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Urea and limestone additions to forage sorghum silage

Abstract

Adding urea or limestone to forage sorghum silage increased lactic and acetic acids compared with untreated silage. Urea also elevated the ensiling temperature and increased the DM loss in the silo. Although calves fed the three silages had similar performance, those fed the urea-treated silage tended to have the highest consumption but poorest feed conversion. There were no apparent improvements in silage conservation or feeding value from either urea or limestone.

Keywords

Cattlemen's Day, 1985; Kansas Agricultural Experiment Station contribution; no. 85-319-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 470; Beef; Urea; Limestone; Forage sorghum silage

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Urea and Limestone Additions to Forage Sorghum Silage

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Summary

Adding urea or limestone to forage sorghum silage increased lactic and acetic acids compared with untreated silage. Urea also elevated the ensiling temperature and increased the DM loss in the silo. Although calves fed the three silages had similar performance, those fed the urea-treated silage tended to have the highest consumption but poorest feed conversion. There were no apparent improvements in silage conservation or feeding value from either urea or limestone.

Introduction

In four previous trials with corn and sorghum silages (Reports of Progress 377, 394, and 448), non-protein nitrogen (ammonia or urea) has increased the crude protein content by 3 to 5 percentage units, increased the amount of fermentation acids, and extended the bunk life of the silage. However, adding NPN to the silage generally decreased cattle performance when compared to an all-natural supplement, and decreased silage dry matter recovery. Although ammonia is a cheaper source of NPN, urea is safer to handle and a higher percent of the nitrogen is retained in the silage. Limestone has been added to corn in the past to increase the calcium and lactic acid contents of silage, but little is known about its use with wetter forage sorghum silages.

Our objectives were to further document the effects of urea and limestone on the conservation and feeding value of sorghum silages.

Experimental Procedures

Three whole-plant forage sorghum silages were compared: 1) control (no additive); 2) urea (10 lb/ton of fresh crop); and 3) limestone (15 lb/ton of fresh crop). Urea was applied in a 50% water solution; limestone, in dry form. The silages were made by the alternate load method in 10 x 50 ft concrete stave silos on September 27 and 28, 1983 from Pioneer 947 forage sorghum harvested in the hard-dough stage at 27 to 28% dry matter (DM). Ensiling temperatures were monitored for the first 42 days and nylon bags of crop (six per silo) were buried for additional observations of silage DM recoveries. The silos were opened on November 16 and emptied at a uniform rate during the following 14 weeks.

Each silage was fed to 12 crossbred steer calves housed in individual pens. The 84-day growing trial began November 17, 1983 and ended February 9, 1984. Silages were full-fed and all calves received 2.0 lb of supplement daily (as-fed basis). Rations were formulated to provide 12.5% crude protein (DM basis), 150 mg of Rumensin® per calf daily, and equal amounts of calcium, phosphorus, and vitamin A.

Calf weights, silage samples, and silage bunk life procedures were similar to those described on page 60 of this report.

Results and Discussion

Performance by calves fed the three forage sorghum silage rations is shown in Table 24.1. Calves fed the limestone silage gained slowest; those fed urea silage had the highest DM intake; and those fed control silage had the lowest feed to gain ratio. None of the performance differences were statistically significant.

Chemical analyses and ensiling temperatures of the silages are shown in Table 24.2. All three silages appeared well preserved, although the urea silage was a darker brown and reached higher ensiling temperatures than the other two silages. Urea and limestone produced much more extensive fermentations with higher pH and total acid values, and lower lactic to acetic acid ratios than untreated silage. Approximately 95% of the urea-nitrogen added to the fresh crop was recovered in the silage.

Silage DM recovery and loss results are shown in Table 24.3. In the concrete stave silos, the DM lost during fermentation, storage, and feedout was highest for the urea silage. The silage in buried nylon bags was similar to that in the silos, with the control and limestone silages having lower losses than urea silage. Al1 three silages were highly stable in air, in spite of a rather slow feeding rate.

There were no apparent benefits with either urea or limestone. The greater DM loss in the silo from adding urea agrees with our previous trials. NPN silages have usually given poorer performance with calves, but not in this trial. We were surprised that limestone gave a DM recovery nearly identical to the control, since the increased acids indicate more extensive fermentation.

Table 24.1. Performance by Calves Fed the Control, Urea, and Limestone Silages

Item	Silage Treatment		
	Control	Urea	Limestone
No. of Calves	12	12	12
Initial Wt., lb	466	467	466
Avg. Daily Gain, lb	1.10	1.08	1.01
Avg. Daily Feed, lb[1]	ll.38	ll.87	ll.55
Feed/lb of Gain, lb[1]	11.0	ll.3	ll.8

[1] 100% dry matter basis.

Table 24.2. Chemical Analyses and Ensiling Temperature for the Control, Urea, and Limestone Silages Made in the Concrete Stave Silos[1]

Item	Silage Treatment		
	Control	Urea	Limestone
Dry Matter:			
Pre-Ensiled, %	27.0	27.2	28.4
Silage, %	25.0	25.4	27.4
Maximum Temp. Rise From Initial Forage Temp., °F	17	23	19
Day of Maximum Temp.	7	10	7
	% of the Silage DM		
Lactic Acid	7.96	10.91	10.72
Acetic Acid	2.25	4.50	4.96
Total Fermentation Acids	10.4	15.6	15.8
Crude Protein	4.8	9.9	5.2
pH	3.86	4.21	4.36
Lactic:Acetic Ratio	3.8	2.9	2.5

[1] Each value is the mean of 14 samples.

Table 24.3. Forage Sorghum Silage Recoveries and Losses From the Concrete Stave Silos and Buried Bags for the Control, Urea, and Limestone Silages

Silo and Silage Treatment	DM Recovery		DM Lost During Fermentation, Storage, and Feedout
	Feedable	Non-feedable (Spoilage)	
	% of the DM Ensiled		
Concrete Stave Silos:			
Control	86.5	2.0	11.5
Urea	79.3	2.0	18.7
Limestone	86.9	2.2	10.8
Buried Nylon Bags:			
Control	93.5	-	6.5
Urea	90.1	-	9.9
Limestone	93.6	-	6.4