IMPLANT EFFECTS ON BONELESS SUBPRIMAL YIELDS AND BOXED BEEF VALUE

C.P. Foutz[1], H.G. Dolezal[2], D.R. Gill[3],
T.L. Gardner[1] and J.L. Hensley[1]

Story in Brief

Crossbred yearling steers (n=140) weighing 778 lb were allocated to one of five implant treatments: Nonimplanted = Control; Synovex-S on day 1; Revalor on day 1; Synovex-S + Trenbolone acetate (TBA) on day 1; Synovex-S + TBA on day 1 with a reimplant of TBA on day 58. Steers were fed for 119 to 126 days on a high concentrate finishing diet and slaughtered. A subsample of 40 carcasses equally distributed across implant treatment and weight block were selected for fabrication into boneless, trimmed subprimals to determine boxed beef cutout yields and values. Fat thickness, percentage kidney, pelvic and heart fat and marbling score were unaffected by implants. Larger ribeyes and more desirable yield grades were observed for TBA implanted steers than for controls. The percentage of choice carcasses was lowest for steers receiving Revalor. Compared to controls, absolute weight and percentage yields of subprimal and total side lean were higher for implanted steers; the most notable increases occurred in TBA treatments. Likewise percentage of fat trim to .25 inch was lowest for implanted steers. By increasing weight, TBA increased absolute carcass value, however due to a reduced percentage of choice, carcass value/cwt was lower for Revalor and double TBA implanted steers than for controls. Boxed beef cutout values ranged from $0.76 to $1.96/cwt higher for implanted steers compared to controls. Based on these values, increased subprimal yields associated with implants (particularly TBA) apparently offset discounts in carcass prices resulting from lower percentages of choice.

(Key Words: Steers, Implants, Carcass, Cutability, Subprimals.)

Introduction

Exogenous sources of anabolic steroids in the form of subcutaneous implants are used extensively in the cattle feeding industry. In the United

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

States, estrogenic implants have been used commercially for over 30 years and recently the androgenic compound trenbolone acetate (TBA), a synthetic analogue of testosterone, was approved. Extensive research has shown that estrogenic implants and TBA increase average daily gain, improve feed efficiency and often increase muscle mass. The exact mode of action for these anabolic compounds is not known although it is postulated that estrogen increases the rate of protein synthesis while TBA decreases the rate of protein catabolism. It is thought that the modes of action are independent and therefore improvements in performance above that of a single implant of estrogen or TBA can be realized when the two are combined.

Traditionally, slaughter cattle are marketed on a live or carcass (grade and yield) basis. Regardless of marketing scheme used, absolute weight is extremely important since producers receive payment on a per pound basis. Until the advent of USDA yield grades in the 1960's, there was no systematic method to assess carcass merit based on cutability; dressing percentage and quality grade were the two traits with the greatest impact on carcass value. Because dressing percentage and quality grade are positively correlated with carcass fatness, cattle which are over fattened by today's standards, often receive the highest prices when marketed on a grade and yield basis. Quality grade still remains important in carcass pricing, but with the shift in consumer preference towards leaner beef, yield grade or cutability also influences carcass value.

The extent to which USDA yield grades are used to reflect cutability-based value differences is limited. Presently, the only large discrepancy in price is a discount for Yield Grade 4 and 5 carcasses and retail trim levels are much lower (0 - .25 inch) than the .5 inch trim level that yield grades were initially designed to reflect. Furthermore, boxed beef has virtually eliminated historical carcass beef as the method of trade between packer and retailer. Although, the USDA National Carlot Meat Report provides carcass beef prices, these values are becoming more unreliable based on limited volume of trade. Conversely, "boxed beef cut-out value", a reflection of the composite price of major subprimals, is based on a much higher volume of trade and is becoming a more reliable method for determining value. Currently, the National Association of Meat Purveyors (NAMP) Institutional Meat Purchase Specifications (IMPS) for boxed beef require only that external fat not exceed 1 inch in thickness. Perhaps if a standard fat trim level more indicative of retail trim levels was established for boxed beef subprimals, cutout value would become an even more accurate method to assess value differences based on cutability.

At the feedlot level, implants improve profitability by increasing live gains and improving feed efficiency. At the packer and retail levels, composition and quality as well as weight are important economically. Increased growth in the form of muscle is beneficial to both producer and packer; unfortunately, the use of implants has also been associated with decreased numbers of cattle grading choice (Cross and Belk, 1989; Foutz et al., 1989). The objectives of this study were twofold: 1) to examine the effect of implant protocol on carcass grade traits as well as boxed beef subprimal yields at two fat trim levels (1.0 inch and .25 inch) and 2) to examine possible value differences in the cattle relative to different implant programs.

Materials and Methods

One hundred forty crossbred yearling steers were obtained from wheat pasture in late March and shipped to Oklahoma State University where they were individually weighed, tagged and processed. The steers were blocked by initial weight into four different weight replications and assigned to one of five implant treatments: nonimplanted = Control (C); Synovex-S (20 mg estradiol benzoate + 120 mg progesterone) on day 1 (S); Revalor[4] (20 mg estradiol benzoate + 140 mg TBA) on day 1 (R); Synovex-S + Finaplix-S (140 mg TBA) on day 1 (ST); Synovex-S + Finaplix-S on day 1 with reimplants of Finaplix-S on day 58 (STT). Steers in the same weight replication and treatment (n=7) were assigned to one of 20 pens and were fed a typical high concentrate finishing diet. The two heavier replications of steers were commercially slaughtered after 119 days and the two lighter replications slaughtered after 126 days on feed.

Quality and yield grade data were collected approximately 24 h after slaughter (USDA, 1989). Two carcasses with carcass weights closest to the mean of their respective pen were selected for a boxed beef cutout subsample. Carcasses in the subsample were equally distributed across weight replication and implant treatment, but were selected independent of quality and yield grade. The left side of each carcass in the subsample was shipped to the Oklahoma State University Meat Laboratory for fabrication into boneless subprimals. Sides were initially fabricated into the four major wholesale cuts (round, loin, rib and chuck) and further fabricated into the subprimals as listed in the USDA National Carlot Meat Report to determine boxed beef cutout value (Table 1). Weights were recorded for the untrimmed subprimals and at two subcutaneous fat trim levels (1.0 inch and .25 inch). The quantity of seam fat in chucks is relatively large because of the large number of muscles comprising this cut. Therefore, seam fat was trimmed to approximately .25 inch along with external fat. The minor wholesale cuts (foreshank, plate and flank) were fabricated into the various items reported in the Blue Sheet to determine carcass credit value. Weights for 1.0 inch fat trim, .25 inch fat trim, total retail product (trimmed to .25 inch) and total bone were recorded for each side. Component percentages were calculated using aggregate side weight.

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[4]Currently, **Revalor is not FDA approved** for commercial use.

Boxed beef cutout value was calculated using Blue Sheet prices current at the time of slaughter (Table 1). The price listed for choice carcasses was \$104/cwt with discounts of \$12/cwt and \$6/cwt for Yield Grade 4 and select carcasses, respectively. A standard kill cost of \$23.00/head and a fabrication-boxing cost of \$40.00/carcass were assumed. Blue Sheet prices of \$8.30/cwt live weight and \$25.67/cwt carcass weight were used for drop credit (hide, blood, offal etc.) and carcass credit (minor subprimals, fat trim etc.) values, respectively. Total dollar value and value/cwt were calculated for each carcass and estimated live values were derived from these calculations. Whole carcass and corresponding live values for the subsample (n=40) and entire data (n=137) set were determined using the respective grade data for each group. Boxed beef prices were calculated for the subsample, but due to a disparity in the percentage of choice carcasses between the subsample and overall data set, boxed beef prices were also determined by adjusting values to reflect that of the entire data set.

Previous studies have indicated that TBA tends to magnify masculinity characteristics in steers, particularly in the development of the neck and

Table 1. Boxed-Beef pricing schedule.[a]

IMPS	Cut name	Price/cwt Choice	Price/cwt Select
112A	Ribeye Roll (lip-on)	\$340.00	\$315.00
115	Chuck, 2 piece, boneless	114.50	114.00
120	Brisket (boneless)	102.00	100.00
167	Knuckle	147.00	144.00
168	Top Inside Round	163.00	162.00
170	Bottom Gooseneck Round	125.00	123.00
180	Strip Loin, boneless	293.00	258.00
184	Top Sirloin Butt	207.00	201.00
185A	Bottom Sirloin Flap	225.00	225.00
185B	Bottom Sirloin Ball-tip	198.00	156.00
185C	Bottom Sirloin Tri-tip	175.00	175.00
189A	Tenderloin, defatted	525.00	465.00
	Credits Value	25.67	25.67
	Blue Sheet Value	112.87	108.89

[a] Prices based on the USDA National Carlot Meat Report (Blue Sheet) July 24, 1989.

shoulders (Foutz et al., 1989). Development of the crest muscle, pizzle eye (crus of penis) and bald spot (bulbo-cavernosus muscle) was subjectively scored for each carcass using a 5 point bullock score (5 = no bullock tendencies, 1 = extremely severe bullock tendencies). Individual weight of the splenius (crest) muscle was recorded after fabrication of the chuck. Additionally, semitendinosus muscle (eye of round) weights were recorded to determine if implants affect muscle development differently at a posterior anatomical location.

Statistical analysis of grade traits and carcass components was conducted using least squares means with treatment and weight replication included in the model as main effects. No apparent interactions were observed between weight replication and implant treatment. Contrasts were conducted for effects of all implants compared to controls (CI); TBA+estradiol (treatments R, ST and STT) compared to controls (CT) and Synovex-S only (ST); TBA on day 1 and day 58 compared to TBA on day 1 only (EL). Significance was reported at the .05 and .10 probability levels. The various boxed beef cutout, carcass and live values shown in Figures 1-6, were not statistically partitioned since they are highly dependent on current market prices.

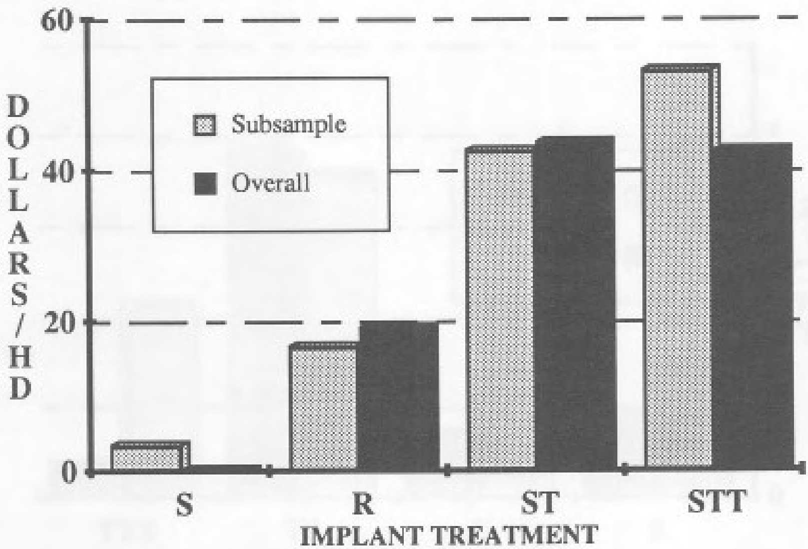

Figure 1. Absolute boxed beef value differences of implanted steers compared to controls (See text for explanation of implant treatment).

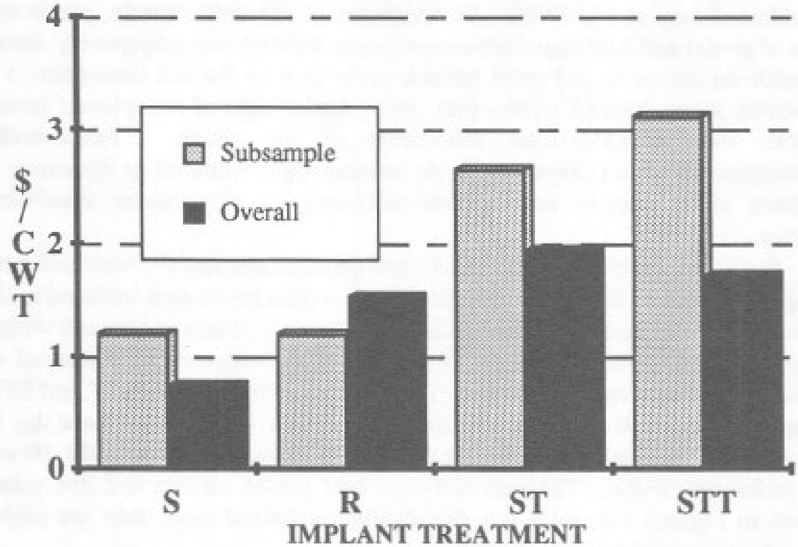

Figure 2. Boxed beef cutout value differences of implanted steers compared to controls (See text for explanation of implant treatment).

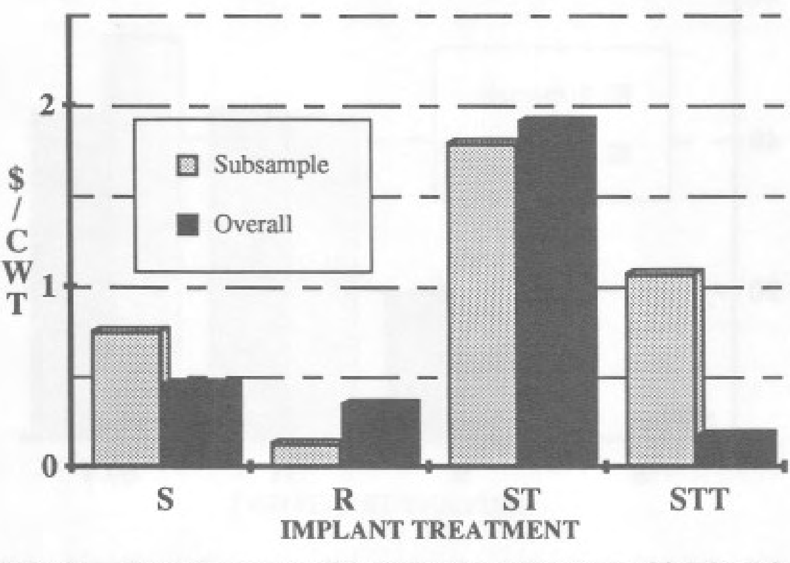

Figure 3. Boxed beef adjusted live value differences of implanted steers compared to controls (See text for explanation of implant treatment).

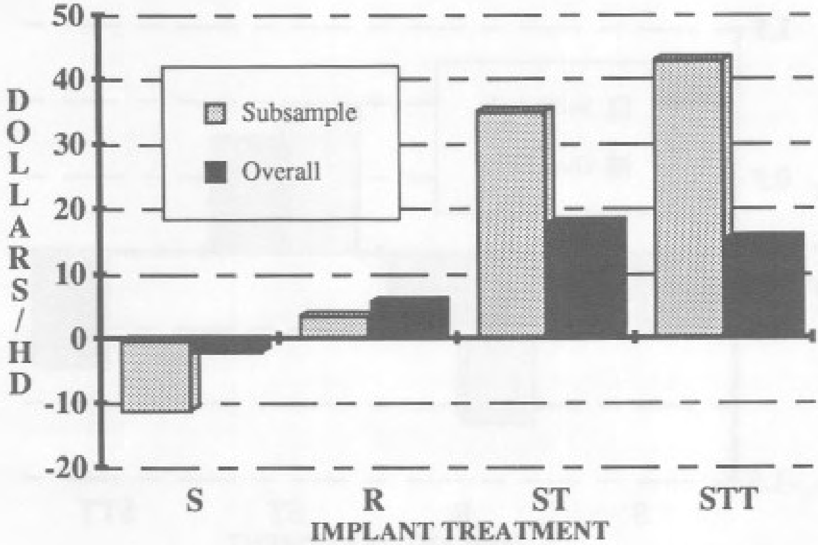

Figure 4. Absolute carcass beef value differences of implanted steers compared to controls (See text for explanation of implant treatment).

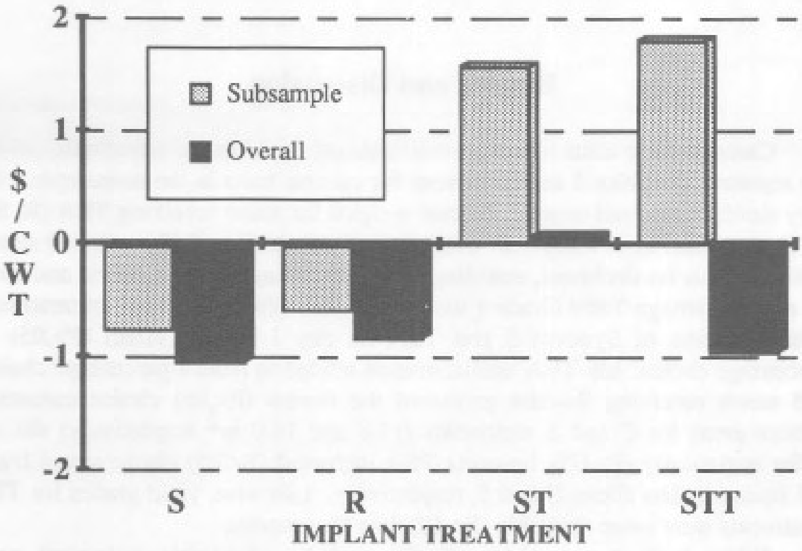

Figure 5. Carcass value differences of implanted steers compared to controls (See text for explanation of implant treatment).

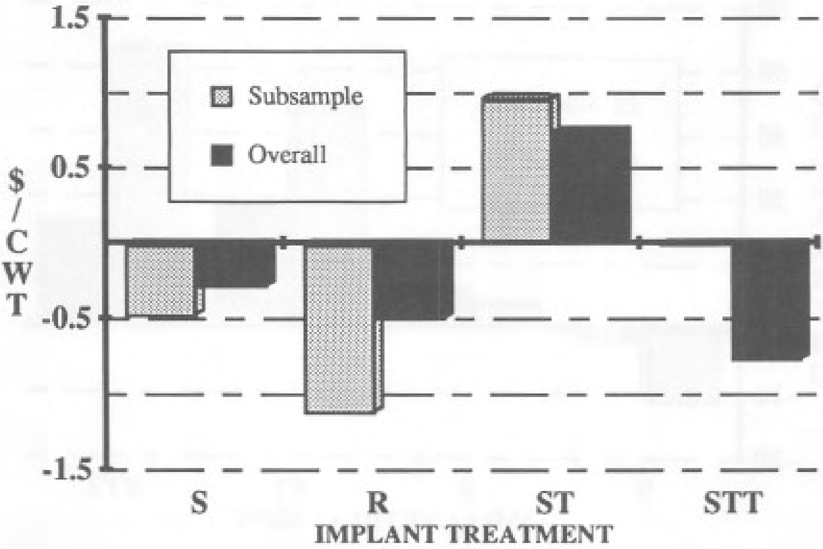

Figure 6. Carcass adjusted live value differences of implanted steers compared to controls (See text for explanation of implant treatment).

Results and Discussion

Carcass grade traits for the overall data set (n=137) and subsample (n=40) are reported in Tables 2 and 3. Means for carcass traits in the subsample were very similar to overall means. Carcass weights for steers receiving TBA (R, ST, STT) were heavier (P<.05) than weights for C (control) or S (Synovex-S) steers. Subcutaneous fat thickness, marbling score, percentage kidney, pelvic and heart fat and percentage Yield Grade 4 were unaffected (P>.05) by implant treatment. Administration of Synovex-S and TBA on day 1 had no effect (P>.05) on percentage choice; late TBA administration tended to reduce percentage choice, and steers receiving Revalor produced the fewest (P<.05) choice carcasses. Ribeye areas for C and S treatments (12.8 and 13.0 in^2 respectively) did not differ statistically (P>.05), however TBA increased (P<.05) ribeye area 1.0 and 0.8 square inches above C and S, respectively. Likewise, yield grades for TBA treatments were more desirable (P<.10) than for controls.

Table 4 illustrates yields of the various subprimals expressed as a percentage of side weight. Yields exhibited a positive numerical response to implants in 34 of the 40 observations, but most differences were too slight for

Table 2. Overall 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	
Marbling score[c]	463	435	418	447	438	14.7	
Percentage Choice	82.1	82.1	51.8	85.7	71.4	7.87	
Bullock score[d]	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 administration.

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

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

significance. Boneless chuck (IMPS 115) yields were higher for implanted compared to control steers and TBA increased yield above Synovex-S alone (P<.05). Striploin (IMPS 180) yields were also significantly higher for implanted compared to nonimplanted steers. Overall, implants increased (P<.05) cumulative subprimal yields by 0.8, 2.4, 2.7 and 1.7% for S, R, ST and STT, respectively, over controls.

Values for subprimal lean, total side lean, fat trim and side bone are presented in Table 5. An increase in muscling due to TBA was observed. Steers receiving TBA produced more total pounds of subprimal and total lean (trimmed to .25 inch fat) than C or S steers (P<.05). TBA increased total lean yields by 2.8 and 2.4% above C and S, respectively. Apparently, reimplants of TBA on day 58 did not increase muscling beyond TBA on day 1 only. Fat trim

Table 3. Subsample carcass traits as stratified by implant treatment.

	Treatment[a]						
	C	S	R	ST	STT	SE	Effect[b]
No. of carcasses	8	8	8	8	8		
Live weight, lb	1142	1135	1165	1173	1202	15.1	CT ST
Hot carcass wt, lb	746	741	754	766	772	7.59	CT ST
Fat thickness, in	.63	.64	.54	.52	.63	.07	
KPH fat, %	2.3	2.1	1.9	2.2	2.0	.16	CI
Ribeye area, in^2	12.4	12.6	13.3	13.9	14.1	.40	CT ST
Yield grade	3.4	3.3	2.8	2.7	2.9	.25	ci CT st
Percent YG 4, %	12.5	25.0	0.0	0.0	12.5	10.9	
Marbling score[c]	436	411	385	460	459	23.1	
Percent Choice, %	75.0	87.5	37.5	75.0	100	14.3	

[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.

[c] Marbling score: 300 = "slight" = select; 400 = "small" = lower 1/3 of choice.

was inversely related to lean yields with larger differences occurring at the .25 rather than 1.0 inch level. Although no differences were noted in fat thickness or internal fat at the carcass level for the subsample, TBA carcasses produced fewer total pounds of fat at the .25 inch trim level than controls (P<.05). Percentage of fat trim at the 1.0 and .25 inch levels was likewise lowest for TBA treatments. The increase in total bone weight due to implants can be attributed to heavier carcass weights as no significant differences (P>.05) were noted in the proportion of bone.

Development of the splenius (crest) muscle is illustrated in Table 6. Absolute weights for splenius muscle and chuck lean were heaviest (P<.05) for steers receiving TBA. Absolute weight alone is not a strong indicator of splenius development since it could reflect an increase in overall weight,

Table 4. Boneless trimmed (.25 inch) subprimal yields expressed as a percentage of cumulative side weight.

	Treatment[a]						
	C	S	R	ST	STT	SE	Effect[b]
No. of cuts	8	8	8	8	8		
112A Ribeye roll	2.91	2.83	2.94	3.05	3.02	.08	st
115 Bnls chuck	17.91	18.16	19.29	18.92	18.99	.36	CI CT ST
120 Brisket	2.61	2.66	2.40	2.86	2.56	.10	EL
167 Knuckle	2.51	2.72	2.48	2.71	2.64	.08	
168 Top round	4.96	5.11	5.22	5.16	5.08	.11	
170 Btm round	6.88	6.92	7.10	7.15	6.93	.13	
180 Striploin	3.00	3.12	3.37	3.22	3.18	.09	CI CT
184 Top sirloin	2.76	2.89	2.89	2.93	2.89	.10	
185 Btm sirloin[c]	1.87	1.79	2.07	1.98	1.78	.10	
189A Tenderloin	1.43	1.45	1.49	1.56	1.50	.04	ct
Total primal lean increase, %	----	.81	2.41	2.70	1.73	.71	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:
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 administration.

[c] 185 Bottom sirloin represents the combination of 185A-flap, 185B-ball tip and 185C-triangle.

Table 5. Side boxed beef lean, fat trim and bone weights and percentages.

	Treatment[a]						
	C	S	R	ST	STT	SE	Effect[b]
No. of sides	8	8	8	8	8		
Primal lean, lb[c]	168.5	170.8	178.8	182.5	180.9	2.83	CI CT ST
Side lean, lb	226.3	226.8	239.1	244.4	242.2	3.78	CI CT ST
Fat trim 1", lb	56.4	53.4	49.2	49.8	53.9	2.78	
Fat trim .25", lb	87.4	82.5	75.7	75.1	81.9	4.19	ci CT
Side bone, lb	45.6	49.0	48.4	48.8	48.1	1.24	CI ct
Primal lean, %	46.8	47.6	49.3	49.6	48.6	.71	CI CT st
Side lean, %	62.9	63.3	65.8	66.3	65.0	.89	CI CT ST
Fat trim 1", %	15.8	14.9	13.6	13.5	14.5	.75	ci CT
Fat trim .25", %	24.4	23.0	20.9	20.4	22.1	1.12	CI CT
Side bone, %	12.7	13.7	13.3	13.3	12.9	.34	

[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.

[c] Primal lean consists of the 12 major boneless subprimals used to calculate boxed beef cutout value.

however a slight increase in splenius development was detected when expressed as a percentage of chuck lean. Bullock scores were also slightly elevated (P<.05) for the same treatments. Although statistically significant, differences noted in bullock score and splenius development in this study were considered too slight for practical implication.

Figures 1 through 6 summarize boxed beef cutout values, whole carcass (grade and yield) values and corresponding calculated live values. Percentage choice for the various treatments differed between the subsample and overall data sets. Because of a larger number of observations, means for carcass traits in the overall data set were presumed to be more accurate than subsample means. Values for the subsample are presented, but only the overall means are addressed in our discussion.

Table 6. Splenius muscle development.

	Treatment[a]						
	C	S	R	ST	STT	SE	Effect[b]
No. of samples	8	8	8	8	8		
Splenius, lb[c]	1.40	1.60	1.94	1.79	1.69	.11	CI CT
Chuck lean, lb	69.01	69.93	74.70	74.73	75.50	1.41	CI CT ST
Splenius/chuck lean, %	2.03	2.28	2.60	2.39	2.22	.14	CI CT
Splenius ratio[d]	.35	.38	.42	.37	.37	.02	

[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.

[c] Splenius weight is the dissected weight of the crest muscle.

[d] Splenius muscle weight divided by semitendinosus muscle (eye of round) weight.

Boxed beef value determinations

Administration of implants enhanced total boxed beef value per/head with the largest increases of $43.86 and $42.85 for ST and STT treatments, respectively. A portion of this increase is attributed to an increase in absolute weight although ST and STT treatments did maintain respective advantages of $1.96/cwt and $1.74/cwt over controls. Advantages of $0.76/cwt and $1.55/cwt were also observed in S and R treatments, respectively, over controls. Percentage choice for S and ST were very comparable to controls, but R and STT exhibited substantially fewer choice carcasses, suggesting the advantage in boxed beef cutout value for all implant treatments was largely due to increased cutability or subprimal yields. Corresponding adjusted live cattle values were $0.47, $0.36, $1.92 and $0.19/cwt higher for S, R, ST, and STT, respectively, over controls. Synovex-S steers surpassed Revalor steers in live value/cwt; the disparity between boxed and live value differences for these two treatments can be partially explained by the slightly higher dressing percentage of steers in the S treatment.

Traditional carcass value determinations

Interestingly, carcass (grade and yield) prices did not follow the same pattern as boxed beef cutout prices. Compared to controls, total carcass value/head was higher for TBA (R, ST and STT) steers while lower for S steers. Carcass price/cwt surpassed controls in the ST group only, and was lower than controls in other treatments (-$1.05, -$0.84 and -$0.96/cwt for S, R, and STT, respectively). All carcasses ranged between 600 and 850 lb and, accordingly, quality and yield grade were the primary determinants of price/cwt. Lower carcass prices in the S treatment can be attributed to the higher number of yield grade 4 carcasses whereas R and STT steers were discounted because of a lower number of choice carcasses. Adjusted live value/cwt differences followed the same relative trend.

Summary

The increase in muscling for steers in this study receiving a combination of TBA and an estrogen was apparent both in ribeye area and lean yields. Additionally, the tendency for fewer choice carcasses associated with late administration of TBA is consistent with prior studies (Foutz et al., 1989). Since TBA was not evaluated as a single implant, it is difficult to determine the proportion of differences in traits specifically due to TBA. Reimplants of TBA on day 58 did not yield additional improvements in muscling beyond TBA implants on day 1 only, but a slight reduction in percentage choice occurred. Although the dosage levels of TBA (140 mg) and estradiol (20 mg) are identical for Revalor and combined implants of Synovex-S and Finaplix-S, steers in R and ST treatments did not exhibit the same response across all traits.

Boxed beef pricing is a step closer to consumer demands than historical carcass pricing. The disparity in relative value differences using boxed beef cutout and whole carcass pricing schemes indicates that boxed beef cutout value may send a stronger message from consumers to cattlemen concerning the net worth of their end product. This could be strengthened if boxed beef fat trim levels are standardized to coincide with ultimate retail trim levels (*.25 inch or less*). The use of implants increased boxed beef value in this study despite reduced percentages of choice in two treatments. This value increase may be attributed primarily to increased subprimal yields. Attempts to relate the use of implants to end product value are limited and additional research is need in this area to strengthen predictions.

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