NUTRITION—FEEDLOT

Avoparcin, Monensin and Implants For Growing Heifers

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Story in Brief

An experimental feed additive, Avoparcin, was fed to 126 growing heifers (509 lb) for 112 days after cattle were adapted to rations. For comparison, half the heifers were implanted with Ralgro, and the heifers in two pens were fed monensin. Avoparcin fed at 60 g per ton of feed decreased feed intake by 11.5 percent and rate of gain by 6.8 percent (3.26 vs. 3.04 lb/day) for a feed efficiency improvement of 5.1 percent (5.7 vs. 5.4). Similar values for monensin at 30 g per ton of feed were a 4.6 percent decrease in feed intake, a 1.5 percent increase in rate of gain and a 6.0 percent improvement in feed efficiency. Heifers fed Avoparcin tended to be fatter than those fed other rations. Fecal pH tended to be lower and fecal starch higher with Avoparcin feeding. Implanting Ralgro twice during the trial increased both rate and efficiency of gain by 3.1 percent. Effects of Avoparcin and implants on feed efficiency were both positive with the combination increasing feed efficiency by 9 percent.

Introduction

Avoparcin is a new feed additive being widely tested for feedlot cattle. It is not commercially available yet. Similar to monensin, Avoparcin increases propionate concentrations in the rumen and generally improves efficiency of feed use by 6 to 11 percent. Avoparcin also has increased rate of gain in some trials. The objectives of this trial were: 1) to determine if Avoparcin effects were enhanced by a) adding a growth stimulating implant and b) feeding antibiotics to newly arrived cattle and 2) to compare performance and carcass characteristics of heifers fed Avoparcin, monensin or no feed additive.

Materials and Methods

One hundred twenty-six Charolais by black baldy heifers (509 pounds) were trucked from Arnett, Oklahoma, to Stillwater. Upon arrival they received vaccinations for bovine rhinotracheitis, leptospira pomona, bovine virus diarrhea, parainfluenza 3, blackleg and malignant edema. The heifers were randomly assigned to 18 pens and adapted to a high concentrate ration by stepwise removal of cottonseed hulls (Table 1) with rations switched on days 4, 17 and 22 of the starting period. The starting ration for 10 of the pens had 140 g AS-700 added per ton of feed which was decreased to 118 in the two subsequent rations. Heifers in ten of the pens were ear implanted with 36 mg of Ralgro initially and again 84 days later. After 28 days on feed, cattle were weighed, AS-700 removed from the feed and Avoparcin (60 g/ton) or monensin (30 g/ton) added. Cattle were weighed thereafter at monthly intervals, Avoparcin was removed after 112 days and cattle were slaughtered 61 days later. Fecal samples from three or four heifers per pen were obtained after 29 and 111 days of feeding Avoparcin or monensin.

Table 1. Composition of rations

Item	Rations			
	Starting	2	3	Top
Corn, rolled	41.0	53.5	63.5	71.5
Cottonseed hulls	30.0	20.0	12.0	11.0
Alfalfa dehy	15.0	15.0	15.0	8.0
Soybean meal	12.5	10.0	8.0	8.0
Limestone	.75	.75	.75	.75
Dical	.25	.25	.25	.25
Salt	.50	.50	.50	.50
Vitamin A	+	+	+	+
Trace minerals	+	+	+	+
AS–700[a]	+–	+–	+–	0
Additive[b]	0	0	0	+–

[a]To contain 70, 59 and 59 g of aureomycin and similar amounts of sulfamethazine per ton of feed.
[b]To provide 60 g avoparcin or 30 g monensin per ton of feed.

Table 2. Additive and implant effects on heifer performance

	Avoparcin, ppm		Raigro, mg		AS-700		
	0	66	0	36	0	350	
Days	0-112		0-84		-28-0		LSD
Heifers	56	56	56	56	56	56	—
Pens	8	8	8	8	8	8	—
Initial weight, lb	515	512	516	511	516	511	—
Daily gain, lb							
–28–0	—	—	2.99	3.20	3.23	2.96	.38
0–56	3.49[a]	3.17[b]	3.37	3.28	3.35	3.30	.19
56–112	3.02	2.91	2.80[a]	3.13[b]	2.93	3.00	.33
0–112	3.26[a]	3.04[b]	3.09	3.21	3.14	3.15	.17
–28–173	2.97	2.89	2.88	2.97	2.96	2.90	.11
Daily feed, lb DM							
–28–0	—	—	12.7	13.0	12.9	12.9	.83
0–56	17.6[a]	15.6[b]	16.9	16.4	16.7	16.6	1.05
56–112	19.2[a]	17.0[b]	17.9	18.2	18.0	18.1	.87
0–112	18.4[a]	16.3[b]	17.4	17.3	17.3	17.4	.70
–28–173	17.4[a]	16.1[b]	16.8	16.8	16.7	16.8	.62
Feed/gain							
–28–0	—	—	4.32	4.11	4.07	4.37	.46
0–56	5.07	4.93	5.02	4.99	4.98	5.03	.38
56–112	6.41[a]	5.89[b]	6.43	5.88	6.21	6.09	.64
0–112	5.66	5.37	5.64	5.40	5.52	5.51	.34
–28–173	5.88[a]	5.57[b]	5.82[a]	5.64[b]	5.66	5.80	.11
Feces							
1st pH	6.03[a]	6.51[b]	6.18	6.37	6.47[a]	6.07[b]	.28
1st DM, %	24.5	25.4	25.0	25.0	23.6[a]	26.3[b]	2.60
1st starch, %	11.1	14.1	12.9	12.3	11.8	13.4	7.29
2nd pH	5.78	5.73	5.73	5.78	5.79	5.72	.42
2nd DM, %	22.1[a]	24.3[b]	23.1	23.3	22.7	23.6	2.05
2nd starch, %	11.4	14.9	12.8	13.4	11.9	14.3	6.17

[ab]Means in a comparison with different superscripts differ significantly ($P<.05$).

Table 3. Additive and implant effects on carcass characteristics

	Avoparcin, ppm		Ralgro, mg		AS-700		
	0	66	0	36	0	350	
Days:	0-112		0-84		−28−0		LSD
Carcass wt, lb	689	678	679	687	688	678	17
Dressing %	63.8	63.6	63.5	63.9	63.6	63.8	.91
Liver abscesses							
Incidence, %	7.4	0	5.7	1.8	2.1	5.4	10.4
Severity[a]	.16	0	.11	.54	.02	.14	.24
Rib eye area							
Sq. inches	12.9	13.1	12.8	13.2	13.0	12.9	.68
in^2/cwt	1.89	1.94	1.89	1.93	1.91	1.92	.10
Fat thickness, in	.51	.54	.51	.54	.55	.51	.07
KHP, %	2.96	2.90	3.02	2.85	3.00	2.87	.33
Marbling[b]	16.0[f]	13.8[e]	15.5	14.3	15.4	14.4	1.34
Quality grade[c]	13.7[e]	12.9[f]	13.5[e]	13.1[f]	13.5	13.1	.45
Yield grade[d]	3.43[e]	3.57[f]	3.42[e]	3.57[f]	3.57[e]	3.43[f]	.14
Cutability	50.2	50.3	50.2	50.3	50.0	50.4	.95

[a]Single abscess = 1; severe abscess = 3.
[b]Small minus = 13; small = 14.
[c]Choice minus = 13; choice = 14.
[d]Federal yield grade.
[ef]Means in a comparison with different superscripts differ significantly (P<.05).

Table 4. Avoparcin and Ralgro for feedlot heifers

Avoparcin, g/ton Implant	0 0	0 Ralgro	60 0	60 Ralgro	interaction probability
Heifers	28	28	28	28	—
Pens	4	4	4	4	—
Daily gain, lb					
0−112	3.20	3.31	2.97	3.10	.92
−28−173	2.91	3.03	2.86	2.92	.11
Feed/gain					
0−112	5.86	5.47	5.41	5.33	.34
−28−173	5.99	5.77	5.64	5.50	.51

The design was a 2^3 factorial with all combinations of AS-700 in the receiving ration, Avoparcin in the top ration and Ralgro implants. In addition to the 16 pens (duplicate pens on each combination), two pens of heifers which had been fed AS-700 and implanted with Ralgro were fed 30 g of monensin per ton of feed. Data were analyzed as a 2^3 factorial for AS-700, implant and Avoparcin effects. For contrast of Avoparcin with monensin, only heifers fed AS-700 and implanted were compared.

Heifers had feed available *ad libitum* from self feeders. In order to calculate feed efficiency, feed was removed and weighed when rations were changed and when steers were weighed. All calculations are for feed dry matter. Cattle were weighed shrunk initially and before slaughter and full otherwise. Final weights were calculated from carcass weight based on dressing percentage of 62.

Results and Discussion

Effects of Avoparcin feeding on performance are presented in Table 2. During the 112 days of Avoparcin feeding, cattle fed this compound consumed 11.5 percent less feed and gained 6.8 percent less weight, but efficiency of feed use was improved by 5.1 percent. Fecal samples obtained 29 days after the start of Avoparcin feeding revealed that feces from cattle fed Avoparcin had a higher pH than feces from control cattle. In a

Table 5. Feed additive comparison: performance

	Control	Avoparcin	Monensin	LSD
Heifers	14	14	14	
Pens	2	2	2	
Weights				
Initial	506	509	511	
Final	1083	1051	1103	
Carcass	693	675	709	83.0
Daily gain, lb				
–27–0	2.97	2.94	2.94	.66
0–56	3.28	3.25	3.55	1.41
56–112	3.30	3.12	3.13	0.60
0–112	3.29	3.18	3.34	1.01
–28–173	3.05	2.88	3.15	0.57
Daily feed, lb DM				
0–56	17.09	15.59	16.75	5.10
56–112	18.97	17.43	17.68	3.09
0–112	18.03	16.51	17.21	3.72
–28–173	17.69	16.04	17.02	2.87
Feed/gain				
0–56	5.24	4.80	4.75	1.54
56–112	5.76	5.59	5.64	0.32
0–112	5.49	5.19	5.16	0.90
–28–173	5.81	5.56	5.40	0.16
NE_g 0–112	68.8	72.5	73.5	9.95
–28–173	71.3[a]	73.7[ab]	76.2[b]	4.30

[ab]Means in a row with different superscripts differ significantly (P<.05).

Table 6. Feed additive comparison: carcass and fecal characteristics

	Control	Avoparcin	Monensin	LSD
Carcass weight, lb	693	675	709	83.01
Dressing %	64.0	64.3	64.3	2.86
KHP, %	2.71	2.82	3.18	0.66
Fat thickness, in.	.50	.56	.48	0.30
Abscesses				
Incidence, %	7.1	0	7.1	26
Severity[a]	.21	0	.21	0.79
Marbling[b]	14.2	12.9	14.2	2.74
Ribeye, in^2	13.0	13.3	13.5	0.59
in^2/cwt	1.89	1.97	1.91	0.26
Cutability	50.34	50.31	50.49	2.73
Grade[c]	13.07	12.64	13.14	1.14
Choice, %	78.6	71.4	100	41.5
Yield grade[d]	3.36	3.69	3.48	0.70
% YG 4 & 5	0[e]	28.6[f]	7.1[ef]	18.5
Feces analysis				
1st pH	6.20	6.09	6.56	2.63
1st Dry matter, %	26.6	26.1	24.7	7.4
1st Starch, %	9.1	20.7	13.6	13.6
2nd pH	5.92	5.68	6.04	1.20
2nd Dry matter, %	24.2	24.4	23.3	11.4
2nd Starch, %	12.4	18.6	13.6	23.7

For footnotes see table 3.

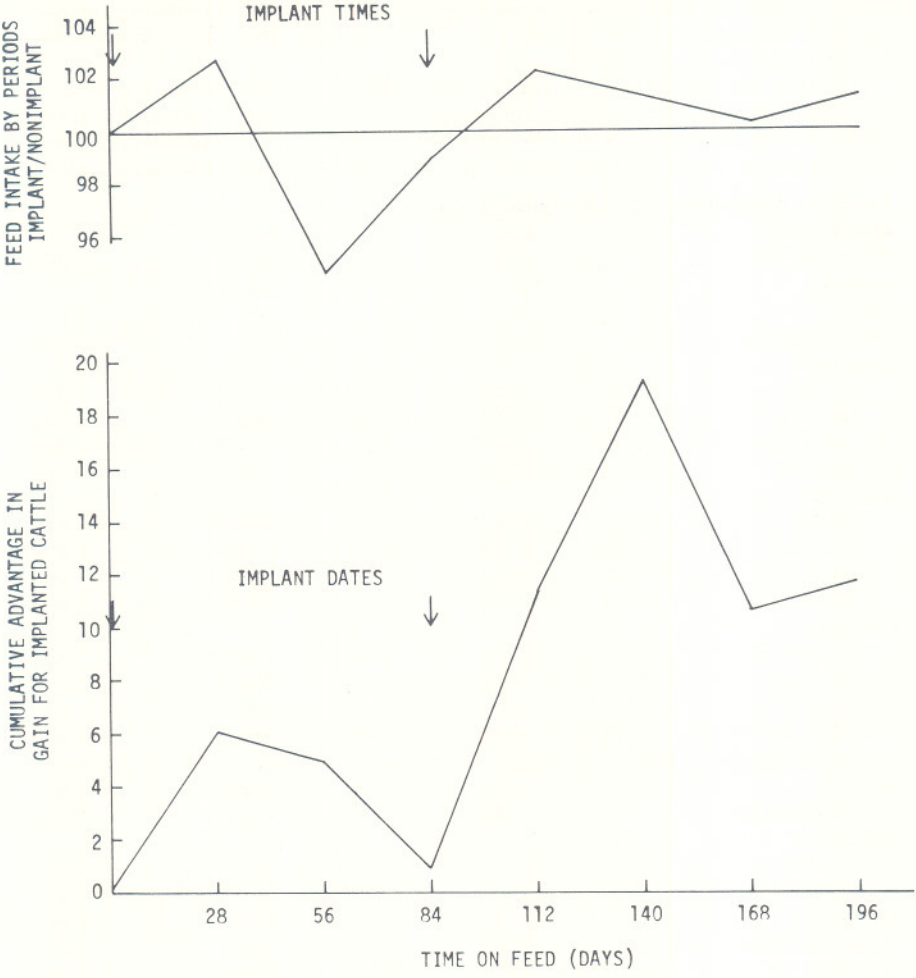

Figure 1. Ralgro and gains and feed intake

sample obtained later as well, Avoparcin-fed cattle tended to have more starch in feces. Slaughter data (Table 3) collected 61 days after withdrawl of Avoparcin indicated that cattle fed Avoparcin had less marbling and lower carcass grade than control cattle.

Effects of Ralgro implants on performance are presented in Table 2. Implants increased overall weight gain by 3.1 percent without altering feed intake for a feed efficiency improvement of 3.1 percent. Subdividing effects by periods (Figure 1) illustrates that feed intakes of implanted cattle were increased during the first month after implanting but that feed intake and weight advantages deteriorated with time after implantation. Only during periods of higher feed intakes did implanted cattle gain more than those not implanted. The tendency for greater response to the second than to the first implant may be due to sensitization of the cattle from the first implant or greater metabolic effect of implants with cattle having greater maturity or finish. Had a

second implant not been given, little if any advantage from the first implant would be expected. Implanted heifers tended to have less marbling and a lower grade than non-implanted heifers (Table 3).

Feeding AS-700 for the first 28 days had no influence on performance, feed intake, feed efficiency or carcass characteristics. However, feces obtained from heifers three weeks after withdrawl of AS-700 were lower in pH (6.05 vs. 6.47) and contained less moisture (74 vs. 76 percent). Percent of fecal starch was unchanged. Two months later,

Table 7. Avoparcin - implant interactions

Avoparcin, g/ton Implant, mg/heifer	0 0	60 0	0 +	60 +	LSD
Heifers	56	56	56	56	
Pens	4	4	4	4	
Initial weight, lb	518	515	511	510	
Daily gain,					
0–56	3.67[f]	3.08[e]	3.31[e]	3.26[e]	.322
56–112	2.73	2.87	3.32	2.94	.558
0–112	3.20[ef]	2.97[e]	3.31[f]	3.10[ef]	.290
–28–173	2.91	2.86	3.03	2.92	.187
Daily feed					
0–56	18.15[f]	15.64[e]	17.12[ef]	15.60[e]	1.80
56–112	19.26[f]	16.56[e]	19.07[f]	17.36[e]	1.49
0–112	18.70[f]	16.10[e]	18.10[f]	16.48[e]	1.20
–28–173	17.40[f]	16.12[e]	17.48[f]	16.08[e]	1.06
Feed/gain					
0–56	4.96	5.08	5.19	4.78	.65
56–112	7.07[f]	5.78[e]	5.76[e]	5.99[e]	1.10
0–112	5.86	5.41	5.47	5.33	.59
–28–173	5.99[g]	5.64[ef]	5.78[f]	5.50[e]	.19
Carcass weight, lb	683	675	694	681	28.5
KHP, %	3.09	2.95	2.84	2.86	.56
Fat thickness, in	.49	.52	.53	.56	.12
Abscesses					
Incidence	11.3	0	3.6	0	17.7
Severity[a]	.22	0	.107	0	.41
Marbling[b]	16.7[f]	14.3[e]	15.3[ef]	13.3[e]	2.29
Rib eye area, in^2	12.72	12.87	13.12	13.27	1.16
Cutability, %	50.11	50.21	50.23	50.28	1.61
Quality grade[c]	13.95[f]	13.13[e]	13.43[ef]	12.75[e]	.77
Percent choice	100.0[f]	76.8[ef]	85.7[ef]	67.9[e]	31.6
Yield grade[d]	3.37[e]	3.48[ef]	3.49[ef]	3.66[f]	.24
4 & 5, %	7.7	3.6	17.9	25.0	25.7
Dressing, %	63.8	63.2	63.8	64.0	1.5
Fecal analysis					
1st pH	5.87[e]	6.48[f]	6.18[ef]	6.52[f]	.51
1st DM	24.1	25.9	24.6	25.3	4.5
1st starch					
2nd pH	5.70	5.77	5.87	5.70	.71
2nd DM	21.7	24.4	22.4	24.2	3.5
2nd starch	11.7	14.0	11.0	15.8	10.5
NE_m –28–173	110[e]	118[fg]	115[ef]	122[g]	6.2
NE_g –28–173	70[e]	73[f]	72[ef]	74[f]	2.4

For footnotes see table 3.

no differences in composition of feces were observed. Results suggest that antibiotic feeding may alter site of digestion or acid production by microorganisms in the large intestine.

The effects upon cattle performance of Avoparcin, Ralgro and their combination is shown in Table 4. A report from Nebraska suggests that Avoparcin is more effective when cattle are implanted. The two materials produced additive effects on rate of gain and feed efficiency in our trial. Comparison of Avoparcin (60 g per ton) with monensin (30 g per ton) in this trial is presented in Table 5. Most previous trials have demonstrated that Avoparcin depresses feed intake less than does monensin when added to a ration and thereby increases rate of gain. In this study, feed intake was depressed more with Avoparcin than monensin. Also, gains of heifers fed Avoparcin were 3.3 percent less than control cattle while with monensin, gains were 1.5 percent above that of control cattle. Feed efficiencies for the 112 days of Avoparcin feeding were improved by 5.5 and 6.0 percent with the two compounds. Avoparcin tended to reduce fecal pH and increase fecal starch whereas monensin had opposite effects. Carcasses of cattle fed Avoparcin tended to be fatter and have a higher fat cover and yield grade than other cattle (Table 6).

Results of four earlier trials in various states with feedlot heifers fed Avoparcin have shown increased rates of gain (3.7 percent) and an improvement in feed efficiency (7.2 percent) with Avoparcin at 60 g per ton. Why gains and feed intakes were depressed during feeding and after Avoparcin withdrawl for cattle fed Avoparcin in this trial is unclear, but improvements in efficiency of feed use indicate that Avoparcin will be a useful, effective feed additive which will act equally well with or without an anabolic implant.

Thiopeptin or High Roughage in Starting Rations for Feedlot Steers

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Story in Brief

Thiopeptin was fed at 0 or 11 ppm to two groups of 560-pound growing steers not adapted to a high concentrate ration, and a third group of steers was started on a ration diluted with roughage (40 percent cottonseed hulls for 10 days followed by 20 percent cottonseed hulls for 10 days). Six pens of seven steers were fed each of the three rations. Over the first 28 days, gains were 14 percent greater and feed efficiency was 10 percent improved ($P<.05$) by thiopeptin addition to the 90-percent concentrate ration. Thiopeptin was removed from the ration on day 28. The advantage of 16 pounds for cattle fed thiopeptin at 28 days increased to 32 pounds by day 160. Over the 160-day feeding trial, thiopeptin improved ($P<.05$) gain and feed efficiency by 7 and 6 percent respectively. Carcass characteristics were unchanged with thiopeptin feeding. Performance and carcass characteristics of the steers started on the roughage ration and those fed the high concentrate ration with added thiopeptin were similar.

Introduction

Thiopeptin (Merck product MK-747) is a narrow spectrum antibiotic (Muir and Barreto, 1979) which decreases acidosis in sheep (Kezar and Church, 1979) and cattle (Mies *et al.*, 1978) and may increase rate of gain in cattle (Gill *et al.*, 1979). Previous