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Summary

One hundred seventy-four mixed crossbred yearling steers (789 lb) were used to determine if ultrasound technology could be used to predict eventual marbling score in incoming feedlot cattle. Implants were also administered to study the effects of anabolic agents on marbling. Steers were fed in a single pen at a commercial feedlot for an average of 127 days, slaughtered, and carcass data were collected. Implanted cattle gained significantly more weight ($P<.05$) than nonimplanted cattle. Steers implanted with Revalor gained weight more rapidly than Synovex implanted cattle. Steers that were implanted with Revalor showed a significant decrease in marbling score when compared to no implant and Synovex groups. The percentage of choice carcasses for no implant, Revalor, and Synovex were 65.5, 47.4, and 68.4. The correlation between initial ether extract, as estimated by ultrasound, and marbling score was .45 and a prediction equation including coat color, initial ether extract, and Revalor implant accounted for 26.59% of the variability in the final marbling score.

Key Words: Implants, Ultrasound, Marbling

Introduction

Implants have been used in the beef industry to improve growth rates, feed conversion, and cutability. However, some studies have shown that implants may reduce marbling score and, therefore, reduce USDA quality grades. According to the 1991 National Beef Quality Audit, $21.68/carcass was lost due to insufficient amounts of marbling and another $219.25 from excess fat. These nonconformities are pushing the beef industry toward a value based marketing system in order to more adequately meet consumer demand for quality and lean.

With value based marketing, risk will be transferred from buyer to seller. Management and marketing tools will be needed to minimize this risk. Ultrasound technology could provide a means to make decisions such as implant or marketing strategy at feedlot arrival. The objectives of this study were to evaluate the use of ultrasound technology to sort incoming feedlot cattle by marbling potential and to study how implants affect marbling.

Materials and Methods

One hundred seventy-four crossbred yearling steers (789 lb) were delivered to a commercial feedlot[3] in central South Dakota. Steers had been on pasture in western South Dakota and had not been implanted during the grazing season.

At processing, cattle were weighed, vaccinated, treated for parasites with Ivomec[4] and implanted. Hip height was measured and coat color was recorded as red, black, or other. Ultrasound scans for initial rib eye area, 12th rib fat, and percentage of intramuscular fat were collected by Middle America Network of Mapleton, Iowa, and evaluated by Iowa State

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[4]Product of MSD AGVET, Rahway, NJ.

University, Ames, Iowa. Implants (Revalor[5], Synovex[6], or no implant) were administered in a completely random design. Steers were then fed in one pen for an average of 127 days, slaughtered, and carcass data collected after a 24-hour chill. Final weight was determined by dividing hot carcass weight by average dressing percentage at each slaughter date.

Average daily gain and carcass traits were evaluated using GLM procedures of SAS. Class variables included in the model were color and treatment. Treatment means were separated using orthogonal contrasts. The model to predict marbling score was developed using forward selection regression techniques. The full model evaluated was marbling score = a + b (blk) + c (red) + d (Rev) + e (Syn) + f (hpht) + g (in fat) + h (in REA) + i (in EE) + j (in wt) + error, where blk = black steers, red = red steer, Rev = Revalor, Syn = Synovex, hpht = hip height, in fat = initial fat, in REA = initial rib eye area, in EE = initial ether extract, and in wt = initial weight. Two-way interactions were also examined in the analysis. Only variables that were significant ($P<.10$) were left in the reduced model. Percentage choice data were tested using Chi square analyses.

Results and Discussion

Table 1 shows the effect of implant on weight and average daily gain. Implants had a significant effect ($P<.05$) on average daily gain as compared to controls. Steers implanted with Revalor had greater ($P<.05$) average daily gains when compared to Synovex implanted steers.

Table 1. Weight and average daily gain (lb)[a]

Item	Control	Revalor	Synovex
Initial weight, lb	787 ± 8.97	783 ± 8.40	791 ± 8.50
Final weight, lb	1142 ± 14.20	1228 ± 12.02	1186 ± 11.75
Average daily gain, lb[bc]	2.78 ± .07	3.51 ± .09	3.17 ± .09

[a]Means ± standard error.
[b]Implant vs control ($P<.05$).
[c]Revalor vs Synovex ($P<.05$).

Table 2 displays carcass data for the steers. Implants did not affect hot carcass weight, 12th rib fat, rib eye area, or yield grade. Revalor significantly reduced ($P<.05$) marbling score. Percentage of choice carcasses for control, Revalor, and Synovex were 65.5, 47.4, and 68.4, respectively. These differences were statistically significant as determined by Chi square ($P<.10$).

Table 3 shows initial fat, initial rib eye area, and initial ether extract as determined by ultrasound. Initial fat thickness averaged .13 inch and ranged from .06 to .25 in. Initial ether extract as predicted by ultrasound averaged 1.74% and ranged from .957 to 2.85%. The correlation between initial ether extract and marbling score was .45.

Table 4 shows the reduced model predicting marbling score. Initial ether extract entered the model first and accounted for 19.86% of the variability. For each additional percent unit of ether extract, marbling score increased .56 units. The second variable to enter the model was Revalor which accounted for an additional 3.84% of the variation in marbling score. If Revalor was used as the implant, marbling score appears to have been reduced as compared to the nonimplanted control steers. However, the effect of Revalor on marbling appeared to depend on the initial ether extract content as the interaction between Revalor and ether extract

[5]Hoescht-Roussel, Somerville, NJ.
[6]Syntex Animal Health, Des Moines, IA.

Table 2. Implant effect on carcass traits[a]

	Control	Revalor	Synovex
Hot carcass wt, lb	694 ± 8.69	747 ± 3.33	722 ± 7.17
Fat thickness, in.	.35 ± .02	.43 ± .141	.39 ± .02
Rib eye area, in.^{2}	12.39 ± .15	12.99 ± .18	12.33 ± .97
Yield grade, units	2.54 ± .08	2.53 ± .08	2.75 ± .10
Marbling score units[bcd]	5.01 ± .08	4.76 ± .08	5.01 ± .08
Percentage choice[e]	65.5	47.4	68.4

[a]Means ± standard error.
[b] 4.00 = slight°, 5.00 = small°.
[c]Implant vs no implant (P<.05).
[d]Revalor vs Synovex (P<.05).
[e]Chi square analysis (P<.10).

Table 3. Initial values determined by ultrasound

Variable	Minimum	Maximum	Average	Std Dev
Initial fat, in.	.06	.25	.13	.03
Initial rib eye area, in.^{2}	6.35	11.69	8.88	1.04
Initial ether extract, %	.96	2.85	1.74	.38

Table 4. Regression statistics for the equation predicting marbling score

	Regression coefficient[a]	Standard error[a]	Partial R^2	P[b]
Intercept	3.98	.23		.0001
Ether extract	.56	.13	.1986	.0001
Revalor	-1.02	.46	.0384	.0280
Black	.19	.10	.0148	.0570
Revalor x ether extract	.45	.26	.0141	.0838

[a]Marbling score units (4.00 = slight°, 5.00 = small°.
[b]Probability that the regression coefficient equals 0.

approached significance (P=.0838). For low marbling potential (low initial ether extract) cattle, Revalor tended to reduce marbling. For high marbling potential (high initial ether extract) cattle, Revalor may have had minimal effect (Figure 1).

If a steer was black, marbling was increased by .19 units as compared to steers categorized as other. The partial R^2 for the variable black was .0148.

To adequately test this model, a second independent set of data are necessary. This research is being repeated in 1994 to allow for a proper evaluation of the prediction equation. However, to illustrate the potential effectiveness of the model, the prediction equation was used to sort cattle into high, moderate, and low marbling groups. Table 5 indicates that 85.2% of the cattle that were in the high predicted marbling group graded choice as compared to 52.7% and 43.6% grading choice for the

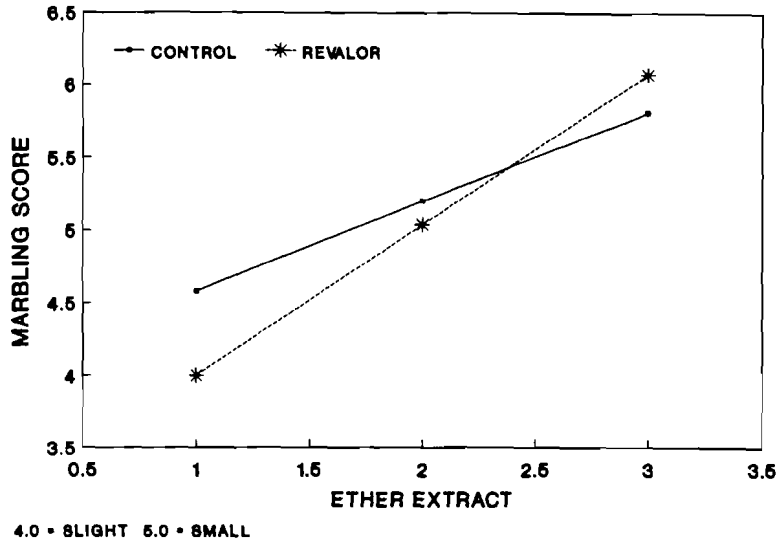

Figure 1. Interaction between Revalor and initial ether extract.

Table 5. Marbling group as determined by prediction equation[a]

Variable	Low 1/3	Middle 1/3	High 1/3
Ether extract, %	1.38 ± .030	1.72 ± .026	2.12 ± .036
Initial fat, in.	.12 ± .002	.13 ± .004	.14 ± .005
Marbling score units[b]	4.65 ± .059	4.84 ± .086	5.30 ± .081
Percentage choice	43.6	52.7	85.2

[a]Means ± standard error.
[b]4.00 = slight°, 5.00 = small°.

moderate and low groups, respectively. Percentage of choice for these categories were significantly different as determined by Chi square ($P<.10$).

For comparison, data were sorted only by coat color into black, red, and other categories (Table 6). Not as many high quality cattle were identified as with the prediction equation. However, Chi square analysis suggested this method was effective ($P<.10$).

The data were then sorted based on initial condition. Sixty-eight percent of the steers in the fat category graded choice compared with 53.6 and 56.5 for the thin and moderate categories, respectively (Table 7). These percentages were not significantly different ($P>.10$) as determined by Chi square analyses, indicating that sorting by initial condition did not adequately identify high marbling cattle.

In conclusion, ultrasound technology may be used to aid producers in making earlier marketing decisions and therefore may help alleviate some of the risks associated with value based marketing. However, additional research is needed to validate the prediction equation developed through this study.

Table 6. Effect of coat color on percentage choice[a]

Variable	Black	Red	Other
Ether extract, %	1.89 ± .06	1.68 ± .04	1.68 ± .09
Initial fat, in.	.14 ± .005	.13 ± .003	.13 ± .006
Marbling score units[b]	5.2 ± .10	4.8 ± .06	4.7 ± .15
Percentage choice	74.5	55.9	50.0

[a]Means ± standard error.
[b]4.00 = slight°, 5.00 = small°.

Table 7. Effect of initial fat thickness on percentage choice[a]

Variable	Thin	Average	Fat
Ether extract, %	1.60 ± .04	1.77 ± .05	1.84 ± .05
Initial fat, in.	.10 ± .001	.13 ± .002	.16 ± .003
Marbling score units[b]	4.75 ± .071	4.89 ± .094	5.11 ± .082
Percentage choice	53.6	56.5	68.3

[a]Means ± standard error.
[b]4.00 = slight°, 5.00 = small°.

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