PERFORMANCE, CARCASS, MEAT SENSORY AND ENDOCRINE TRAITS OF YOUNG BULLS AND STEERS IMPLANTED WITH TRENBOLONE ACETATE AND ZERANOL

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INTRODUCTION

Steroid implants commonly used in steers and heifers in the U.S. have been studied in bulls as well. Inconsistent performance responses to steroid implants in bulls might be attributed to high endogenous concentrations of androgens and estrogens in bulls that allow for near maximal expression of their genetic growth potential. This is the primary reason why implants have not been utilized in young bulls (Schanbacher 1984).

Trenbolone acetate (TBA), a recently approved growth implant for feedlot steers in the U.S., in combination with estrogenic agents, improved performance of male veal calves at the time when endogenous androgen and estrogen concentrations were low (Grandadam et al. 1975; VanderWal et al. 1975; Bouffalt and Willemart 1983). Generally, positive growth responses from implanting with TBA plus an estrogenic agent have been observed in steers (Heitzman 1978; Lobley et al. 1985; Steen 1985). However, there is little information about the effects of TBA implants combined with estrogenic agents on masculinity and meat sensory traits of young bulls and steers.

Our objectives were to determine implant effects on performance, masculinity, carcass, meat sensory and endocrine traits of bulls and steers; and to evaluate the effects of TBA plus zeranol early in life, followed by subsequent reimplanting with zeranol on bull masculinity and meat quality.

EXPERIMENTAL METHODS

Twenty-five, Polled Hereford bull calves were assigned randomly to one of three treatments shortly after birth. Five calves remained as nonimplanted, control bulls (CB). Nine bulls were implanted (IB) with 140 mg trenbolone acetate (TBA) and 36 mg zeranol (Z) at about 1 mo of age and reimplanted with both compounds 10 wk later. When these nine IB were about 21 wk of age, the TBA implants were removed, and calves were reimplanted with Z every 10 wks until slaughter. The remaining six calves were castrated at about 3 wk of age and implanted (IS) with TBA and Z every 10 wk until slaughter.

Calves were weaned at an average age of 7 mo. Over an 8-wk period, calves were fed continually increasing proportions of concentrate up to 89%. Calves were fed this diet until slaughter. Animal weights were obtained at 28-d intervals, and feed efficiencies were calculated. Blood samples were obtained via jugular venipuncture at 14-d intervals from about 5 wk of age until slaughter. Testosterone (T) concentrations were determined by the radioimmunoassay technique described by Pruitt et al. (1986). Masculinity was scored prior to slaughter by a four-member panel. Cattle were slaughtered at an average age of 13.6 mo. After a 24-h chill, USDA (1976) yield- and quality-grade data, carcass-masculinity scores and *longissimus*-quality traits were evaluated. A wholesale rib from each carcass was aged for 7 d at 2°C. Two steaks, 2.54-cm thick, were removed from the 11th to 12th rib-region and evaluated by a trained sensory panel (SP) and by a Warner-Bratzler shear (WBS) force machine mounted on an Instron Universal Testing Machine. Steaks were oven broiled at 166°C to an internal temperature of 70°C. Cores 1.27 cm in diameter were either served warm to a trained SP (AMSA 1978) or cooled to room temperature for 2 h prior to WBS determination. The SP rated steaks on an 8-point scale.

Data were analyzed by analysis of variance using the Statistical Analysis System (SAS 1982). Serum hormone concentrations were analyzed by a split-plot analysis of

Table 1. PERFORMANCE TRAITS AND MASCULINITY OF CONTROL BULLS AND IMPLANTED BULLS AND STEERS

Trait	Treatments: Implanted Steers	Implanted Bulls	Control Bulls	SE
Weaning wt., kg	214	218	205	9.2
Slaughter wt., kg	514[a]	517[a]	479[b]	10.9
Average daily gain, kg	1.6	1.5	1.4	.1
Feed/Gain (DM basis)	5.2	5.4	5.2	.1
Masculinity score at 13 mo[1]	2.3[a]	3.0[b]	3.2[b]	.2

[a,b]Means in the same row with different superscript letters differ (P<.10).

[1]Score of 1 to 5: 1 = steer, 2 = slightly masculine, 3 = moderately masculine, 4 = masculine, 5 = very masculine.

Table 2. CARCASS CHARACTERISTICS OF CONTROL BULLS AND IMPLANTED BULLS AND STEERS

Characteristics	Treatments: Implanted Steers	Implanted Bulls	Control Bulls	SE
No. animals	6	9	5	---
Hot carcass weight, kg	306	311	291	7.2
Dressing percent	59.5	60.1	60.7	.6
Carcass maturity	A^{52}	A^{53}	A^{55}	4.8
Marbling score	$Small^{07}$	$Small^{00}$	$Slight^{82}$	.1
Fat thickness, cm	1.2	1.0	.9	.1
Ribeye area, cm^2	81.3	83.2	85.2	3.7
Kidney knob, %	1.5	1.3	1.5	.2
Yield grade	2.5	2.3	1.9	.2
Jump muscle and crest score[1]	1.3	1.6	1.5	.1

[1]Scores of 1 to 6: 1 = none, 2 = barely evident, 3 = slightly prominent.

variance with treatments serving as the main plot and 14-d bleeding periods as subplots. Main-effect means were separated by Fisher's LSD.

RESULTS AND DISCUSSION

Performance data are presented in table 1. Both IB and IS tended (P = 0.07) to be heavier at slaughter than CB. Groups had similar weaning weights and were similar in feedlot ADG and FE.

Numerous researchers have demonstrated that TBA plus an estrogenic agent improved performance in young bulls (Grandadam et al. 1975; Galbraith 1982; Bouffalt and Willemart 1983; Fabry et al. 1983) and implanted steers (Heitzman 1978; Galbraith and Geraghty 1982; Bouffalt and Willemart 1983; Lobley et al. 1985; Steen 1985). Yet, Fisher et al. (1986) and Silcox et al. (1986) reported no differences between implanted bulls and CB. Performance of bulls implanted with Z near birth, and sequentially thereafter, was unaffected (Calkins et al. 1986; Gray et al. 1986) or increased (Greathouse et al. 1983).

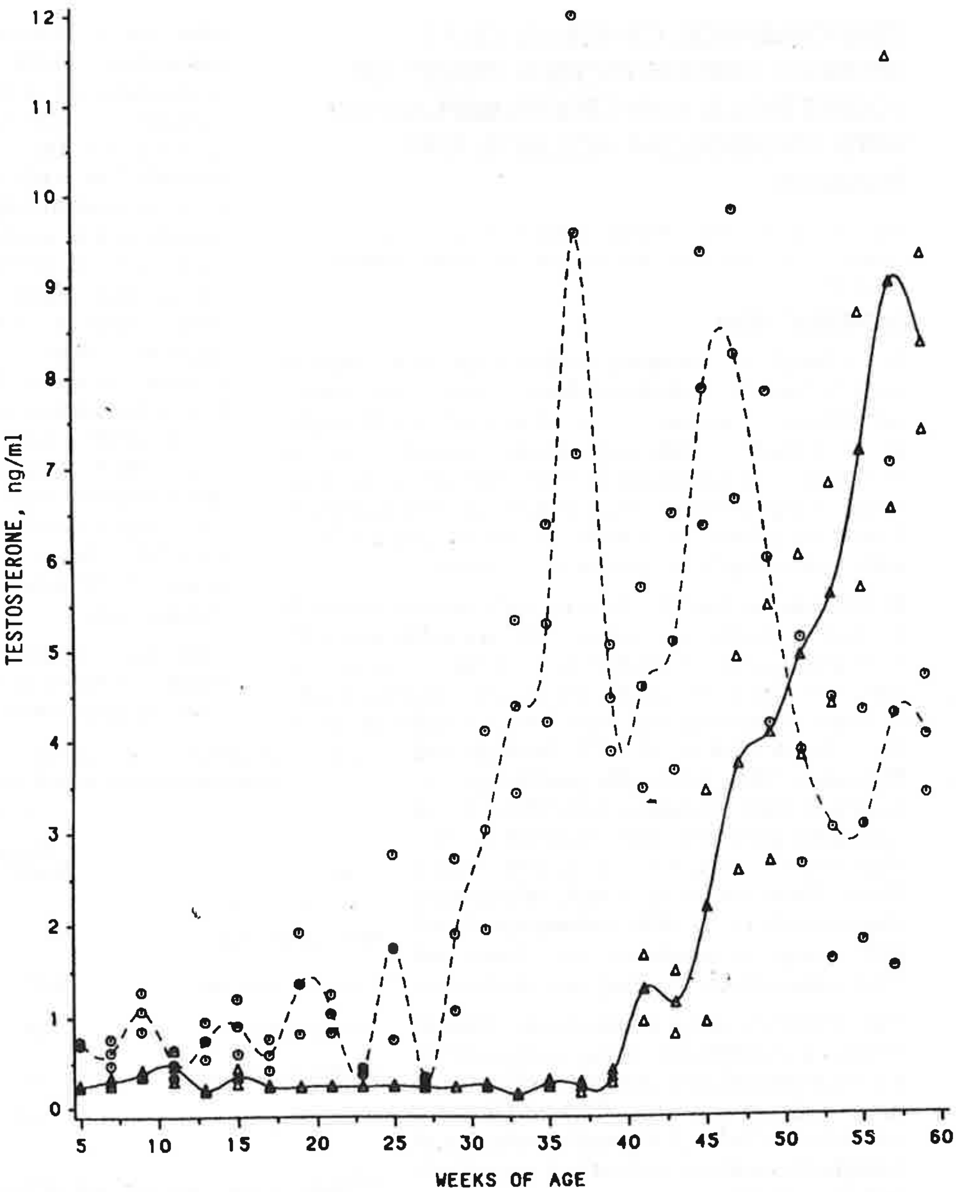

Figure 1. Serum testosterone concentrations of control bulls (- - - -) and implanted bulls (——). Values are reported as ng/ml with SE represented by the treatment symbols above and below the mean for each biweekly bleeding period. Least significant difference (LSD) (P < 0.05) within treatment = 1.92 ng/ml. Between treatment LSD (P < 0.05) = 2.5 ng/ml.

Implanted steers tended (P < 0.10) to be less masculine than either CB or IB (table 1); however, our implant scheme for bulls did not suppress masculinity. However, implanting bulls with estrogenic agents from near birth until slaughter has reduced masculinity development (Ralston 1978; Unruh et al. 1983 1986a; Hopkins and Dikeman 1986). Age at implanting and type of steroid implant used may be important factors in affecting masculinity.

Since steers had levels of T equal to the lower limit of assay sensitivity, their values were not included in figure 1. Implanting bulls with TBA and Z early in life, and reimplanting with Z alone after 5 mo of age resulted in very low T levels until 10 mo of age. Then, T increased (P < 0.05) substantially from 11 mo until 13.6 mo and was higher (P < 0.05) than the level for CB from 12 to 13.6 mo of age. Nevertheless, CB had higher (P < 0.05) T levels than IB from 7.5 to 11 mo of age. Our findings agree with those previously reported for Z (Staigmiller et al. 1985; Gray et al. 1986), TBA plus Z (Fabry et al. 1983; Silcox et al. 1986) and E_2 (Schanbacher et al. 1983; Hopkins and Dikeman 1988).

There were no treatment differences in carcass characteristics (table 2). Since our cattle were slaughtered at a young age (13.6 mo), neither carcass masculinity nor maturity was different among treatments. Steers generally have higher marbling scores than bulls; however, marbling was enhanced when bulls were implanted near birth with Z and reimplanted sequentially until slaughter (Calkins et al. 1986; Unruh et al. 1986). Fisher et al. (1986) reported that implanting steers with TBA plus E_2 appeared to reduce muscle lipid content.

Table 3. TASTE PANEL EVALUATIONS AND WARNER-BRATZLER SHEAR VALUES OF RIBEYE (LONGISSIMUS) STEAKS FOR CONTROL BULLS AND IMPLANTED BULLS AND STEERS

	Treaments			
	Implanted			
Trait	Steers	Bulls	Control bulls	SE
Flavor intensity[a]	6.3	6.3	6.1	.2
Juiciness[a]	6.4	6.3	6.1	.1
Connective tissue amount[b]	7.2[a]	7.1[a]	6.7[b]	.1
Myofibrillar tenderness[c]	6.4	6.2	5.4	.3
Overall tenderness[c]	6.5	6.4	5.9	.3
Warner-Bratzler shear, kg.	3.3	3.4	4.0	.3

[a]6 = Slightly intense or slightly juicy, 7 = very intense or very juicy.

[b]6 = Slight amount, 7 = practically none.

[c]Scores of 1 to 8: 5 = slightly tender, 6 = moderately tender.

[a,b]Means in same row with different superscripts differ (P=.07).

Implanted steers had nonsignificantly (P.10) higher yield grade numbers than CB. Bulls generally have less fat thickness and larger ribeye areas than steers, which results in bulls having an advantage in yield grade (Crouse et al. 1985; Vanderwert et al. 1985). Steen (1985) reported that bulls implanted with Z were trimmer than steers implanted with Z plus TBA. Furthermore, Silcox et al. (1986) found that ribeye areas and fat thicknesses were similar for nonimplanted bulls and bulls implanted with Z or Z plus TBA. In contrast, Calkins et al. (1986) and Unruh et al. (1986b) both reported increased fat thicknesses and higher numerical yield grades for bulls implanted near birth with Z than for CB. It appears that time of implantation influences carcass composition, particularly with regard to fat deposition in young bulls.

Carcass masculinity, as measured by jump muscle and crest development, was scored fairly low for all treatments (table 2) and no differences were attributable to treatment. Because these cattle were slaughtered at 13.6 mo of age, secondary-sex characteristics may not have been fully developed. Longissimus firmness, texture and colour were very desirable for all treatments (data not presented), and the incidence of heat ring was negligible. This likely was due to adequate insulation (fat cover) over the longissimus muscle of our cattle during chilling (Riley et al. 1983).

Implanting bulls and steers from near birth until slaughter had no significant effects on SP flavour intensity, juiciness, myofibrillar or overall tenderness, or WBS values (table 3). However, connective tissue amount tended ($P = .07$) to be higher for CB than for IB or IS. This may be linked to the early, higher levels of T observed in CB, which may have hastened the collagen maturation process (Hall 1976). Although IS and CB were not different ($P < 0.10$), tenderness-related traits tended to be higher for IS. Based on our results, life-long implanting had no negative effects on SP traits. However, since no control group of steers was available for this trial, we cannot speculate on the effects that TBA plus Z has on the meat sensory traits of steers.

SUMMARY AND CONCLUSIONS

Our results indicate that implanting bulls near birth with TBA plus Z and then Z alone after about 5 mo of age did not affect performance, except that IB tended ($P = .07$) to be heavier at slaughter. Serum T of IB was suppressed ($P < 0.05$) from 7.5 to 11 mo of age, but was increased ($P < 0.05$) from 12 to 13.6 mo of age. Implanting bulls also resulted in ribeye steaks that had less ($P = 0.07$) detectable connective tissue. Thus, implanting with TBA and Z early in life and then Z alone may counteract some of the problems of feeding bulls for meat production. Implanting steers from near birth and until slaughter with TBA plus Z resulted in performance traits similar to those of bulls, along with very desirable carcass characteristics and SP palatability ratings. For small-framed cattle like those in our study, castration and implantation with TBA plus Z near birth may optimize performance, carcass and meat quality traits. This system was superior to the production of either nonimplanted or implanted bulls.

ACKNOWLEDGEMENTS

Contribution No. 88-107-A, Department of Animal Science and Industry, Kansas Agriculture Experiment Station, Manhattan, KS 66506-USA.

The authors are grateful to Center for Regulatory Services, 2347 Paddock Lane, Reston, VA 22091 for their support of this research.

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