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Performance and Carcass Characteristics of Feedlot Steers: Effects of Delayed Implanting and Programmed Feeding During the Growing Period[1]

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Abstract

This experiment was conducted to determine the effect of programming the rate of gain and delaying the first implant in feedlot steers on feedlot performance and carcass characteristics. Ninety-six growing steers (269 ± 16.2 kg) were assigned to 12 pens in a completely randomized design. Treatments were implant (Synovex-S®; 20 mg estradiol benzoate and 200 mg progesterone; Fort Dodge Animal Health, Overland Park, KS) on d 1 or no implant and programmed feeding to gain at a slow (0.68 kg/d) or fast (1.14 kg/d) rate during the growing period; these treatments were randomly assigned (n = 8) to pens of steers in a 2 × 2 factorial arrangement. Steers were fed a growing diet and after 88 and 60 d (for steers fed to gain at a slow or fast rate, respectively), steers were transitioned to ad libitum consumption of a high concentrate finishing diet. Growing period implant treatments did not affect ADG but did affect (P<0.01) gain efficiency during the finishing period. Feeding steers for a slow rate of BW gain during the growing period improved (P=0.062) gain efficiency in the finishing period (169 vs 145 g gain/kg feed). Correlation coefficients between fat thickness and marbling score obtained via ultrasound and fat thickness and marbling score measured at harvest were greater the closer the ultrasound measurements were made to the final harvest date. These data indicate that feeding level prior to the start of the finishing period may affect BW gain efficiency during the finishing period.

(Key Words: Steer, Rate of Gain, Implant, Carcass Characteristics.)

Introduction

Anabolic growth agents are routinely used in beef cattle to increase growth efficiency, feed conversion, protein deposition, carcass weight, *Longissimus* area, and carcass yield and to decrease production costs (Montgomery et al., 2001). Managing feed intake by restriction or programmed feeding for specific rates of gain may yield performance advantages to beef cattle feeders (Galyean, 1998). In addition, increasing pressures on beef cattle feeders to meet environmental standards may increase the use of feed intake management techniques as a means of altering nutrient excretion and manure loads from confined feeding operations. The use of restricted intake or programmed feeding as a best management practice has the potential to reduce the cost of production (Galyean, 1998). This application is especially attractive

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when roughage, or pasture costs, or both are high or when pasture is unavailable. Programmed feeding of high concentrate diets has been particularly useful for small- to medium-framed cattle as a means of adding carcass weight at harvest (Loerch and Fluharty, 1998). Simplifying bunk management, avoiding overconsumption of feed when starting cattle on feed, improving feed efficiency, and decreasing manure loads are among the factors that give restricted or programmed feeding the potential to decrease costs. Feeding high concentrate diets at less than ad libitum intake can decrease feed waste and improve feed efficiency (Hicks et al., 1990; Galyean, 1998; Loerch and Fluharty, 1998).

The objective of this experiment was to determine the effects of management strategies (time of implant and programmed feeding for slow or fast rate of gain) used during the growing period on subsequent feedlot performance and carcass characteristics at harvest.

Materials and Methods

Two hundred and thirteen British × Continental steers (average BW = 195 ± 11 kg; approximate age = 8 mo) were received at the James Bush Research Farm, Texas Agricultural Experiment Station, in Bushland, Texas. (Forty-two bulls were castrated upon arrival.) Approval for animal use was provided by the Cooperative Research, Education, and Extension Triangle Animal Care and Use Committee of the Texas A & M University Agricultural Research and Extension Center (Amarillo); USDA-ARS (Bushland), and West Texas A & M University. All steers were provided a metaphylaxis treatment with Micotil® (tilmicosin; Elanco Animal Health, Indianapolis, IN) for bovine respiratory disease upon arrival. Liquamycin LA-200® (oxytetracycline; Pfizer Animal Health, New York, NY) was used as a second antibiotic if follow-up treatment was required. All steers received Ivomec® (ivermectin; Merial, Duluth, GA) and were vaccinated with Bovishield 4® (IBR, BVD, PI3, BRSV; Pfizer, Newark, NJ) and 7-way Clostridial® (Merial). Horns were tipped, and steer BW was obtained upon arrival. Steers were revaccinated 10 d after arrival. Steers grazed on a dormant short grass prairie pasture and were supplemented with 0.84 kg (DM basis) of pelleted canola meal per steer three times a week for 92 d before the start of the experiment. On January 26, 96 steers (average BW = 269 ± 16.2 kg) were randomly selected and transported 5 km to the Texas Agricultural Experiment Station/USDA-ARS Experimental Feedlot in Bushland. Steers were assigned to 12 experimental pens in a completely randomized design (8 steers per pen) and were fed a grower diet (Table 1). Three steers died within the 1st mo

TABLE 1. Ingredient and chemical composition of the diets.

Item	Diet		
	Supplement	Growing	Finishing
	(% of DM)		
Steam-flaked corn	—	64.2	79.1
Cottonseed hulls	—	—	10.6
Alfalfa pellets	—	25.5	—
Supplement	—	10.3	10.3
Cottonseed meal	72.3	—	—
Calcium carbonate	11.3	—	—
Urea	6.0	—	—
Rice bran	5.5	—	—
Salt	2.5	—	—
Ammonium sulfate	0.99	—	—
Monocalcium phosphate	0.86	—	—
Rumensin[a]	0.16	—	—
Iron sulfate[b]	0.08	—	—
Zinc sulfate	0.06	—	—
Vitamin E[c]	0.06	—	—
Manganese sulfate	0.06	—	—
Tylosin[d]	0.04	—	—
Copper sulfate	0.03	—	—
Sodium selenite[e]	0.01	—	—
Cobalt sulfate	0.0004	—	—
Vitamins A and D[f]	0.008	—	—
EDDI[g]	0.004	—	—
Chemical composition			
CP[h], %		13.52	14.03
NE_m[i], Mcal/kg		1.62	1.72
NE_g[i], Mcal/kg		1.06	1.15

[a]254 mg of Monensin (Elanco Animal Health, Indianapolis, IN)/kg.
[b]21% Fe.
[c]264,600 IU/kg.
[d]82 mg of Tylosin® (Elanco Animal Health)/kg.
[e]0.06% selenium.
[f]264.6 and 26.46 × 10^6 IU/kg, respectively.
[g]EDDI = Ethylenediamine dihydroiodide (110 g/kg).
[h]Analyzed.
[i]Calculated.

in the feedlot because of complications attributable to pneumonia and were not replaced.

Pens of steers were randomly assigned to one of two implant treatments, implant (Synovex-S®; 20 mg estradiol benzoate and 200 mg progesterone; Fort Dodge Animal Health, Overland Park, KS) on d 1 of the growing period or no implant, and two programmed feeding management strategies during the growing period, fed to gain at a slow (0.68 kg/d) or fast (1.14 kg/d) rate (NRC, 1996) in a 2 × 2 factorial arrangement of treatments. From d 1 to 88 (for steers fed at the slow rate of BW gain) and until d 60 (for steers fed at the fast rate of BW gain), the amount of feed offered to steers was increased at 7-d intervals to account for changes in NE_m and NE_g requirements. Using the NRC (1996) model and assuming an increase in BW as expected (0.68 and 1.14 kg/d for slow and fast rate of gain), projected DMI was calculated, and that amount was fed for the following 7-d period.

When the average BW of steers within a pen reached 320 kg (end of the growing period), all steers were implanted with Synovex-S® and were transitioned to a high concentrate finishing diet (Table 1). Steers were then allowed ad libitum feed consumption of the high concentrate diet until harvest. On average, all steers received the last implant (Revalor-S®; Intervet Inc., Millsboro,

TABLE 2. Least squares means for performance, daily feed intake, and gain efficiency of steers with initial BW as covariate.

	Implanted		Not implanted					
	Programmed to gain					P^a		
Item	Slow	Fast	Slow	Fast	SEM	I	L	I × L
Days on feed								
Growing period	88	60	88	60	—	—	—	—
Finishing period	133	132	114	132	1.71	0.081	0.111	0.081
d 1 to reimplant	63	72	63	72				
Reimplant to harvest	69	59	50	59				
Growing + finishing	221[x]	192[y]	202[x]	192[y]	1.71	0.081	0.004	0.081
Initial BW, kg	269.5	268.0	268.9	268.3	1.2	—	—	—
Final BW, kg	574.3[x]	559.5[x]	533.8[y]	549.9[y]	3.3	0.025	0.947	0.122
ADG, kg								
Growing period	0.94[x]	1.22[x]	0.87[y]	0.88[y]	0.02	0.009	0.060	0.053
Finishing period	1.68	1.70	1.82	1.73	0.03	0.221	0.578	0.404
d 1 to reimplant	2.34[x]	2.03[y]	2.27[x]	2.15[y]	0.04	0.703	0.029	0.236
Reimplant to harvest	1.09	1.18	1.13	1.22	0.05	0.875	0.732	0.983
Growing + finishing	1.38[x]	1.52[y]	1.31[x]	1.47[y]	0.02	0.137	0.007	0.777
DMI, kg/d								
Growing period	5.24[x]	6.29[y]	5.18[x]	6.26[y]	0.02	0.218	0.0001	0.684
Finishing period	10.67	9.60	10.16	10.22	0.31	0.843	0.156	0.086
d 1 to reimplant	10.17	9.29	9.80	9.86	0.06	0.677	0.158	0.008
Reimplant to harvest	11.12	9.98	10.60	10.66	0.14	0.838	0.247	0.159
Growing + finishing	7.95	7.95	7.67	8.24	0.19	0.967	0.120	0.081
Gain efficiency, g/kg								
Growing period	179[x]	194[x]	167[y]	140[y]	3	0.011	0.607	0.070
Finishing period	158[x]	121[x]	180[y]	169[y]	5	0.008	0.062	0.203
d 1 to reimplant	229	218	232	218	3	0.856	0.108	0.807
Reimplant to harvest	98	118	106	114	5	0.937	0.564	0.787
Growing + finishing	173[x]	191[y]	170[x]	179[y]	6	0.063	0.012	0.209

[a]I = Implant effect, L = rate of gain effect, and I × L = interaction effect.

[x,y]Means within the same row followed by different letters differ (P<0.05).

DE) 59 d before harvest. The numbers of days for the growing and finishing periods are given in Table 2.

Ultrasound measurement of external fat thickness was obtained initially and at re-implant of the finishing period using a real-time linear array ultrasound instrument (SSD-500V; Aloka Co., Wallingford, CT). Ultrasound measurements were taken caudal to the last rib and approximately 8 cm distal to the centerline of the steer's back. Ultrasound measurements were used to project the number of days required for the steers in a pen to have 12 mm of external fat, at which time they were harvested. Both external fat thickness and marbling score were estimated with procedures that incorporate image analysis software (Brethour, 1994). On the date of harvest, steers were transported to a commercial packing plant 34 km from the experimental feedlot. The BW change was monitored every time the cattle were implanted or ultrasounded. Body weights were determined before the daily feeding and with no drinking water restriction. Individual BW were not obtained at the experimental feedlot immediately before steers were harvested to prevent stress and bruising. Therefore, the final estimated live BW of each steer was calculated as the hot carcass weight divided by the average dressing percentage of the load being marketed. After a 36-h chilling period, carcasses were evaluated by trained personnel for *Longissimus* area at the 12th rib; USDA carcass Quality Grade; marbling score; external fat thickness; percentage of kidney, pelvic, and heart fat (USDA, 1989); and lean color (Herschler et al., 1995).

All data were analyzed using GLM procedures of SAS® (1990), as a completely randomized design with a 2 × 2 factorial arrangement of treatments. Pen was used in the model as the experimental unit. Initial BW was used as the covariate for the performance data. Mean separations were performed using LSD (α = 0.05) when an interaction between rate of gain and implant treatment occurred (P<0.15). Regression equations (SAS, 1990) were obtained for ultrasound-predicted marbling scores and 12th rib fat thickness from the respective carcass measurements collected at slaughter. Chi-square analysis (SAS, 1990) was performed to compare USDA quality grades of carcasses. If the overall χ^2 analysis was significant, Fisher's exact test of SAS was used to separate the percentages.

Results and Discussion

Least squares means for days on feed, ADG, DMI, and BW gain efficiency of steers are presented in Table 2. A trend (P=0.081) occurred between implant and programmed feeding strategies for number of days on feed in the finishing and combined growing and finishing periods. The interaction between main effects during the finishing period occurred because non-implanted steers programmed to gain slowly required fewer days on the finishing diet to reach the harvest end point. For the combined growing and finishing periods, the interaction occurred because implanting on d 1 of the growing period increased the days on feed (221 d) of steers fed to gain at a slow rate compared with those not receiving the implant on d 1 (202 d).

The final shrunk BW of steers should be reduced by 25 to 45 kg for nonuse of an estrogenic implant (NRC, 1996). In the present study, all steers were implanted with an estrogenic implant at the beginning of the finishing period and with Revalor-S® 60 d before harvest. At the end of the finishing period, steers implanted on d 1 of the growing period and non-implanted steers differed (P=0.084) in BW by 25 kg. No difference (P=0.947) in final BW between steers programmed-fed for a slow or fast rate of gain was detected. In contrast, NRC (1996) reported that an increase in final shrunk BW of 25 to 45 kg is expected when there is an extended period at a slow rate of gain. On the other hand, NRC (1996) reported that a decrease in final shrunk BW of 25 to 45 kg is also expected for continuous feeding of a high energy diet from weaning. Steers program-fed to gain at a slow rate had ad libitum access to a high energy diet for 19 more d than steers program-fed to gain at a faster rate. Assuming an ADG of 1.3 kg, the extra 19 d on feed would have resulted in about 25 kg of difference in BW if steers were harvested on the same day, which might be the reason that there was no difference (P=0.947) between steers program-fed for slow and fast rates of BW gain.

Steers program-fed to gain slowly had a longer growing period than did steers program-fed to gain faster (Table 2). On d 89 and 61 (for steers programmed for the slow and fast rate of gain, respectively) of the experiment, steers were implanted with Synovex-S®. Seventy-two and 63 d after the beginning of the finishing period (for steers programmed for the slow and fast BW gain during the growing period, respectively), steers were re-implanted with Revalor-S®. The period from last implant until harvest averaged 59 d for both groups of program-fed steers.

The performance data are presented in Table 2. During the growing period, there was an interaction of main effects on ADG (P=0.053) and gain efficiency (P=0.070). For ADG, the interaction occurred because of a more rapid ADG in implanted steers when they were fed to gain fast *vs* slowly (1.22 *vs* 0.94 kg/d, respectively) compared with non-implanted steers fed to gain fast *vs* slowly (0.88 *vs* 0.87 kg/d, respectively). For gain efficiency, the interaction occurred because of a greater efficiency for implanted steers when fed to gain fast *vs* slowly compared with non-implanted steers fed to gain faster *vs* slower. These effects are similar to those reported by Mader et al. (1999) and Bartle et al. (1990) but are in contrast to those reported by Foutz et al. (1997). Mader et al. (1999) reported that implanted steers gained more rapidly and were more efficient than control steers during the first 66 d of their study. Mader (1994) reported that steers implanted with Synovex-S® had 14% greater gains and 10.2% lesser gain efficiency than steers not receiving an implant during the growing period. In the present study, daily DMI during the growing period was less ($P<0.0001$) for steers fed to gain slowly compared with those fed to gain at a faster rate because of experimental design.

Programmed feeding during the growing period affected ($P<0.05$) ADG from d 1 to re-implantation during the finishing period. Steers that were fed to gain slowly during the growing period gained faster than steers that were fed to gain faster during the same period (2.31 and 2.09 kg/d, respectively). From last implant to harvest, no effects were detected on ADG. When ADG of the finishing period was summarized from d 1 to harvest, there was no difference caused by implant or programmed feeding level imposed during the growing period. When data were summarized from d 1 of the growing period until harvest, programmed feeding affected ($P<0.01$) ADG. Steers that were fed to gain faster since d 1 in the feedlot maintained a greater ADG during the whole experimental period than did those that were fed for a lesser rate of gain during the growing period (1.5 and 1.35 kg/d). There was a trend ($P=0.086$) for DMI during the finishing period. Implanted steers fed to gain slowly during the growing period consumed more feed (10.67 kg/d) than did non-implanted steers fed to gain fast (10.22 kg/d) during the same period. Similarly, non-implanted steers fed to gain slower during the growing period consumed more feed (10.16 kg/d) than did implanted steers fed to gain faster (9.6 kg/d). This effect during the finishing period is mainly explained by the results obtained from d 1 of the finishing period to last implant application.

When summarizing performance data across both the growing and finishing periods, the ADG of steers was less for those fed to gain slower than for those fed to gain faster during the growing period (Table 2). This difference in ADG is primarily a response of the experimental design. When the growing and finishing periods were combined, a trend was detected ($P=0.081$) for DMI, which was a result of the data obtained for the finishing period. Samber et al. (1996) found no effect of delaying implant on overall performance of feedlot steers. Delaying implanting until the finishing period had no effect on finishing and overall gains (Mader, 1994). Bartle et al. (1990) reported that steers implanted with Synovex-S® on d 0 gained faster and were more efficient than non-implanted steers. Conversely, Foutz et al. (1997) found no differences in ADG or gain efficiency between steers implanted with Synovex-S® on d 1 and non-implanted steers. Milton et al. (2000) determined the effect of delaying the implant (Synovex-Plus®) on performance and carcass characteristics of 300-kg steers. Those researchers reported that ADG and gain efficiency were similar when steers were implanted with Synovex-Plus® on d 0 or 35, but were greater than those recorded when steers received the implant on d 70. There was an implant effect on BW gain efficiency during the finishing period. Delaying the first implant in steers increased gain efficiency (175 kg/d) compared with those implanted on d 1 of the growing period (140 kg/d). For the same period, programmed feeding tended

TABLE 3. Carcass characteristics of steers implanted or not implanted and fed to gain at different rates during the growing program.

	Implanted		Not implanted					
	Programmed to gain					P		
Item	Slow	Fast	Slow	Fast	SEM	I	L	I × L
Hot carcass weight, kg	373.7	369.3	345.0	363.1	3.05	0.077	0.452	0.226
Marbling score[b]	455	429	482	456	5.87	0.146	0.161	0.990
Fat thickness, mm	15.0	14.5	14.4	15.0	0.37	0.994	0.953	0.599
Longissimus area, cm^2	88.1	86.6	82.9	89.1	0.65	0.474	0.246	0.068
Kidney, pelvic, and heart fat, %	2.04	1.87	2.02	2.00	0.03	0.549	0.327	0.437
Yield grade	3.14	3.11	3.10	3.00	0.06	0.661	0.726	0.860
Lean color score[c]	4.51	4.95	4.62	4.79	0.08	0.927	0.212	0.562

[a]I = Implant effect, L = rate of gain effect, and I × L = interaction effect.

[b]Marbling scores are coded as 400 = small, 500 = modest.

[c]Lean color scores are coded as 4 = light cherry red, 5 = cherry red, and 6 = dark red.

(*P*=0.062) to increase gain efficiency. Both effects were maintained when data for the growing period and finishing period were combined.

The carcass characteristics of steers with different implant and programmed feeding strategies during the growing period are presented in Table 3. Hot carcass weight tended (*P*=0.08) to be less for steers with a delayed implant than for steers implanted at the beginning of the growing period (354.0 *vs* 371.5 kg). Duckett et al. (1996) reported the same difference in hot carcass weight when comparing 23 experiments evaluating implanted and non-implanted steers. Rate of gain during the growing period did not affect (*P*=0.452) hot carcass weight (Table 3). Steers were targeted to be harvested at 12 mm of fat thickness, and the actual mean value at harvest was 14.75 mm. Because of the experimental design, treatments did not affect fat thickness. Marbling score was similar across experimental treatments. A trend was observed (*P*=0.068) between implant and programmed feeding strategies during the growing period for *Longissimus* area (Table 3). Non-implanted steers program-fed to gain at a slow rate during the growing period had the smallest *Longissimus* area, whereas non-implanted steers program-fed to gain fast had the largest *Longissimus* area; implanted steers, regardless of rate, were intermediate. *Longissimus* area was 4% greater in implanted than in non-implanted steers (Duckett et al., 1996). In the 112 individual trial comparisons between implanted and non-implanted steers for *Longissimus* area, 40 comparisons reported increased (*P*<0.05) *Longissimus* area (Duckett et al., 1996). Murphy and Loerch (1994) reported no difference in *Longissimus* area between steers with ad libitum access to feed and those with 10 or 20% restriction from ad libitum intake. Implanting and rate of gain during the growing program did not affect kidney, pelvic, and heart fat percentage, yield grade, or lean color score. Previous research comparing the effect of various implant strategies on beef carcass quality has produced inconsistent results. Some studies have shown that the use of implants has little or no effect on marbling score or quality grade (Gerken et al., 1995). Other studies indicate that the use of implants causes a substantial decrease in marbling score and quality grade (Hancock et al., 1994), which is in contrast with the studies of Mader (1994) and Kerth et al. (1995). Mader (1994) reported no change in any carcass characteristics caused by delaying the first implant (Synovex-S®) for 80 d.

Implanted steers program-fed for a slow rate of gain during the growing period had 91% of the carcasses grading Prime and Choice (Table 4) followed by non-implanted steers program-fed to gain slowly, and non-implanted steers program-fed to gain faster with 71 and 67%, respectively. Implanted steers fed for a faster rate of gain during the growing period had the least proportion (50.0%) of carcasses grading USDA Prime or Choice. Kerth et al. (1995) evaluated the effect of implanting with Ralgro®; Schering-Plough Animal Health, Union, NJ) or Revalor-S® on d 0 (the second implant was Revalor-S® on d 90 of the feeding period for all cattle) on characteristics of 1574 beef carcasses from Continental European, Continental European × British, and British-type cattle. Source of implant did not affect marbling score; USDA quality grades; adjusted preliminary yield grade; percentage of kidney, pelvic, and heart fat; and carcass weight for Revalor-S®/Revalor-S® or Ralgro®/Revalor-S®, respectively. However, a larger *Longissimus* area and lesser USDA Yield Grade was reported for cattle implanted twice with Revalor-S®.

The correlation coefficients of ultrasound measurements of fat thickness and marbling score at the beginning and at re-implantation during the finishing period with yield grade, quality grade, fat thickness, and marbling score are presented in Table 5. Ultrasound measurements of fat thickness at the beginning (d 1) and at re-implantation during the finishing period (d 67) were correlated to actual fat thickness (*P*<0.0001). Ultrasound measurement of marbling score at the beginning and at re-implantation of the finishing period was correlated with quality grade (*P*<0.001). Similar values to those presented by Perkins et al. (1997) were found for estimation of marbling score and quality grade. The correlation for marbling score was less than the 0.85 reported by Brethour (2000).

The regressions predicting external fat and marbling score at two differ-

TABLE 4. Chi-square analyses of number of carcasses in each USDA quality grade.

	Implanted		Not implanted	
	Programmed to gain			
Item	Slow	Fast	Slow	Fast
Prime	1[a]	2[a]	2[a]	2[a]
Choice	20[a]	9[b]	15[ab]	14[ab]
Select	2[a]	11[a]	6[a]	7[a]
Standard	0[a]	0[a]	1[a]	1[a]
Prime + Choice	21[a]	11[b]	17[ab]	16[ab]

[a,b] Within a row, means without a common superscript letter differ (*P*<0.05).

TABLE 5. Correlation between fat thickness and marbling score of steers estimated by ultrasound at different times during the finishing period and Yield Grade, USDA quality grade, marbling score, and fat thickness determined by visual observation at harvest.

	Estimate of fat thickness		Estimate of marbling score	
Item	d 1	d 67	d 1	d 67
Yield grade	0.4479	0.6405	0.1694	0.3131
	(<0.001)[a]	(<0.0001)	(0.105)	(0.002)
Quality grade	0.1754	0.2766	0.4032	0.6346
	(0.093)	(0.007)	(<0.001)	(<0.0001)
Fat thickness	0.5108	0.7379	0.1564	0.2795
	(<0.0001)	(<0.0001)	(0.134)	(0.007)
Marbling score	0.2081	0.3309	0.5265	0.6565
	(0.045)	(0.002)	(<0.0001)	(<0.0001)

[a]*P* value of the correlation.

ent times in the experiment are given in Figure 1. Again, the closer the ultrasound measurement was conducted to the day of harvest, the greater the correlation of final fat thickness and marbling score. The r^2 for fat thickness altered from 0.261 on d 1 to 0.545 60 d before harvest. A similar tendency was observed for marbling score, with an r^2 that altered from 0.277 on d 1 to 0.431 60 d before harvest. At the beginning of the feeding period, ultrasound technology was not an accurate predictor of external fat endpoint for steers with an average age of 8 mo because they did not have enough external fat deposits (<1 mm). A more appropriate time would be when the animal receives the second implant. However, based on these data, a better prediction of the final fat thickness is obtained approximately 2 mo before harvest.

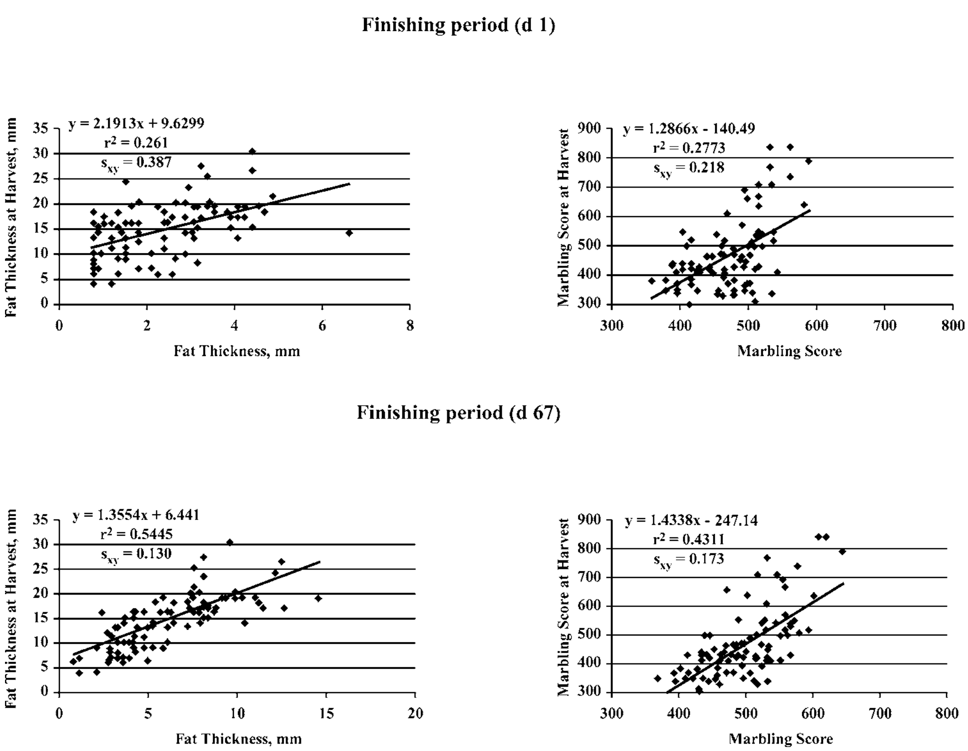

Figure 1. Regression analysis of fat thickness and marbling score determined at harvest with ultrasound fat thickness and marbling score as determined on d 1 and 67 of the finishing period.

Implications

Overall, results of this experiment indicate that programmed feeding during the growing period did not affect feed intake and ADG during the finishing period. Delaying the first implant until the beginning of the feedlot phase and programmed feeding during the growing period are tools that may be used to increase BW gain efficiency of beef steers during the feedlot phase and have a positive contribution on cost of gain in a finishing program. Measurement of fat thickness using ultrasound technology to estimate time of harvest may be a useful tool to decrease time on feed.

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