrasound predicted percent intramuscular fat scan 1, 2

Ribeye area specification comparisons

Ribeye area classifications were formed based on carcasses having less than 70.95 cm^2 (referred to as Lower) 70.95 cm^2 to 90.3cm^2 (referred to as Middle) and over 90.30 cm^2 (referred to as Upper). This range was utilized based on industry preferred REA size for marketing purposes.

Group 1

When looking at the cattle representing the three ranges of lower, middle and upper ribeye area classes for Group 1 there were only cattle that fell into the middle and upper ranges of specifications were observed. When evaluating carcass traits across ribeye area ranges there were not any considerable differences across ribeye classification for hot carcass weight or final fat thickness as represented by FHCW (*P* = 0.48) and FFT (*P* = 0.10), in Table 10.

Table 10. Summary of carcass trait ANOVA for Group 1 (TAMU) cattle based on ribeye classification

Trait	FHCW	FREA	FFT
Ribeye area P-value	0.48		0.10
Means Square error	6341.90		0.02
R-Square	0.18		0.07
CV	10.00		45.29

Final HCW = hot carcass weight at harvest
Final REA = Carcass rib eye area at the 12th rib
Final FT = Carcass 12th rib fat thickness.

Based on ANOVA of ultrasound traits for ribeye classifications (Table 11) there were no differences in scan weight 1 or 3 among ribeye ranges, however a slight difference was seen in scan weight 2 (*P* = 0.09). Additional traits that saw no change were fat or percent intramuscular fat at all three scan sessions 1, 2 and 3 respectively. Ribeye area at scan 1 and 2 saw no differences across ribeye specifications, however scan 3 showed a difference (*P* = 0.01). Scan 3 ribeye area for the middle classification measured 79.2 $cm^2 \pm 3.3$ as compared to the upper range of ribeye area at 88.4 $cm^2 \pm 1.3$, therefore the upper ribeye area range was 9.2 cm^2 more than the middle range ribeye area , as depicted in Table 12 of least squares means for all traits based on ribeye area classifications.

Table 11. Summary of ultrasound trait ANOVA for Group 1 (TAMU) cattle based on ribeye classification

Trait	Reaspec	Mean square error	R-square	CV
WW, kg	0.21	6607.9	0.096	14.20
SC1REA, cm^2	0.27	0.715	0.239	11.94
SC1FT, cm	0.45	0.0003	0.016	24.37
SC1IMF,%	0.80	0.1553	0.007	24.37
SC2WT, kg	0.09	6830.5	0.138	14.10
SC2REA, cm^2	0.19	1.218	0.144	14.70
SC2FT , cm	0.71	0.0003	0.016	24.27
SC2IMF ,%	0.40	0.157	0.159	21.44
SC3WT,kg	0.11	7352.4	0.136	12.37
SC3REA,cm^2	0.01	1.466	0.376	8.97
SC3FT, cm	0.28	0.007	0.044	53.78
SC3IMF ,%	0.66	0.204	0.114	22.93

Weaning weight = BW at ultrasound; scan1, 2, 3 = ultrasound scan session
REA = of rib eye area at the 12^{th} and 13^{th} rib; scan1, 2, 3 = ultrasound scan session
FT = ultrasound of 12^{th} and 13^{th} fat thickness; scan1, 2, 3 = ultrasound scan session
IMF = ultrasound predicted percent intramuscular fat; scan1, 2, 3 = ultrasound scan session

Table 12. Least squares means (LSM $\pm$ SE) for ultrasound and carcass measurements Group 1 (TAMU) for middle and upper ribeye area specification levels

	Middle	Upper
Live animal measurements		
WW, kg	279.3 $\pm$ 15.6	258.3 $\pm$ 6.4
SC1REA, cm^2	48.5 $\pm$ 0.3	45.7 $\pm$ 0.8
SC1FT, cm	0.8 $\pm$ 0.0	0.8 $\pm$ 0.0
SC1IMF,%	1.6 $\pm$ 0.2	1.6 $\pm$ 0.1
SC2WT, kg	292.4 $\pm$ 15.8	263.6 $\pm$ 6.5
SC2REA, cm^2	52.8 $\pm$ 3.3	48.5 $\pm$ 2.0
SC2FT , cm	0.8 $\pm$ 0.0	0.8 $\pm$ 0.0
SC2IMF ,%	1.7 $\pm$ 0.2	1.8 $\pm$ 0.1
SC3WT,kg	340.6 $\pm$ 16.4	312.3 $\pm$ 6.7
SC3REA,cm^2	79.2 $\pm$ 3.3	88.4 $\pm$ 1.3
SC3FT, cm	1.3 $\pm$ 0.0	1.3 $\pm$ 0.0
SC3IMF ,%	1.8 $\pm$ 0.2	1.9 $\pm$ 0.1
Carcass measurements		
FHCW , kg	352.4 $\pm$ 15.3	364.1 $\pm$ 6.3
FFT, cm	0.3 $\pm$ 0.8	2.0 $\pm$ 0.0

Weaning weight = BW at ultrasound; Scan1, 2, 3 = ultrasound scan session; REA = of rib eye area at the 12^{th} and 13^{th} rib; FT = ultrasound of 12^{th} and 13^{th} fat thickness; IMF = ultrasound predicted percent intramuscular fat; Final HCW = hot carcass weight at harvest; Final REA = Carcass rib eye area at the 12^{th} rib; Final FT = Carcass 12^{th} rib fat thickness.

Group 2

In Table 13 ANOVA for carcass traits , Group 2 (BBU) there were no considerable differences among fat, kidney heart and pelvic fat or marbling were observed for Group 2 (BBU) cattle, however, there were differences in yield grade (*P* = .001) across ribeye classifications, and differences in carcass weight approached significance. Yield grades averaged 3.4 ± 0.2 in the lower range of ribeye as compared to 2.5 ± 0.2 in the upper range.

Table 13. Summary of carcass trait ANOVA Group 2 (BBU) cattle based on ribeye classifications

Trait	HCW	FAT	AFT	KPH	MARB	YG
Reaspec P-value	0.10	0.32	0.28	0.25	0.55	0.001
Means Square error	2269.1	0.28	0.03	0.17	1457.45	0.37
R- Square	0.62	0.31	0.31	0.27	0.25	0.52
CV	5.84	39.17	38.09	18.12	10.43	19.16

HCW = hot carcass weight at harvest; FT = ultrasound of 12th and 13th fat thickness; AFT = actual fat thickness at the 12th rib; REA = of rib eye area at the 12th and 13th rib; KPH = percent kidney, heart, and pelvic fat; MARB = marbling score = carcass numeric marbling score where 300-399 is Slight 00 to Slight 99 (Select), 400 -499 is Small 00 to Small 99 (low Choice).

In Table 14 ultrasound traits, Group 2 differences for ribeye specifications were not considerable when evaluating fat or % IMF at either of the two scan sessions; however, there were differences seen in ribeye area at scan time 1 (*P* = 0.03) and scan time 2 (*P* = 0.002). As seen in Table 15 least square means for ultrasound and carcass measurements for Group 2 (BBU) cattle REA 1 measured the greatest for the upper specification at 54.8 ± 0.8. This trend was also observed at scan 2 REA with the largest measurement in the upper range at 72.9 ± 0.9.

Table 14. Summary of ultrasound trait ANOVA Group 2 (BBU) cattle based on ribeye classifications

Effect	FAT1	IMF1	REA1	FAT2	IMF2	REA2
Reaspec P-value	0.70	0.27	0.03	0.48	0.15	0.0002
Means Square error	0.0005	0.19	0.49	0.001	0.18	0.79
R-Square	0.57	0.42	0.60	0.36	0.52	0.63
CV	19.48	30.19	8.95	22.50	25.83	8.57

FAT = ultrasound of the 12th and 13th fat thickness scan 1, 2
REA = ultrasound of the rib eye area at the 12th rib scan 1, 2
IMF = ultrasound predicted percent intramuscular fat scan 1, 2.

Table 15. Least squares means (LSM ± SE) for ultrasound and carcass measurements in Group 2 (BBU) calves for lower, middle and upper ribeye area specification levels

	Lower	Middle	Upper
Carcass measurements			
HCW , kg	355.8 ± 6.1	370.7 ± 4.2	374.5 ± 7.2
FAT ,cm	1.0 ± 0.8	1.3 ± 0.3	1.0 ± 0.3
AFT ,cm	1.0 ± 0.3	1.3 ± 0.3	1.0 ± 0.3
KPH ,%	2.2 ± 0.1	2.4 ± 0.1	2.4 ± 0.1
MARB	358.3 ± 10.7	369.5 ± 7.4	376.5 ± 12.8
YG	3.4 ± 0.2	3.3 ± 0.2	2.5 ± 0.2
Live animal measurements			
WT1, kg	267.0 ± 20.5	286.8 ± 26.3	287.1 ± 22.7
FAT1,cm	0.1 ± 0.0	0.8 ± 0.0	0.3 ± 0.3
IMF1 ,%	1.6 ± 0.1	1.5 ± 0.1	1.7 ± 0.1
REA1,cm^2	45.8 ± 0.9	51.0 ± 0.8	54.8 ± 0.8
FAT2 ,cm	0.5 ± 1.0	0.5 ± 1.3	0.5 ± 0.3
IMF2 ,%	1.9 ± 0.6	1.6 ± 0.5	1.6 ± 0.5
REA2, cm^2	58.7 ± 1.1	69.0 ± 0.9	72.9 ± 0.9

HCW = hot carcass weight at harvest; FT = ultrasound of 12th and 13th fat thickness; AFT = actual fat thickness at the 12th rib; REA = of rib eye area at the 12th and 13th rib; KPH = percent kidney, heart, and pelvic fat; MARB = marbling score = carcass numeric marbling score where 300-399 is Slight 00 to Slight 99 (Select), 400 -499 is Small 00 to Small 99 (low Choice)
UFAT = ultrasound of the 12th and 13th fat thickness scan 1, 2; UREA = ultrasound of the rib eye area at the 12th rib scan 1, 2; UIMF = ultrasound predicted percent intramuscular fat scan 1, 2.

<u>Correlations among traits</u>

Correlation coefficients are used commonly to evaluate the accuracy of certain traits to predict other traits. However, correlation coefficients alone do not provide quantitative information that allows economic interpretations, but rather give a degree of relationship between traits. In addition, a user might be more interested in categorization and whether ultrasound technology simply can predict whether an animal will grade a certain USDA grade (Brethour, 2000).

In most research related to ultrasound use, ultrasound measurements are often correlated to carcass measurements, which is comparable to the method utilized in this project. The challenge encountered is delineating the contribution of environment in the outcome of the data collected. Stenzleni et al. (2002) evaluated genetic and phenotypic parameters as related to ultrasound and the information collected suggests that there was low to almost zero, genetic correlation of REA and FT (-0.09). There is also low genetic correlation between REA and % IMF.

The use of correlation coefficients in this project concentrates on the usefulness of RTU to determine if scanning of cattle early in life (i.e., at weaning or the period during a pre-conditioning phase, feellot entry, etc.) relates usefully to actual carcass traits. As a result, the correlations investigated were among the carcass traits and their respective ultrasound measurements at earlier times.

Ribeye Area

Table 16 provides the correlations among ribeye area measurements in Group 1 (TAMU) cattle. The highest correlation was between ribeye area at scan 3 and carcass ribeye area (r = 0.8094; *P* < .0001). The least significant was the correlation of ribeye area at scan 1 and carcass ribeye area (r = .1576; *P* = 0.3381). As anticipated the correlation grew stronger between ultrasound measures and carcass ribeye area as the scan time was closer to harvest date. The correlation of ribeye area at time 2 and carcass ribeye area was intermediate (r =.3438; *P* = .0321).

Table 16. Correlation coefficients for Group 1 (TAMU) ribeye measurements

Trait	SC2REA	SCREA3	FREA
SC1REA	0.4976	0.2605	0.1576
	0.0013	0.1093	0.3381
SC2REA			
		0.2625	0.3438
		0.1064	0.0321
SC3REA			
			0.8094
			< .0001

SC 1, 2, 3 = ultrasound scan session
REA = of rib eye area at the 12^{th} and 13^{th} rib
FREA = final rib eye area at the 12^{th} and 13^{th} rib.

Group 2 (BBU) ribeye area correlations are shown in Table 17. The most significant correlation was found between ribeye area at times 1 and 2 (r =.8092; *P* < .0001). There was an intermediate correlation between carcass REA and REA1 at (r = 0.5525; *P* <.0001) and carcass REA and REA2 (r = 0.6386; *P* < .0001). Both group 1 and 2 cattle depict a similar trend when evaluating the correlations of ribeye area.

These data support findings of Crews et al. (2002) for the trend in REA growth by establishing that muscle area measurements taken at weaning, yearling and prior to harvest had high and positive residual correlations ranging from 0.79 to 0.86, indicating that repeated measures of muscle area from the same animal are similar when utilizing real time ultrasound (RTU). Similarly, Hassen et al. (1998) reported repeatability estimates for RTU muscle area of 0.97 when the two measurements were taken on consecutive days prior to harvest.

Table 17.Correlation coefficients for Group 2 (BBU) ribeye measurements

Trait	REA2	REA
REA1	0.5525 <.0001	0.6386 <.0001
REA2		0.8092 <.0001

REA = of rib eye area at the 12th and 13th rib
REA1 and 2 = rib eye area ultrasound scan session

Backfat Thickness

Correlations in many studies depict a relationship between carcass fat thickness and ultrasound fat thickness, especially as scan sessions were performed closer to slaughter date. These correlations are presented in Table 18 for Group 1(TAMU) cattle. Similar to the correlations found for REA, it is recognized that the correlations for fat became stronger when closer to the end-point. This was observed with most significant correlation at scan 3 FT and final fat thickness (r = 0.8304, *P* = <.0001) and the least significant at scan 1 and scan 2. Scan1 appeared to have a low correlation with scan 2 and scan 3 or for final fat thickness. The least significant correlation was noted between scan 2FT (r =0.3287, P =0.0411) and fat thickness. Scan 2FT also showed little relationship with scan 3FT or FFT but the least significant measurement of all was scan FT with scan 3FT (r = 0.2095, P = 0.2006).

In other similar studies correlation estimates between ultrasound and actual FT have been found to range from .76 to .93 (Perkins et al., 1997). The general consensus of most studies is that RTU of FT is fairly accurate, but variation may occur by underestimating actual FT in fatter cattle and overestimating FT in leaner cattle (Perkins et al., 1997; Charagu et al., 2000). Ultrasound estimates of FT have been within .1 inch of actual FT in 70% (Perkins et al., 1992), 72% (Perkins et al., 1992), 62 % (Walder et al., 1992) and 56% (Hassen et al., 1995) of animals scanned. This has relevance to this project due to the range in fat that would be seen from weaning to the scan session performed in the feeding phase.

Waldner et al. (1992), evaluated scan sessions ranging from 4 mos to 2 yrs on Brangus bulls and found that the analysis of actual differences between scanned and actual FT were significant amongst all scan periods performed in the study. Estimation of FT was most accurate ($P < .05$) at 16 mos, followed by mo 12, 20 and 24. Waldner et al. (1992) further stated that as FT increased above 1.0 cm, FT was increasingly underestimated. These findings agree with (Parrett et al. (1987) and Smith et al. (1990). In addition, Waldner et al. (1992) found there was a tendency to overestimate thin cattle and underestimate fat cattle.

Table 18. Correlation coefficients for Group 1 (TAMU) fat measurements

Trait	SC2FT	SC3FT	FFT
SC1FT	0.4221 0.0074	0.3287 0.0411	0.3383 0.0352
SC2FT		0.2095 0.2006	0.0499 0.7628
SC3FT			0.8304 <.0001

SC 1, 2, 3 = ultrasound scan session;
FT = ultrasound of 12th and 13th fat thickness;
FFT= final fat thickness at the 12th rib.

When evaluating Group 2 (BBU) cattle for correlations of fat measurements there were similar findings to those of Group 1 (TAMU) cattle. FAT1 (Table 19) had the most significant value when related to FAT2 scan measurement at (r = 0.5098, *P* = <.0001) and the least when compared to actual fat measurements on the carcass. FAT2 is most significant when correlated to FAT at (r = 0.627, *P* = < .0001).

The trend of greater relationship in scanning periods continues to be seen when the scan sessions are performed closer to the animal's end-point; however, the ability of RTU to estimate backfat in cattle that are not excessive in subcutaneous fat or thinner in condition is a useful management tool.

Table 19. Correlation coefficients for Group 2 (BBU) fat measurements

Trait	FAT2	FAT
FAT1	0.5098 <.0001	0.3117 0.0097
FAT2		0.6027 <.0001

FAT 1 and 2 = ultrasound scan session;
FAT= final fat thickness at the 12th rib.

Intramuscular Fat

A major point of interest in many studies utilizing RTU is determining intramuscular fat. Of the typical traits evaluated, RTU does seem to have one of the stronger relationships with actual carcass data. Correlations between ultrasound intramuscular fat and actual marbling scores have ranged from 0.35 to 0.87 (Wilson, 1992; Izquierdo et al., 1994; Hassen et al., 1995; Perkins et al., 1997). Perkins et al. (1997) found correlations between ultrasound intramuscular fat and actual carcass quality grade to be 0.69. Brethour (2000) indicated correlations between serial ultrasound marbling scores to be as high as 0.85. Duckett and Klien (1997) found that carcass quality grade was accurately predicted from ultrasound intramuscular fat content for 75% of steers used in their project. In a study where stocker steers were scanned at the end of a stocker grazing period prior to shipment to the feedyard, correlations between actual carcass quality grade and pre-feeding period ultrasound intramuscular fat have been estimated at 0.49 (Field et al., 2000).

The information gathered in this particular study compliments the findings of other projects. When analyzing Group 1 (TAMU) cattle for intramuscular fat correlations, there was a highly significant relationship between scan 2 IMF and scan 3 IMF (r = 0.9116, *P* = < .001), as seen in Table 20. The lowest correlation occurred between scan 1 IMF and scan 3 IMF (r = 0.3865, *P* = 0.151) and was very similar to the correlation between scan 1 IMF and scan 2 IMF (r = .3982; *P* = .0121).

Table 20. Correlation coefficients for Group 1 (TAMU) IMF measurements

Trait	SC2IMF	SC3IMF
SC1IMF	0.3982 0.0121	0.3865 0.0151
SC2IMF		0.9116 <.0001

SC 1, 2, 3 = ultrasound scan session;
IMF = ultrasound predicted percent intramuscular fat

Group 2 (BBU) cattle are represented by somewhat different time frames for scanning periods when compared to Group 1 (TAMU) cattle. However, when looking at Table 21 and comparing IMF1 to IMF2 it is noted that relatively strong relationship exists (r = 0.6983, *P* = < .0001). When comparing IMF1 and IMF2 to MARB they were lowly correlated as represented by (r = 0.2023, *P* = 0.0947) and (r = 0.2661, *P* = 0.0295), respectively.

Wall et al.; (2004) studied the body composition changes in steers and utilized RTU 100 and 65 d before slaughter and this project found the correlation between IMF and marbling scores remained somewhat constant from 100 d before slaughter to just 1 wk Pre-slaughter (r = 0.63 to 0.61). This pre-slaughter correlation is similar to that published by Tait (2002; r = 0.63). Results from the 61 to 69 d scanning period were consistent with all other scan sessions (r = 0.62). Results from Tait (2002) indicated that the deposition of marbling appears to be linear over days of age, suggesting IMF measurements taken 100 d before slaughter may be useful as one taken much closer to the slaughter date.

Table 21. Correlation coefficients for Group 2 BBU IMF measurements

Trait	IMF2	MARB
IMF1	0.6983	0.2023
	<.0001	0.0947
IMF 2		0.2661
		0.0295

IMF 1 and 2 = ultrasound predicted percent intramuscular fat at scan sessions
MARB = MARB = marbling score = carcass numeric marbling score where 300-399 is Slight 00 to Slight 99 (Select), 400 -499 is Small 00 to Small 99 (low Choice)

SUMMARY

The objective of this study was to determine if utilizing ultrasound data on the life of feeder calves and throughout the feeding period could provide meaningful carcass information that may be incorporated into subsequent management or marketing decisions. The project evaluated quality grade (choice and select) and ribeye specifications in two sets of cattle. The importance of the project rests on the increased emphasis on value-based marketing which has forced producers to consider quality and carcass merit in their cattle prior to marketing decisions. Producers have little objective information on which to base marketing decisions prior to harvest and the use of ultrasound could prove to be a viable source to meet these needs.

The challenge for the producer is to know when to utilize ultrasound and if it is feasible economically. This study scanned two separate (Group 1 = TAMU and Group 2 = BBU) but similarly managed groups of cattle at weaning and periods throughout the feeding period. Emphasis was placed on evaluated ultrasound differences between choice and select carcasses and ribeye area size classes designated as Lower (less than 70.95 cm^2), Middle 70.95 cm^2 to90.3cm^2), and Upper over 90.30 cm^2).

Group 1(TAMU) cattle saw no differences in weight between choice and select carcasses. However, differences in ribeye area (P = 0.04) and fat thickness (P = 0.01) did exist across quality grades. Choice carcasses weighed 362.80 kg $\pm$ 8.7 kg and select carcasses weighted 356.23 kg $\pm$ 8.9 kg while choice carcasses had 0.26 cm more fat than select carcasses.

Group 1 cattle for ultrasound traits showed no considerable differences in weight, ribeye area or percent intramuscular fat among scan 1, 2 or 3. The one trait that did express difference across quality grades was fat at scan 1 (*P* = 0.06), with no differences seen in fat at scan 2 or 3. Group 2 (BBU) cattle saw slight differences between choice and select carcasses when looking at the change among ribeye area in designated scan sessions (*P* = 0.09). Choice carcass ribeye areas differed across scan sessions 18.13 cm^2 $\pm$ 1.29 compared to select carcass ribeye 15.35 cm^2 $\pm$ 0.8.

Group 1 (TAMU) cattle saw ribeye area at scan 1 and 2 with no differences across ribeye specifications, however scan 3 showed a difference (*P* = 0.01). Scan 3 ribeye area for the middle classification measured 79.2 cm^2 $\pm$ 3.3 as compared to the upper range of ribeye area at 88.4 cm^2 $\pm$ 1.3. Group 2 (BBU) cattle had differences in yield grade (*P* = .001) across ribeye classifications, and differences in carcass weight approached significance. Yield grades averaged 3.4 $\pm$ 0.2 in the lower range of ribeye as compared to 2.5 $\pm$ 0.2 in the upper range.

The concept of early ultrasound data appears to hold promise in predicting carcass traits for commercial and feedlot systems. From the data collected in this project it appears that there are stronger correlations when scan sessions are closer to end-point; this presents challenges because managers need to sort and make management decisions early in the feeding phase. Procedures to incorporate multiples sources of information are needed. Additionally, this type of research needs more study with other cattle types and other feedlot management programs for wide-scale adoption.

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