Observations on the Palatability of an Inorganic Salt Product for Mitigation of High Sulfur Levels in Feedlot Diets

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Introduction

Distillers grains are often the lowest cost protein feed available for cattlemen. This ingredient can be used in cow/calf production as well as feedlot diets. However, distillers grains often contain high levels of sulfur. There is significant variation in the sulfur content of distillers grains from plant to plant and even within a plant as sulfuric acid may be added to batches to improve fermentation efficiency by altering the pH. Sulfuric acid is also used to clean equipment. While sulfur level is often between 0.65 and 0.85% on a dry-matter basis, levels as high as 1.25% sulfur have been analyzed.

Beef cattle can tolerate a maximum of 0.40% sulfur in the diet (NRC, 1996) before polio-like symptoms of sulfur toxicity are generally observed, with the first noticeable sign often being death. Toxic symptoms and death have been reported when a diet contains as low as 0.25% sulfur in grain-based diets. Grain diets are thought to be less tolerant to high sulfur levels but with forage diets, sulfur tolerance may be greater. It is unknown how many health and reproductive problems have occurred due to sub acute sulfur toxicity from feeding distillers grains, high-sulfate content water, or sulfur in other feed sources. Survey data may be inconclusive due to the unwillingness of producers to admit to these losses, or inconclusive diagnosis by producers or their veterinarians. Any feed ingredient or management technique that would mitigate sulfur toxicity and allow increased use of distillers grains with less potential for illness or death will be well received in the livestock industry. New feed products are under development that may tie up sulfur and reduce negative effects of higher sulfur levels in the diet of cattle. The objective of this field study was to determine the effect of adding a proprietary inorganic salt product to feedlot finishing diets on feed intake, gain, and carcass traits.

Experimental Procedures

Forty-eight Angus feeder calves were blocked by sex (heifers and steers) and assigned within block to one of two treatments. One pen of steers and one pen of heifers were fed the proprietary inorganic salt product developed to mitigate sulfur levels in feedlot rations. The second pen of steers and heifers was fed the same diet without the inorganic salt product. The inorganic salt product was fed at 13.8 grams per head per day based on recommendations of the manufacturer. This product was mixed into the feedlot supplement (Table 1) which was added to the grain component of the ration in the daily ration preparation. The supplements were manufactured at the Northern Crops Institute (NCI) on the campus of NDSU under the direction of Dr. Kim Koch, manager of the NCI Feed Production Center. Supplements were transported to the Carrington Research Extension Center in tote bags. Supplements were formulated to be fed at 0.33 pounds per head per day, and contain minerals, vitamins, Rumensin (300 mg/hd/d), and carrier feed products (Table 1). Supplements were formulated to be identical except for the addition of the inorganic salt product.

Table 1. Supplements with and without organic salt to mitigate sulfur.

	Control Supplement	Inorganic Salt Supplement
	% DM basis	
Corn, ground	25.00	25.00
Distiller grains	13.75	13.75
Malt sprouts	23.50	14.40
Calcium carbonate	12.00	12.00
Potassium chloride	11.25	11.25
Zinc sulfate	0.20	0.20
Dical-Phosphate (18.5%)	3.75	3.75
Feed-grade salt	8.25	8.25
Rumensin (80 g/lb)	1.10	1.10
Vit A-D 10:1 Beef	0.30	0.30
Vitamin Premix	0.90	0.90
Inorganic salt	0.00	9.10
Total	100.00	100.00

Cattle were fed in the morning after bunk calls were made for increase, decrease or no change in the ration. Increases or decreases were done at 2.5% of the diet dry matter for each pen. Feed delivered to each pen was recorded daily. The ration was assembled, mixed and delivered using a Knight LA-9 Little Augie, three-auger mixer box. The corn-based ration was formulated at 62 Mcal NEg/lb, (Table 2). It included a minimum of 20% modified (50% moisture) distillers grains and solubles (dry matter basis) procured from the Blue Flint Ethanol facility in Underwood, ND. Samples of each ingredient were collected monthly and submitted to a commercial laboratory for dry matter, NEm, NEg, crude protein, fat, sulfur, calcium, and phosphorous. Water samples tested contained 74 mg/l sulfates, which is very low.

Inorganic salt could become useful in high-sulfur distillers grains diets.

Table 2. Ration for cattle fed sulfur-mitigating inorganic salt.

Ingredient	Percent, DM basis	Percent, As Fed
Corn # 2	62.00	50.83
Dist grains, wet	20.00	34.84
Straw	10.00	8.20
Canola meal	5.00	3.87
Supplement	2.00	1.55
Calcium carbonate	1.00	0.71
Total, Percent	100	100

Nutrient content	
Dry Matter, %	69.68
NEg, Mcal/lb	62.71
Crude Protein, %	13.61
Calcium, %	0.64
Phosphorous, %	0.35
Potassium, %	0.59
Sulfur, %	0.36

All calves were weighed individually at the start of the trial on March 14, 2009, and when the trial was completed and the cattle went to market on May 4. Dry-matter intake, gain, and feed efficiency were calculated for each animal and averaged for each pen and for each treatment. Cattle were marketed as a group.

Results

The base diet fed in this study was 0.36% sulfur, with distillers grains as the primary source of sulfur. The primary question of the study was to determine if the inorganic salt product had any negative effect on feed intake or animal performance. There were insufficient replications to conduct confident statistical comparisons so the raw data is reported on a pen and sex-of-calf basis. The results of this field study (Table 3) suggest that feed intake was not affected. While this cannot be deduced from the limited replications, numerical values suggest some potential for positive effects on intake and gain from the addition of the inorganic salt. No health issues or illnesses were observed for the calves during the 50-day feeding period.

Table 3. Performance of feeder cattle fed inorganic salt product for sulfur mitigation.

	Control	Inorganic Salt
No. head		
Heifers	11	11
Steers	12	12
Start wt., lb.		
Heifers	957.4	960.7
Steers	987.5	971.4
AVG	972.5	966.1
End wt., lb.		
Heifers	1125.5	1135.3
Steers	1141.1	1159.7
AVG	1133.3	1147.5
DMI, lb/hd/day		
Heifers	22.73	22.52
Steers	20.89	23.76
AVG	22.07	23.18
ADG, lb/hd/day		
Heifers	3.40	3.65
Steers	3.49	3.50
AVG	3.45	3.58
Feed Efficiency (DM/gain)		
Heifers	6.68	6.16
Steers	5.99	6.78
AVG	6.41	6.48

As distillers grains continue to be a significant feed source and sulfuric acid is used in the process, a product such as the inorganic salt could become useful especially in scenarios where ethanol plants produce high-sulfur distillers grains or where the price of distillers grains is low enough to use at more than nominal levels. More research is needed to prove the efficacy of this product, however, followed by commercial availability and documented economic advantages.