EFFECTS OF COMBINATION ANABOLIC IMPLANTS ON BOXED-BEEF YIELDS OF SERIALLY SLAUGHTERED STEERS

M. T. Al-Maamari[1], H. G. Dolezal[2], E. S. Johnson[1], T. L. Gardner[1], B. A. Gardner[1] and D. R. Gill[3]

Story in Brief

Forty-eight pens of yearling crossbred steers (n=514, initial weight = 704 lb) were blocked by weight and allocated to one of four implant treatments: Nonimplanted (Control) = CON, ET = 28 mg estradiol benzoate and 200 mg trenbolone acetate on day 0, ETET = ET implanted on day 0 and reimplanted on day 61, SET = 20 mg estradiol benzoate and 200 mg progesterone on day 0 and ET reimplanted on day 61. Pens of cattle were divided into three slaughter groups and fed a high concentrate diet for 127, 148 or 169 days. Two steers from each pen (n=96) were selected randomly prior to slaughter and their subsequent carcasses were fabricated into boneless subprimals to three fat thickness levels (1.0, 0.25 and 0.00 inch) to determine boxed beef cutout yields. Compared with the controls, the absolute weight and yield of subprimals and total lean were higher ($P<.05$) for implanted steers. Administration of implants enhanced total boxed beef yield with the largest increase obtained with the administration of ETET and SET. Percentage yields of boxed beef products, trimmable fat, and bone were not different among the implant treatments, especially at the 0.25 and 0.00 inch fat trim endpoints. These results imply that implanting does not alter carcass tissue percentages at specified time endpoint. Implanting increased weight of salable lean without increasing the amount of trimmable fat.

(Key words: Beef, Anabolic Implants, Carcass Cutout.)

Introduction

Enhancing the performance and cutability of beef cattle has long been of interest to animal scientists and a financial incentive to cattle producers. Anabolic implants (both estrogenic and androgenic) enhance live weight gain by feedlot cattle. Further improvements in animal efficiency and carcass characteristics are needed. Trenbolone acetate (TBA) in combination with estrogenic implants has further improved carcass performance beyond estrogenic implants alone (Wagner et al., 1990). The intent of this study was to

[1]Graduate Student, [2]Associate Professor, [3]Regents Professor

examine the boxed beef cutout characteristics of carcasses from steers implanted at different stages of the feedlot phase.

Material and Methods

Five hundred fourteen Charolais crossbred steer calves from a single source of uniform size, weight and genetic type were selected for this implant trial. Upon arrival at a commercial feedlot, steers were individually weighed, tagged, processed, and blocked into four weight groups. Implant treatment assignments included: CON = nonimplanted control; ET= 28 mg estradiol benzoate plus 200 mg trenbolone acetate on day 0; ETET= ET administered on day 0 and reimplanted on day 61; SET= 20 mg estradiol benzoate plus 200 mg progesterone on day 0 and a reimplant of ET on day 61. Each treatment consisted of four pens of 11 steers designated for three slaughter dates (127, 148 and 169 days). Quality and yield grade data were collected approximately 66 hr after slaughter (USDA, 1989). Two steers were selected randomly prior to slaughter from each of the 48 pens for carcass fabrication and determination of boxed beef cutout. Left sides of each carcass in the subsample (n = 96) were initially fabricated into the four major wholesale cuts (round, loin, rib and chuck) and further fabricated into subprimals to determine weights at three subcutaneous fat trim levels (1.0, 0.25 and 0.0 inch). Boxed beef yields were assessed as major subprimals (inside round, gooseneck round, knuckle, top sirloin butt, strip loin, tenderloin, lip-on ribeye, chuck roll, and clod), minor subprimals, lean trim (50:50 and 75:25 lean:fat) and total boxed beef (major subprimals + minor subprimals + lean trim). All subprimals except for two small cuts (short ribs and backribs) were boneless.

The statistical model included weight block, implant treatment, days-fed and the implant treatment X days-fed interaction. Additionally, contrasts were used to examine linear or curvilinear effects over days-fed for dependent variables of interest both overall and within implant treatment groups. Dependent variables were assessed at four constant end points: days-fed (148), slaughter weight (1225 lb), fat thickness (0.60 in), and marbling score (small^{59}). Considering the serial slaughter design of this study, overall implant treatment means represent comparisons at a constant time (148 days-fed). These means were separated via least squares means analysis. Appropriate days-based regression equations were used to predict trait values at the other three endpoints. Tukey's HSD procedure was used to test values after adjusting error variances for regression estimates along the days-based lines. Contrasts were conducted for effects of all implants compared with 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 grade traits characterizing the subset of carcasses used for fabrication are presented in Table 1. Carcasses from implanted steers had heavier weights, more advanced skeletal maturity, and larger ribeyes than carcasses from nonimplanted steers. Carcasses from ETET steers had lower (P<.05) marbling scores than controls. The mean yield grade and adjusted fat thickness for carcasses from ET steers tended to be higher than for other implant treatment groups; however, differences were not significantly different in this subset.

Constant Time-On-Feed. Time-constant endpoints are used frequently in feedlot marketing programs across the U.S. Comparisons made at this endpoint should reveal absolute differences in tissue growth associated with implant treatment groups over a specified high concentrate feeding period. Recall that all steers were blocked by weight and assigned randomly to implant treatment groups at the onset of the finishing phase. Fortunately, initial weights among treatment groups (CON = 699, ET = 698, ETET = 696, and SET = 697) for this subset were not (P>.05) different.

Least squares implant treatment group means for boxed beef lean, fat trim, and bone at various fat trim levels are presented in Table 2. Previously cited differences in weight as well as external fatness due to implant treatments were maintained through boxed beef yields. Carcasses from implanted steers produced more total pounds of major and minor subprimals, lean trim, total boxed beef, and bone at all three levels of trimmable fat. Likewise, no differences (P>.05) were detected among implant treatment groups for weights of trimmable fat, regardless of the severity of trim.

These results imply that implanting does not alter composition of gain to a specified time endpoint; however, implanting increased weight of salable lean without increasing the amount of trimmable fat.

Constant Slaughter Weight. Weight-constant comparisons should magnify tissue developmental differences attributable to implant treatments. Predicted least squares means at a constant slaughter weight for carcass component yields stratified by implant treatment groups are reported in Table 3. Carcasses from steers doubly implanted with ET (ETET) yielded more (P<.05) total pounds of major subprimals and total boxed beef than carcasses from nonimplanted steers. No (P<.05) differences were detected in the total boxed beef and major subprimals yields among CON, SET and ET treatment groups. Carcasses from all implanted steers yielded fewer (P <.05) total pounds of fat than control carcasses at all levels of trim (1.0, 0.25, and 0.0 inch). Yields of minor subprimals, lean trim, and bone were not affected (P>.05) by implant treatments when comparisons were made at this constant slaughter weight.

Constant Fat Thickness. Comparisons at a constant fat thickness contrast differences in developmental patterns independent of stage of fattening. At this endpoint, carcasses from implanted steers still yielded more ($P<.05$) boxed beef (total, major subprimals, minor subprimals, and lean trim) at all trim levels as well as more bone than carcasses from nonimplanted steers (Table 4). As expected, no differences were detected ($P>.05$) among implant treatment groups for pounds of trimmable fat at a constant fat thickness endpoint. Carcasses from steers reimplanted with ET tended to produce more total pounds of major subprimals and, accordingly, more total boxed beef than carcasses from steers implanted with ET only at the onset of the finishing phase.

Constant Marbling Score. Comparisons at a constant marbling score (level of quality) are presented in Table 5. Such Comparisons reflect an economically important bench-mark for the beef industry. Treatment effects at this endpoint were similar to comparisons made at a constant fat thickness except that carcasses from implanted steers yielded significantly more trimmable fat (1.0, 0.25, and 0.00 trim levels) than carcasses from nonimplanted steers.

Implications

Results of this study indicate that steers receiving combination (estrogenic + androgenic) implants maintained their advantage in weight through to boxed beef yield level regardless of the trimming specification. Implanting did not appear to alter composition of gain (tissue percentage basis) in time-constant comparisons; however, implanting increased weight of salable lean without increasing the amount of trimmable fat.

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Table 5. Predicted least squares means for boxed beef lean, fat trim and bone for the 1.0 , 0.25 and 0.0 fat trim specification stratified by implant treatment at a constant marbling (Small[50]).

	Implant Treatment[a]			
Trait	CON	ET	ETET	SET
Number of sides	25	24	25	22
Boxed beef Total, lb				
1.0 inch	503.7[d]	592.7[c]	630.3[b]	620.0[b]
0.25 inch	480.5[d]	564.6[c]	599.4[b]	588.5[b]
0.0 inch	468.1[c]	551.2[b]	584.8[b]	573.4[b]
Major primals, lb				
1.0 inch	301.8[d]	354.5[c]	384.8[b]	376.2[b]
0.25 inch	255.7[d]	298.3[c]	322.6[b]	312.5[b]
0.0 inch	235.8[d]	275.3[c]	297.0[b]	287.8[bc]
Minor subprimals, lb				
1.0 inch	124.4[d]	144.9[c]	149.5[bc]	150.7[b]
0.25 inch	120.1[d]	140.3[c]	144.2[bc]	146.6[b]
0.0 inch	112.3[c]	131.2[b]	134.9[b]	136.4[b]
Lean trim, lb				
1.0 inch	77.5[c]	93.4[b]	96.0[b]	93.1[b]
0.25 inch	104.8[d]	126.0[c]	132.5[b]	129.4[bc]
0.0 inch	119.9[d]	144.7[c]	152.8[b]	149.2[bc]
Fat trim, lb				
1.0 inch	106.5[c]	126.3[b]	131.8[b]	134.8[b]
0.25 inch	129.6[c]	155.4[b]	162.7[b]	160.3[b]
0.0 inch	142.1[d]	167.7[c]	177.3[b]	181.3[b]
Bone, lb	101.2[c]	122.9[b]	127.7[b]	125.1[b]

[a] Implant treatments: CON= control (non- implanted); ET=28 mgestradiol benzoate and 200 mg trenbolone acetate on day 0; ETET=ET on day 0 and day 61; SET=20 mg estradiol benzoate plus 200 mg progesterone on day 0 and ET reimplanted on day 61.

[b,c,d] Means in the same row with a common superscript letter are notdifferent ($P > .05$).

Table 4. Predicted least squares means for boxed beef lean, fat trim and bone for the 1.0, 0.25 and 0.0 fat trim specification stratified by implant treatment at constant fat thickness (0.6 inch).

Trait	Implant Treatment[a]			
	CON	ET	ETET	SET
Number of sides	25	24	25	22
Boxed beef total, lb				
1.0 inch	525.1[d]	553.3[c]	576.2[b]	565.3[b]
0.25 inch	499.4[d]	529.5[c]	549.0[b]	539.4[bc]
0.0 inch	486.4[d]	517.5[c]	536.2[b]	525.4[b]
Major primals, lb				
1.0 inch	314.2[d]	329.2[c]	347.3[b]	341.9[b]
0.25 inch	264.3[d]	280.2[c]	293.7[b]	289.4[bc]
0.0 inch	243.6[c]	259.2[b]	271.5[b]	266.7[b]
Minor subprimals, lb				
1.0 inch	129.2[c]	135.9[b]	139.0[b]	136.1[b]
0.25 inch	124.7[c]	131.2[b]	134.5[b]	131.8[b]
0.0 inch	116.2[c]	122.8[b]	125.8[b]	122.6[b]
Lean trim, lb				
1.0 inch	81.6[c]	88.1[b]	89.8[b]	87.2[b]
0.25 inch	110.4[c]	118.0[b]	120.8[b]	118.2[b]
0.0 inch	126.2[c]	135.4[b]	138.8[b]	136.0[b]
Fat trim, lb				
1.0 inch	115.3	108.4	112.0	114.3
0.25 inch	141.0	133.0	139.1	136.0
0.0 inch	154.0	144.2	152.0	154.1
Bone, lb	106.3[c]	112.1[b]	116.5[b]	112.5[b]

[a] Implant treatments: CON= control (non- implanted); ET=28 mgestradiol benzoate and 200 mg trenbolone acetate on day 0; ETET=ET on day 0 and day 61; SET=20 mg estradiol benzoate plus 200 mg progesterone on day 0 and ET reimplanted on day 61.

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

Table 3. Predicted least squares means for boxed beef lean, fat trim and bone for the 1.0, 0.25 and 0.0 fat trim specification stratified by implant treatment at a constant slaughter weight (1225 lb).

Trait	Implant Treatment[a]			
	CON	ET	ETET	SET
Number of sides	25	24	25	22
Boxed Beef Total, lb				
1.0 inch	552.9[c]	555.7[bc]	566.6[b]	558.5[bc]
0.25 inch	523.9[c]	531.7[bc]	540.2[b]	533.3[bc]
0.0 inch	510.2[c]	519.6[bc]	527.6[b]	519.5[bc]
Major Primals, lb				
1.0 inch	330.4[c]	330.8[c]	340.7[b]	337.7[bc]
0.25 inch	275.5[c]	281.4[bc]	288.6[b]	286.6[bc]
0.0 inch	253.8[c]	260.2[bc]	267.0[b]	264.1[bc]
Minor Subprimals, lb				
1.0 inch	135.5	136.5	137.2	134.3
0.25 inch	130.6	131.8	132.8	130.0
0.0 inch	121.2	123.3	124.2	120.9
Lean Trim, lb				
1.0 inch	87.1	88.4	88.8	86.5
0.25 inch	117.8	118.5	118.8	116.8
0.0 inch	135.2	136.0	136.4	134.4
Fat Trim, lb				
1.0 inch	126.8[b]	109.5[c]	108.6[c]	111.8[c]
0.25 inch	155.8[b]	134.4[c]	135.0[c]	133.0[c]
0.0 inch	169.5[b]	145.6[c]	147.5[c]	150.7[c]
Bone, l	113.0	112.9	114.6	111.0

[a] Implant treatments: CON= control (non- implanted); ET=28 mgestradiol benzoate and 200 mg trenbolone acetate on day 0; ETET=ET on day 0 and day 61; SET=20 mg estradiol benzoate plus 200 mg progesterone on day 0 and ET reimplanted on day 70.

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

Table 2. Least squares means for boxed beef lean, fat trim and bone for the 1.0, 0.25 and 0.0 fat trim specifications stratified by implant treatment at a constant days-fed (148 d).

	Implant Treatment[a]			
Trait	CON	ET	ETET	SET
Number of sides	25	24	25	22
Boxed beef total, lb				
1.0 inch	536.9[c]	591.1[b]	598.3[b]	590.5[b]
0.25 inch	510.0[c]	563.3[b]	569.6[b]	562.5[b]
0.0 inch	496.7[c]	550.1[b]	555.9[b]	547.9[b]
Major primals, lb				
1.0 inch	321.0[c]	353.5[b]	362.4[b]	358.0[b]
0.25 inch	269.2[c]	297.8[b]	305.3[b]	300.6[b]
0.0 inch	248.1[c]	274.9[b]	281.7[b]	277.0[b]
Minor subprimals, lb				
1.0 inch	131.9[c]	144.5[b]	143.5[b]	143.0[b]
0.25 inch	127.2[c]	140.0[b]	138.6[b]	138.9[b]
0.0 inch	118.4[c]	130.9[b]	129.5[b]	129.3[b]
Lean trim, lb				
1.0 inch	84.0[c]	93.1[b]	92.5[b]	89.5[b]
0.25 inch	113.6[c]	125.6[b]	125.7[b]	123.0[b]
0.0 inch	130.2[c]	144.3b	144.6[b]	141.7b
Fat trim, lb				
1.0 inch	119.5	125.0	120.1	123.8
0.25 inch	146.4	152.7	148.8	151.8
0.0 inch	159.7	165.9	162.4	166.3
Bone, lb	109.2[c]	121.6[b]	121.0[b]	118.4[b]

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

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

Table 1. Least squares means for slaughter and carcass traits stratified by implant treatment.

Trait	Implant treatment[a]				
	CON	ET	ETET	SET	Effect[b]
No. of Sides	25	24	25	22	
Slaughter, weight, lb	1190.9[g]	1297.3[f]	1287.7[f]	1280.5[f]	CI
Hot carcass weight, lb	765.6[g]	837.6[f]	839.3[f]	832.6[f]	CI
Dressing percentage	64.4	64.5	65.2	65.0	
Carcass maturity[c]					
Skeletal	129.2[g]	150.9[f]	156.4[f]	166.4[f]	CI
Lean	142.4	145.3	144.3	160.6	CI
Overall	135.8[g]	148.1[fg]	150.3[fg]	163.5[f]	CI
Marbling score[d]	490.5[f]	454.1[fg]	410.3[g]	442.5[fg]	
Fat thickness, in	0.55[g]	0.73[f]	0.65[fg]	0.64[fg]	
Adjusted fat thickness, in	0.58	0.77	0.67	0.69	CI
Ribeye area, sq. in	11.9[g]	12.9[f]	13.3[f]	13.2[f]	CI
KPH, %	2.95	2.81	2.63	2.78	CI
Yield grade	3.63	4.02	3.64	3.72	
Masculinity score	4.55[f]	4.45[f]	4.05[g]	4.13[f]	CI ET

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

[b] Contrast effect: CI ($P<.05$) = CON versus all implants; ET ($P<.05$) = ETET versus ET;

[c] Carcass maturity score: 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 requirement for U.S Choice (USDA, 1989).

[e] Masculinity score: 5 = slight; 1 = severe bullock carcass characteristics

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