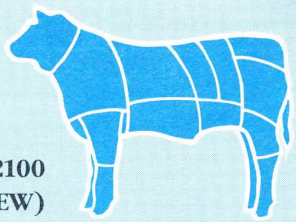
Ionophores for Grazing Cattle
Michigan State University
Michigan State University Extension
S.R. Rust, Animal Science
Issued February 1988
4 pages

MICHIGAN BEEF PRODUCTION

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY

EXTENSION BULLETIN E-2100
FEBRUARY 1988 (NEW)



Ionophores for Grazing Cattle

S. R. Rust
Department of Animal Science

Ionophores are carboxylic polyether antibiotics that alter rumen metabolism and improve animal performance. Currently, two ionophores—monensin (trade name Rumensin) and lasalocid (trade name Bovatec)—are approved by the Food and Drug Administration and marketed for commercial use in the cattle industry. These ionophoric compounds are synthesized as a portion of the cell walls of various strains of *Streptomyces* microorganisms. The active ionophores are separated from the cell wall fragments during a harvesting procedure, the end results of which are prepared for commercial sale.

A recent review summarizing 16,000 cattle records from 228 trials indicated that supplementing monensin in feed increased daily gains in cattle by 1.6 percent, reduced dry matter intake 6.4 percent and, in grain diets, reduced the amount of feed required per unit of gain by 7.5 percent. There was a considerable amount of variation among the trials, however. This bulletin will focus on some of the effects of ionophores in grazing beef cattle, including expected cattle performance, and examine the approved use and safety of the antibiotics.

Effects of Monensin and Lasalocid

Monensin disrupts the normal membrane transport systems, resulting in the death of gram-positive microorganisms in the gastrointestinal tract of cattle. The inhibition of the gram-positive microbes results when ion gradients dissipate, or break up and scatter, and the microbes starve. This causes a shift in the type of volatile fatty acids that rumen bacteria produce. More propionate and less acetate are produced. Propionate production traps a higher percentage of the ingested energy for the host animal to utilize for growth. And, as more propionate is produced, less feed energy is lost as methane.

In addition, monensin also has been reported to benefit beef cattle by increasing the amount of time feed spends in the digestive tract, reducing bloating and acidosis, suppressing coccidia (a form of bacteria) overgrowth in the lower gut, and inhibiting the maturation of fly pupae in feces.

In the summarized review of data mentioned above, steers and heifers younger than 18 months old responded similarly to the addition of monensin to the diet. Cattle dislike the taste of monensin but over time, adapt to the taste. Producers should allow cattle several days to adjust to monensin in supplemental feeds.

Lasalocid has been reported to provide similar performance results, and it appears to provide the same reactions and benefits as monensin. Lasalocid does not cause the initial taste aversion that monensin does, however.

Approved Usage and Safety

Monensin is available under the trade name Rumensin 60, which contains 60 grams of monensin per pound of premix. Monensin is approved for use to increase rate of weight gain on pasture for slaughter, feeder and stocker cattle, and dairy or beef replacement heifers that weigh more than 400 pounds. Supplements for pasture cattle have been approved to contain levels of between 25 and 400 grams of monensin per ton of supplement on an air-dry basis. Cattle should each receive not less than 50 nor more than 200 milligrams (mg) of monensin daily in not less than 1 pound of feed.

During the first five days that monensin is supplemented in the diet, each animal should not consume more than 100 mg daily. After a five-day adjustment period at the 100 mg level, which will help animals get used to the taste of the supplement, producers may

feed 400 mg per animal every other day in 2 pounds of feed. To ensure maximum benefits, complete cattle supplements for pasture cattle should bear an expiration date of 30 days after date of manufacture.

Several commercial companies have received federal approval to market Rumensin 60 in company-branded nutrient blocks and in mineral supplements for feeding free choice. Companies marketing free-choice Rumensin products at the time this bulletin was printed include A. E. Staley (Pacific Molasses), Central Soya Co., Cooperative Research Farms (Land O'Lakes), Dale Alley Co., Farmer's Friend Mineral Co. (Also licensed to Archer Daniels Midland Co. and Blair Milling), Farmland Industries and Moorman Manufacturing.

Lasalocid is available under the trade name Bovatec 68, which contains 68 grams of active ingredient per pound of premix. Like monensin, lasalocid has been approved for increasing rate of weight gain in slaughter, stocker and feeder cattle, and dairy or beef replacement heifers. Unlike monensin, however, there is no weight restriction for pasture cattle to receive lasalocid.

Cattle should each consume not less than 60 nor more than 200 mg of lasalocid in at least 1 pound of feed daily. Furst McNess Co. has received FDA approval to market a free-choice vitamin and mineral mixture of lasalocid for grazing cattle.

Excessive consumption by cattle of either monensin or lasalocid can result in reduced performance and, in severe cases, death. Consumption of either ionophore by horses can be fatal. Producers should recognize that it is *unlawful* to feed either of these ionophores to species unapproved by the FDA.

Several new ionophoric compounds, including salinomycin, are currently being evaluated at the research level.

Table 1: Effects of ionophores on daily gains.

	Monensin	Lasalocid	Salinomycin	MSE[a]
No. of comparisons[b]	60	24	5	—
No. of cattle[c]	1,843	1,334	254	—
Avg. daily gain, lbs/day	1.53	1.40	1.28	.202
Improvement over control, lbs/day	.08	.12	.13	.027
Probability[d]	.092	.003	.03	

[a]Mean square error—a measure of the amount of variability within the 80 trials.
[b]More than one ionophore may have been used within a specific trial.
[c]Number of control animals = 2,072.
[d]Probability that improvement over control is greater than zero.

Expected Cattle Performance

A Michigan State University summary of 80 trials was used to evaluate the use of ionophores on performance of grazing cattle that were fed various forms of the supplement and grazed pasture of varying quality. The set of data contained a variety of ionophore types, levels used and pasture types.[1]

The summary included 5,503 cattle that grazed on four pasture types—actively growing native pastures, dormant native pastures, improved pastures and small-grain pastures. Three ionophores—monensin, lasalocid and salinomycin—were evaluated. (Salinomycin is an experimental ionophore only). The ionophores were fed at seven levels: 0, 25, 50, 100, 150, 200 and 300 mg per animal per day.

Supplements containing the ionophores were fed in one of three forms—meal containing grain or protein, mineral salt mixture or block formulation.

Averaged across the 80 trials, gain responses to the three ionophores were similar (see Table 1). Therefore, the author suggests that selection of an ionophore should be based on local availability, cost, manufacturer support services, class of cattle and palatability. Because of differences in FDA clearances, certain situations exist under which a specific ionophore may be recommended over others (Table 2). For example, in situations where feeding a supplement every other day is advantageous, supplements containing 200 mg of monensin per pound can be fed to each animal at a rate of 2 pounds. Lasalocid is the only ionophore that can be fed to calves weighing less than 400 pounds. Lasalocid also has the advantage of greater palatability than other ionophores tested, which may enhance consumption of supplements that are

[1]Since each of the 80 trials that were summarized used different pasture types, ionophore levels and types, and supplement forms, a special statistical tool was utilized. This tool was a general linear models procedure which generated least squares means to accurately evaluate the ionophores across the dissimilar experimental conditions.

designed to be fed at very low levels of consumption.

Since the interaction of ionophore type by dosage level was not significant, the optimal level was determined across the three ionophore types. A daily gain response of .13 pounds per animal to ionophore supplementation was evident for cattle that consumed between 50 and 300 mg daily (Table 3). Greater response (.16 pounds/day) tended to occur at the 150 mg per animal daily level.

Based on the analysis of these 80 trials, it appears that a level of 100 to 150 mg per animal daily would provide the optimal gain response (Table 3). In situations where palatability is of concern, such as block or mineral supplementation, lower levels (50 to 100 mg per animal daily) could be fed. Producers will see a smaller economic return, however.

The use of ionophores on dormant native grass pasture appears to be of lesser value than use with other types of pasture because the producer is less likely to see a gain response. A gain response to ionophore supplementation was seen with the actively growing native, improved and small-grain pastures.

Adding an ionophore to a mineral mix appears to be the least desirable method of delivery (Table 5). Cattle receiving mineral mixtures in which ionophores were added did not consistently demonstrate an increase in weight gain. However, the meal or block delivery system did provide a consistent advantage. The inconsistent gain response with ionophores added to free-choice minerals is most likely the result of erratic consumption.

In summary, 100 to 150 mg per animal per day appears to be the optimum level of ionophore consumption to maximize daily gain. Monensin or lasalocid will provide similar gain response, and meal or block methods of supplementation appear to give the best response. Dormant or slowly growing pastures will not provide the necessary nutrients for grazing cattle to respond to ionophore supplementation.

Table 2: Situations under which feeding of a specific ionophore would be recommended for pasture cattle.

Monensin	Lasalocid
• Every-other-day feeding	• To calves weighing less than 400 lbs. • Where palatability is a concern

Table 3: Effects of ionophore levels on cattle gains.

	Levels, mg/head/day							
	0	25	50	100	150	200	300	MSE[a]
No. of comparisons[b]	80	5	19	45	4	47	9	—
No. of cattle	72	90	449	954	66	1,679	193	—
Avg. daily gain, lbs/day	1.32	1.40	1.29	1.51	1.50	1.42	1.38	.202
Improvement over control, lbs/day[c]		.018	.109	.118	.156	.135	.139	.027
Probability[d]		.83	.02	.003	.11	.007	.05	

[a]Mean square error—a measure of the amount of variability within the 80 trials.
[b]More than one comparison may occur within a trial.
[c]Consumption of 50-300 mg of ionophore per head per day resulted in a significant weight gain ($P < .09$).
[d]Probability that ionophore dosage response is greater than zero.

Table 4: Effects of ionophores on different types of pastures.

	Pasture types				
	Native, growing	Native, dormant	Improved	Small grains	MSE[a]
No. of trials	54	9	10	7	—
No. of cattle	3,880	649	504	470	—
Avg. daily gain, lbs/day	1.41[b, c]	1.02[b]	1.58[c]	1.59[c]	.202
Ionophore response, lbs/day	.18[e]	.02[d]	.14[d, e]	.11[d, e]	.027
Probability[f]	.0001	.72	.008	.06	

[a]Mean square error—a measure of the amount of variability within the 80 trials.
[b, c]Where different subscripts are indicated, the mean (average) differs in average daily gain. ($P < .0001$).
[d, e]Where different subscripts are indicated, the mean (average) differs in ionophore response. ($P < .02$).
[f] Probability that ionophore response is greater than zero.

Table 5: Effects of delivery method on the ionophore responses in grazing animals.

	Meal	Trace Mineral	Block	MSE[a]
No. of trials	64	9	7	—
No. of cattle	4,553	545	405	—
Avg. daily gain, lbs/day	1.43	1.48	1.29	.202
Ionophore response, lbs/day	.10	.07	.17	.027
Probability[b]	.001	.29	.02	

[a]Mean square error—a measure of the amount of variability within the 80 trials.
[b]Probability that the ionophore response is greater than zero.

1P-4M-2:88-TCM-UP-New. Price 40 cents. File 19.218. Livestock-Beef