Salinomycin Levels For Feedlot Steers and Heifers

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Story in Brief

A new feed additive, salinomycin, was fed to 70 finishing steers (initial weight of 772 lb) and 70 finishing heifers (initial weight of 495 lb) for 139 and 145 days, respectively. Salinomycin was fed at 0, 5, 10, 15, and 20 g per ton of a ground corn based diet. Averaged across salinomycin levels, gain was increased 2.6 percent and efficiency of feed use was improved by 7.8 percent. Feed intake was increased slightly with the lower levels of salinomycin. At the optimum drug level in the trial, 15 g per ton of feed, gain and feed efficiency were increased by 8.9 and 10.9 percent. Carcass measurements were not changed by salinomycin feeding. This drug shows excellent promise for improving efficiency and rate of gain of both feedlot steers and heifers.

Introduction

Feed additives of a class called ionophores have proven to increase efficiency of feed use by feedlot cattle. Monensin, lasalocid and salinomycin are three ionophores. Monensin and lasalocid are widely fed today. Salinomycin has been evaluated previously in one study at Oklahoma State. In that study, gain and efficiency increases of 10 to 13 percent were reported for beef steers fed a 5 percent roughage diet. In this trial, salinomycin was fed at 5 levels to finishing steers to examine its effect on rate of efficiency of gain.

Materials and Methods

Steers of mixed breeding which had commonly grazed pasture near Purcell, Oklahoma were sorted and trucked to Stillwater on November 1, 1981. Heifers were purchased at Oklahoma City Stockyards and trucked to Stillwater on November 13, 1981. On arrival, animals were ear taged and vaccinated for bovine rhinotracheitis, leptospirapomoma, bovine virus diarrhea, parainfluenza 3, blackleg and malignant edema. Cattle were held on pasture until December 4, 1981, and were then divided into four groups by sex and weight within sex. Cattle within each weight and sex group were randomly allocated to one of 5 pens. Five levels of salinomycin (0, 5, 10, 15 and 20 g/ton of feed) were randomly assigned to pens within each group. Cottonseed hulls, alfalfa pellets and corn comprised 92.31 percent of the ration with the percentage hulls and alfalfa pellets in the ration sequentially decreasing from 40 to 26 to 17 and 12 percent at 3-day intervals at the start of the trial until the final ration (Table 1) was being fed. Results of drug assays are presented in Table 1a.

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Table 1. Feed composition, dry matter basis[a].

Ration sequence Ingredient	1	2	3	4
Alfalfa, dehy-pellets	29.63	16.35	7.36	7.31
Cottonseed hulls	10.00	10.00	10.00	5.00
Corn, rolled	54.51	64.69	75.22	80.81
Soybean meal	4.92	7.58	5.33	4.71
Salt	.35	.35	.35	.35
Dicalcium phosphate	.46	.38	.43	.40
Potassium chloride	--	--	.06	.15
Urea	--	--	.30	.30
Calcium carbonate	.12	.64	.94	.96
Premix	.01	.01	.01	.01

[a]Average analysis ration 4: 90.2% dry matter, 12.20% protein, ME = 2.79 on an as fed basis. Premix contained trace mineral, vitamin A (to supply 30,000 IU per day) and Salinomycin (0, 5, 10, 15, or 20 g active drug per as fed ton).

Cattle were weighed following withdrawal of feed and water at the start of the trial and on day 140 for steers and 146 for heifers. Other weights were taken full. Cattle were weighed full and a 5 percent pencil shrink was applied to calculate rate of weight gain. Hair coat length was visually appraised and rectal temperature was measured on day 112 of the trial. At slaughter, three heifers, two from pen 11 (15 g salinomycin) and one from pen 12 (control), were found to be pregnant and another heifer aborted during the trial. Data includes information for these animals. One heifer in pen 20 (salinomycin at 10 g per ton) died from acidosis during the trial. Salinomycin was withdrawn from the ration on day 139 for steers and 145 for heifers. On day 154 for heifers and day 160 for steers, cattle were trucked to Oklahoma City, Oklahoma and Booker, Texas, respectively, for slaughter and carcass evaluation. On day 112 of the trial, after steers had been weighed, the steer with the greatest and the steer with the least rate of gain for the trial in each of 10 pens received 20 g of chromic oxide in two gelatin boluses. Fecal samples were obtained after 30, 54, 78 and 102 hours after boluses were administered. Ruminal turnover of chromium was presumed to represent solids leaving the rumen. Turnover was calculated by regressing the natural logarithm of the chromium concentration of fecal dry matter against time.

Results and Discussion

Daily gain and feed intake tended to increase with salinomycin added to the diet for both steers (Table 2) and heifers (Table 3). Efficiency of feed and energy use was maximized with 15 g salinomycin per ton with both steers and heifers. With this diet, gain and feed efficiency were improved an average of 8.4 and 10.8 percent. This compares with 12.9 and 9.5 percent improvements in a previous trial (Owens and Gill, 1982) with salinomycin at 10 g per ton of feed. The one higher salinomycin level gave slightly less response.

Carcass characteristics were obtained 21 and 9 days after withdrawal of the drug from the diet for steers and heifers, respectively (Tables 4 and 5).

Table 1-A. Salinomysin Assay Results.

Theory Level g/t	Sample 1	2	3	4	5	6	7	8	9	10	11	MEAS.D.
0	<2.10	<2.10	<2.10	<2.10	<2.10	<2.10	<3.00	<2.10	<2.10	<2.10	<2.10	<2.1
5	3.70	3.30	7.00	4.00	4.10	4.40	4.80	3.50	5.40	4.10	4.40	4.404
10	7.70	8.20	9.00	8.00	8.10	10.00	10.00	4.90	10.40	12.00	10.00	8.987
15	18.33	15.00	15.00	15.00	17.00	9.30	15.00	8.70	20.00	17.00	17.00	15.246
20	33.00	25.00	19.00	19.00	32.00	19.00	16.00	12.00	23.00	9.90	15.00	20.246

Table 2. Performance data - steers.

Item	Salinomycin level, g/ton					SE
	0	5	10	15	20	
Weight, lb						
Initial, shrunk	626	631	629	628	625	4.6
31 days, full	763	785	763	777	772	11.9
56 days, full	839	860	846	866	860	17.1
84 days, full	921	966	943	949	931	20.7
112 days, full	1016	1032	1034	1029	1008	18.2
140 days, shrunk	1024	1081	1076	1074	1041	18.3
160 days, carcass/.62	1104	1163	1140	1119	1097	17.1
Daily gains, lb						
0-56 days	3.05	3.33	3.13	3.49	3.43	.22
57-140 days	2.70	3.15	3.23	2.99	2.66	.13
0-140 days	2.84	3.22	3.19	3.19	2.96	.12
0-160 days	2.99	3.32	3.20	3.09	2.95	.09
Feed intake, lb/day at 90% dry matter						
0-56 days	21.5	23.2	21.8	21.3	21.9	.78
57-140 days	22.2	23.1	22.3	22.0	21.4	.53
0-140 days	21.9	23.1	22.1	21.7	21.6	.48
0-160 days	21.8	23.0	22.1	21.7	21.3	.52
Feed/gain						
0-56 days	7.04	7.06	6.97	6.14	6.39	.29
57-140 days	8.20^{a}	7.34^{ab}	6.88^{b}	7.36^{ab}	8.10^{a}	.25
0-140 days	7.70^{a}	7.22^{ab}	6.91^{b}	6.83^{b}	7.29^{ab}	.14
0-160 days	7.29^{a}	6.92^{c}	6.91^{c}	7.01^{bc}	7.22^{ab}	.06
Metabolizable energy, mcal/kg feed	2.58^{b}	2.68^{ab}	2.74^{a}	2.77^{a}	2.66^{ab}	.03

^{abc}Means with different superscripts differ ($P<.05$).

Table 3. Performance data - heifers.

Item	Salinomycin level, g/ton 0	5	10	15	20	SE
Weight, lb						
Initial, shrunk	495	488	494	499	500	3.5
31 days, full	592	578	579	598	599	7.5
56 days, full	646	643	644	662	667	11.3
84 days, full	719	708	724	726	751	14.2
112 days, full	790	766	782	797	791	9.9
140 days, full	818	814	820	814	831	16.3
146 days, shrunk	823	817	840	842	840	11.8
154 days, carcass/.62	847	821	854	844	859	10.7
Daily gains, lb/day						
0-56 days	2.13	2.19	2.10	2.33	2.40	.20
57-146 days	2.43	2.41	2.48	2.21	2.34	.07
0-146 days	2.25	2.26	2.37	2.35	2.33	.09
0-154 days	2.28	2.16	2.34	2.24	2.33	.08
Daily feed, lb/day						
0-56 days	15.7	14.8	16.1	15.7	16.6	.66
57-146 days	17.0	17.2	17.5	15.4	16.3	.80
0-146 days	16.4	16.1	16.8	15.4	16.3	.44
0-154 days	16.4	16.0	16.7	15.5	16.4	.50
Feed/gain						
0-56 days	7.57	6.72	7.64	6.75	7.00	.71
57-146 days	7.03	7.10	7.08	7.03	6.94	.21
0-146 days	7.32^{a}	7.16^{ab}	7.11^{ab}	6.56^{b}	7.00^{ab}	.17
0-154 days	7.18	7.40	7.14	6.90	6.99	.18
Metabolizable energy, mcal/kg	2.79^{b}	2.82^{b}	2.82^{b}	3.00^{a}	2.88^{ab}	.04

^{ab}Means in a row with different superscripts differ (P<.05).

Table 4. Carcass measurements - steers.

Item	Salinomycin, g/ton					SE
	0	5	10	15	20	
Carcass weight, lb	685	721	707	694	680	10.6
Dressing percent	63.6[a]	63.0[ab]	62.0[ab]	61.3[b]	62.1[ab]	.92
Liver abscess Incidence, %	21.4	28.6	28.6	29.8	28.6	12.4
Ribeye area,						
Square in.	12.8[a]	12.6[ab]	12.1[b]	11.9[b]	12.5[ab]	.17
Sq. in./cwt carcass	1.89[a]	1.74[ab]	1.72[b]	1.72[ab]	1.85[ab]	.04
Fat thickness, in.	.44	.64	.49	.46	.40	.06
KHP, %	2.46[b]	2.89[a]	2.79[a]	2.15[c]	2.71[a]	.05
Marbling score[d]	11.7	12.8	12.1	12.2	12.1	.79
Federal grade[e]	12.5	12.8	12.4	12.6	12.4	.22
Cutability, %	50.8	48.9	49.6	50.1	50.7	.56
Percent choice	42.9	71.4	42.9	42.9	28.6	19.1
Hair coat[f]	3.2[a]	2.2[b]	2.3[b]	2.9[ab]	2.9[ab]	.20
Temperature[g]	102.9	102.5	102.2	102.8	102.6	.31

[abc]Means in a row with different superscripts differ ($P < .05$).
[d]Slight plus = 12; Small minus = 13.
[e]High good = 12; Low choice = 13.
[f]Short = 0; long = 5 on day 112.
[g]Rectal temperature on day 112.

Table 5. Carcass measurements - heifers.

Item	Salinomycin level, g/ton					SE
	0	5	10	15	20	
Carcass weight, lb	525	509	529	524	533	8.6
Dressing percent	62.6[a]	60.9[b]	61.6[ab]	61.7[ab]	62.0[ab]	.31
Liver abscess Incidence, %	7.1	0	15.5	28.6	21.4	23.2
Ribeye area						
Square in.	10.9	10.5	11.0	10.7	10.6	.14
Sq. in./cwt carcass	2.09	2.08	2.10	2.05	2.01	.04
Fat thickness, in.	.51	.46	.52	.50	.52	.05
KHP, %	2.89[ab]	2.36[c]	2.64[bc]	2.68[abc]	3.04[a]	.09
Marbling score[d]	13.1	11.9	12.0	12.2	12.2	.33
Federal grade[e]	12.6	12.4	12.5	12.6	12.6	.04
Cutability, %	50.2	50.7	50.4	50.3	49.9	.38
Percent choice	42.9	35.7	46.4	57.1	57.1	8.1
Hair coat[f]	5.6	5.1	5.0	5.2	5.1	.59
Temperature[g]	102.4	102.4	102.5	102.3	102.0	.36

[abc]Means in a row with different superscripts differ ($P<.05$).
[d]Slight plus = 12; Small minus = 13.
[e]High good = 12; Low choice = 13.
[f]Short = 0; long = 5 on day 112.
[g]Rectal temperature on day 112.

The incidence of liver abscesses tended to increase with this drug with both steers and heifers as in a previous trial (Owens and Gill, 1982). Rib eye area declined slightly for steers fed 10 and 15 g per ton levels of salinomycin. No such effect was apparent with heifers in this trial or steers in the previous trial. The percentage kidney, heart and pelvic fat of steers generally increased with added drug as occurred in an earlier trial though some spurious values are noted for certain drug levels with both steers and heifers. Cutability also tended to decline with added salinomycin, possibly due to heavier carcass weights. Marbling scores and percent choice carcasses also tended to be higher with heavier carcasses in this and the earlier trial. Haircoat length seemed slightly less and rectal temperature slightly lower with drug feeding.

Results indicate that efficiency of feed use of feedlot steers and heifers can be improved with added salinomycin. Optimal drug level from this trial for feed efficiency of both steers and heifers was 15 g per ton, though lower levels (5 and 10) produced more rapid gain. Responses to salinomycin feeding generally paralleled results of an earlier trial and, at the optimal level of the diet considerably exceeded gain and efficiency responses observed from other ionophores (Owens and Gill, 1982).

Chemical composition of feces was not significantly changed with added salinomycin though fecal ash appeared to increase slightly (Table 6). Dilution rate of chromium also tended to decrease with added salinomycin. Reduced rate of outflow of ruminal solids matches the effect of monensin on ruminal passage. Longer retention of solids in the rumen may help increase digestibility.

Table 6. Composition of feces for steers fed salinomycin.

	Salinomycin level, g/ton				
	0	5	10	15	20
Feces dry matter, %	27.6	24.2	27.2	24.8	26.7
Fecal starch, % of DM	13.2	12.3	9.9	16.6	12.5
Fecal ash, % of DM	7.1	9.3	9.4	7.9	11.1
Chromium dilution rate, % per hour	4.4	3.8	4.3	3.2	3.9

Compared with slower gaining steers, steers gaining weight more rapidly had feces which were higher in dry matter and starch content (Table 7). In previous trials dry matter and starch content have been shown to increase to decrease together. Higher gains probably reflect higher levels of feed intake. Limiting feed intake usually decreases the concentration of starch in fecal dry matter (Teeter et al., 1981). Surprisingly, rate of passage of chromium and presumably solids from the rumen averaged the same for rapidly and slowly gaining steers. Possibly faster gaining steers eat more feed because they have a larger rumen than slower growing steers. Selection for feed intake may increase ruminal volume but reduce digestiblity.

Table 7. Feces composition of slowly and rapidly gaining steers.

Growth rate	Feces Composition			Cr Dilution Rate
	Dry Matter	Starch	Ash	
	%	% of DM	% of DM	% per hour
Rapid	27.2[a]	16.6[a]	8.4	3.9
Slow	25.0[b]	9.2[b]	9.5	3.8

[a,b]Means in a column with different superscripts differ ($P < .01$).

Literature Cited

Owens, F.N. and D.R. Gill. 1982. Salinomycin levels for feedlot steers. OSU MP-112:131

Teeter, R.G. 1981. OSU MP-108:161