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IMPLANT REMOVAL TO DETERMINE THE RESPONSE-LIFE OF A COMBINATION IMPLANT

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Story in Brief

To evaluate the response-life of Revalor-S® (REV; 24 mg estradiol + 120 mg TBA), yearling steers (n=100, 735 lb) that had never previously received an implant were assigned to one of five implant regimes during a 140-d feeding trial. Implant/removal regimes included 1) no implant during the finishing period; 2) a single implant of REV on d 0; 3) as 2 but removal of that implant on d 56 and replacement with a second REV; 4) as 3 but replacement on d 84; 5) as 3 but replacement on d 112. Throughout the trial, implanted steers, regardless of implant regime, had greater gains (3.35 vs 2.31 lb/d), consumed more DM (19.86 vs 16.67 lb/d), and converted DM to live weight more efficiently than nonimplanted cattle (6.25 vs 7.69 feed/gain). Compared with nonimplanted steers, implanted steers yielded heavier carcasses (736 vs 648 lb) that had more advanced skeletal maturity scores (A^{48} vs A^{20}) and larger ribeye areas. Skeletal maturity was markedly increased by all implant treatments. No differences in performance or carcass characteristics were detected among steers from which implants were removed (Treatments 3 through 5) and those from which implants were never removed (Treatment 2). A single implant administered at the beginning of the finishing period enhanced gain, gain:feed, carcass weight, and skeletal maturity without negatively affecting quantitative carcass traits or marbling score. These results suggest that any performance benefits noted from reimplanting steers with Revalor-S® more often than 112 d must be due to factors other than reduced delivery of active ingredients from the implants.

Key Words: Beef, Implant, Performance, Carcass Traits

Introduction

In the United States, growth-stimulating implants have been used commercially for over 30 yr. Extensive research has shown that implants increase average daily gain, improve feed efficiency, and often increase muscle mass of beef cattle. Over 90% of feedlot beef cattle marketed in the U.S. are administered exogenous hormones during the finishing period to enhance performance; some cattle are reimplanted (given a second implant to further enhance gain and performance). A second implant often is administered during the feeding period based on the assumption that implants expire so that delivery of active ingredient(s) from the implant is no longer adequate. Yet, most tests of reimplanting consist of ADDING a second implant, not REPLACEMENT of the first implant that can be achieved by removal of the first implant at the time the second implant is given. The current study was conducted to determine the response-life of a combination (strong estrogen plus adrogen; Revalor-S®) implant through testing response to REPLACEMENT of that implant, as well as effects of this implant on performance and carcass characteristics.

Materials and Methods

Animals and Diets. Spring-born Angus x Senepol steers (n=100) weighing 735 lb were received at the Oklahoma State progeny test facility in Stillwater, OK, on June 13, 1998. Upon arrival, steers were weighed, stratified by percentage Senepol breeding, and assigned randomly within breed type (blocks) to one of five implant/removal regimes. These regimes consisted of 1) no implant during the finishing period; 2) a single implant of Revalor-S® (REV; 24 mg estradiol 17β + 120 mg trenbolone acetate) on d 0; 3) as 2 but removal of that implant on d 56 and replacement with a second REV; 4) as 3 but replacement on d 84; 5) as 3 but replacement on d 112. By removing previous implants, response to a **new** implant beyond that of steers not reimplanted was used as an indicator that the previous implant was not producing maximum performance. This differs from reimplant studies where the total implant dosage may be increased by adding a new implant to the pre-existing implant.

Steers were housed (5 steers/pen) in 20 partially covered pens (4 pens/block and 4 pens/treatment) with slatted floors and covered cement fence-line bunks. Cattle were dewormed with Ivomec® pour-on on d 56 of the feeding period. A corn-based diet (Table 1) was fed twice daily at approximately 7 a.m. and 4:00 p.m.. Steers were weighed immediately following transport to the feeding facility and at 28-d intervals thereafter. A 4% pencil-shrink was applied to all live weights (except for initial weight that was obtained immediately following transport) for calculating gain and feed efficiency. After 140 d on feed, steers were transported to and harvested at Excel Corporation in Dodge City, KS. Carcasses were chilled at 0^oC for approximately 36 h, after which USDA quality and yield grade (USDA, 1997) carcass measurements were collected by trained Oklahoma State University personnel.

Statistical Analysis. Data were analyzed using the GLM procedure of SAS (SAS, 1996) as a randomized complete block design with percentage Senepol used as a blocking factor and pen serving as experimental unit for all performance traits as well as quality and yield grade percentages. Steer served as experimental unit for analysis of carcass characteristics. Treatment sums of squares were separated using nonorthogonal contrasts that compared 1) control vs implanted (CI), 2) response to a second implant following implant removal of first implant on d 56 (D56), 3) response to a second implant following implant removal of first implant on d 84 (D84), and 4) response to a second implant following implant removal of first implant on d 112 (D112).

Results and Discussion

Live Animal Performance. Performance data are reported in Table 2. Steers that were implanted, regardless of implant regimen, had greater daily weight gains throughout the finishing period; overall, implanting enhanced daily gain by 45% as compared with not implanting during the finishing period. This daily weight gain benefit resulted in a 14% (145 lb) live weight advantage and a 14% (88 lb) carcass weight advantage for implanted as compared with nonimplanted steers. Advantages of this magnitude are seldom seen with an expected ADG response to a single Revalor-S® being 26% (Duckett et al., 1997). Steers that were implanted consumed 19% more feed and more efficiently (18%) converted that feed to pounds of live weight than nonimplanted controls. Although substantially greater, these data support conclusions by Duckett et al. (1997); implants increased both feed intake (13%) and gain/pound of feed consumed (10%). Note that the history of cattle used in this study was known. Thus, we were positive that these cattle had never received any implants earlier in their lives; implant history of cattle often is not known and carryover from previous implants may influence mature size and thereby the performance benefits from implants.

No differences in daily gain attributable to implant regime were detected. Among implanted steers, no differences in feed intake were detected due to a second implant. These data contrast those reported by Duckett et al. (1997); implanting initially and reimplanting with a strong estrogen plus androgen resulted in a 25% improvement in daily gain and a 6% improvement in feed efficiency as compared with nonimplanted control steers. Because response to a second implant was not detected, these data may be interpreted to suggest that hormone release from a single implant of the type being tested when administered only once at the onset of the finishing period provides and maintains sufficient hormone concentrations needed to provide maximum implant response. However, these data should not be interpreted to indicate that reimplanting cannot elicit additional performance benefits, but instead that any benefit from reimplants must be ascribed to "hormone stacking" or the additional hormone provided beyond the first implant and not to hormonal expiration of the initial implant.

Carcass Characteristics **(Table 3).** Dressing percentage was similar among all treatments, but because of their heavier final live weights, implanted steers yielded 88 lb more carcass than the nonimplanted steers (a 14% advantage). No differences in external fat thickness, percentage internal fat, or ribeye area expressed on a carcass weight basis were detected; thus, mean yield grade was similar among all carcasses regardless of implant regimen. Although carcasses from steers that received an implant had larger ribeye areas (REA), this difference can be ascribed to the heavier carcass weights of the implanted steers because implants did not increase REA/100 lb of carcass weight.

Lean maturity scores were similar among all implant treatment groups, but carcasses from implanted steers consistently had more advanced skeletal maturity scores (mean of 28-degrees) than carcasses from nonimplanted steers. Consequently, overall maturity scores were 13 degrees further into the "A" maturity group for those carcasses from implanted steers. Despite accelerating maturation, all carcasses remained well within the "A" maturity classification. However, these data support the concept that the maturity score and thereby the quality grade of those cattle producing carcasses near the "A" - "B" maturity "break point" might be affected adversely by implanting. In other words, if historical carcass data indicate that steers/heifers may produce "B" maturity carcasses, then implants may exclude such cattle from the U.S. Choice and U.S. Select quality grades. Although the difference was not statistically significant, carcasses from implanted steers tended to have reduced marbling scores; the percentage of U.S. Choice carcasses (premium Choice plus low Choice) tended to be decreased and the frequency of U.S. Select carcasses tended to be increased.

Implications

Implanting feedlot steers enhanced rate and efficiency of gain. Because replacement of implants at up to 112 d on feed did not improve performance, lifespan of the implant tested (Revalor-S®) must have exceeded 112 d. This indicates that performance responses often seen with reimplanting may be due to hormone stacking, not to exhaustion of previous implants. The negative effects of implanting on carcass quality (decreased marbling score plus accelerated carcass maturity indices), attributable to the use of implants, was consistent across all implanting times tested. Detrimental effects of implants on carcass quality and value must be balanced against daily gain and feed efficiency benefits of implants to judge the economic merit of implant schemes.

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Table 1. Feedstuff and energy content of diet fed to steers during 140-d feeding period.

Ingredient	% of diet dry matter
Dry corn	86.53
Cottonseed hulls	5.09
Cottonseed meal	5.09
Wheat midds	1.01
Limestone	1.13
Urea	.45
Salt	.33
Potassium chloride	.34
Rumensin-80	.02
Tylan-40	.011
Vitamin A-30	.011
Selenium-600	.006
Manganous oxide	.005
Zinc sulfate	.003
Copper sulfate	.001
NEm, Mcal/cwt	96.20
NEg, Mcal/cwt	61.48

Table 2. Feedlot performance least squares means stratified by implant regime for steers fed 140 d.

	Implant regimen[a]						
Item	Control	R_0	R_{56}	R_{84}	R_{112}	SE	Effect[b]
Steers	20	20	20	20	20		
Weight, lb							
Initial	736	730	734	735	740	6.94	--
Final[c]	1060	1204	1206	1207	1202	19.23	CI
Daily gain[d], lb/d							
0 □ 28	2.54	4.48	4.34	4.45	4.34	.44	CI

28 □ 56	2.38	3.28	3.35	2.59	3.28	.39	
56 □ 84	1.51	2.56	3.11	3.32	2.91	.44	CI
84 □ 112	3.03	3.08	2.12	2.93	2.20	.35	
112 □ 140	2.12	3.55	3.95	3.57	3.76	.31	CI
Total	2.32	3.39	3.37	3.37	3.30	.15	CI
Feed intake, lb/d							
0 □ 28	16.3	18.8	17.6	19.9	18.1	1.17	
28 □ 56	15.9	20.3	19.7	19.3	19.9	1.45	CI
56 □ 84	15.6	19.2	20.0	19.7	20.9	1.25	CI
84 □ 112	16.1	20.3	17.5	18.3	18.2	1.47	
112 □ 140	19.5	24.4	21.3	22.8	21.3	1.27	CI
Total	16.7	20.6	19.2	20.0	19.7	.97	CI
Feed:Gain							
0 □ 28	6.95	4.23	4.10	4.55	4.23	.49	CI
28 □ 56	6.71	6.27	6.24	8.34	6.20	.94	
56 □ 84	10.91	7.97	6.57	6.90	7.30	1.03	CI
84 □ 112	5.50	6.85	8.70	6.41	8.31	.70	CI, D84
112 □ 140	10.13	7.05	5.49	6.35	5.75	.84	CI
Total	7.25	6.07	5.71	5.94	5.96	.28	CI

[a]Implant regimen: Control=never implanted; R_0=a single implant of Revalor-S® on d 0; R_{56}=as R_0 but removal of that implant on d 56 and replacement with a second REV; R_{84}=as R_{56} but replacement on d 84; R_{112}=as R_{84} but replacement on d 112.

[b]Effect: CI=control vs all implanted steers ($P<.05$); D84=implant removal/reimplant on d 84 vs implant removal/reimplant on d 56 ($P<.05$).

[c]Final weight = gross weight * .96.

[d]ADG was calculated after a 4% pencil shrink was applied to full weights except actual initial shrunk weight was used.

Table 3. Least squares means for carcass characteristics stratified by implant regimen for steers fed 140 d.

	Implant regimen[a]						
Item	Control	R_0	R_{56}	R_{84}	R_{112}	SE	Effect[b]
Carcasses	20	20	20	20	20		
Dress, %	61.1	61.0	60.8	61.0	61.5	.43	
Hot carcass wt, lb	648	735	733	737	738	10.89	CI

Fat tk, in	.44	.48	.44	.47	.48	.08	
Adj. fat tk, in	.55	.62	.60	.59	.63	.07	
Ribeye area, in^2	11.1	12.4	12.6	12.1	12.7	.28	CI
REA/100 lb HCW	1.71	1.70	1.73	1.65	1.72	.34	
KPH, %	2.8	2.4	2.4	2.4	2.4	.14	CI
Yield grade	3.38	3.35	3.22	3.39	3.29	.11	
Lean maturity[c]	A^{51}	A^{44}	A^{47}	A^{53}	A^{48}	2.60	
Skeletal maturity[c]	A^{20}	A^{50}	A^{48}	A^{48}	A^{47}	3.16	CI
Overall maturity[c]	A^{35}	A^{47}	A^{47}	A^{51}	A^{48}	2.15	CI
Marbling score[d]	Sl^{96}	Sl^{74}	Sl^{87}	Sl^{59}	Sl^{87}	13.37	
Quality grade							
Prem Choice[e], %	13.3	0	5.0	0	10.0	5.00	
Low Choice[f], %	28.3	21.3	30.0	22.5	25.0	11.47	
Select, %	58.3	78.8	60.0	72.5	65.0	14.88	
Standard, %	0	0	5.0	5.0	0	3.16	
Yield grade							
2, %	15.0	10.0	25.0	25.0	30.0	9.04	
3, %	66.7	72.5	75.0	57.5	70.0	9.76	
4, %	18.3	17.5	0	17.5	0	8.08	

[a]Implant regimen: Control=never implanted; R_0=a single implant of Revalor-S® on d 0; R_{56}=as R_0 but removal of that implant on d 56 and replacement with a second REV; R_{84}=as R_{56} but replacement on d 84; R_{112}=as R_{84} but replacement on d 112.

[b]Effect: CI=control vs all implanted steers (P<.05).

[c]Maturity score: "A", between 9 and 30 mo of age.

[d]Marbling score: Sl = "slightoo", the minimum required for U.S. Select.

[e]Prem Choice = Modest^{oo} to Moderate^{99} marbling (Average and High Choice).

[f]Low Choice = Small^{oo} to Small^{99} marbling (Low Choice).

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