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Summary and Implications

A commercial feedlot trial tested three implant strategies (Revalor-200 on day 0, Revalor-IH on d 0 and re-implanted with Revalor-200 on d 56, or Revalor-XH on d 0) on growth performance and carcass characteristics of heifers fed for 138 d. There were no differences observed for final body weight, dry matter intake, or average daily gain on a live basis among implant strategies. Heifers implanted with Revalor-IH/200 combination had greater carcass-adjusted final body weight and improved feed conversion compared to Revalor-200 and Revalor-XH. Hot carcass weights, dressing percent, and LM area were improved for Revalor-IH/200 implanted heifers relative to Revalor-200 and Revalor-XH implanted heifers. Marbling score and 12th-rib fat thickness were not different among implant treatments. Heifers implanted with Revalor-IH/200 had a shift to a lower USDA yield grade distribution compared to 200 and XH implanted heifers. The greater concentration of trenbolone acetate and estradiol provided by Revalor-IH/200 combination slightly improved growth and carcass performance compared to the non-coated Revalor-200 implant and partially coated Revalor-XH implant.

Introduction

Growth promoting implants improve average daily gain (ADG) and hot carcass weight (HCW) in steers and heifers. Cattle tend to respond to more aggressive terminal implant protocols with increased growth performance and delayed fattening at equal days on feed. Heifers tend to have more adipose tissue at the same chronological age as steers and therefore poorer growth performance. To improve growth rate, HCW, and feed efficiency, feeding programs typically have more aggressive implant protocols containing higher levels of trenbolone acetate (TBA) and estradiol (E2). The objective of this study was to evaluate effects of implanting heifers with a partially coated Revalor-XH implant on d 0 compared to non-coated Revalor-200 on d 0 or a more aggressive implant protocol of Revalor-IH on d 0 followed by Revalor-200 to target approximately 80 d with terminal implant on finishing heifer performance and carcass characteristics.

Procedure

Crossbred heifers (n = 1,728; initial BW = 906; SD = 24 lb) were utilized in a randomized complete block design with eight blocks. Heifers were sourced from sale barns in Nebraska and Oklahoma. Heifers were fed for an average of 138 d (range 135–139 d) from June 2018 to November 2018 in a commercial feedlot in Nebraska. Treatments included: Revalor-200 on d 0 (200 mg TBA/20 mg E2, Merck Animal Health, noncoated; 200), Revalor-IH on d 0 (80 mg TBA/8 mg E2, Merck Animal Health, noncoated) and re-implanted with Revalor-200 on approximately d 56 to target approximately 80 d with terminal implant (200 mg TBA/20 mg E2, Merck Animal Health, noncoated; IH/200), or Revalor-XH on d 0 [200 mg TBA and 20 mg E2, partially coated (XH); Merck Animal Health, DeSoto, KS]. Revalor-XH contains four uncoated pellets (80 mg TBA and 8 mg E2) for immediate release and six coated pellets (120 mg TBA and 12 mg E2) to release approximately 70 to 80 d after implanting.

Heifers were assigned randomly to pen (n = 24) based on weight strata at arrival. Pay weight and records of historical data of similar cattle at the feedlot were used to estimate range of two standard deviations above and below the pay weight. Heifers outside of this range were not used on the study. Within the range a series of randomization sheets were created, one for every 50 lb increment. Each row on every sheet contained a random assignment to treatment so that the first animal weighed that qualified for that stratum was assigned to one treatment while the next animal within that weight range was assigned to one of the remaining two treatments. Treatments were assigned randomly to pens within blocks for all 24 pens. Heifers were processed, weighed, and assigned to treatment in a single event on d 0. At processing, heifers received Vista Once SQ (Merck) to protect against bovine rhinotracheitis (IBR), parainfluenza$_3$ (PI$_3$), and bovine respiratory syncytial virus (BRSV); and an implant based on the assigned treatment. In addition, heifers received external parasite control via dosing with ivermectin (Noromectin, Norbrook) and internal parasite control via drenching with fenbendazole (Safe-Guard, Merck) oral suspension. All heifers were checked for pregnancy using rectal ultrasound, and if pregnant, were administered dinoprost tromethamine (Lutalyse HighCon, Zoetis) or both Lutalyse HighCon and dexamethasone if the heifer's fetus was determined to be 90 d or older to induce abortion. Implant sites were examined from four replications selected randomly from the eight total replications 28 d after initial implanting. All three pens from the chosen replications were checked with the first ten heifers out the gate selected. After re-implanting, the remaining four replications were checked but only the pens that had been re-implanted with Revalor-200. Pens from the remaining four replications that did not receive a terminal implant were not checked.

Cattle were housed in open lots with ad libitum access to water and feed. Diets were consistent across all treatments. Heifers were started on a diet consisting of 16.42%

Table 1. Performance and carcass characteristics of heifers implanted with three different strategies

	Treatment[1]				
Item	Rev-200	Rev-IH/200	Rev-XH	SEM	F-Test
Head Count[2]	508	505	506	—	—
Days on Feed	137.6	137.6	137.6	—	—
Animals Removed, %	0.38	0.40	0.42	0.251	0.99
Death Loss, %	1.22	0.17	0.21	0.312	0.06
Live Performance					
Initial BW	901	903	903	1.0	0.24
Final BW[3]*, lb*	1394	1398	1393	3.7	0.63
DMI, Ib/d	25.3	25.1	25.2	0.14	0.48
ADG, lb	3.58	3.60	3.56	0.029	0.67
F:G	7.09[b]	6.99[a]	7.09[b]	—	0.05
Carcass-Adjusted Performance					
Final BW[4]*, lb*	1389[b]	1405[a]	1390[b]	4.7	0.05
ADG, lb	3.55	3.65	3.54	0.037	0.09
F:G	7.14[b]	6.85[a]	7.09[b]	—	< 0.01
Carcass Characteristics					
HCW, lb	866[b]	876[a]	867[b]	3.0	0.05
Dressing, %	62.1[b]	62.7[a]	62.2[b]	0.0011	0.01
LM area, in[2]	13.6[b]	14.1[a]	13.7[b]	0.10	0.02
Marbling[5]	529	523	539	5.0	0.12
12th rib fat, in	0.71	0.68	0.70	0.010	0.17
Calculated YG[6]	3.82[a]	3.63[b]	3.75[ab]	0.048	0.05

[a, b] Means within rows without common superscripts differ ($P \leq 0.05$)

[1]Treatments included: Revalor-200 on d 0 (200 mg TBA/20 mg E2, Merck Animal Health, noncoated; 200), Revalor-IH on d 0 (80 mg TBA/8 mg E2, Merck Animal Health, noncoated) and re-implanted with Revalor-200 on approximately d 56 to target approximately 80 d with terminal implant (200 mg TBA/20 mg E2, Merck Animal Health, noncoated; IH/200), or Revalor-XH on d 0 [200 mg trenbalone acetate (TBA) and 20 mg estradiol (E2), partially coated (XH); Merck Animal Health, DeSoto, KS]. Revalor-XH contains four uncoated pellets (80 mg TBA and 8 mg E2) for immediate release and six coated pellets (120 mg TBA and 12 mg E2) to release approximately 70 to 80 d after implanting.

[2] Due to missing carcass data only replications 1–7 were analyzed for growth performance and carcass characteristics.

[3]Final BW is the average pen weight shrunk four percent. Subsequent ADG and F:G are calculated from shrunk final BW.

[4]Carcass-adjusted final BW was determined by dividing average HCW per treatment by the average dressing percent of 62.35%.

[5]USDA marbling scores. 400 = small, 500 = modest, 600 = moderate.

[6]YG = 2.50 + (2.5 * 12th-rib fat depth, in) + (0.2 * 3.0 KPH fat, %) + (0.0038 * HCW, lbs)—(0.32 * LM area, in^2) where KPH fat was assumed to be 3.0 %.

dry-rolled corn, 35.0% wet distillers grains plus solubles, 35.0% alfalfa hay, 10.0% corn stalks, 3.5% supplement, and 0.08% micro-ingredients (DM basis). Four step-up diets were used to transition the heifers to the finishing diet. Approximately 98 d (range 93–105 d) into the trial, dry-rolled corn was replaced with high-moisture corn for all animals on trial. The supplement and micro-ingredient premixes were formulated to target 8.9 g/ton DM of Tylan (Elanco Animal Health) and 30 g/ton DM of Rumensin (Elanco Animal Health). Melengestrol acetate (MGA, Zoetis) was fed at a rate of 0.45 mg/heifer daily once heifers reached the finishing ration. Actogain (Zoetis) was fed at a targeted rate of 300 mg/heifer for the last 35 d of the feeding period. Diet samples were obtained monthly and analyzed for dry matter, crude protein, crude fiber, calcium, phosphorous, potassium, sulfur, zinc, and copper.

Cattle were scheduled for slaughter at approximately 135 d (range 135–139 d) on feed. Cattle were shipped by pen with each pen on a separate truck and trucks were weighed and shrunk four percent to serve as the average final live weight. Cattle were processed at JBS in Grand Island, NE and individual carcass data were collected. Individual HCW was collected at slaughter. Following a 24 hr chill, 12th-rib fat depth, LM area, marbling, USDA quality grade, and USDA yield grade were collected from JBS's camera data. Carcass-adjusted final BW was calculated by dividing treatment average HCW by the average dressing percent of 62.35% across all study animals. In replication eight, carcass data were not collected on 31 carcasses from the 200 treatment. As a result, all live and carcass data from that replication were removed from analysis. Therefore, growth performance and carcass data were analyzed with 508 heifers in 200, 505 heifers in IH/200, and 506 heifers in XH (n = 1519; Table 1) as a RCBD with 7 blocks and 7 replications.

Percent mortality was calculated by the total number of animals that died in a pen divided by the total number of animals enrolled in that pen. Percent removed from study, excluding deads, was determined by dividing the number of cattle removed (i.e. lameness or injury) per pen by total number of heifers enrolled in that pen.

Performance and carcass data were analyzed as a randomized complete block design using the MIXED procedure of SAS (9.4, SAS Institute Inc., Cary, NC). Treatment and block were fixed effects. The model included implant treatments and blocks. Pen was the experimental unit. Treatment averages were calculated using the LSMEANS option of SAS. Frequency data, such as USDA quality grade and yield grade distributions, were analyzed using the GLIMMIX procedure of SAS using a multinomial approach. Treatment differences were significant at $\alpha \leq 0.05$ and tendencies were discussed when $0.05 \leq \alpha \leq 0.10$.

Results

There were eight heifers that died over the course of the study. Additionally, six heifers were removed from the trial due to bodily injury (i.e. dislocated hip, hoof issues, strained shoulder). No differences ($P \geq 0.99$) were observed between implant treatments for percent removed from the study. However, a tendency ($P = 0.06$) was observed for increased mortality with heifers implanted with 200 compared to IH/200 or XH implanted heifers.

Overall, no differences ($P = 0.48$; Table 1) were observed in live final BW, DMI, and live ADG among implant treatment. However, heifers implanted with IH/200 were

Table 2. Quality grade and yield grade distribution of heifers fed for an average of 138 d implanted with three different strategies

	Treatment[1]			
Item	Rev-200	Rev-IH/200	Rev-XH	*P*-Values
Quality Grade[2], %				
Prime	8.9%	8.0%	11.0%	0.55
Upper Choice	47.7%	46.1%	49.5%	
Choice	35.8%	34.6%	31.0%	
Select	7.3%	11.1%	8.5%	
Standard	0.2%	0.2%	0.0%	
Yield Grade Distribution[2], %				
YG 1	0.8%	1.5%	1.7%	<0.01
YG 2	13.3%	20.6%	12.7%	
YG 3	46.3%	44.7%	48.3%	
YG 4	33.3%	29.6%	34.0%	
YG 5	6.3%	3.6%	3.2%	

[1]Treatments included: Revalor-200 on d 0 (200 mg TBA/20 mg E2, Merck Animal Health, noncoated; 200), Revalor-IH on d 0 (80 mg TBA/8 mg E2, Merck Animal Health, noncoated) and re-implanted with Revalor-200 on approximately d 56 to target approximately 80 d with terminal implant (200 mg TBA/20 mg E2, Merck Animal Health, noncoated; IH/200), or Revalor-XH on d 0 [200 mg trenbalone acetate (TBA) and 20 mg estradiol (E2), partially coated (XH); Merck Animal Health, DeSoto, KS]. Revalor-XH contains four uncoated pellets (80 mg TBA and 8 mg E2) for immediate release and six coated pellets (120 mg TBA and 12 mg E2) to release approximately 70 to 80 d after implanting.

[2]All numbers are expressed as percentages. The yield grade and quality grade values represent the proportion of carcasses within each group that received a yield and quality grade.

1.42% more efficient, on a live basis, compared to heifers implanted with 200 or XH ($P = 0.05$). Carcass-adjusted final BW for heifers implanted with IH/200 were 16 and 15 lbs heavier than 200 and XH, respectively ($P = 0.05$). Carcass-adjusted ADG tended to be greater for heifers implanted with IH/200 compared to heifers implanted with 200 or XH ($P = 0.09$). Heifers implanted with IH/200 were 3.7% more efficient ($P < 0.01$), on a carcass-adjusted basis, compared to heifers implanted with 200 and XH.

Heifers implanted with IH/200 had 10 and 9 lbs greater HCW than 200 and XH, respectively ($P = 0.05$). Likewise, IH/200 implants improved dressing percentage and LM area compared to 200 and XH ($P \leq 0.02$). There were no differences ($P \geq 0.12$) in marbling score and 12th-rib fat thickness among implant strategies. Calculated USDA yield grade was improved for IH/200 treatment compared to 200 treatment, with XH treatment being intermediate ($P = 0.05$). The distribution of USDA quality grades was not different ($P = 0.55$; Table 2) among treatments. The distribution of USDA yield grades was significantly different ($P < 0.01$) with a shift from yield grade 3 and 4 to yield grade 2 for IH/200 heifers.

Conclusion

Heifers implanted with the combination IH/200 strategy had greater carcass adjusted ADG and HCW, and improved feed conversion (F:G). Final BW, DMI, and ADG were not different among implant treatments when based on live performance. The greater concentration of TBA and E2 provided by IH/200 combination improved carcass weight and performance compared to the non-coated 200 implant and partially coated XH implant. While no differences in growth performance and carcass characteristics were observed among 200 and XH implant treatments.

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