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Delayed Implant Strategies Using Synovex® Plus™ on Performance and Carcass Characteristics in Finishing Yearling Steers

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Implanting with Synovex Plus on day 35 resulted in performance and carcass characteristics similar to using Ralgro initially followed by Synovex Plus on day 70 in feedlot steers fed 152 days.

Summary

This experiment evaluated delayed single-dose Synovex Plus implant or reimplant strategies using Ralgro and Synovex Plus or Synovex S. Delaying Synovex Plus until day 35 produced similar performance and carcass characteristics as Synovex Plus initially or Ralgro initially followed by Synovex Plus on day 70. Delaying Synovex Plus until day 70 reduced gain, but efficiency was similar to other Synovex Plus strategies. Two doses of Synovex S increased marbling, but efficiency declined 4% compared with implant strategies using Synovex Plus.

Introduction

The use of low-dose estrogenic implants followed by a terminal implant containing a combination of estrogen and trenbolone acetate 70 to 90 days before slaughter have become common practice in feedlots. Based on large pen data, these implant strategies reduce the incidence of social challenges, such as bullers, compared with the administration of a single combination implant initially. Daily gain and feed efficiency appear to be enhanced with this reimplant strategy compared to a single combination implant. Another successful implant strategy has been delaying administration of a single combination implant until cattle have reached maximum or near maximum energy consumption and established a social order within the pen. With delayed strategies, cattle are usually administered the implant about 100 days before slaughter or after 20 to 40 days on feed, whichever occurs first. However, the optimal time for the delayed administration of a single combination implant has not been investigated in great detail. The objectives of this experiment were to: 1) compare single implant strategies using Synovex® Plus™ versus a reimplant strategy using Ralgro® and Synovex Plus, 2) evaluate time of Synovex Plus administration in a single implant strategy, and 3) compare a reimplant strategy using only Synovex® S versus a single administration of Synovex Plus and a reimplant strategy using Ralgro and Synovex Plus in finishing steers fed 150 days.

Procedures

Two hundred twenty-five steers (665 lb) were used in a randomized complete block design to evaluate the effect of delayed implant strategies using Synovex® Plus< on performance and carcass characteristics in finishing steers. Steers were blocked by body weight into five weight replicates. Within each replicate, steers were stratified by body weight to one of five pens. Pens were randomly assigned to one of five implant strategies: 1) Synovex Plus (**Syn-Plus**) on day one, 2) Syn-Plus on day 35, 3) Syn-Plus on day 70, 4) Ralgro on day one followed by Syn-Plus on day 70 (**Ral-Plus**), or 5) Synovex S (**Syn-S**) on day one and 70.

The corn-based finishing diet contained 45.2% high-moisture and 19.3% dry-rolled corn (70:30 combination), 20% wet corn gluten feed, 7.5% alfalfa hay, 3% tallow, and 5% milled supplement (DM basis; Table 1). The final finishing diet was formulated to contain 13% crude protein (minimum of 6.8% degradable intake protein), .7% calcium, .43% phosphorus, .60% potassium, 27 g/t Rumensin® and 10 g/t Tylan® (DM basis). Steers were acclimated to the final diet in 17 days using four step-up diets that contained 45, 35, 25 and 15% alfalfa hay (DM basis), replacing equal proportions of high-moisture and dry-rolled corn from the final diet formulation. Steers were fed once daily and allowed ad libitum access to feed and water.

Table 1. Finishing diet and ingredient composition.

Item	% of Dry Matter
Ration ingredient composition	
High-moisture corn	45.2
Dry-rolled corn	19.3
Wet corn gluten feed	20.0
Alfalfa hay	7.5
Tallow 3.0	
Supplement	5.0
Supplement composition	
Fin ground corn	44.92
Limestone	29.70
Urea	9.98
Sodium chloride	6.00
Ammonium chloride	5.00
Potassium chloride	.60
Tallow	2.00
Trace mineral premix	1.00
Vitamin premix	.20
Rumensin-80	.34
Tylan-40	.26
Ration nutrient composition[a]	
Crude protein, %	13.0
NE_m, Mcal/lb	94.6
NE_g, Mcal/lb	64.2
Calcium, %	.70
Phosphorous, %	.43
Potassium, %	.60

[a] Ration nutrient composition based on NRC values for ration ingredients.

Initial weights were the average of two consecutive early morning weights taken prior to feeding. Interim body weights were taken at reimplanting dates,

(Continued on next page)

Table 2. Effect of implant strategy on interim performance of finishing steers.

	Implant Strategy[a]						Contrast P values[d]			
Item	Plus-0	Plus-35	Plus-70	Ralgro/ Plus	Syn-S/ Syn-S	SEM[b]	F-test[c]	TBA vs E2 only	Linear TBA	Quad TBA
Day 1-70										
DM intake, lb/day	23.3[e]	23.3[e]	22.3[f]	23.4[e]	23.4[e]	.28	.05	.40	.02	.17
Daily gain, lb	4.99[e]	4.81[e]	3.84[f]	4.32[g]	4.51[g]	.10	<.01	.87	<.01	.01
Feed/gain	4.68[e]	4.85[e]	5.81[f]	5.44[g]	5.19[h]	.10	<.01	.93	<.01	.01
Day 70-152										
DM intake, lb/day	25.3[eg]	25.6[e]	23.9[f]	24.5[fg]	24.9[eg]	.35	.03	.95	.01	.03
Daily gain, lb	3.07[e]	3.47[fi]	3.80[gh]	3.67[fh]	3.29[i]	.08	<.01	.04	<.01	.75
Feed/gain	8.24[e]	7.40[f]	6.32[g]	6.70[h]	7.57[f]	.13	<.01	.01	<.01	.47

[a]Plus-0, Plus-35, Plus-70=implanted with Synovex Plus on day 0, 35, or 70, respectively; Ralgro/Plus=implanted with Ralgro on day 0 and reimplanted with Synovex Plus on day 70; Syn-S/Syn-S=implanted with Synovex S on days 0 and 70.
[b]SEM= Standard error of the mean.
[c]Overall F-test for treatment.
[d]TBA vs E2=average of steers implanted with Synovex Plus versus steers implanted with Synovex S; Linear TBA=linear effect of Synovex Plus administered on day 0, 35, or 70; Quad=quadratic effect of Synovex Plus administered on day 0, 35, or 70.
[e,f,g,h,i]Means in the same row not bearing a common superscript differ (P < .10).

Table 3. Effect of implant strategy on performance of finishing steers fed 152 days.

	Implant Strategy[a]						Contrast P values[d]			
Item	Plus-0	Plus-35	Plus-70	Ralgro/ Plus	Syn-S/ Syn-S	SEM[b]	F-test[c]	TBA vs E2 only	Linear TBA	Quad TBA
Live Performance										
Initial wt, lb	665	666	664	666	664	.94	.51	.42	.66	.27
Final wt.[e], lb	1266[gi]	1286[gh]	1244[i]	1268[hi]	1249[i]	10.2	.07	.16	.15	.02
DM intake, lb/day	24.4[g]	24.6[g]	23.2[h]	24.0[gh]	24.2[g]	.30	.04	.69	.01	.05
Daily gain, lb	3.96[gh]	4.08[h]	3.82[g]	3.96[gh]	3.85[g]	.07	.08	.18	.16	.03
Feed/gain	6.17[gh]	6.02[g]	6.08[g]	6.07[g]	6.28[h]	.06	.08	.01	.31	.20
Carcass Adjusted Performance										
Final wt.[f], lb	1264[gi]	1274[gh]	1236[i]	1261[hi]	1242[i]	10.8	.12	.18	.08	.09
Daily gain, lb	3.95[gh]	4.01[g]	3.77[i]	3.92[gh]	3.80[hi]	.07	.13	.19	.08	.10
Feed/gain	6.18[g]	6.14[g]	6.15[g]	6.14[g]	6.37[h]	.07	.14	.02	.78	.71

[a]Plus-0, Plus-35, Plus-70=implanted with Synovex Plus on day 0, 35, or 70, respectively; Ralgro/Plus=implanted with Ralgro on day 0 and reimplanted with Synovex Plus on day 70; Syn-S/Syn-S=implanted with Synovex S on days 0 and 70.
[b]SEM= Standard error of the mean.
[c]Overall F-test for treatment.
[d]TBA vs E2=average of steers implanted with Synovex Plus versus steers implanted with Synovex S; Linear TBA=linear effect of Synovex Plus administered on day 0, 35, or 70; Quad=quadratic effect of Synovex Plus administered on day 0, 35, or 70.
[e]Final live weight pencil shrunk 4%.
[f]Final live weight calculated as hot carcass weight divided .63.
[g,h,i]Means in the same row not bearing a common superscript differ (P < .10).

including steers not receiving an implant, and on day 105. Final 152-day body weights were determined as the average of two consecutive early morning weights taken prior to feeding and pencil shrunk 4%. Additionally, final weights were calculated using hot carcass weight adjusted to a common dressing percentage (63). Steers were slaughtered at a commercial packing facility and carcass characteristics were evaluated following a 24-hour chill. Carcass measurements included: hot carcass weight, dressing percentage, marbling score, KPH fat, 12th rib fat thickness, longissimus muscle area, overall maturity score and incidence of abscessed livers.

The data were analyzed using the General Linear Model of SAS as a randomized complete block design. Treatment means were separated by the LSMEANS procedure with a protected (significant) F-test. Independent contrasts were conducted to compare linear and quadratic effects of the timing of Syn-Plus administration and the average of those treatments using Syn-Plus compared with the reimplant strategy of Syn-S. Percentages of carcasses grading USDA Choice and liver abscesses were analyzed using the Frequency procedure of SAS. Variables were considered significant when $P < .10$. Pen means were regressed against time on feed and Syn-Plus administration using a quadratic model to estimate the optimal implant time when using Syn-Plus as a single-delayed implant strategy. Optimal implant timing was determined by calculating the point where the first derivative of the quadratic equation was zero.

Results

The effects of implant strategy on interim and overall performance are presented in Tables 2 and 3. During the first 70 days on feed, delaying the administration of Syn-Plus resulted in a linear

Table 4. Effect of implant strategy on carcass characteristics of finishing steers fed 152 days.

	Implant Strategy[a]						Contrast P values[d]			
Item	Plus-0	Plus-35	Plus-70	Ralgro/ Plus	Syn-S/ Syn-S	SEM[b]	F-test[c]	TBA vs E2 only	Linear TBA	Quad TBA
Hot carcass wt, lb	797^{km}	802^{k}	779^{l}	794^{kl}	783^{lm}	6.8	.12	.18	.08	.09
Dressing percent	62.9	62.4	62.6	62.7	62.6	.33	.85	.95	.53	.35
Longissimus muscle area										
sq. in.	13.8^{km}	14.0^{k}	13.9^{k}	13.5^{lm}	13.2^{l}	.17	.01	<.01	.53	.40
sq. in./cwt HCW	1.73^{k}	1.74^{kl}	1.79^{l}	1.70^{k}	1.69^{k}	.02	.05	.06	.08	.53
KPH[e] fat, %	2.50	2.41	2.46	2.48	2.47	.03	.44	.84	.56	.09
Yield grade[f]	2.81^{k}	2.60^{l}	2.52^{m}	2.77^{kl}	2.93^{kl}	.09	.03	.02	.03	.54
12th rib fat, in.	.48^{k}	.42^{l}	.42^{l}	.43^{kl}	.47^{k}	.02	.12	.12	.05	.28
Marbling score[g]	5.13	5.12	5.10	5.08	5.33	.12	.55	.10	.85	.96
Maturity score[h]	1.57^{k}	1.55^{k}	1.50^{lm}	1.55^{k}	1.54^{km}	.02	.01	.73	.01	.45
USDA Choice[i], %	68.9	61.4	55.5	61.4	80.0					
Abscessed livers[j], %	13.3	6.8	20.0	8.9	6.7					

[a]Plus-0, Plus-35, Plus-70=implanted with Synovex Plus on day 0, 35, or 70, respectively; Ralgro/Plus=implanted with Ralgro on day 0 and reimplanted with Synovex Plus on day 70; Syn-S/Syn-S=implanted with Synovex S on days 0 and 70.
[b]SEM= Standard error of the mean.
[c]Overall F-test for treatment.
[d]TBA vs E2=average of steers implanted with Synovex Plus versus steers implanted with Synovex S; Linear TBA=linear effect of Synovex Plus administered on day 0, 35, or 70; Quad=quadratic effect of Synovex Plus administered on day 0, 35, or 70.
[e]KPH=kidney, pelvic, and heart.
[f]Calculated using hot carcass weight, fat thickness, KPH fat, and ribeye area.
[g]5.0=Small 0; 5.5=Small 50, etc.
[h]1.0=A^{0}; 1.5=A^{50}, etc.
[i]Chi square statistic (P = .40).
[j]Chi square statistic (P = .22).
[k,l,m]Means in the same row not bearing a common superscript differ (P < .10).

(P = .02) decline in dry matter intake (Table 2). Delaying the administration of Syn-Plus resulted in quadratic (P = .01) response for daily gain and feed efficiency. Daily gain and feed efficiency were similar when steers were implanted with Syn-Plus on day 0 or 35, but improved compared with those receiving Syn-Plus on day 70. This is to be expected since steers allotted to receive Syn-Plus on day 70 had not yet been implanted. Steers implanted with Syn-Plus on day 0 or 35 gained 10% faster and were 11% more efficient compared with those implanted with Ralgro or Syn-S on day 0 (P < .10). Compared within steers receiving estrogen implants only, those implanted with Syn-S gained 4.3% faster and were 4.8% more efficient compared with those implanted with Ralgro.

During the final 82 days on feed (day 71 until slaughter), delaying the administration of Syn-Plus resulted in a quadratic (P = .03) response in dry matter intake (Table 3). Dry matter intake was similar for steers implanted with Syn-Plus on day 0 or 35, but higher than those implanted with Syn-Plus on day 70. Daily gain and feed efficiency were improved linearly (P < .01) by delaying the administration of Syn-Plus during this phase of the feeding period. Steers implanted with Syn-Plus on day 70 as the only implant during the feeding period were more efficient than all other implant strategies (P < .10). Compared with those implanted with Ral-Plus, steers implanted with Syn-Plus on day 70 only were 5.5% (P < .10) more efficient, while daily gain was similar between these two implant strategies.

Cumulative feedlot performance is presented in Table 3. A quadratic (P = .05) response was observed for dry matter intake with the delayed implant strategies using Syn-Plus. Dry matter intake was reduced when the administration of Syn-Plus was delayed until day 70, whereas dry matter intake was similar between steers implanted with Syn-Plus on day 0 or 35. Additionally, delaying the administration of Syn-Plus to day 70 resulted in lower (P < .10) dry matter intake compared with two doses of Syn-S or Ral-Plus. Based on the cumulative and interim data, it appears that delaying a single implant of Syn-Plus until day 70 does not increase dry matter intake similar to other strategies where implants, regardless of type or dosage, are administered earlier in the feeding period.

In general, the responses in daily gain and feed efficiency were similar among implant strategies when expressed on a live or carcass basis (Table 3). Daily gain of steers implanted with Syn-Plus on day 35 was higher (P < .10) than those implanted with Syn-Plus on day 70, but similar to those implanted with Syn-Plus on day 0 (quadratic, P = .03) and Ral-Plus. Additionally, steers implanted with Syn-Plus on day 0 or 35 or those implanted with Ral-Plus gained 3.8% faster (P < .10; live basis) than those implanted with Syn-S only. Feed efficiency was similar among Syn-Plus implant strategies, but improved 3.7% (P = .01, live basis; P = .02, carcass basis) compared with the implant strategy using Syn-S only.

The effects of implant strategy on hot carcass weight were similar to those observed for daily gain (Table 4). Carcass weights were reduced (quadratic; P = .09) by delaying the administration

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of Syn-Plus until day 70 compared with administration on day 0 or 35. Expressed as square inches ($P < .01$) or square inches/cwt of hot carcass weight ($P = .06$), ribeye area was larger for steers implanted with Syn-Plus compared with Syn-S only. Additionally, ribeye area per cwt of hot carcass weight was increased linearly ($P = .08$) by delaying the administration of Syn-Plus in a single implant strategy. Yield grade ($P = .03$), 12th rib fat ($P = .05$), and maturity score ($P = .01$) were decreased linearly by delaying a single Syn-Plus implant. Steers implanted with two doses of Syn-S had a higher yield grade ($P = .02$) and marbling score ($P = .10$) compared with implant strategies using Syn-Plus. Dressing percentage and percentage of USDA Choice carcasses were unaffected by implant strategy. Although no statistical differences were observed, implant strategies using Syn-Plus appeared to have some effect on the percentage of USDA Choice carcasses. Excluding the implant strategy using a single dose of Syn-Plus administered on day 70, the percentage of USDA Choice carcasses was reduced by 16 percentage units compared with the Syn-S strategy. Using a $10 Choice/Select spread, the 14-lb increase in carcass weight offsets the loss in revenue due to the reduction in USDA Choice carcasses. Due to the 3% improvement in feed efficiency, these three implant strategies using Syn-Plus would increase profitability compared with two doses of Syn-S.

Delaying the administration of Syn-Plus until 35 days on feed can be an effective implant strategy in cattle fed about 150 days. Delaying administration until 70 days on feed appears to reduce overall daily gain, but does not compromise feed efficiency. Regression analysis of these data suggested that daily gain would have been maximized if a single administration of Syn-Plus was administered at 29 days on feed ($r^2 = .43$; live basis) or 23 days on feed ($r^2 = .41$; carcass basis).

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