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Comparison of Estradiol-Trenbolone Acetate Implant Programs for Yearling Steers of Two Genotypes

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CATTLE 98-1

Summary

Yearling steers (n = 400) were used to evaluate relative payout periods for implants when feeding high grain content diets. Implant treatments included (1) control (nonimplanted), (2) Synovex Plus, (3) revalor-s, and (4) Ralgro-revalor-s. The Synovex Plus (2), revalor-s (3) and Ralgro (4) were administered on day 1. The reimplant with revalor-s (4) was admnistered after 56 d on feed. Steers were managed in two groups. Initial BW and days fed were 782 lb, 131 d (Group I), and 661 lb, 145 d (Group II). Implants increased production rates and efficiencies, increased carcass size and reduced marbling when compared to nonimplanted controls. Production rates and efficiencies and carcass sizes were similar among steers that received implants. Marbling scores and percentage choice carcasses were affected by implants. In general, the delayed use of an estradiol-trenbolone acetate implant improved marbling over d 1 implanting even though there were 56 fewer days on feed after implanting. The energy density of live weight gain was calculated over the course of the feeding period based upon interim period BW and DMI determinations. Higher energy content of gain early in the feeding period for treatments 1 and 4 were related to marbling, while the energy content of gain late in feeding period was not. These data showed no differences in the relative effective duration of Synovex Plus and revalor-s implants. The influence of implants on carcass quality grades was affected by factors other than elapsed time from implanting to harvest.

Introduction

Optimizing implant strategies requires striking a balance between implant payout, production costs, and carcass specifications. The influence of implants on cost of gain erodes over time. This encourages shortening the expected payout of the implant. However, it is generally considered that carcass marbling is increased as the elapsed time from implanting to slaughter is increased. The label associated with implant clearances generally does not stipulate how prolonged exposure to the implant relates to these conflicting variables.

Presently there are two estradiol-trenbolone acetate implant formulations available for use in steers being fed for slaughter. One product provides 24 mg estradiol and 120 mg trenbolone acetate. A second available product provides the equivalent of 20 mg estradiol as estradiol benzoate and 200 mg trenbolone acetate. These are potent tools for improving production rates in steers. The concentration and proportion of active ingredients in these implants differ as does the carrier matrix. This experiment was designed to compare the relative payout of these products. The information is intended to help producers define the time exposure appropriate for their production constraints.

To evaluate effective payout, it is advantageous to have a nonimplanted control to use as a reference point during growth. It would also be advantageous to have a positive control that provides high levels of implant payout during the same time frame associated with the expected depletion of the test implant(s). This could be accomplished by administering implants in a staggered time schedule in the positive control treatment. Coincidentally, this would also allow consideration of a re-implant program.

In the experiment described here we wished to evaluate the relative effective payout for revalor-s (20 mg estradiol/120 mg trenbolone acetate) and Synovex Plus (28 mg estradiol benzoate/200 mg trenbolone acetate). Nonimplanted steers were used as the negative control. The positive control involved delaying revalor-s implanting for 56 d to provide a staggered payout during the later stages of the feeding period. In the positive control Ralgro (36 mg zeranol) was used to provide growth promoting activity during the initial 56 d on feed.

Approach

The implant strategies used included (1) Control (nonimplanted); (2) Synovex Plus; (3) revalor-s; and (4) Ralgro-revalor-s. The Synovex Plus (2), revalor-s (3), and Ralgro (4) were administered on day 1. The re-implant with revalor-s (4) was administered after 56 d on feed.

Forty pens of 10 steers were assigned to the experiment. Steers were purchased as two major groups. Group I consisted primarily of black hided steers and Group II was predominately continental crosses. Each group provided enough steers to fill 20 pens (5 pens per implant treatment per group). The groups were fed and managed as distinctive lots of cattle to accommodate differences in implant response and marketing needs that could occur between differing biological types. The nutrition, processing and implant management were common across groups. Days on feed were 131 for Group I and 145 for Group II.

The 200 steers used in Group I were selected from a group of 223 steers. The Group II steers (n=200) were drawn from a pool of 234 steers. At arrival cattle were observed for thriftiness, structural soundness and type characteristics. Any unacceptable subjects were deleted. Within a source group, cattle were ranked by arrival BW and outliers were deleted. Once the pool was reduced to 200 subjects, treatment was assigned (1 to 4) using a random sequence of treatment codes. Data were resorted by treatment and BW and assigned a random sequence of replicate codes. The treatment-replicate combinations were then assigned pen numbers such that treatment was randomly distributed throughout the 20 pens allocated to the group. This allotment system distributed BW ranges similarly in all pens. Starting dates were May 1, 1996, for Group I and May 23, 1996, for Group II.

Incoming cattle were eartagged and then vaccinated for IBR, BVD, PI_3, BRSV, H. somnus and 7 clostridial sp using Ultrabac 7 and Resvac 4/somubac[4]. Parasite control was provided by administering Expar (external) and Panacur[5] (internal) according to label instructions. During processing, ears were palpated for evidence of viable implants. None were found. During the receiving period long hay and the step 1 diet (Table 1) were fed. The milled feed delivery was limited to 1.5% BW during receiving (3 or 4 d).

Initial and final individual BW each were recorded on two consecutive days. Initial implants were administered during the second initial BW processing. Re-implanting with revalor-s was done during the d-56 BW processing. Implant integrity was evaluated at the next weigh day following implanting. Interim BW were determined as noted in Table 2. All BW were collected with no prior restriction of feed or water.

Cattle were fed twice daily. A five step program was used to adapt cattle to the finishing diet (Table 1). Feed calls were made daily at 0700 based on bunk and cattle condition. A clean bunk management system was used. Rations were mixed using a stationary mixer. A single batch of feed was distributed within replicate so that implant treatment and feed batch were not confounded. Samples of feed ingredients were collected once each week. The analyses of these samples were combined with batching records to reconstruct the composition of diets fed. While on step 5, these diets contained DM 75.5% ± .5, CP 12.4% ± .07, ADF 5.6% ± .15, NDF 12.6% ± .8, and ash 2.7% ± .04. The estimated final diet energy density was NE_m 94.8 Mcal/cwt ± .12 and NE_g 63.7 Mcal/cwt ± .10. All pens were fed the final diet (5) within 15 d on trial. These weekly assays and feed delivery records were used to produce DMI summaries each week or more frequently when necessary.

Initial and interim BW reported in Table 3 were not corrected for fill. The final BW referred to in Table 3 included a 3% shrink. This shrunk BW was used to calculate cumulative ADG and dressing percentage. To evaluate the performance response to the re-implant treatment (4), performance variables were summarized for the periods prior to (EARLY) and following re-implanting (LATE). The Group I cattle were fed for 131 d and the Group II were fed for 145 d. This caused the LATE performance windows to be 57 to 131 and 57 to 145 d, for Group I and II, respectively.

Two steers were removed from the study, one for lameness and one suffered apparent metabolic disorders. These individuals had been individually hospitalized prior to deleting them from the study. Their BW contribution to the pen mean was deleted from the onset of the experiment. Feed records were corrected for the days the subjects were hospitalized. It was assumed that these individuals consumed pen average DMI up to the point of hospitalization.

On the evening following the final BW, steers were transported 75 miles to the beef packing plant at Luverne, MN. They stood overnight and were processed at 0700 the following day. Individual carcass identity was maintained. Hot carcass weight was recorded the day of slaughter. Longissimus area, ribfat thickness, marbling score, bone maturity, lean maturity, KPH (omitted in Group I), and masculinity were collected 24 h after exsanguination. Data were collected by SDSU personnel trained in carcass evaluation.

One steer was mishandled during transit and was not slaughtered as part of this experiment. Consequently, carcass data were available for 397 subjects.

All performance variables were evaluated in a statistical model that included treatment, group, and the treatment x group interaction using the GLM package of SAS. The experimental unit in these analyses was the pen. Orthogonal contrasts were used to separate treatments. The contrasts included (a) control vs implants; (b) Synovex Plus and revalor-s vs Ralgro/revalor-s, and (c) Synovex Plus vs revalor-s. Carcass data were handled similarly except that the individual steer was considered to be the experimental unit.

Results

The initial BW for Groups I and II were 782 lb ± 5.5 and 661 lb ± 4.2, respectively. The predominately Angus x Hereford steers in Group I were large framed and had never been implanted prior to entering our feedlot. The Continental cross steers used in this study were smaller framed than the Angus x Hereford steers. Initial body condition was not quantified. Flesh was considered comparable between the groups and typical for yearlings entering our feedlot.

Implants increased ($P<.001$) ADG and DMI and reduced feed/gain ($P<.001$). These responses were evident during most interim measures of performance (Table 3). In the latter stages of feeding period, interactions developed between cattle group and implant treatment for ADG and feed/gain. The nonimplanted steers in Group II were growing more rapidly and more efficiently than Group I contemporaries during 113 to 130 d on feed. These (Group II) steers started on feed at a lighter weight and were not as close to finish at 130 d. In contrast, the Group II steers implanted with Synovex Plus had lower ADG at 112 d (3.63 vs 3.09) and 130 d (3.47 vs 2.44) than Group I contemporaries. The DMI of these steers also tended to be lower during these interim periods.

Short intervals between BW measurements can be misleading. To average responses overtime ADG from 90 to 130 d was calculated (Table 3). This approach showed that cattle were becoming less efficient as they approached harvest BW. A response to implanting was still in effect as feed/gain was 15% lower in steers initially receiving Synovex Plus or revalor-s than in nonimplanted steers. There was an additional 11% improvement ($P<.01$) in feed/gain during this period in re-implanted steers.

To evaluate the merits of re-implanting, data were calculated for 1 to 56 (early) and 57 to final (late) feeding periods. During the early phase, combination implants caused better ADG and feed/gain than Ralgro implants ($P<.001$). Synovex Plus tended ($P<.095$) to cause higher ADG than revalor-s. During the late phase, re-implanted steers grew faster ($P<.012$) and more efficiently ($P<.006$) than single implant steers. Interactions existed because the magnitude of response to implants differed between groups. This may be an artifact of this experiment or that cattle respond differently to these implants based upon their relative size when implants are administered.

Implants increased hot carcass weight (HCW) by 65 lb. The carcasses produced by implanted steers were of comparable weight (Table 5). The dressing percentage was affected when comparing Synovex Plus and revalor-s. This may have been due to differences in DMI at the termination of the feedlot study.

Longissimus area was increased ($P<.001$) by implants. There was no appreciable influence on ribfat thickness. Bone maturity and masculinity were increased by implants. Bone and lean maturity were greater for re-implanted than single implanted cattle, but the magnitude of difference is probably inconsequential as regards carcass value.

Influences on marbling were more distinctive. Implants reduced marbling scores and percentage Choice carcasses (Table 5). Marbling scores were lower ($P<.05$) for single implant strategies (Synovex Plus and revalor-s) than the re-implant strategy. These influences were more pronounced in the leaner cattle of Group II (Table 6). As was noted earlier regarding late gain responses, cattle may be responding differently to implants based on their relative size when implants are administered.

A desirable approach to addressing implant payout would be to evaluate changes in interim period feed/gain. However, fluctuations in feed/gain within treatment can occur during latter stages of the feeding period. This problem becomes exaggerated with short intervals of BW change. Because of these circumstances, the interim ADG, DMI, and feed/gain were not useful for explaining differences in marbling scores attributable to implant treatment. When intake was re-evaluated as DMI, g/kg $BW^{.75}$ the only distinctive separation that occurred was much lower relative DMI for non-implanted steers. This response began to appear after 112 d on feed (Figure 1).

To further evaluate implant payout, the energy density of live weight gain (ED_G) was calculated as NE_g (Mcal)/live weight gain (lb). Higher ED_G values would be indicative of higher fat content in live weight gain. The NE_m and NE_g intakes used were based upon tabular values for feedstuffs and actual feed ingredient intakes. Maintenance requirements were calculated based upon the mean BW for each pen during interim periods. The NE_m requirement was estimated to be increased by 10% during exposure to E_2TBA implants (Birkelo, personal communication). The final period was averaged to 138 d on feed.

During the initial 56 d ED_G was lower ($P<.05$) in steers exposed to E_2TBA. Ralgro caused only a slight numerical decline from control values during this period. The ED_G content of re-implanted steers converged with the d-1 E_2TBA treatments during the 57 to 89- and 90 to 112-d periods. The ED_G of nonimplanted steers continued to climb and create an increasingly wider separation from values for implanted steers.

During the final feeding period, the ED_G was lower ($P<.05$) for re-implanted steers than for either d-1 E_2TBA treatment. This followed a 137-d payout for the d-1 E_2TBA treatments. The E_2TBA implant payout for the re-implant treatment was only 81 d at this point. The difference in ED_G reflects more active implant activity at this late date and is consistent with expectations of implant responses over time.

If the deposition of fat as marbling is most pronounced late in the feeding period, the ED_G curves suggest that marbling would be highest in the nonimplanted steers and lowest in the re-implanted steers. Consistent with this concept, marbling scores were highest ($P<.001$) for the nonimplanted steers. However, marbling scores were higher ($P<.05$) for the re-implanted steers than for those on the d-1 E_2TBA treatments. When the pattern of ED_G is compared with the ranking by marbling scores, it is the early ED_G values that best matched the rank of marbling scores. The ED_G was higher through 56 d for those treatments causing higher marbling scores. The separation that occurred between the nonimplant and re-implant treatments at d 89 may be indicative of the phase of growth when marbling scores among re-implanted steers was depressed.

Conclusions

Actual payout optimums for implants were not defined by this research. In Group I it appeared that Synovex Plus was more potent at 130 d than was revalor-s. This observation was reversed in the Group II replication.

Cumulative feedlot production costs would be comparable for the implants used in that weight gain and DMI were similar among implanted steers. There is an additional cost associated with re-implanting (treatment 4). This cost may be offset by the increased carcass value associated with this strategy in the Group II steers in some fed cattle pricing mechanisms. The explanation for improved grading associated with re-implanting may relate to fewer total days of TBA exposure. However, an evaluation of gain energy density suggested that it may be the influence of implants early in the feeding period that has the greatest effect on marbling scores. Theoretically this influence may be lessened in cattle, carrying more flesh when placed in the feedlot. This (along with genetics) would help explain why the Choice percentage can vary dramatically among cattle receiving the same implant strategy. Consideration of this aspect of growth would be important in determining optimum management of implants. Future studies may reveal that Choice percentage may be dictated more so by the existing body condition when E_2TBA implants are administered than by the days from implanting to harvest.

Table 1. Diets fed

	Step 1	Step 2	Step 3	Step 4	Step 5	Step 5[a]
	————————— % DM basis —————————					
Corn silage	55.00	35.00	25.00	15.00	10.00	–
Oat silage	–	–	–	–	–	8.00
Whole shelled corn	26.65	40.65	47.65	54.65	57.65	59.65
High moisture corn	9.75	15.75	18.00	21.00	23.00	23.00
LS460[b]	3.50	3.50	4.25	4.25	4.25	4.25
Soybean meal, 44%[c]	5.00	5.00	5.00	5.00	5.00	5.00
Limestone[c]	.10	.10	.10	.10	.10	.10

[a] Switch occurred on August 20, 1996.

[b] 70% DM, contained 460 g monensin/T AFB. Diet provided 28.5 g monensin/T DMB.

[c] Fed as a pelleted supplement that included tylosin. Diet provided 11 g tylosin/T DMB.

Table 2. Processing schedule

Group I		Group II		
DOF	Date	DOF	Date	Procedure
-2	April 29	-2	May 21	Allotment weight
-1	April 30	-1	May 22	Sort to pens
0	May 1	0	May 23	Initial BW$_1$
1	May 2	1	May 24	Initial BW$_2$, implant
28	May 30	28	June 21	BW, palpate implant
56	June 27	56	July 19	BW, Re-implant (4)
89	July 30	89	August 21	BW, palpate implant
112	August 22	112	September 13	BW
130	September 9	130	October 1	BW
131	September 10			BW
		144	October 15	BW
		145	October 16	BW

Table 3. Pooled performance summary

	Treatment					Contrast P <			
	Control	Synovex Plus	revalor-s	Ralgro revalor-s	SEM	1 vs 2,3,4	2,3 vs 4	2 vs 3	Trt*Grp
Initial BW, lb	721	721	722	722	1.7	NS[a]	NS	NS	NS
<u>1 to 28 d</u>									
BW 28, lb	839	864	856	848	3.4	.001	.007	.120	NS
ADG, lb	4.23	5.10	4.81	4.49	.110	.001	.002	.073	NS
DMI, lb/d	17.54	17.92	17.92	17.82	.257	NS	NS	NS	NS
F/G	4.23	3.57	3.81	3.99	.095	.001	.015	.082	NS
<u>29 to 56 d</u>									

BW 56, lb	953	1002	993	973	4.3	.001	.001	.129	NS
ADG, lb	4.05	4.94	4.87	4.46	.114	.001	.004	NS	.005
DMI, lb/d	20.82	21.63	21.03	21.38	.287	.124	NS	.148	NS
F/G	5.15	4.40	4.33	4.85	.091	.001	.001	NS	.001
57 to 89 d									
BW 89, lb	1076	1146	1140	1122	4.8	.001	.001	NS	NS
ADG, lb	3.75	4.37	4.47	4.49	.106	.001	NS	NS	NS
DMI, lb/d	22.27	23.40	23.32	23.12	.279	.004	NS	NS	NS
F/G	6.01	5.39	5.24	5.18	.129	.001	NS	NS	.149
90 to 112 d									
BW 112, lb	1136	1223	1222	1207	6.3	.001	.055	NS	NS
ADG, lb	2.61	3.36	3.55	3.73	.159	.001	NS	NS	NS
DMI, lb/d	21.52	23.85	23.68	23.88	.337	.001	NS	NS	NS
F/G	8.59	7.24	6.75	6.45	.361	.001	NS	NS	NS
113 to 130 d									
BW 130, lb	1173	1277	1268	1267	6.0	.001	NS	NS	.003
ADG, lb	2.03	2.96	2.54	3.29	.197	.001	.032	.146	.003
DMI, lb/d	20.14	23.87	23.35	23.63	.227	.001	NS	.118	.001
F/G	11.14	8.85	9.89	7.49	.851	.021	.082	NS	.005
90 to 130 d									
ADG, lb	2.36	3.18	3.10	3.54	.113	.001	.008	NS	.005
DMI, lb/d	20.90	23.86	23.53	23.76	.248	.001	NS	NS	.025
F/G	9.02	7.67	7.63	6.79	.251	.001	.009	NS	.001

Table 3. Continued

	Treatment					Contrast P <			
	Control	Synovex Plus	revalor-s	Ralgro revalor-s	SEM	1 vs 2,3,4	2,3 vs 4	2 vs 3	Trt*Grp
Early (1 to 56 d)									
ADG, lb	4.14	5.02	4.84	4.48	.073	.001	.001	.095	NS
DMI, lb/d	19.18	19.77	19.47	19.60	.244	.135	NS	NS	NS
F/G	4.65	3.95	4.05	4.40	.044	.001	.001	NS	.029
Late (57 to end)									
ADG, lb	2.89	3.66	3.71	3.92	.073	.001	.012	NS	.004
DMI, lb/d	21.41	23.66	23.47	23.51	.233	.001	NS	NS	.053
F/G	7.49	6.49	6.34	6.00	.114	.001	.006	NS	.001
Cumulative									
Final BW[b], lb	1191	1301	1298	1296	6.1	.001	NS	NS	.007
ADG, lb	3.14	3.92	3.88	3.86	.039	.001	NS	NS	.001
DMI, lb/d	20.51	22.07	21.85	21.93	.200	.001	NS	NS	NS
F/G	6.56	5.63	5.63	5.69	.050	.001	NS	NS	.001

[a] P>.15.

[b] Final BW includes a 3% shrink.

Table 4. Interactions between implant and group

	Treatment					Contrast P <			
	Control (1)	Synovex Plus (2)	revalor-s (3)	Ralgro revalor-s (4)	SEM	1 vs 2,3,4	2,3 vs 4	2 vs 3	Trt*Grp
				Late (56 to end)					
ADG, lb									
Group I	2.63	3.81	3.65	3.85	.073	.001	.012	NS[a]	.004
Group II	3.15	3.50	3.78	4.00					
DMI, lb/d									
Group I	21.23	24.26	23.80	23.30	.233	.001	NS	NS	.053
Group II	21.59	23.06	23.14	23.72					
F/G									
Group I	8.09	6.37	6.53	6.07	.114	.001	.006	NS	.001
Group II	6.88	6.60	6.14	5.94					
				Cumulative					
ADG, lb									
Group I	2.93	3.95	3.75	3.68	.039	.001	NS	NS	.001
Group II	3.35	3.89	4.01	4.04					
DMI, lb/d									
Group I	20.47	22.41	22.18	21.79	.200	.001	NS	NS	NS
Group II	20.56	21.73	21.52	22.06					
F/G									
Group I	6.98	5.68	5.91	5.92	.050	.001	NS	NS	.001
Group II	6.14	5.59	5.36	5.46					

[a] NS indicates P>.15.

Table 5. Effect of implant treatment on carcass traits

	Treatment					Contrast P <			
	Control (1)	Synovex Plus (2)	revalor-s (3)	Ralgro revalor-s (4)	SEM	1 vs 2,3,4	2,3 vs 4	2 vs 3	Trt*Grp
HCW, lb	717	781	785	781	5.8	.001	NS[f]	NS	.139
Dressing %	62.10	61.85	62.35	62.17	.161	NS	NS	.028	NS
REA, in^2	12.77	13.86	13.82	13.64	.135	.001	NS	NS	NS
Ribfat, in.	.385	.394	.419	.390	.014	NS	NS	NS	NS
Marbling[a]	5.37	4.90	5.02	5.17	.082	.001	.026	NS	NS
Bone maturity[b]	133	145	146	149	1.7	.001	.114	NS	NS
Lean maturity[c]	141	139	136	141	1.6	NS	.054	NS	NS
Masculinity[d]	.63	.96	1.03	1.05	.060	.001	NS	NS	.002
% Choice[e]	68.4	43.0	51.0	59.6					

[a] 4.0 = select ; 5.0 = small .

[b,c] 100 = A ; 200 = B .

[d] scale 0 to 3; 3 = stag.

[e] P=.002 by Chi square analysis.

[f] NS indicates P>.15.

Table 6. Marbling scores and percentage choice by implant x group

		Treatment				
Item		Control (1)	Synovex Plus (2)	revalor-s (3)	Ralgro revalor-s (4)	0
Marbling[ab]	Group I	5.52	4.95	5.13	5.19	5.20
	Group II	5.21	4.85	4.90	5.16	5.03
Choice, %[cd]	Group I	67.4	54.0	58.0	59.2	59.6
	Group II	69.4	32.0	44.0	60.0	51.3
Ribfat[e]	Group I	.414	.430	.470	.418	.433
	Group II	.356	.357	.369	.362	.361

[a] Treatment effect (P<.001).

[b] Group effect (P<.05).

[c] Treatment effect (P=.002).

[d] Group effect (P=.09).

[e] Group effect (P<.001).

Figure 1. Feed intake per unit metabolic body size as affected by implants and days on feed.

Figure 2. Energy density of live weight gain as affected by implants and days on feed.

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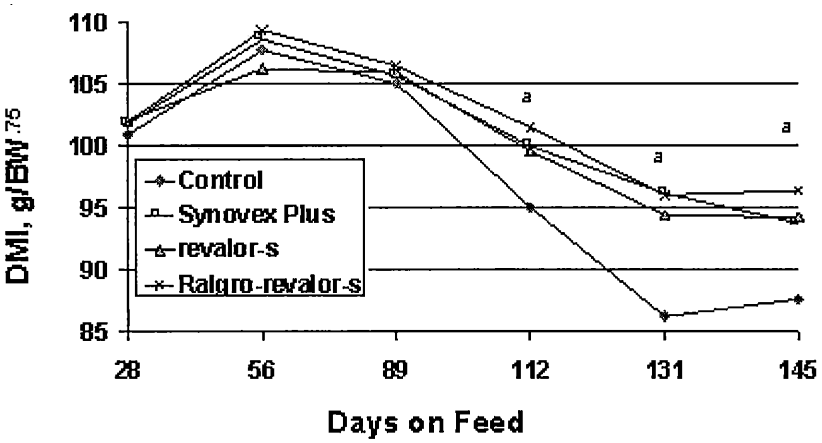
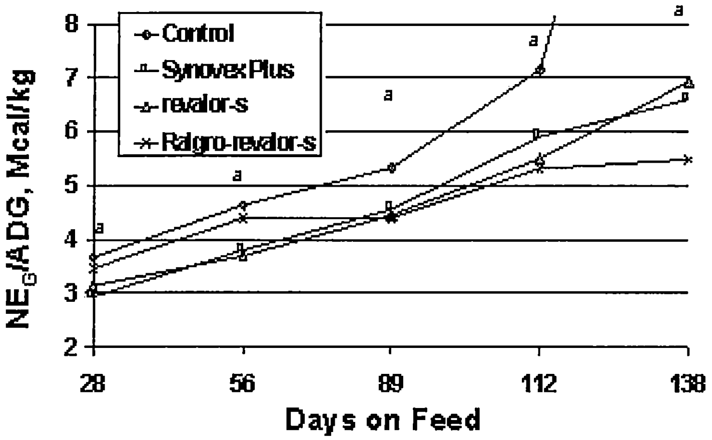


[a]Treatment ($P<.05$).

Figure 1. Feed intake per unit metabolic body size as affected by implants and days on feed.



[a]Treatment (P<.05).

Figure 2. Energy density of live weight gain as affected by implants and days on feed