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Effects of Implanting and Explanting on Growth Performance and Carcass Traits of Finishing Steers

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Story in Brief

Previously nonimplanted Angus x Senepol crossbred steers were assigned randomly to one of five implanting schemes for a 140-d finishing trial. All treatment groups, with the exception of negative controls (Treatment 1), received a combination estradiol (24 mg) and trenbolone acetate (120 mg) implant on d 0. The treatments on d 84 consisted of: 1) no implant administered; 2) a second combination implant; 3) removal of the initial implant and administration of a second combination implant; 4) removal of the initial implant without reimplantation; and 5) no reimplantation without removal of the initial implant. Overall gain was 20% greater and dry matter intake was increased 16% for implanted steers collectively, as compared with control steers. Steers on Treatment 2 had higher daily gains than all other treatments and lower feed to gain ratios than all other treatments except Treatment 3. The two implant treatment groups with only one implant from d 84 to d 140 (Treatments 3 and 5) had similar daily gains but steers from both treatments groups had greater gains than Treatment 4. These two groups converted similarly indicating a failure of the initial implant to reach payout during the feeding period. As compared with nonimplanted cattle, implanted cattle yielded 58.0 lb more of carcass weight, had lower kidney pelvic and heart fat percentages, more advanced skeletal maturity, and greater fat thickness. Ribeye area per 100 lb of carcass wt, yield grade, marbling score, and percentage of cattle grading Choice were similar among groups. After a 14-d aging period, Treatment 2 steaks were less tender than steaks from all other treatments.

Key Words: Beef, Cattle, Implant, Tenderness, Feedlot Performance

Introduction

Gardner et al. (1999) evaluated the effects of replacement of an initial combination estradiol and trenbolone acetate implant at either d 56, d 84, or d 112 on growth performance and carcass characteristics as compared with negative control and a single combination implant administered on d 0. They concluded that all implanted cattle had improved feedlot performance over negative controls, as well as heavier carcasses and larger ribeye areas. Between implant removal groups, however, no improvement was noted by replacement of the initial implant. These results indicate that the initial implant had not, in fact, reached “payout.”

The objective of this study was to determine feedlot and carcass response to additional implant regimens by modifying treatments explored by Gardner et al. (1999) to include a treatment of a single combination implant administered on d 0 followed by a second combination implant administered on d 84 without removal of the initial implant. By addition of reimplanted cattle to the study, presumably, a wider range of dose levels could be evaluated as to their relationship with feedlot and carcass performance.

Materials and Methods

Animals and Diets. Previously nonimplanted yearling Angus x Senepol (n = 125, BW = 731 lb ± 29) steers were received at the Willard Sparks Beef Research Center in Stillwater, OK, on June 14, 1999. Upon arrival, steers were individually weighed and ear-tagged, stratified by weight into five blocks, and assigned randomly within block to one of five implant/explant treatments. All treatment groups, with the exception of negative control (Treatment 1), received a combination estradiol 17β (24 mg) and trenbolone acetate (120 mg) implant (Revalor® S) on d 0. On d 84, the treatments consisted of: 1) no implant administered; 2) a second Revalor-S® implant; 3) removal of the initial implant and administration of a new Revalor-S® implant; 4) removal of the initial implant without reimplantation; and 5) no reimplantation without removal of the initial implant.

Steers were housed (5 steers/pen) in 25 partially covered pens (5 pens/block and 5 treatments/block) with the majority of the pen being uncovered and the cement pads and bunks being covered. Cattle were stepped-up to a 95% concentrate diet containing 86.5% whole-shelled corn, 5.09% cottonseed hulls, and 8.39% OSU finishing supplement on a dry matter basis formulated to contain 12.49% crude protein, 96.98 Mcal/cwt NEm, and 62.15 Mcal/cwt NEg. The supplement consisted of: 1) 41.04% cottonseed meal, 2) 30.31% soymeal, 3) 13.42% limestone, 4) 6.67% urea, 5) 4.00% potassium chloride, 6) 3.92% salt, 7) 0.18% Rumensin® 80, 8) 0.13% Tylan® 40, 9) 0.07% Vit A-30,000, 10) 0.05% Selenium 600, 11) 0.04% manganous oxide, 12) 0.02% Vit E–50%, and 13) 0.01% copper sulfate. All animals reached the final diet within 21 d. Animals were fed twice daily at approximately 7:00 a.m. and 1:00 p.m. Steers were weighed immediately upon arrival and every 28 d thereafter. Live weights, with the exception of the initial weight received a 4% shrink in order to obtain daily gain and feed efficiency. Final weights were calculated by dividing the animal’s hot carcass weight by the average dressing percentage of all treatments.

After 140 d on feed, steers were harvested at Excel Corporation in Dodge City, KS. Following a 0^{O}C, approximately 36 h chill period, Oklahoma State University personnel collected USDA quality and yield grade

(USDA, 1997) carcass measurements. Loin strips were removed from the right side of the carcass by plant personnel for Warner-Bratzler shear force evaluation and transported to Oklahoma State University where they were subsequently cut into three 1-in steaks. One steak from each strip was aged at $0^{O}C$ for 7 d prior to being placed in a $-80^{O}C$ freezer and two steaks were aged at $0^{O}C$ for 14 d prior to placement in a $-80^{O}C$ freezer. Steaks were tempered overnight at $0^{O}C$, cooked in an impingement oven to a $70^{O}C$ core temperature and allowed to cool to room temperature prior to shear force evaluation. Six, 1.25cm core samples were removed from each steak and shear force pressure was evaluated using a Series IX Automated Materials Testing System 3.0.

Statistical Analysis. Data were analyzed using the GLM procedure of SAS (SAS, 1996) as a randomized complete block design. Pen served as the experimental unit for gain, dry matter intake, and efficiency data with steer being used for carcass traits. Non-orthogonal contrasts were used to compare: 1) control vs collective implant groups; 2) response to a second implant administered on d 84 as compared with a single implant; 3) response to a second implant following implant removal on d 84 as compared with a second implant administered without removal of the initial implant, and an initial implant administered on d 0; 4) response to removal of the initial implant on d 84 without replacement as compared with control; and 5) response to a single implant administered on d 0 as compared with a single implant administered on d 84 following removal of an initial implant administered on d 0.

Results and Discussion

Feedlot Performance. Performance data are presented in Table 1. Regardless of implant regimen, implanted steers had an overall 20% greater daily gain than control steers resulting in an 8% carcass weight advantage as compared with nonimplanted steers. This is supported by Duckett et al. (1997), who reported in a compilation of implant trials that a single combination strong estrogen and androgen implant resulted in a 21% increase in gain. As would be expected due to identical treatments, daily gain did not differ between implanted cattle during the initial 84-d period. During this period all implanted treatment groups had significant ($P<.0001$) improvements in gain as compared with control. From d 85 to 140 cattle that were reimplanted without removal of the initial implant had improved ($P<.002$) gains above all other cattle. All other treatments were similar to controls with the exception of steers explanted without replacement. This treatment group had less ($P<.04$) gain than control. During the overall feeding period, implant response followed supposed dose lines. Cattle reimplanted without removal of the initial implant had greater ($P<.008$) gains than all other groups. In addition, steers that carried only one implant during d 85 to 140 had greater ($P<.001$) gains than control or cattle that had their implants removed without replacement. Cattle that had their implants removed without replacement had greater (P<.003) gains than control; presumably due to carryover of implant hormone. It is interesting to note that steers that had their implants replaced and steers that received a single implant on d 0 had similar gains from d 85 to140. These data indicate that increased dose, not renewal of implant dosage, is the major contributor to improved gain by reimplanted cattle. Also, cattle that had their implant removed on d 84 had less gain from d 85 to finish than control. This effect could be due to high early compensatory gain for cattle receiving an implant during d 0 to 84. It is also important to note that effects of surgical removal of implant pellets from the ears of cattle could not be factored into the model. This surgical stress could have caused a decrease in performance that would be statistically unquantified.

Overall, implanted steers consumed 16% more feed than nonimplanted steers. The size of this improvement is greater than that reported by Deckett et al. (1997), who found a 7% increase in feed consumption. However, Gardner et al. (1999) reported a 13% increase in feed intake in a study with Angus x Senepol steers. This suggests that possibly a breed effect existed that made this study and the study by Gardner et al. (1997) different from reported literature. For the overall feeding period, all treatment groups had higher (P<.004) consumption than control. However, no differences (P>.05) in feed intake could be detected among implanted cattle. For the initial period, implanted steers had greater (P<.008) consumption than control with steers implanted on d 0 and d 84 without implant replacement having similar (P>.35) consumption with control cattle. However, presumably due to pen-to-pen variation, identical implant treatment groups had different (P<.05) intakes. From d 85 to 140, all implanted steers had greater (P<.004) consumption compared with control. Consumption did not differ (P>.05) between implant treatments. Collectively, steers that carried at least one implant from d 85 to finish consumed more feed than steers that carried no implant during that period. Steers with stacked implants did not differ from steers carrying only one implant. This experiment might have lacked power to detect significant differences between cattle with such a high level of variability and a larger sample size might be needed.

Overall feed efficiency was improved by reimplanting. In comparison of individual treatment groups, steers that were implanted twice had lower feed:gain than all groups except steers that were explanted followed by reimplantation on d 84. Single implant steers had no improvement over control. Although feed efficiency was improved (P<.004) collectively for implanted steers as compared with control, the difference in feed consumption from d 0 to d 84 resulted in feed efficiency differing for identical treatments during that period as well as one treatment group being similar to control. Steers that had their implant removed without replacement had significantly (P<.025) higher feed:gain than all other treatments except steers receiving an initial implant exclusively. Steers that were implanted twice converted more efficiently than steers receiving one implant on d 0. These data differ from those presented by Duckett et al. (1997) and Gardner et al. (1999) who reported 11% and 10% improvements in feed efficiency by cattle implanted with a single combination implant as compared with negative control.

Carcass Traits. Carcass characteristics are shown in Table 2. Dressing percentage, lean maturity, quality grade, and yield grade were not affected by implant treatment. Steers in treatment groups that had at least one implant from d 84 to 140 yielded more (P<.001) pounds of carcass than did steers that did not have an implant during that period. Ribeye area differed (P<.002) between treatment groups, however, when expressed on a per 100 lb of hot carcass weight basis no difference was detected. Skeletal maturity was affected (P<.001) by implant treatment. All implanted groups had more advanced (P<.001) skeletal maturities than control steers with explanted steers having less (P<.04) advancement than other implanted steers. Steers that had an implant from d 84 to finish had decreased (P<.0001) KPH percentages than control and explanted steers. Cattle that were implanted on d 0 and d 84 without removal had less tender (P<.05) loin steaks in Warner-Bratzler shear force comparison than steaks from all other steers following a 14-d aging period and steaks from all steers except steers reimplanted on d 84 following explant after a 7-d aging period. Collectively, steaks from implanted steers were less tender following a 7-d age than steaks from control steers, however, only steaks from reimplanted steers implants differed (P<.05) in tenderness following a 14-d age. Steaks from control cattle had similar (P>.10) tenderness after a 7- or 14-d age compared with single implant cattle and cattle with their implant removed without replacement.

Implications

Reimplanting steers increased daily gain and improved efficiency compared with administering a single implant. Daily gain was also improved for singularly implanted steers as compared with control although this experiment did not show improvements in efficiency. However, producers must be conscious of the potential downfalls associated with aggressive implant strategies. Aggressive implanting strategies increased shear force values beyond consumer acceptance in this experiment. As the beef industry continues to move toward a value-based product, this approach may become unacceptable for some situations

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Table 1. Least squares means for feedlot performance by implant regime for steers fed 140 d.

	Treatment[a]						
d 0	Control	R_0	R_0	R_0	R_0		Prob>
d 85	Control	R_{84}	E_{84}/R_{84}	E_{84}	Control	SE[b]	F
Steers	24	25	25	25	25	--	--
Pens, n	5	5	5	5	5	--	--
Weight, lb							
Initial	734	732	728	728	729	5.9	.93
Final[c]	1223^{d}	1367^{e}	1310^{fg}	1271^{f}	1317^{g}	14.7	.001
<u>Daily gain, lb/d</u>							
d 0-84	3.72^{d}	4.62^{e}	4.62^{e}	4.71^{e}	4.72^{e}	.11	.001
d 85-140	3.07^{d}	4.32^{e}	3.38^{d}	2.53^{f}	3.33^{d}	.89	.001
d 0-140	3.46^{d}	4.50^{e}	4.13^{f}	3.85^{g}	4.17^{f}	.09	.001
<u>Intake, lb DM/d</u>							
d 0-84	20.2^{d}	21.1^{de}	22.6^{ef}	22.7^{eg}	24.0^{fg}	.70	.012
d 85-140	19.9^{d}	25.3^{e}	23.3^{e}	23.8^{e}	25.0^{e}	.70	.001
d 0-140	20.1^{d}	22.8^{e}	22.9^{e}	23.2^{e}	24.4^{e}	.59	.002
<u>Feed:Gain</u>							
d 0-84	5.4^{d}	4.5^{e}	4.8^{ef}	4.8^{eg}	5.0^{dfg}	.15	.015
d 85-140	6.6^{df}	5.9^{d}	7.0^{df}	9.5^{e}	8.1^{ef}	.62	.001
d 0-140	5.8^{d}	5.0^{e}	5.5^{de}	6.0^{d}	5.8^{d}	.16	.007

[a] Implant regime: Control = no implant administered, R_0 = Revalor® S implant administered on d 0, R_{84} = Revalor ® S implant administered on d 84, E_{84} = Initial implant removed on d 84.

[b] Standard error of the least-squares mean.

[c] Final weight calculated using HCW/Average DP.

[d,e,f,g] Means in same row with different superscript differ significantly ($P < .05$).

Table 2. Least squares means for carcass traits by implant regime for steers fed 140 d.

	Treatment[a]						
d 0	C	R_0	R_0	R_0	R_0		Prob
d 84	C	R_{84}	E_{84}/R_{84}	E_{84}	C	SE[b]	> F
HCW, lb	754^{j}	843^{g}	808^{hi}	784^{i}	812^{h}	9.0	.001
Dress, %	62.3	62.1	61.1	61.0	61.7	2.0	.064
Fat thck, in	.32^{h}	.42^{gh}	.38^{h}	.50^{g}	.51^{g}	.04	.015
Adj fat thck, in	.48^{h}	.52^{gh}	.50^{h}	.56^{g}	.56^{g}	.02	.027
KPHF, %	3.4^{g}	3.3^{h}	3.3^{h}	3.4^{gi}	3.3^{hi}	.02	.001
REA, in^2	11.8^{h}	13.0^{g}	12.8^{g}	11.8^{h}	12.6^{g}	.26	.002
REA/100 lb HCW	1.6	1.5	1.6	1.5	1.5	.03	.369
Yield grade	3.5	3.5	3.4	3.8	3.6	.11	.079
Lean mat[c]	A^{39}	A^{38}	A^{40}	A^{42}	A^{41}	4.6	.972
Skel mat[c]	A$^{25\ g}$	A$^{51\ i}$	A$^{58\ I}$	A$^{40\ h}$	A$^{52\ i}$	3.8	.001
Marb score[d]	Sm^{37}	Sm^{21}	Sm^{24}	Sm^{15}	Sm^{46}	13.5	.428
Quality Grade							
Choice[e], %	76.7	67.1	73.3	65.1	85.7	11.7	--
Select, %	23.3	30.4	26.7	34.8	14.3	7.8	--
Standard, %	--	2.5	--	--	--	--	--
Yield Grade							
1, %	1.4	--	--	--	--	--	--
2, %	8.6	5.8	17.9	2.7	6.1	5.8	--
3, %	72.9	65.2	58.2	69.9	63.6	5.7	--
4, %	17.1	29.0	23.9	27.4	30.3	5.3	--
Shear force, lbF							
Aged 7 d	8.1^{g}	10.3^{i}	9.6^{hi}	9.0^{gh}	9.0^{gh}	1.8	.002
% tough[f]	9.5	66.7	50.0	38.7	33.3	21.1	--
Aged 14 d	8.3^{g}	10.2^{h}	9.0^{g}	8.9^{g}	8.7^{g}	.19	.020
% tough[f]	19.1	66.7	32.0	52.9	9.5	16.7	--

[a]Implant regime: C = no implant administered, R_0 = Revalor® S implant on d 0, R_{84} = Revalor® S implant on d 84, E_{84} = initial implant removed on d 84.

[b]Standard error of the least-squares means.

[c]Maturity score: “A”, between 9 and 30 mo of age.

[d]Marbling score: Sm = “small^{00}”, the minimum required for U.S. Choice

[e]Choice = Small^{00} to Moderate^{99}.

[f]Determined by percent of cattle in treatment with shear value exceeding 10 lbF

(Shackelford et al., 1991).

[g,h,i,j]Means in same row with different superscripts differ significantly (P<.05).

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