EFFECTS OF ESTRADIOL OR AN ESTRADIOL-TRENBOLONE ACETATE REIMPLANT SCHEME AND TIME ON FEED ON PERFORMANCE AND CARCASS TRAITS OF FINISHING STEERS[1]

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Summary

Two hundred eighty-eight predominantly British and British crossbred steers (702 lb) were used in a 2 × 3 factorially arranged experiment. Main effect factors were reimplant scheme [estradiol (E_2) vs estradiol plus trenbolone acetate (E_2 + TBA)] and time on feed (111, 125 or 139 days). The initial slaughter occurred when 65 to 70% of all steers were estimated to grade low Choice. No interactions occurred for any variable measured. Reimplanting 57 days after the initial implant with E_2 + TBA increased overall daily gain 6.9% ($P < .003$) and feed efficiency 4.9% ($P < .005$). Feeding steers for an additional 14 or 28 days resulted in linear decreases in overall daily gain ($P < .005$) and feed efficiency ($P < .0004$). Reimplanting with E_2 + TBA increased ($P < .001$) carcass weight but did not reduce marbling score or percent Choice carcasses. Feeding steers for an additional 14 or 28 days resulted in linear increases ($P < .0001$) in hot carcass weight, ribeye area, adjusted backfat ($P < .004$), and skeletal maturity ($P < .0005$). Additional days on feed increased dressing percentage ($P < .002$) and marbling score ($P < .05$) curvilinearly and tended ($P = .25$) to increase the percentage of carcasses grading Choice and Prime. Incidence of dark cutters was higher ($P < .05$) for E_2 + TBA carcasses, and was very high at the first slaughter date (54 days after reimplantation). Although feeding for an additional 14 or 28 days can result in heavier live and carcass weights, higher dressing percentage, and increased marbling, poor efficiency of gain may create negative feeding margins.

(Key Words: Estradiol, Trenbolone Acetate, Reimplantation, Time on Feed.)

Introduction

The improvement in rate and efficiency of gain in feedlot steers from combined use of estradiol (E_2) and trenbolone acetate (TBA) implants is well documented. It appears that 1) implanting more than once with TBA is not effective and 2) the response to TBA is greater when it's used at reimplant time rather than at the beginning of the feeding period. However, research has shown this may result in an average of 8 to 10% fewer Choice carcasses, particularly if reimplanting with TBA in the form of Finaplix® occurs less than 60 to 70 days before slaughter. The effective payout period of TBA from Finaplix implants is considered to be 60 to 65 days. Because most implant studies have utilized a time-constant slaughter endpoint, whether an additional 14 to 28 days on feed would overcome TBA's observed quality grade reduction, yet maintain a feedlot performance advantage, is largely unknown. Therefore, we evaluated the main effects and potential interaction of reimplant scheme (E_2 vs E_2 + TBA) and additional days on feed (0, 14, or 28) on performance and carcass traits of finishing steers.

[1]The cooperation of Bill Haw, Kansas City, MO, who supplied cattle used in this study, is gratefully acknowledged.

Experimental Procedures

Three hundred eighty-eight predominantly British and British crossbred steers that had been pastured together in an early-intensive stocking program on Flint Hills range were delivered to the KSU Beef Research Unit on July 17, 1991. Steers were individually weighed; ear-tagged; dewormed (Ivomec®); and vaccinated against IBR, PI_3, BVD (modified live vaccine), and seven clostridial organisms. Steers were adapted to a high grain finishing diet over 14 days by stepwise increases in concentrate and reductions in roughage. The final diet, based on rolled corn and sorghum silage (10% of DM), was formulated to contain (DM basis) 12% CP, .70% Ca, .35% P, .36% salt, .70% K, 75 ppm Zn, 1,800 IU Vitamin A/lb, and 27.7 plus 11 g/ton of Rumensin® plus Tylan®, respectively.

Following the step-up period, individual, early morning weights were obtained on 2 consecutive days. Steers were selected on weight and breed type uniformity, implanted with E_2 (Synovex-S®; 20 mg estradiol benzoate plus 200 mg progesterone), and allotted to one of four weight replicates. Within each replicate, steers were randomly allotted to one of six pens, with the exception that Angus and Angus-crossed cattle were stratified equally across pens. Each pen was randomly assigned to one of six treatments in a 2×3 factorially arranged experiment. Main effect factors were reimplant type (E_2 or E_2 + TBA) and additional time on feed (0, 14, or 28 days). Trenbolone acetate was supplied in the form of Finaplix-S (140 mg TBA). The initial slaughter was when 65 to 70% of all steers in the study were estimated to grade Choice, based on projected performance and visual appraisal. Thus, slaughter dates were 54, 68, and 82 days following reimplantation. Final weights were the average of early morning weights on 2 consecutive days. Weighing, shipping, and slaughter procedures were identical for each slaughter group. Carcass measurements were made following a 24-hour chill.

Results and Discussion

There was no effect of interaction between reimplant scheme and time on feed on any performance or carcass variables. Therefore, results are presented for main effects of reimplant scheme and additional days on feed. There was no difference in steers' performance during the initial implant period (Table 1), indicating that all groups responded similarly to the initial E_2 implant. However, use of E_2 + TBA vs E_2 alone increased ($P < .0001$) daily gain 13.9% and feed efficiency 10.8% during the reimplant period, which resulted in an additional 28 lb ($P < .003$) of final live weight for the E_2 + TBA steers. The large differences observed in the reimplant period resulted in improvements of 6.9% ($P < .003$) in daily gain and 4.9% ($P < .005$) in feed efficiency over the entire feeding period for steers reimplanted with E_2 + TBA. The magnitude of these performance responses are similar to other published research results. There was no effect of reimplant scheme on performance of steers fed for an additional 14 or 28 days (68 or 82 days after reimplanting). Because the proposed payout time of TBA in Finaplix-S is 60 to 65 days, that was not a surprise.

Reimplanting with E_2 + TBA vs E_2 alone resulted in heavier ($P < .001$) carcass weights (Table 1). Ribeye area was only slightly larger, but adjusted fat thickness was .04 in. greater ($P < .03$) for E_2 + TBA steers. Ratios of fat to lean, expressed as either depth or area of subcutaneous fat to ribeye area, did not differ. These results, which indirectly suggest proportionality in composition of gain, agree with previously reported carcass chemical composition work with E_2 + TBA (Huck et al., 1991 Cattlemen's Day Report). It may be that implants in general, and E_2 + TBA in particular, enhance rate and efficiency of growth by extending the physiological growth curve (same composition at a heavier weight), rather than by any "nutrient partitioning" activity that favors lean tissue deposition at the expense of fat deposition.

Although feeding for an additional 14 or 28 days beyond a 65 to 70% Choice endpoint resulted in a linear increase ($P < .0001$) in final liveweight (Table 2), performance during the extra periods was expectedly low. As fed cattle approach finish weight, composition of gain changes to an increased proportion of fat deposition, resulting in poorer feed conversion. Analysis of data for the entire feeding period revealed linear reductions in daily gain ($P < .005$) and feed efficiency ($P < .0004$) with days on feed. Using a ration cost of $95/ton (as fed) and non-feed costs (interest, yardage, etc) of $.35/hd daily, the cost of gain was $.487, .507, and .522 per lb for steers fed for 111, 125 and 139 days, respectively. The added gain realized from feeding for an additional 14 or 28 days cost $77.03 or $74.62 per cwt, respectively, to produce. These results emphasize the fact that carrying cattle beyond normal finish weight can result in negative feeding margins, which reduce profitability or increase losses.

Feeding for an additional 14 or 28 days resulted in linear increases in hot carcass weight, ribeye area (all $P < .001$), adjusted backfat thickness ($P < .004$), and skeletal maturity ($P < .0005$). Dressing percentage ($P < .002$) and marbling score ($P < .05$) increased curvilinearly with additional days fed. The lower average marbling score for steers fed for an additional 28 vs 14 days may be partially explained by the fact that carcasses from that slaughter date apparently were not as well chilled as those from the two previous dates. Standard deviations for marbling score were 60, 69, and 66 degrees for steers fed for 111, 125, and 139 days, respectively, suggesting that variation within a slaughter group was relatively constant, and that the statistical distribution of marbling level was not affected by feeding for 14 or 28 additional days.

Chi-square statistics were used to evaluate the frequency of Choice grading and dark-cutting carcasses as affected by reimplant scheme and additional days on feed (Table 3). Additional days on feed tended ($P = .25$) to increase percentage Choice in this study, whereas reimplant scheme had no effect. Steers implanted with E_2 + TBA had a higher ($P < .05$) incidence of dark cutting carcasses, which was particularly pronounced in the first slaughter group (54 days after reimplanting). Pooled across reimplant scheme, the overall incidence was higher ($P < .03$) in the initial slaughter group than in subsequent slaughter groups. There were no differences in weighing, shipping, or slaughter procedures nor any discernible changes in environment between slaughter dates to account for these differences.

Table 1. Effect of Reimplant Scheme on Finishing Performance and Carcass Traits

Item	Reimplant Scheme E_2	E_2 + TBA	SE	P > F
No. pens	12	12		
No. steers	144	144		
Initial wt, lb[a]	702	702	.5	.82
Final wt, lb[a]	1111	1139	6	.003
Avg. days fed[b]	125	125		
Initial implant period (0-57d)				
Daily gain, lb	3.97	4.03	.06	.55
Daily feed, lb DM	20.0	20.4	.2	.18
Feed/gain[c]	5.03	5.05	.05	.69
Reimplant period (58-125d)				
Daily gain, lb	2.74	3.12	.05	.0001
Daily feed, lb DM	22.1	22.5	.2	.19
Feed/gain[c]	8.06	7.19	.09	.0001
Entire period (0-125d)				
Daily gain, lb	3.31	3.54	.05	.003
Daily feed, lb DM	21.1	21.5	.2	.17
Feed/gain[c]	6.37	6.06	.08	.005
Additional 14 or 28d				
Daily gain, lb	2.22	2.13	.20	.86
Daily feed, lb DM	20.9	21.1	.45	.77
Feed/gain[c]	9.52	9.90	.68	.77
Carcass traits				
Hot carcass wt, lb	707	723	3	.001
Dressing percent	63.6	63.4	.1	.25
Ribeye area, $in.^2$	12.9	13.0	.1	.38
Adjusted backfat, in.	.50	.54	.01	.03
Fat:lean ratio:[d]				
Method 1	.32	.33	.01	.16
Method 2	.040	.042	.001	.20
KPH fat, %	2.40	2.47	.05	.30
Yield grade	2.80	2.92	.06	.13
Marbling score[e]	5.22	5.24	.05	.77
Skeletal maturity	A^{49}	A^{50}	^{01}	.27

[a]Weights pencil shrunk 4%.
[b]Data pooled across slaughter dates; excludes 14-day pretrial step-up period.
[c]Calculated and analyzed statistically as gain/feed.
[d]Method 1 = Area of subcutaneous fat over ribeye ÷ ribeye area, Method 2 = Adjusted backfat thickness ÷ ribeye area.
[e]Marbling score: Sl^{50} = 4.5, Sm^{0} = 5.0; Sm^{50} = 5.5, etc.

Table 2. Effect of Additional Days on Feed on Finishing Performance and Carcass Traits

Item	Additional days fed, n				P > F[a]	
	0	14	28	SE	L	Q
No. pens	8	8	8			
No. steers	96	96	96			
Initial wt, lb[b]	701	702	703	.6	.10	.33
111-day wt, lb[b]	1093	1094	1094	6	.79	.86
Final wt, lb[b]	1093	1124	1158	7	.0001	.83
0-111 d						
Daily gain, lb	3.56	3.57	3.56	.05	.97	.88
Daily feed, lb DM	21.3	21.4	21.5	.2	.47	.88
Feed/gain[c]	5.98	5.98	6.03	.06	.61	.72
Additional 14 or 28 d						
Daily gain, lb	--	2.07	2.28	.20		
Daily feed, lb DM	--	20.6	21.4	.5		
Feed/gain[c]	--	10.07	9.33	.62		
Entire period						
Total days fed, n[d]	111	125	139			
Daily gain, lb	3.56	3.40	3.30	.05	.005	.65
Daily feed, lb DM	21.3	21.3	21.4	.2	.77	.82
Feed/gain[c]	5.98	6.25	6.47	.07	.0004	.68
Cost of gain, $/lb[e]	.487	.507	.522			
Carcass traits						
Hot carcass wt, lb	683	719	744	4	.0001	.31
Dressing percent	62.5	63.9	64.2	.1	.0001	.002
Ribeye area, in.^{2}	12.4	13.0	13.4	.2	.0001	.63
Adjusted backfat, in.	.48	.53	.55	.02	.004	.40
KPH fat, %	2.39	2.48	2.43	.06	.69	.28
Yield grade	2.80	2.90	2.88	.07	.43	.55
Marbling score[f]	5.07	5.35	5.27	.07	.036	.027
Skeletal maturity	A^{47}	A^{48}	A^{53}	^{01}	.0005	.23

[a]Probability values for linear (L) or quadratic (Q) effect of additional days on feed.
[b]Weights pencil shrunk 4%.
[c]Calculated and analyzed statistically as gain/feed.
[d]Excludes 14-d warm-up period.
[e]Using ration cost of $95/ton (as fed), $.35/hd/d yardage, interest, etc and $10/hd for processing, medicine, etc.
[f]Marbling score: Sl^{50} = 4.5; Sm^{0} = 5.0; Sm^{50} = 5.5, etc.

Table 3. Effect of Reimplant Scheme and Additional Days on Feed on Carcass Quality Grade, Yield Grade, and Incidence of Dark Cutting

Item	ADOF[a]:	Reimplant scheme: E_2 0	E_2 14	E_2 28	E_2 + TBA 0	E_2 + TBA 14	E_2 + TBA 28	P > F[b]: RS	P > F[b]: ADOF
Reimplant to slaughter, d		54	68	82	54	68	82		
Pct. Choice & Prime		65	69	73	69	73	77	.78	.25
Yield grade (YG):								.68	.53
YG 1, %		19	12	13	11	9	11		
YG 2, %		43	42	38	46	38	39		
YG 3, %		36	46	43	41	49	43		
YG 4, %		2	0	6	2	4	7		
Dark cutters, %		8	2	0	25	2	0	.05	.03

[a]ADOF = additional days on feed.
[b]Chi-square probabilities for effect of reimplant scheme (RS) and DOF, respectively.