EFFECTS OF COMBINATION ANDROGENIC AND ESTROGENIC ANABOLIC IMPLANTS ON CARCASS TRAITS OF SERIALLY-SLAUGHTERED STEERS

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Story in Brief

Yearling steers from a similar background (n=514) were fed a high concentrate diet and serially-slaughtered after 127, 148 or 169 days on feed to evaluate the effects of an androgenic implant, trenbolone acetate (TBA), in combination with estradiol benzoate on carcass grade traits. Implant treatments were: CON = nonimplanted control, ET = 28 mg estradiol benzoate plus 200 mg TBA on day 0, ETET = ET administered on day 0 and implanted on day 61, and SET = 20 mg estradiol benzoate plus 200 mg progesterone on day 0 with an implant of ET on day 61. Carcass grade traits were evaluated at approximately 66 hours postmortem. Implant treatment least squares means were compared at four constant endpoints: time-on-feed (148 days), slaughter weight (1225 lb), fat thickness (0.60 in), and marbling score (Small[59]). Implanted steers were heavier (slaughter and carcass weights), more advanced in skeletal and overall maturity, similar in fat thickness, and possessed larger ribeyes than nonimplanted steers. Lean color was similar for all treatment groups. Of the 514 steers slaughtered, no dark cutters were detected. The use of a combination estrogenic and androgenic implant resulted in lower marbling scores and fewer U.S. Choice carcasses than controls. Under the conditions of this study, implanted steers required an additional 35 to 44 days of high concentrate feeding to achieve a similar degree of marbling to nonimplanted controls.

(Key Words: Beef, Anabolic Implants, Carcass Traits.)

Introduction

Anabolic implants have been used to improve growth and feed efficiency. Trenbolone acetate (TBA), an androgenic compound, has an additive effect with estradiol benzoate (EB) to increase feedlot performance, muscling and leanness. Because combination implants (TBA and EB) have been profitable, usage by feedlot operators has increased.

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On the negative side, the percentage of feedlot cattle implanted with TBA grading U.S. Choice or above is as low as 40% compared with 70 to 80% for other implants (Anderson, 1991). In comparing three weight endpoints, Anderson et al. (1991) noted that increasing the days fed or the live weight at slaughter for TBA+EB implanted steers would reduce differences in marbling without the loss of other TBA+EB induced carcass size and muscularity advantages. Various reimplant studies have been conducted to determine if reimplantation during the finishing phase would optimize muscle growth and feeding efficiency. Reimplantation with EB plus TBA has improved steer performance with no depression in marbling score or percentage of U.S. Choice as compared with EB alone (Bartle et al., 1992). Hence, numerous researchers have suggested that an implant window exists in which reimplant time prior to slaughter must be considered to balance performance, carcass cutability, and carcass quality.

Various feeding and implant strategies are being utilized today. Timely research is needed to determine the best implant protocol to optimize production and carcass traits. The objective of this study was to compare the effects of combination implants administered at the start of the finishing phase and (or) at reimplant time on carcass grade traits among serially-slaughtered steers.

Materials and Methods

Yearling Charolais and Angus crossbred steers were obtained from a single source and blocked by initial weight (avg. 698 lb) into four groups. Implant treatments consisted of: CON = non-implanted control; ET = 28 mg estradiol benzoate plus 200 mg trenbolone acetate implanted on day 0; ETET = ET administered on day 0 and implanted on day 61; and SET = 20 mg estradiol benzoate plus 200 mg progesterone given on day 0 with an implant of ET on day 61. Steers were serially-slaughtered after 127, 148 and 169 days of feeding a high concentrate diet. Carcass grade data were obtained approximately 66 hours postmortem (USDA, 1989). Additionally, all carcasses were assigned scores for masculinity characteristics (bullock scores: 5 = no evidence, 1 = extremely severe).

The statistical model included weight block, implant treatment, days-fed and the implant treatment by days-fed interaction. Contrasts were used to assess linear or curvilinear responses across days-fed for carcass traits of interest both overall and within implant treatment groups. Least squares means for treatment effects reflect comparisons at a days-constant (148) endpoint. Appropriate days-based regression equations were used to predict carcass trait values at three additional endpoints (constant weight of 1225 lb, constant fatness of 0.60 in, and a constant marbling score of small[59]). These values

were separated using Tukey's HSD procedure (Steel and Torrie, 1980). Contrasts were conducted for effects of all implants compared to controls (CI); early versus late TBA administration (EL); and ET late implant versus SET (ST). Significance was reported at the .05 probability level.

Results and Discussion

Least squares means for slaughter and carcass traits adjusted to the four constant endpoints are presented in Tables 1 through 4. The use of multiple endpoints provides greater insight for producers to examine the effects of implant treatments on steers slaughtered at a constant time-on-feed, similar live weight, constant external fatness, or constant quality grade (similar marbling score). The time-constant endpoint allows for comparisons after a specified feeding time. Weight-constant endpoints provide comparisons for developmental differences in carcass cutability and quality traits and reflect differences in degree of tissue maturation attributable to implants. The fat constant endpoints compare implant treatments at similar stages of tissue (i.e., fat thickness for cutability or marbling for quality) development. Each of these endpoints have practical marketing implications.

Constant Time-On-Feed. Implanted steers were heavier ($P<.05$) at slaughter and produced carcasses with significantly heavier weights, more advanced skeletal and overall maturity, larger ribeyes and more pronounced masculinity than control steers (Table 1). Moreover, carcasses from implanted steers had less ($P<.05$) marbling resulting in lower percentages of U.S. Choice and higher percentages of U.S. Select quality grades. There were no ($P>.05$) differences among implant treatment groups and controls for lean maturity nor were there any dark cutters in the 514 steers in this study. Likewise, no differences were noted in yield grade among treatment groups and controls. A second implanting with ET produced heavier ($P<.05$) weights (slaughter and carcass) and higher skeletal maturities than a single ET implant at the onset of the finishing phase. Steers doubly implanted with ET produced the heaviest, most masculine carcasses and tended to have the least marbling. It is important to note that despite significant differences in carcass maturity and masculinity, all carcasses were well within the "A" maturity category (youngest for beef) and not pronounced enough in bullock characteristics to warrant a discount in quality grading.

Constant Slaughter Weight. Implanted steers required about 30 fewer days of high-concentrate feeding to reach a constant slaughter weight endpoint than control steers (Table 2). At a constant slaughter weight, implanted steers had significantly larger ribeyes, less internal fat, similar fat thickness, and more desirable yield grades than carcasses from non-implanted steers. Additionally,

implanted steers had significantly lower marbling scores. Unlike the constant days-fed comparison, few differences were noted among treatment groups for skeletal, lean and overall maturity when steers were compared at a similar weight.

Constant Fat Thickness. Results of this study are similar to previous reports in that anabolic implants had little effect on subcutaneous fat thickness. Accordingly, time-on-feed to a constant fat thickness was similar among treatment groups (Table 3). Nonetheless, heavier ($P<.05$) slaughter and carcass weights as well as more advanced skeletal maturity were noted for carcasses from implanted steers. Carcasses from nonimplanted steers had higher ($P<.05$) marbling scores (small vs slight), higher amounts of internal fat, and smaller ribeyes than carcasses from implanted groups. As with similar endpoint comparisons, yield grades were similar among treatment groups.

Constant Marbling Score. Implanted steers required an additional 35 to 44 days-on-feed to reach the constant marbling score of small^{59} (Table 4). Unfortunately, the mean marbling score for several of the treatment groups was well above small^{00} (the minimum marbling requirement for U.S. Choice and preferred score for this constant endpoint) on the first slaughter date. Thus, a score closer to the overall mean had to be selected to remain within the marbling range of each treatment group. The implanted steers produced heavier ($P<.05$) slaughter and carcass weights along with a higher dressing percentage for doubly implanted steers. All implant treatments exhibited advanced ($P<.05$) skeletal, lean and overall maturities at a constant marbling score endpoint. Because implanted steers required additional days-on-feed, their carcasses were fatter ($P<.05$), both externally and internally, and produced less desirable yield grades than controls. Even though implanted steers exhibited larger ($P<.05$) ribeyes than controls, the extra time-on-feed and weight necessary to attain small-plus marbling resulting in final yield grades approaching 4.0.

Implications

Implanting results in heavier slaughter and carcass weights as well as larger ribeye areas at constant time, weight, and fatness endpoints. Results of this study revealed no adverse effects of implant on lean color and the incidence of dark cutting beef. However, marbling score and thereby the percentage of U.S. Choice were depressed by implants. Steers of similar biological type (Continental European x British) administered a similar combination implant require approximately 35 to 44 more days of high concentrate feeding to deposit a similar amount of marbling to nonimplanted controls, and after this time, yield grade is affected adversely.

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Table 1. Least squares means for carcass traits stratified by implant treatment at a constant time-on-feed (148 days).

Trait	Implant Treatment[a]				
	CON	ET	ETET	SET	Effect[b]
Slaughter weight, lb	1187.0[h]	1263.2[g]	1288.3[f]	1280.4[f]	CI EL
Hot carcass weight, lb	762.8[i]	809.3[h]	838.8[f]	826.0[g]	CI EL ST
Dressing percentage	64.3[g]	64.1[g]	65.1[f]	64.5[g]	EL ST
Skeletal maturity[c]	130.8[h]	148.3[g]	154.7[f]	154.5[f]	CI EL
Lean maturity[c]	146.5	145.9	148.0	150.2	
Overall maturity[c]	138.7[h]	147.1[g]	151.3[g]	152.3[f]	CI
Marbling score[d]	490.5[f]	444.6[g]	419.3[h]	433.6[gh]	CI EL
U.S. Prime, %	4.8	2.3	0.8	0	
U.S. Choice, %	81.8	76.0	58.1	72.3	
U.S. Select, %	13.5	21.7	39.5	27.7	
U.S. Standard, %	0	0	1.6	0	
Fat thickness, in.	0.58	0.63	0.63	0.63	CI
Adjusted fat thickness, in.	0.62[g]	0.65[g]	0.68[f]	0.66[g]	CI
Ribeye area, sq. in	12.13[g]	13.05[f]	13.37[f]	13.25[f]	CI
Ribeye area/cwt.	1.60	1.62	1.60	1.61	
Internal (KPH) fat, %	2.94	2.72	2.69	2.68	CI
Yield grade	3.65	3.57	3.64	3.60	
YG 1, %	2.4	3.9	3.8	5.4	
YG 2, %	17.6	27.6	27.0	18.6	
YG 3, %	50.4	39.4	41.3	47.3	
YG 4, %	23.2	20.5	18.3	19.4	
YG 5, %	6.4	8.7	9.5	9.3	
Bullock score[e]	4.6[f]	4.3[g]	4.0[h]	4.2[g]	CI EL ST

[a] Implant treatments: CON = nonimplanted control, ET = 28 mg estradiol benzoate plus 200 mg trenbolone acetate on day 0, ETET = ET on day 0 and 61, SET = 20 mg estradiol benzoate plus 200 mg progesterone on day 0 and ET on day 61.

[b] Contrast effects:
CI (P<.05) = control versus all implants;
EL (P<.05) = early versus late TBA administration (ET vs. ETET);
ST (P<.05) = 20 mg estradiol benzoate plus 200 mg progesterone on day 0 versus ET implants (ETET vs. SET).

[c] Carcass maturity scores: 100 to 199 = "A" maturity, approximately 9 to 30 months of chronological age at slaughter (USDA, 1989).

[d] Marbling score: 400 to 499 = "small" degree, the minimum for U.S. Choice.

[e] Bullock score: 5 = no evidence; 1 = severe bullock characteristics.

[f,g,h,i] Means in the same row with a common superscript letter are not (P>.05) different.

Table 2. Predicted values for carcass traits stratified by implant treatment at a constant slaughter weight (1225 lb).

	Implant treatment[a]			
Trait	CON	ET	ETET	SET
Days-fed	160.9	133.3	129.8	131.2
Slaughter weight, lb	1225.0	1225.0	1225.0	1225.0
Hot carcass weight, lb	789.4	779.1	790.1	781.6
Dressing percentage	64.7[d]	63.5[e]	64.5[d]	63.8[e]
Carcass maturity[b]				
Skeletal	134.3	143.9	146.4	147.5
Lean	148.9[d]	141.5[e]	143.6[de]	144.1[de]
Overall	142.8	142.5	145.0	145.9
Marbling score[c]	508.4[d]	421.9[e]	393.7[e]	416.5[e]
Fat thickness, in.	0.65	0.59	0.53	0.56
Adjusted fat thickness, in.	0.69	0.62	0.56	0.57
Ribeye area, sq. in	12.11[e]	12.90[d]	13.18[d]	13.08[d]
Ribeye area/cwt.	1.54	1.66	1.67	1.68
Internal (KPH) fat, %	3.10[d]	2.68[d]	2.53[e]	2.48[e]
Yield grade	3.95[d]	3.43[e]	3.17[e]	3.21[e]

[a] Implant treatments: CON = nonimplanted control, ET = 28 mg estradiol benzoate plus 200 mg trenbolone acetate on day 0, ETET = ET on day 0 and 61, SET = 20 mg estradiol benzoate plus 200 mg progesterone on day 0 and ET on day 61.

[b] Carcass maturity scores: 100 to 199 = "A" maturity, approximately 9 to 30 months of chronological age at slaughter (USDA, 1989).

[c] Marbling score: 500 to 599 = "modest" (avg Choice), 400 to 499 = "small" (low Choice); 300 to 399 = "slight" (Select).

[d,e] Means in the same row with a common superscript letter are not (P>.05) different.

Table 3. Predicted values for carcass traits stratified by implant treatment at a constant fat thickness (0.6 inch).

	Implant treatment[a]			
Trait	CON	ET	ETET	SET
Days-fed	137.8	131.9	134.3	134.4
Slaughter weight, lb.	1166.2[e]	1219.9[d]	1243.7[d]	1238.1[d]
Hot carcass weight, lb.	741.4[e]	774.3[d]	803.9[d]	794.6[d]
Dressing percentage	64.0[e]	63.4[e]	64.7[d]	64.0[e]
Carcass maturity[b]				
Skeletal	131.2[e]	143.1[d]	151.2[d]	151.5[d]
Lean	144.8	141.1	144.7	145.3
Overall	140.0	142.0	148.0	149.0
Marbling score[c]	466.0[d]	420.8[e]	392.4[e]	416.7[e]
Fat thickness, in.	0.55	0.58	0.58	0.59
Adjusted fat thickness, in.	0.59	0.61	0.62	0.61
Ribeye area, sq. in	12.14[e]	12.89[d]	13.22[d]	13.22[d]
Ribeye area/cwt.	1.65	1.67	1.65	1.66
Internal (KPH) fat, %	2.81[d]	2.68[e]	2.57[e]	2.52[e]
Yield grade	3.45	3.38	3.37	3.34

[a] Implant treatments: CON = nonimplanted control, ET = 28 mg estradiol benzoate plus 200 mg trenbolone acetate on day 0, ETET = ET on day 0 and 61, SET = 20 mg estradiol benzoate plus 200 mg progesterone on day 0 and ET on day 61.

[b] Carcass maturity scores: 100 to 199 = "A" maturity, approximately 9 to 30 months of chronological age at slaughter (USDA, 1989).

[c] Marbling score: 400 to 499 = "small" (low Choice); 300 to 399 = "slight" (Select).

[d,e] Means in the same row with a common superscript letter are not (P>.05) different.

Table 4. Predicted values for carcass traits stratified by implant treatment at a constant marbling score (Small[59]).

Trait	Implant treatment[a]			
	CON	ET	ETET	SET
Days-fed	125.2	160.1	168.9	169
Slaughter weight, lb.	1123.8[e]	1302.3[d]	1356.7[d]	1345.8[d]
Hot carcass weight, lb.	717.7[g]	842.8[f]	891.0[d]	876.5[e]
Dressing percentage	63.5[f]	64.5[e]	65.8[d]	65.4[d]
Carcass maturity[b]				
Skeletal	124.7[e]	153.2[d]	160.3[d]	159.8[d]
Lean	142.5[e]	149.5[d]	152.9[d]	157.8[d]
Overall	131.4[e]	151.0[d]	156.5[d]	158.0[d]
Marbling score[c]	459.0	459.0	459.0	459.0
Fat thickness, in.	0.47[e]	0.70[d]	0.72[d]	0.72[d]
Adjusted fat thickness, in.	0.50[e]	0.73[d]	0.80[d]	0.76[d]
Ribeye area, sq. in	12.16[e]	13.18[d]	13.58[d]	13.46[d]
Ribeye area/cwt.	1.69	1.55	1.53	1.54
Internal (KPH) fat, %	2.65[e]	2.75[d]	2.87[d]	2.93[d]
Yield grade	3.14[e]	3.87[d]	4.08[d]	4.03[d]

[a] Implant treatments: CON = nonimplanted control, ET = 28 mg estradiol benzoate plus 200 mg trenbolone acetate on day 0, ETET = ET on day 0 and 61, SET = 20 mg estradiol benzoate plus 200 mg progesterone on day 0 and ET on day 61.

[b] Carcass maturity scores: 100 to 199 = "A" maturity, approximately 9 to 30 months of chronological age at slaughter (USDA, 1989).

[c] Marbling score: 400 to 499 = "small" (low Choice);

[d,e,f,g] Means in the same row with a common superscript letter are not (P>.05) different.