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Summary

A commercial feedlot experiment utilizing 12 pens and 1038 steers evaluated initial implant strategies for feedlot steers. Steers were administered either Revalor-IS® or Synovex S® at initial processing. Both treatment groups received Revalor-S® as a terminal implant. Revalor-IS® as an initial implant improved hot carcass weight and carcass adjusted final weight; however, there was no effect on any other measure of performance or carcass characteristics. Selling steers on a carcass merit basis resulted in a similar return per head for both implant strategies. Reduced-dose combination implants may improve hot carcass weight and carcass adjusted final weight with no impact on carcass merit.

Introduction

Growth-promoting implants increase growth rate (i.e. daily gain), improve feed conversion, and increase final weight of cattle by as much as 40 to 90 lb (Guiroy et al., 2002; *Journal of Animal Science*) compared to non-implanted cattle. If implanted cattle are marketed at weights comparable to non-implanted cattle, the increase in growth rate and lean deposition may occur at the expense of meat quality (reduction in marbling score), suggesting implanted cattle should be fed to higher body weights in order to achieve comparable quality grades.

New reduced-dose initial implant combinations of estradiol and trenbolone acetate are available for steers and may have different effects on animal performance and carcass quality when compared to the more traditional estrogen-based implants. Recently, Hutcheson et al. (2003, *Journal of Animal Science* Vol. 81 Suppl. 1, p112) reported estradiol and trenbolone acetate implants, used in either the full or reduced dosage form, improved gain, feed efficiency, and hot carcass weight while maintaining carcass quality in short-fed yearling steers when compared to a traditional estrogen implant. Also, Farran et al. (*2004 Nebraska Beef Report*, pp. 58-60) observed improvements in gain, feed efficiency, marbling score, and the percentage of carcasses grading upper two-thirds Choice when reduced dosage estradiol and trenbolone acetate implants were compared to initial implants of estrogen plus testosterone in long-fed heifers. Our objectives were: 1) to determine whether a reduced-dose combination of estradiol and trenbolone acetate is effective in maintaining animal performance, and 2) to measure the impact of reduced dosage of estrogen in an estradiol and trenbolone acetate initial implant on carcass quality, yield grade and feeding economics of feedlot steers.

Procedure

Crossbred steers (593 lb. initial BW) were received at a commercial feedlot in Western, Nebraska and were allotted randomly to one of two implant regimens at initial processing (within 72 hours after arrival). Each group of incoming cattle represented a treatment replication for a total of six replications per treatment (12 pens total; 1,077 steers). Steers were kept separate by arrival date and assigned randomly to pens by sorting every other animal as they exited the processing chute during initial processing. Within a replication, all steers were from the same source and arrived to the feedlot at the same time. At initial processing, steers were individually weighed, vaccinated, treated for internal and external parasites, and given a lot-tag for individual and pen identification. The initial implant treatment was either Revalor-IS (16 mg estradiol, 80 mg trenbolone acetate) or Synovex S (20 mg estradiol benzoate, 200 mg progesterone). After processing, animals were weighed by pens for a starting pen weight just prior to being moved into their home pen. Number of animals in a pen ranged from 70 to 120 head and was equal across treatments and replications.

Steers were fed (twice daily) a common finishing diet containing

62.3% steam-flaked corn, 10.6% dry-rolled corn, 9.0% wet distillers grains, 3.0% alfalfa hay, 4.0% mixed hay, 5.0% liquid supplement, 3.5% corn steep liquor, and 2.6% tallow. The finishing diet was formulated to contain 14.7% CP, 0.7% Ca, and 0.4% P, 28 g/ton Rumensin, and 9 g/ton Tylan. Cattle were adapted to the finishing diet over an 18- to 21-day step-up period starting with 45% roughage and progressively replacing roughage with concentrate.

Replications of steers were reimplanted with Revalor-S (24 mg estradiol 17beta, 120 mg trenbolone acetate) as the common terminal implant an average of 78 days (range 71 to 84) prior to slaughter. At re-implant time, steers were removed from their pens and immediately weighed to obtain a pen weight. Steers were then re-vaccinated, poured, individually weighed, and re-implanted prior to being sent back to their home pen for the remainder of the feeding period. Initial implants also were evaluated at this time to identify defects, including abscessed, bunched, missing, crushed, partial, or cartilage-placed implants. Steers were fed an average of 180 days (range 170 to 191). All pens within a replication were marketed under identical conditions at the same commercial abattoir (National Beef Packing; Dodge City, Kansas). Hot carcass weights were recorded on the day of harvest. Carcass fat thickness, longissimus muscle area, and USDA called marbling score and yield grades were recorded following a > 24-hour chill. Empty body fat was calculated from the equations of Guiroy et al. (2002, *Journal of Animal Science*), where empty body fat = 17.76207 + (4.68142 × fat thickness in cm) + (0.01945 × hot carcass weight in kg) + (0.81855 × quality grade) - (0.06754 × longissimus muscle area in cm^2). Calculated yield grade was estimated with the formula from the American Meat Science Association, 2001 *Meat Evaluation Handbook* where Yield Grade = 2.5 + (2.5 × fat thickness in inches) + 0.2 × (% kidney, pelvic, and heart fat; estimated at 2%) + (0.0038 × hot carcass weight in lb) - (0.32 × longissimus muscle area in $in.^2$). Marbling score was recorded on a scale of 450 = Slight ^{50}; 500 = Small ^{0}; 550 = Small ^{50}; 600 = Modest ^{0}.

The economic influence of the initial implant treatment on profit/loss of steers sold on a value-based pricing grid was determined based upon the commodity grid proposed by Feuz (*2002 Nebraska Beef Report,* pp. 39-41). Carcass value was calculated based on USDA quality and yield grade, carcass weight, and nonconformance (i.e., dark cutters and heavy carcasses). A carcass base price of $109.84/cwt (10-year average dressed weight price) was used for low Choice, Yield Grade 3 carcasses weighing 550 to 950 lb. Discounts were calculated on a hundred weight of carcass basis as: $7/cwt Select; $17/cwt Standard; $25/cwt dark cutters; $15/cwt for light (<550 lb) and heavy (>950 lb) carcasses; and $15/cwt for yield grades of 4 and 5. Premiums were calculated as: $6/cwt Prime; $1.50/cwt upper 2/3 Choice; $1/cwt Yield Grade 2; and $2/cwt Yield Grade 1. Ration cost was calculated using 10-year average corn and alfalfa hay price. Non-feed costs were $0.28/head daily yardage, $30/head miscellaneous (medicine, processing, shipping, etc.), and 7% animal and feed interest. Initial implant cost was $1.95/implant for Revalor-IS and $0.80/implant for Synovex S. Initial animal cost was based upon the 10-year average 600- to 700-lb feeder steer price of $83.76/cwt (Feuz et al., *2002, University of Nebraska, Cooperative Extension Bulletin,* PHREC 02-21, p.16).

Animal performance, carcass data and economics were analyzed using the Mixed procedure of SAS for a randomized complete block design where pen served as the experimental unit. Model effects were initial implant treatment, while arrival date was termed a blocking factor, thus placed into the random statement. Least squares means were separated using the PDIFF statement of SAS.

Results

Data are presented with deads and railers removed from the analysis. Fifteen and thirteen head were removed from the Revalor-IS and Synovex S treatments, respectively. Feed intake and head days were adjusted accordingly for the time of removal from the pen. Feed intake was calculated from feedlot closeout information on each pen of cattle. Because all steers received a common terminal implant, initial implant treatment will be referred to when comparing treatment differences.

There were no differences in initial implant defects for either treatment. One animal in the Revalor-IS and three animals in the Synovex S treatments possessed abscessed implants. Additionally, thirteen animals in the Revalor-IS and fifteen in the Synovex S treatment had identifiable defects in the initial implant. Therefore, 2.5% of steers administered Revalor-IS and 2.8% of steers administered Synovex S were found to have implants that fell within the defective criteria. This indicates that initial implants were properly administered.

There were also no differences in morbidity and mortality of steers. Deads and railers were combined as they were all removed from their pens and the data analysis. Deads and railers averaged 3.6% and 3.2% for the Revalor-IS and Synovex S treatments, respectively. Total pulls averaged 56.8% and 52.8% for the Revalor-IS and Synovex S treatments, respectively. Of those pulls, steers treated for respiratory disease on one occurrence were 38.1% and 38.8%, and steers treated for respiratory disease two or more times were 15.0% and 11.9% for the Revalor-IS and Synovex S treatments, respectively. Pulls for other

reasons were 3.7% and 2.0% for the Revalor-IS and Synovex S treatments, respectively.

Steer performance is presented in Table 1 and is expressed on a live and carcass adjusted basis using a common dressing percentage (63%). Dry matter intake was similar between treatments. Steers implanted initially with Revalor-IS had 8 lb. greater ($P = 0.07$) carcass adjusted final weight than steers initially implanted with Synovex S. Implanting steers initially with Revalor-IS improved feed efficiency by 2% in the live category (5.41 vs. 5.53) and 3% in the carcass adjusted calculation (5.31 vs. 5.48); however, neither difference was significantly different from the Synovex S treatment with P-values of 0.30 and 0.23, respectively. Live average daily gain (P = 0.31) and carcass adjusted average daily gain (P = 0.22) were not significantly different and only slightly increased with the initial Revalor-IS treatment.

Carcass merit is shown in Table 2. Revalor-IS implanted steers had 5 lb heavier ($P = 0.07$) hot carcass weights, with similar dressing percentages, 12th rib fat thickness, calculated empty body fat, and longissimus muscle area when compared to Synovex S implanted steers. USDA called yield grade and calculated yield grade were similar between treatments indicating that steers were fed to a similar compositional end-point. Marbling score, carcasses grading upper two-thirds Choice, and total carcasses grading Choice were not different between initial implant treatments. Steer carcass yield grade breakdowns also are presented in Table 5. There were no differences between treatments when analyzed in single numerical categories or when combined as is illustrated when yield grade one and two were combined. These data suggest that reduced-dose combina-

Table 1. Effects of Revalor-IS or Synovex S as initial implants for feedlot steers on live and carcass adjusted performance.

	Initial Implant[a]			
Item	Revalor-IS	Synovex S	SEM	*P*-value
Number of pens	6	6		
Number of steers	518	520		
Initial weight, lb	592	593	4.3	0.80
Dry matter intake, lb	20.0	20.3	0.3	0.45
Carcass performance				
Final weight, lb[b]	1269	1261	3.5	0.07
Daily gain, lb[c]	3.77	3.72	0.04	0.22
Feed:gain[c]	5.31	5.48	0.15	0.23
Live performance				
Final weight[d]	1258	1253	3.4	0.20
Daily gain, lb[e]	3.70	3.67	.03	0.31
Feed:gain[e]	5.41	5.53	0.11	0.30

[a]All steers implanted with Revalor-S as the common terminal implant.
[b]Calculated as hot carcass weight ÷ 63%.
[c]Calculated using carcass-adjusted final weight.
[d]Calculated from live pen weights and shrunk 4%.
[e]Calculated from live final weight.

Table 2. Effects of Revalor-IS or Synovex S as initial implants on steer carcass characteristics.

	Initial Implant[a]			
Item	Revalor-IS	Synovex S	SEM	*P*-value
Hot carcass weight, lb	800	795	2.24	0.07
Dressing percentage	63.6	63.4	0.12	0.26
12th rib fat, in.	0.48	0.48	0.05	1.00
Empty body fat, %[b]	28.8	28.8	0.14	0.74
Longissimus muscle area, sq. in.	13.6	13.5	0.11	0.24
Dark cutters, %	1.12	2.73	0.87	0.14
USDA yield grade, %				
1	7.6	8.3	0.99	0.53
2	52.8	46.5	4.26	0.20
3	32.5	39.4	5.59	0.28
4	6.0	4.8	1.1	0.35
5	1.1	1.0	0.7	0.82
Calculated yield grade[c]	2.9	2.9	0.04	0.37
Marbling score[d]	516	516	4.34	0.97
USDA Quality grade, %				
Prime	1.2	0.2	0.51	0.11
Upper 2/3 Choice	18.8	19.8	3.14	0.76
Low Choice	36.8	39.2	2.06	0.31
Select	40.7	38.8	1.1	0.14
Standard	2.5	2.0	1.38	0.73
Total Choice carcasses	55.6	58.2	1.36	0.15

[a]All steers implanted with Revalor-S as the common terminal implant.
[b]Calculated from Guiroy et al., 2002 (*Journal of Animal Science*), where empty body fat = 17.76207 + (4.68142 × 12th rib fat thickness) + (0.01945 × hot carcass weight) + (0.81855 x quality grade) - (0.06754 × longissimus muscle area).
[c]Calculated YG = 2.5 + (2.5 × 12th rib fat thickness) + (0.2 x kidney, pelvic, and heart fat) + (0.0038 × hot carcass weight) - (0.32 × longissimus muscle area).
[d]Marbling score: 450 = Slight 50; 500 = Small 0; 550 = Small 50; 600 = Modest 0; etc.

Table 3. Feeding economics of steers implanted with Revalor-IS or Synovex S.

Item	Initial Implant[a]		SEM	*P*-value
	Revalor-IS	Synovex S		
Initial animal cost, $/cwt[b]	83.76	83.76	—	—
Ration cost, $/ton DM	126.00	126.00	—	—
Initial implant cost, $/head	1.95	0.80	—	—
Total misc. cost, $/head[c]	103.81	102.72	—	—
Carcass base price, $/cwt	109.84	109.84	—	—
Commodity grid profit(loss), $/head[d]	1.06	-3.89	8.07	0.57

[a]All steers implanted with Revalor-S as the common terminal implant.
[b]10-year average price feeder steers weighing 600 to 700 lb.
[c]Includes $0.28/day yardage, 7% animal and feed interest, and $30/head miscellaneous cost (processing, health, terminal implant, shipping, etc.)
[d]Discounts/cwt = $7 Select, $17 Standard, $15 yield grade 4&5, $25 dark cutter, $15 light & heavy carcasses; premiums/cwt = $6 Prime, $1.50 Upper 2/3 Choice, $2 Yield grade 1, $1 Yield grade 2.

tion (E + TBA) implants used initially may improve carcass weight compared to traditional higher dose implants, when cattle are fed the same number of days. Additionally, implant treatment did not affect the degree of finish of the steers.

The simulated economic analysis of marketing cattle on a value-based carcass merit basis is presented in Table 3. Using 10-year average prices, ration cost was calculated to be $126/ton (DM basis). The added cost of Revalor-IS over that of Synovex S implants also was included in the analysis. Initial animal cost and total miscellaneous costs were similar between treatments. Steers implanted initially with Revalor-IS returned $4.95/head more ($P = 0.57$) than those steers initially implanted with Synovex S. The 5 lb heavier hot carcass weights translate into greater returns for steers implanted with Revalor-IS.

This study provides evidence that Revalor-IS as an initial implant for feedlot steers appears to provide equal performance and slightly better carcass weight than traditional steer initial implants (Synovex S), without affecting carcass characteristics or feeding economics when steers are sold on a value-based grid marketing system. Farran et al. (*2004 Nebraska Beef Report*) found significant increases in gain, feed efficiency, and marbling score when Revalor-IH was used as an initial heifer implant compared to Synovex-H. They observed a 2.5% increase in carcass adjusted feed efficiency. In our study with steers, we observed no differences in gain or marbling score. However, we did find slight increases in hot carcass weight and carcass adjusted final weight. In addition, we observed a 2% decrease in live, and 3% decrease in carcass adjusted feed conversion; however, due to a larger amount of variation or differences in physiology between heifers and steers, the improvements we observed were not statistically significant.

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