SYNOVEX-S, FINAPLIX-S, OR REVALOR IMPLANTS FOR FEEDLOT STEERS

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Story in Brief

One hundred forty steers (778 lb) were implanted at the start of a feeding trial with: No implant (Control); Synovex-S; Revalor; Synovex-S + Finaplix-S (140 mg trenbolone acetate-TBA); Synovex-S + Finaplix-S with a reimplant of Finaplix-S at 58 days and fed a feedlot diet for 119 to 126 days. Daily gains were increased by treatments having trenbolone acetate (from Revalor or Finaplix-S) with the highest response from steers reimplanted with Finaplix-S at 58 days on feed. Carcass adjusted gains for the five respective treatments were 3.24, 3.07, 3.38, 3.45, and 3.50 pounds per day. Feed efficiency improved with implants (6.15, 6.07, 5.88, 5.63, and 5.66 lb feed/lb gain); the largest improvement (8.5%) occurring with Synovex-S + Finaplix-S administered at processing time. Steers receiving both estrogen and trenbolone acetate produced carcasses with larger ribeyes and slightly more masculine carcass characteristics than control or Synovex-S steers. The percentage of choice carcasses was similar for Contol, Synovex-S and early Finaplix-S treatments (82.1, 82.1 and 85.7% respectively) while percentage choice for Revalor was substantially lower at 51.8% and double Finaplix-S was slightly lower at 71.4%. Skeletal maturity was more advanced for all steers receiving implants while subcutaneous fat thickness, percentage kidney, pelvic and heart fat, marbling score, lean color and ribeye chemical composition were not affected. Implanted steers produced ribeye steaks with slightly higher shear force measurements than non-implanted steers.

(Key Words: Implants, Steers, Trenbolone Acetate, Carcass Traits.)

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Introduction

Anabolic implants have been used to increase rate of gain and improve feed efficiency in feedlot cattle in the United States for many years; the vast majority of cattle today are implanted once or more during growth and finishing. Until recently, only estrogenic implants were approved for use in the United States; however, trenbolone acetate (TBA), an androgenic compound, now is approved for use as an implant. Besides improving efficiency of beef production, both estrogenic and androgenic implants increase muscle tissue growth and thus provide beef consumers with a leaner product. The biological method by which estrogens and androgens improve productivity differs; hence additive effects are observed when the two are used in combination.

Effects of implants on growth rate and efficiency have been studied extensively, but effects of implants on carcass traits and meat palatability have been largely ignored. Administration of implants increases muscling in feedlot cattle, but quality grade, which still has a large impact on beef prices, may be altered adversely (Cross and Belk, 1989; Foutz et al., 1989). Consequently, effects of implants on beef quality characteristics need further attention.

The dosage levels of the active compounds (estradiol benzoate and trenbolone acetate), sex classes (steers, heifers, or bulls) and times of administration employed in implant studies have varied; thus, results are difficult to compare. Currently, Synovex-S and Finaplix-S usage is widespread in the U.S. for finishing feedlot steers and, although **Revalor is not currently FDA approved for use in the United States**, the level of active compounds (140 mg of trenbolone acetate and 20 mg of estradiol benzoate) is equivalent to that of combined implants of Finaplix-S and Synovex-S except for the progesterone in Synovex-S. Therefore, the objectives of this study were to examine the effects of various implant programs involving estradiol and trenbolone acetate (at dosage levels employed by industry) on rate and efficiency of growth, carcass traits, and meat tenderness of feedlot steers.

Materials and Methods

One hundred forty crossbred yearling steers averaging 778 lb, which previously had been implanted with Compudose (late August), were obtained from wheat pasture in late March. These steers were shipped approximately 100 miles to Oklahoma State University, individually weighed, tagged and processed. Because these cattle were initially weighed on arrival after being subjected to the stress of movement, trucking and fasting, initial weights were considered to be shrunk weights. Processing of animals consisted of IBR-PI3, 4-way clostridia vaccination and deworming with Ivermectin. The cattle were blocked into one of four different replications based upon initial weight. Steers in each weight replication (n = 35) were assigned randomly to one of five different implant treatments: C = no implant (Control); S = Synovex-S (20 mg estradiol benzoate + 200 mg progesterone) on day 1; R = Revalor (20 mg estradiol benzoate + 140 mg trenbolone acetate) on day 1; ST = Synovex-S + Finaplix-S (140 mg trenbolone acetate) on day 1; and STT = Synovex-S + Finaplix-S on day 1 with a reimplant of Finaplix-S alone on day 58. Following implantation, steers in the same weight replication with common implant treatments (n = 7) were assigned to one of 20 different pens for feeding.

All pens were equipped with self feeders. All steers were started on an initial 50% concentrate diet which was increased stepwise (60, 70, 80, 90%) over a period of 15 days, to a final concentrate level of 95% in the finishing diet (Table 1). Individual live animal weights were obtained on day 30 of the trial and every 28 days thereafter. Feed consumption records for individual pens were recorded each weigh period. To compensate for fill, live weights taken throughout the feeding trial were shrunk by 4% (live weight x .96). Steers from the two heavier weight replications were fed for 119 days; the two lighter replications were fed 126 days prior to slaughter.

On the day designated for slaughter, steers were transported approximately 250 miles and slaughtered within 2 h of arrival at a commercial packing plant. Approximately 24 h postmortem, complete yield and quality grade data (USDA, 1989) were recorded. Additionally, all carcasses were scored subjectively for lean color and masculinity characteristics (bullock score) using the following systems: lean color score of 8 = pink, 7 = very light cherry red, 6 = cherry red, 5 = slightly dark red, 4 = moderately dark red, 3 = dark red, 2 = very dark red, 1 = black; bullock score of 5 = no evidence, 4 = slight, 3 = moderate, 2 = severe, 1 = extremely severe. The bullock score reflects the extent of pizzle eye (crus of the penis), bald spot (bulbo-cavervosus muscle) and crest (chuck splenius muscle) development.

Following collection of carcass data, a boneless portion of the wholesale rib (9th through 12th ribs) was fabricated from the left side of each carcass and vacuum packaged. These samples were cooler aged for 7 days (33°F), crust frozen (outer 1 inch) and faced (removal of .25 inch dehydrated and uneven 12th rib end portion) before a .25 inch steak (for pH and proximate analysis) and a 1 inch steak (for cooking property and tenderness determinations) were removed. For proximate analysis, samples were completely denuded of exterior fat and epimysial connective tissue, placed in Whirlpack bags and stored at -22°F until analysis. Shear force steaks were vacuum packaged and stored at -22°F. Proximate analysis followed procedures outlined by AOAC (1984). Shear force steaks were thawed (35°F) for 24h and broiled on Farberware Open-hearth broilers to an internal temperature of 158°F (AMSA, 1978). Cooking time (minutes to a medium degree of doneness) and cooking shrinkage (percent weight loss) were recorded for each steak. After steaks cooled to 77°F, 6 cores (.5 inch diameter) were removed and individually sheared one time to determine

Table 1. Composition of finishing diet, dry matter basis.

	Percent concentrate					
Feed	50	60	70	80	90	Final
Corn, whole, %	41.6	51.6	61.6	71.6	80.6	86.6
Cotton seed hulls, %	25.0	20.0	15.0	10.0	8.5	5.0
Alfalfa pellets, %	25.0	20.0	15.0	10.0	2.5	-----
Supplement[a], %	8.4	8.4	8.4	8.4	8.4	8.4

	Calculated analysis	
Nutrients	Diet composition	Supplement composition
NE_m, mcal/cwt	95	59
NE_g, mcal/cwt	61	38
Crude protein, %	12.3	48.4
NPN, % of diet	1.12	13.36
Crude fiber, %	5.37	9.37
Potassium, %	.55	2.06
Calcium, %	.45	5.06
Phosphorus, %	.33	.87

[a] Supplement composition: calcium carbonate 12.95%, cotton meal, solvent process 65.55%, potassium chloride 1.91%, Rumensin 60 units .26%, salt 3.57%, soymeal 44 10.47%, trace mineral .01%, Tylan 40 units .13%, urea 4.75%, vitamin A-30 units .26%, vitamin E 226,800 units .01%.

the average pounds of force required for each steak.

During the course of the trial, one steer from each of treatments S, R and ST suffered a broken leg. These steers were excluded from the data set and feed consumption records for their respective pens were adjusted according to net energy requirements for these steers. Feed efficiency and calculated net energy determinations were computed using pen means for feed consumption because animals were not fed individually. All carcass data were analyzed on a per animal basis. Statistical analysis was conducted with implant treatment and weight replication included in the model as main effects. No apparent interactions existed between implant treatment and weight replication. Least squares means were utilized to account for the unequal number of steers among treatments. Contrasts were conducted for the following effects: CI, ci = control versus all implants; CS, cs = control versus Synovex-S; CT, ct = control versus treatments with TBA (R, ST, STT); ST, st = Synovex-S versus treatments including TBA; and EL, el = early versus late TBA administration. Significance was reported at the .05 and .10 probability levels.

Results and Discussion

Effects of implant treatment on cattle performance are presented in Table 2. Final weights were adjusted (hot carcass weight/.64, an assumed dressing

Table 2. Live cattle performance as stratified by implant treatment.

	Treatment[a]						
	C	S	R	ST	STT	SE	Effect[b]
Number of steers	28	27	27	27	28		
Weights, lb							
Initial	776	779	778	777	777	1.15	
Day 114	1203	1188	1230	1222	1240	11.31	ct ST
Final[b]	1172	1156	1192	1199	1206	8.43	CT ST
Gain, lb/d							
0-114 days	3.33	3.16	3.53	3.47	3.63	.10	ct ST
0-slaughter	3.24	3.07	3.38	3.45	3.50	.07	CT ST
Feed intake, lb/d							
0-114 days	20.21	19.45	18.37	18.93	20.05	.53	CS st
0-slaughter	19.94	18.64	19.87	19.39	19.79	.31	CS ST
Feed / Gain							
0-114 days	6.08	5.84	5.50	5.47	5.54	.24	ci ct
0-slaughter	6.15	6.07	5.88	5.63	5.66	.12	CI CT ST
Calculated net energy							
NE_g,mcal/cwt	63.7	65.0	66.2	68.7	68.3	1.09	CI CT ST

[a] Implant treatments: C = control (non-implanted); S = Synovex-S on day 1; R = Revalor on day 1; ST = Synovex-S + TBA on day 1; STT = Synovex-S + TBA on day 1 and TBA reimplanted on day 58.

[b] Contrast effects:
CS (P<.05), cs (P<.10) = control versus Synovex-S;
CI (P<.05), ci (P<.10) = control versus all implants;
CT (P<.05), ct (P<.10) = control versus treatments with TBA;
ST (P<.05), st (P<.10) = Synovex-S versus treatments with TBA.

[c] Final weight = hot carcass weight/.64.

percentage) for more accurate estimation of average daily gain, feed efficiency and estimation of net energy content of the diet. Steers receiving TBA either from Revalor or combined implants of Synovex-S and Finaplix-S were heavier (P<.05) at slaughter than Synovex-S implanted or non-implanted steers (P<.05). In contrast to previous studies, slaughter weights for steers receiving a single implant of Synovex-S tended to be slightly lower than for non-implanted steers. A combination of estradiol and TBA (Treatments R, ST, and STT) increased average daily gains by an average of 6.2 and 11.6% respectively above controls and Synovex-S alone (P<.05). Feed efficiency was improved 1.3, 4.4, 8.5, and 8.0% for treatments S, R, ST, and STT respectively, over controls. The most apparent improvements (P<.05) in feed efficiency occurred for steers receiving TBA. Daily feed intake was similar across treatments except for steers treated with Synovex-S on day 0; they consumed less (P<.05) feed than controls or steers receiving TBA. This may account for their lower gains and final weights. Calculated NE_g values were highest (P<.05) for steers implanted with TBA (R, ST and STT) suggesting these steers used dietary energy most efficiently for live weight gain.

Values for the various carcass traits analyzed are represented in Table 3. Adjusted fat thickness, percentage kidney, pelvic and heart fat, and marbling score were unaffected (P>.05) regardless of implant treatment. However, steers with TBA had larger (P<.05) ribeyes than C or S steers. This increase was also observed when expressed as ribeye area/100 lb of carcass weight. A slight improvement in yield grade was also noted for TBA steers over controls (P<.10). The percentage of carcasses attaining choice was lowest (P<.05) for steers implanted with Revalor (51.8%) and a slight, but not significant reduction in percentage choice was noted for steers reimplanted with Finaplix-S on day 58 (71.4%). Percentage choice for C, S and ST treatments were 82.1, 82.1 and 85.7%, respectively. Exogenous sources of estrogen hasten physiological maturity. Skeletal maturity scores for all steers receiving implants were slightly more advanced (P<.05) than maturity scores for control steers. However, maturity scores for all treatments were well within "A" and this slight increase likely has no practical implication. No differences were noted across treatments for lean maturity or lean color scores (P>.05). Likewise, no problems with "dark-cutting" beef were detected. Steers receiving TBA either from Finaplix-S or Revalor produced carcasses with more masculine characteristics (lower numerical bullock scores) than non-implanted or Synovex-S implanted steers and additionally, bullock traits were most apparent with late administration (day 58) of TBA. Again, the practical implications are minor for these slightly elevated bullock scores since the means for all treatments were between 4 (slight bullock tendencies) and 5 (no evidence).

Values for post rigor longissimus (ribeye) muscle pH , proximate analysis, cooking properties and resistance to shear are presented in Tables 4 and 5. Implant treatment had no effect (P>.05) on post rigor pH or chemical

Table 3. Carcass traits as stratified by implant treatment.

	Treatment[a]						
	C	S	R	ST	STT	SE	Effect[b]
No. of carcasses	28	27	27	27	28		
Carcass weight, lb	751	740	763	767	771	5.39	CT ST
Fat thickness, in	.59	.61	.53	.55	.57	.04	
Ribeye area, in^2	12.8	13.0	13.7	13.8	13.8	.26	CI CT ST
KPH fat, %	2.1	2.0	2.1	2.1	2.0	.06	
Yield grade	3.2	3.1	2.8	2.8	2.8	.15	ct
Percent YG 4	7.1	14.2	0	7.7	10.7	6.66	
Skeletal maturity[c]	145	158	169	160	157	3.76	CI CT
Lean maturity[c]	139	139	138	140	139	1.92	
Marbling score[d]	463	435	418	447	438	14.7	
Percentage Choice	82.1	82.1	51.8	85.7	71.4	7.87	
Lean color score[e]	6.25	6.33	6.33	6.26	6.39	.09	
Bullock score[f]	4.6	4.6	4.3	4.4	4.1	.10	CT ST EL

[a] Implant treatments: C = control (non-implanted); S = Synovex-S on day 1; R = Revalor on day 1; ST = Synovex-S + TBA on day 1; STT = Synovex-S + TBA on day 1 and TBA reimplanted on day 58.

[b] Contrast effects:
CI (P<.05), ci (P<.10) = control versus all implants;
CT (P<.05), ct (P<.10) = control versus treatments with TBA;
ST (P<.05), st (P<.10) = Synovex-S versus treatments with TBA;
EL (P<.05), el (P<.10) = early versus late TBA adminstration.

[c] Maturity score: 100 to 199 = "A" maturity (approximately 9 to 30 months of age).

[d] Marbling score: 400 to 499 = "small" corresponding to choice.

[e] Lean color score: 7 = light cherry red; 6 = cherry red; 5 = slightly dark red.

[f] Bullock score: 5 = no evidence; 4 = slight bullock tendencies.

Table 4. Proximate analysis and pH values as stratified by implant treatment.

	Treatment[a]					
	C	S	R	ST	STT	SE
Number of samples	28	27	27	27	28	
Post rigor pH[b]	5.7	5.7	5.7	5.7	5.7	.02
Moisture, %[b]	72.5	72.9	73.2	72.8	72.9	.19
Protein, %[b]	22.8	22.6	23.1	22.5	22.8	.18
Lipid, %[b]	4.0	4.1	3.3	3.9	3.6	.26
Ash, %[b]	1.1	1.1	1.1	1.1	1.1	.03

[a] Implant treatments: C = control (non-implanted); S = Synovex-S on day 1; R = Revalor on day 1; ST = Synovex-S + TBA on day 1; STT = Synovex-S + TBA on day 1 and TBA reimplanted on day 58.

[b] All means did not differ (P>.05).

Table 5. Cooking property and shear force values as stratified by implant treatment.

	Treatment[a]						
	C	S	R	ST	STT	SE	Effect[b]
Number of steaks	28	27	27	27	28		
Cooking time, min	22.6	21.6	22.3	22.4	22.4	.61	
Cooking shrink, %	29.1	30.0	28.9	30.0	29.5	.65	
Shear force, lb	8.82	9.77	9.52	9.08	9.72	.13	CS CI ct
Percent tough[c]	21.4	37.5	37.5	25.8	35.7	8.57	

[a] Implant treatments: C = control (non-implanted); S = Synovex-S on day 1; R = Revalor on day 1; ST = Synovex-S + TBA on day 1; STT = Synovex-S + TBA on day 1 and TBA reimplanted on day 58.

[b] Contrast effects:
CS (P<.05), cs (P<.10) = control versus Synovex-S;
CI (P<.05), ci (P<.10) = control versus all implants;
CT (P<.05), ct (P<.10) = control versus treatments with TBA;
ST (P<.05), st (P<.10) = Synovex-S versus treatments with TBA.

[c] Percentage of steaks with shear force values of 10 lb or higher.

composition of the ribeye muscle. Additionally, cooking time and cooking shrinkage of boneless rib steaks from implanted steers did not differ (P>.05) from the controls. Implanted steers produced steaks with slightly higher (P<.05) shear force values than non-implanted steers. No differences among treatments were noted for percentage of tough (shear force values greater than 10 lb) steaks.

The results of this study indicate that steers implanted with a combination of TBA and estradiol, managed under similar conditions, are faster gaining, more feed efficient, and more muscular than steers receiving no implant or an estrogen only. However, Revalor or TBA administered late in the finishing phase may reduce the number of carcasses reaching the choice grade. Implants did not adversely affect the ribeye muscle chemical composition and only a slight increase in shear force was noted.

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