Effect of Micro-Aid® Supplementation on Nitrogen Losses from Manure

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Summary

A 2x2 factorial designed experiment was used to study the effects of Micro-Aid and time on OM and N losses from manure, in a simulated feedlot pen setting. Manure was collected from cattle on a common diet, except for the addition of 1 g Micro-Aid /steer daily. Losses of OM were greater at 60 d than 30 d, and greater for control than Micro-Aid. Nitrogen losses at d 30 were similar between treatments but control pans had greater N losses at d 60. Feeding Micro-Aid to cattle may inhibit N volatilization from manure, enhancing the fertilizer value of manure.

Introduction

Measuring N and OM losses from manure in a feedlot pen setting is very challenging. Several factors, such as environmental conditions, cattle movement, and precision in removing manure all affect losses and are difficult to control. Feedlot pen surfaces can be simulated in a laboratory setting under controlled conditions in order to better understand differences due to treatment without confounding effects of environment. An aluminum pan can serve as a simulated pen with the hard pan surface representing the hard interface on a feedlot pen, on top of which is 3-6 inches of a loose soil and manure mixture. Mixing manure and soil together simulates the hoof action of cattle on the pen surface. Treatments, such as time, precipitation, or temperature can then be imposed on these pans to study each factor individually.

The objective of this trial was to determine the impact of Micro-Aid supplementation and time on OM and N losses from manure. Micro-Aid is an all-natural plant extract that has been used as a feed ingredient to reduce manure odors and volatilization of ammonia, which contributes to decreased N losses from manure. Previous research evaluated the effect of Micro-Aid on N losses in a feedlot setting (*2012 Nebraska Beef Cattle Report*, p. 98; *2013 Nebraska Beef Cattle Report*, p. 70). Results were conflicting but overall found minimal benefit due to Micro-Aid. In recent years, commercial fertilizer prices have increased dramatically which has renewed interest in manure as a fertilizer and enhanced the value of manure nutrients, especially N.

Procedure

A 2x2 factorial designed experiment was used to study the effects of Micro-Aid and time on OM and N losses from manure, in a simulated feedlot pen setting. The first factor compared losses after 30 vs. 60 days, and the second factor compared manure with or without Micro-Aid. Sixty aluminum pans (13x9x2 inches) were used to simulate feedlot pen surface, which included the four treatments, resulting in 15 replications. Complete manure (urine and feces) was collected from six ruminally fistulated steers for five days. All cattle were fed a common diet, (Table 1) with three of the steers ruminally dosed with 1 g Micro-Aid/steer daily for 10 days prior to the start of manure collection and throughout manure collection. For manure collection, cattle were tied in stanchions for five days with manure collected in a cement pit behind the cattle. Manure was collected from three Micro-Aid (MA) treated steers and from three control (CON) steers. Soil was collected from the University Research Feedlot near Mead, Neb., in an area used for rebuilding pens after cleaning. Representative samples of manure and soil were taken and analyzed for OM and N in order to calculate OM and N losses over time.

Table 1. Composition of diet fed to cattle during manure collection.

Ingredients, % of diet DM	
High-moisture corn	41.5
Modified distillers grains plus solubles	22.5
Sweet Bran®	25.0
Wheat straw	6.0
Supplement[1]	5.0

[1]Cattle on the Micro-Aid treatment were ruminally dosed with 1 g Micro-Aid per steer daily for 10 days prior to the start of manure collection and throughout manure collection.

On day 1, soil and manure were weighed into each pan in order to equal 60% soil and 40% manure, on a DM basis. Manure and soil were completely mixed together to simulate the hoof action of cattle; the mixture was approximately 1½ inches deep within the pan. Pans were kept in a temperature controlled room (65°F) for either 30 or 60 days to determine N and OM losses over time. At the end of either 30 or 60 days, material from the pans was ground through a 1 mm screen and subsampled. These samples were then analyzed for DM, OM, and N. Data were analyzed as a 2x2 factorial and differences were considered significant at $P < 0.05$.

Results

Samples of initial manure and soil were analyzed for OM and N. Soil was essentially devoid of N, less than 0.001%, thus all N in the pans is assumed to be coming from the manure, which was 2.7% N, regardless of treatment. Soil OM was 2% and both MA and CON manure averaged 84% OM.

Initial OM averaged 142.0 g across all pans and was not different between treatments ($P \geq 0.19$; Table 2). Initial

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Table 2. Effect of Micro-Aid supplementation to cattle on OM and N losses from manure over time.

	30 Day		60 Day			*P*-value[1]		
Variable	Control	Micro-Aid	Control	Micro-Aid	SEM	Int	Time	Trt
Initial OM, g	142.5	141.5	142.4	141.6	0.67	0.87	0.92	0.19
Ending OM, g	98.6[b]	115.7[a]	76.8[c]	104.4[b]	2.28	0.03	< 0.01	< 0.01
OM loss, g	43.9[b]	25.8[d]	65.5[a]	37.2[c]	2.30	0.03	< 0.01	< 0.01
OM loss, %	30.9[b]	18.2[d]	46.0[a]	26.3[c]	1.60	0.03	< 0.01	< 0.01
Initial N, g	4.37[a]	4.31[b]	4.37[a,b]	4.31[a,b]	0.022	0.83	0.90	0.01
Ending N, g	3.31[a]	2.91[a]	2.26[b]	2.86[a]	0.203	0.02	< 0.01	0.62
N loss, g	1.06[b]	1.40[b]	2.10[a]	1.45[b]	0.198	0.02	< 0.01	0.43
N loss, %	24.5[b]	32.4[b]	48.1[a]	33.7[b]	4.62	0.02	< 0.01	0.49

[a,b,c] Within a row, means without a common superscript differ ($P < 0.05$).
[1] Int = *P*-value for the time x trt interaction; Time = main effect of 30 or 60 days; Trt = main effect of Micro-Aid inclusion in cattle diet.

N was approximately 3.1% of initial OM. Initial N for the 30 days MA pans was 4.31 g, slightly less than initial N for 30 days CON pans, 4.37 g ($P = 0.05$). This was due to less manure DM being weighed into these pans, not due to MA manure having less N as a % of DM.

Losses of OM and N are presented as both g lost and as a % of the initial OM or N present in the pan. Losses of OM, measured as both g lost and as % lost, were greater at 60 days than 30 days ($P < 0.01$) and greater for CON than MA ($P < 0.01$). Of total OM losses at day 60, approximately 68% occurred by day 30 for both treatments. At both time points, MA pans lost approximately 42% less OM than CON pans. Nitrogen losses were greater at day 60 than day 30 ($P < 0.01$) for CON pans but MA pans had similar N losses at day 30 and day 60 ($P = 0.84$). Both MA and CON pans had similar N losses at day 30 ($P = 0.23$), but CON pans had greater N losses at day 60 ($P = 0.03$). Of total N losses at day 60, MA pans lost approximately 97% by day 30 while CON pans lost only 50% by day 30. At day 60, MA pans had lost approximately 30% less N than CON pans.

Measuring N losses from manure can be quite challenging, especially in a feedlot setting with many environmental factors influencing N volatilization. Past research on the effects of Micro-Aid on N volatilization in a feedlot pen setting has had mixed results. By controlling these environmental factors we were able to decrease variation and better estimate the impact Micro-Aid has on reducing average N losses. In this pan study, variation in N measures, measured as CV, were greater than variation in measurements of OM.

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