Instrument vs Manual Sortation of Feedlot Steers and Heifers

R.E. Peterson, D.R. Gill, C.R. Krehbiel, and H.G. Dolezal

Story in Brief

The objectives of this study were: 1) to assess the effectiveness of sorting feedlot steers and heifers by traditional practices (visual appraisal and manual sortation) vs using ultrasound (scanned once or twice) for projected yield grade, and 2) to determine the success of sorting based on ultrasound measures for feedlot steers and heifers obtained once (reimplant time) vs twice (upon arrival and again at reimplant time). Based on the results of this experiment, we conclude that the use of ultrasound technology to predict days on feed to optimize yield grade resulted in feedlot cattle being harvested too early in the feeding period. Adjusting the parameters of the ultrasound prediction equations may improve the accuracy of ultrasound sortation of feedlot steers and heifers. In addition, ultrasounding cattle closer to the projected time of harvest may improve the accuracy of ultrasound sortation.

Key Words: Ultrasound, Yield Grade, Days on Feed, Carcass Characteristics

Introduction

Currently, there is an increased interest in the development of objective cattle marketing systems that can evaluate carcass value on an individual live animal basis. Therefore, an objective method that can identify individual carcass merit on a live animal basis is necessary to aid in determining value. The evaluation technique used to determine carcass value in the live animal must be accurate, objective, and able to perform without disrupting normal cattle handling activities. One technology that has been considered, and may satisfy these requirements, is the use of real time ultrasound to predict carcass characteristics (Hamlin et al., 1995; Brethour, 2000). Ultrasound technology is a non-invasive procedure that utilizes an ultrasonic contact transducer and an ultrasonic analyzer. Objectively measured ultrasound variables can be combined with live weight and average daily gain to predict days on feed required to reach a final carcass compositional end point target. The objective of this experiment was to determine, in a commercial feedlot setting, the effectiveness and accuracy of using objective ultrasound sortation measures for grouping feedlot steers and heifers into uniform marketing groups when compared to a subjective, visually sorted control group.

Materials and Methods

Initial Data Collection. All cattle in the experiment were identified and tracked by use of electronic identification (EID; Allflex USA, Dallas, TX; Temple Tag Inc., Temple, TX). Ten lots of cattle were used for initial ultrasound data collection for this experiment. These lots resulted in initial ultrasound data for 239 heifers and 390 steers and an initial control group of 232 heifers and 419 steers for a total of 471 heifers and 809 steers in the experiment. A description of cattle at the time of initial ultrasound sortation is presented in Table 1.

Table 1. List of animals used in experiment

Item	Animals	Weight	STD[a]	DOF[b]
Feedyard A				
Heifers	145	358	40	70
Steers	496	395	50	23
Feedyard B				
Heifers	326	374	41	67
Steers	313	429	61	62

[a]Standard Deviation

[b]Days on feed at first ultrasound

Initial ultrasound data collection occurred on May 14 and 15, 2002. Each animal in his or her respective lot was put through a squeeze chute at the processing area. These animals were then sorted into one of two treatment groups. Treatment groups were either: 1) ultrasounded and placed into one of three ultrasound harvest, or market groups, or 2) not ultrasounded and marketed through traditional subjective visual appraisal and manual sortation. Randomization of treatment groups was accomplished by ultrasounding every other calf that entered the chute at processing. Commercially available ultrasound equipment was used for ultrasound data collection.

Ultrasound sorted groups were differentiated by placing different color visual identification (VID) ear tags in the ear of each animal. Ultrasound managed animals were sorted based on objective ultrasound predictions and each individual calf was placed into a harvest group that would optimize finishing performance by setting a yield grade ceiling of 2.80 with a carcass weight range of 600 to 900 lb regardless of predicted yield grade. The non-ultrasound treatment group was sorted as cattle in those groups reached a market endpoint based on subjective visual appraisal of finish as determined by the respective feedlot manager. Manually sorted cattle were marketed at the discretion of feedlot personnel when cattle appeared to reach the optimum degree of finish.

Second Data Collection. On July 18, 2002, four lots of cattle that were previously ultrasounded were randomly selected for second scan ultrasound data collection. These four lots of cattle resulted in second scan ultrasound data for a combined 348 total animals (n=268 steers; n=80 heifers). Second scan ultrasound data were randomized by ultrasounding every other calf through the squeeze chute that had previously been ultrasounded.

Carcass Data Collection. At harvest, all carcass data were collected via Video Image Analysis (VIA). Video Image Analysis is instrument-grading technology that is now being used in some commercial packing plants to assess an objective measure of yield and quality grade to beef carcasses. Cross et al. (1983) first used VIA to predict carcass composition. When VIA variables, total lean area (cm2) and total fat area (cm2) were combined with rib weight and fat thickness, a coefficient of determination of 93.6% was observed for kilograms of lean. More recently, Cannell et al. (1999) reported that instrument grading technology, such as VIA, may more accurately predict carcass cut out yields and yield grades than online graders. All cattle in the experiment were harvested at the Friona Packing Plant of the Excel Corporation packing division in Friona, Texas.

Statistical Analysis. Carcass data were analyzed using the MIXED procedure of SAS (1998; SAS Inst. Inc., Cary, NC). Individual animal served as the experimental unit. The model included terms for feedlot, lot, treatment, and sex. Tests for interactions of the main effects of feedlot, treatment, and sex were done. Lot served as a random effect in order to control for carcass data recovery rate within lot and feedyard. All treatment means were derived from VIA measures taken at the Friona Packing Plant, Friona, Texas.

Results and Discussion

Carcass data collection from VIA measures by way of EID resulted in an approximately 30% loss of data. These data were not recovered for a variety of reasons, including lost EID tags, missed EID read at the packing plant, or cattle from the experiment being placed in the wrong kill lot. For data recovered, carcass characteristics are reported by treatment and sex in Table 2. Hot carcass weights were lower for heifers and steers that were ultrasounded. Steers had a greater amount of REA compared with heifers, however REA was not different between ultrasound treatment groups. Cattle that were ultrasounded had a greater amount of ribeye area per 100 lb of carcass (REACWT) than did cattle that were not ultrasounded. Likewise, heifers had a greater amount of REACWT than did steers. Fat thickness was not different between heifers and steers. Heifers had a greater percentage of marbling compared with steers and non-ultrasounded cattle had a greater percentage of marbling compared with cattle in the ultrasound treatment group. Vision scan calculated yield grade (VSYG) was lower for cattle that were ultrasounded, but was not different among sexes. Quality grade was lower for cattle that were in the ultrasound treatment group, however, QG was not different between heifers and steers.

These results indicate that cattle in the ultrasound treatment group were harvested too early in the feeding period. Although VSYG was decreased as a result of ultrasound sortation, it was decreased at a much greater rate than desired. The target yield grade ceiling for this experiment was 2.80. Both heifers and steers in the ultrasound treatment group were well below the yield grade ceiling of 2.80, at 2.10 and 2.20, respectively. In addition, HCW was decreased at a much larger rate than desired. The carcass weight ceiling that was the target for this experiment was 900 lb. Both heifers and steers in the ultrasound treatment group were well below 900 lb, averaging 644 and 763 lb, respectively. Decreasing days on feed in an attempt to control yield grade can have negative affects on quality grade.

Ultrasound sortation, in an attempt to control yield grade and carcass weight, resulted in less days fed compared with control cattle. Days on feed averaged 162, 152, 151, and 141 for control and ultrasounded heifers and steers, respectively. The result of decreased days fed on carcass characteristics have been documented by several researchers (Hicks et al., 1987; Van Koevering et al., 1995; Gardner and Dolezal 1996). In a serial harvest study conducted by Hicks et al. (1987), it was reported that numerical USDA yield grades increased with increased time on feed. Similarly, Van Koevering et al. (1995) reported that marbling score and the percentage of cattle grading U.S. Choice increased with time on feed but at a decreasing rate (quadratic; $P<.05$). In addition, Gardner and Dolezal (1996) reported that feeding cattle for extended periods of time resulted in increased yield grades. Although these researchers (Hicks et al., 1987; Van Koevering et al., 1995; Gardner and Dolezal, 1996) were reporting on the negative effects of increased time on feed in an attempt to optimize quality grade, the decreased time fed for cattle that were in the ultrasound treatment group squarely reflects the negative affects of decreased time on feed. It appears these researchers (Hicks et al., 1987; Van Koevering et al., 1995; Gardner and Dolezal, 1996) are in agreement that increasing days on feed will result in increased yield and quality grades, or conversely, decreasing days on feed will result in decreased yield and quality grades.

There may be other factors that could explain some of these results, however, both heifers and steers that were not ultrasounded had more desirable VSYG (2.53 and 2.57) and HCW (715 and 803 lb, respectively) compared with cattle that were ultrasounded. The trends seen here for VSYG and HCW are supported by a similar trend for the remainder of the carcass measures. For example, reduced fat thickness, percent marbling, and quality grade were observed for cattle in the ultrasound treatment group compared with cattle that were not ultrasounded. Because of this it should be evident that cattle in the ultrasound treatment group were simply harvested too early in the finishing period. These trends remain evident when carcass measures are reported as the entire data set or within feedyard.

Table 3 displays the carcass characteristics for steers that were ultrasounded once versus twice. Because of the low initial number of cattle in the scan twice treatment group, there were fewer cattle (n=5 heifers; n=48 steers) for which we were able to collect subsequent carcass data. Because of the low number of heifers in the scan twice treatment group, heifers were not included in the final scan twice analysis.

Hot carcass weight was not different between cattle that were scanned once compared to cattle that were scanned twice. There was a tendency for REA to be greater for cattle that were scanned once compared with cattle that were scanned twice. Fat thickness was different between scan once and scan twice treatments with scan twice cattle (.41 in) having approximately .04 in more fat than scan once cattle (.37 in). There was also a tendency for percent marbling to be higher in cattle that were scanned twice versus once. Scanning cattle twice resulted in an increase in VSYG compared with scanning cattle once. There were no differences in QG between scan once and scan twice cattle.

Although there was a limited number of cattle in the scan twice treatment group, there does appear to be some improvements in carcass merit due to ultrasounding cattle a second time. In order to take full advantage of scanning cattle a second time, initial ultrasound data should be utilized to document rate of compositional change. Ultrasounding cattle a second time will allow the ability to calculate rate of compositional change in the carcass because of documented carcass measures taken at two different points in time. Scanning cattle a second time should improve the prediction when used with initial ultrasound data because of the added knowledge of rate of compositional change that each animal exhibits.

If ultrasound measures and/or prediction equations were inaccurate, and were to be recalibrated, ultrasound sortation may have the ability to do a better job of grouping live cattle into harvest, or market groups based on their carcass composition. In addition to possible calibration errors, errors in objectivity may have also occurred during the time of initial data collection. For example, accurate live weights and real time average daily gain for each animal in the ultrasound treatment group are needed for objective predictions. Regardless of how much emphasis the ultrasound prediction equations place on live weight and live weight gain, it is crucial to have accurate inputs into these equations not only for current predictions, but also for improving the system over time. If at any point during this experiment any type of subjectivity or inaccurate data were used when sorting cattle into ultrasound harvest groups, the purpose of objective appraisal was not accomplished.

Implications

The comparison of data between treatment groups indicates that ultrasounded cattle were harvested too early in the production cycle. The obvious error in harvest time could be a result of an error in calibration of the ultrasound prediction equations or simply a function of inaccurate ultrasound measures. Managing groups of cattle with similar composition, instead of individual animals within groups widely varying in composition, may improve the overall accuracy of ultrasound prediction equations. In addition, utilizing accurate inputs and improving on the prediction equations already in place would not only reduce subjectivity but also increase the accuracy of the methods to identify differences in fatness among live cattle.

Table 2. Comparison of carcass characteristics of feedlot steers and heifers manually (pen riders) or ultrasound sorted in commercial feedlots

	Heifers		Steers			P>F		
Item	No Ultrasound	Ultrasound	No Ultrasound	Ultrasound	SEM	Sex	Ultrasound	Sex Ultrasound
Number of Animals	177	119	301	291	---	---	---	---
Hot Carcass Wt, lb	715	644	804	763	12.16	<.001	<.001	.16
REA, in^2	13.64	13.40	14.37	14.41	.28	<.001	.59	.48
REA/CWT	1.92	2.09	1.79	1.90	.04	<.001	<.001	.50
Fat Thickness, in	.48	.36	.46	.38	.03	.68	<.001	.42
% Marbling	2.55	2.26	2.20	1.98	.09	<.001	<.01	.64
VIA Calc. YG	2.53	2.10	2.57	2.20	.14	.58	<.01	.74
Quality Grade	357	317	336	319	7.23	.52	<.001	.06
%Prime	1.69	1.68	0	0	---	---	---	---
% Choice	57.63	31.09	39.20	28.87	---	---	---	---
% Select	37.29	54.62	56.81	63.57	---	---	---	---
% No Rolls	3.39	12.61	3.99	7.56	---	---	---	---

Table 3. Carcass characteristics of steers ultrasounded once versus twice

	Steers			
Item	Once	Twice	SEM	P>F
Number of Animals	244	48	---	---
Hot Carcass Wt, lb	764	747	13.70	.23
REA, in^2	14.50	14.12	.31	.23
REA/100 lb	1.91	1.90	.05	.82
Fat Thickness, in	.37	.41	.03	.22

% Marbling		.37		.41	.03	.21
VIA Calc. YG		2.19		2.31	.15	.43
Quality Grade		320		315	9.37	.57
% Prime		0		0	---	---
% Choice		6.97		10.42	---	---
% Select		64.34		60.42	---	---
% No Rolls		28.69		29.17	---	---

Literature Cited

Brethour, J.R. 2000. J. Anim. Sci. 78:2055.

Cannell, R.C. et al. 1999. J. Anim. Sci. 77:2942.

Cross, H.R. et al. 1983. J. Anim. Sci. 57:908.

Gardner, B.A. and H.G. Dolezal. 1996. Factors affecting carcass characteristics. Mallinckrodt Veterinary Conference, Beaver Creek, CO.

Hamlin, K.E. et al. 1995. J. Anim. Sci. 73:1725.

Van Koevering, M.T. et al. 1995. J. Anim. Sci. 73:21.
