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Abstract

One percent sodium bicarbonate increased intake of a 50% silage-50% grain ration, but had no effect on intake of an 84% sorghum silage ration. Adding concentrate (rolled sorghum grain) lowered rumen pH slightly and decreased acid detergent fiber and starch digestion. The bicarbonate had no effect on digestibility, but 2% bentonite lowered digestibility of neutral and acid detergent fiber. Neither compound affected ruminal fermentation characteristics.

Keywords

Cattlemen's Day, 1986; Kansas Agricultural Experiment Station contribution; no. 86-320-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 494; Beef; Sodium bicarbonate; Sodium bentonite; Digestion; Ruminal fermentation; Sorghum silage

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Effect of Sodium Bicarbonate and Sodium Bentonite on Digestion and Ruminal Fermentation of Forage Sorghum Silage-based Rations Fed to Growing Steers

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Summary

One percent sodium bicarbonate increased intake of a 50% silage - 50% grain ration, but had no effect on intake of an 84% sorghum silage ration. Adding concentrate (rolled sorghum grain) lowered rumen pH slightly and decreased acid detergent fiber and starch digestion. The bicarbonate had no effect on digestibility, but 2% bentonite lowered digestibility of neutral and acid detergent fiber. Neither compound affected ruminal fermentation characteristics.

Introduction

Silages present a dietary lactic acid load to the rumen and their high moisture content and low pH are thought to be responsible for decreased intake. Bicarbonate, a natural component of the rumen buffering system, has proven beneficial in high concentrate rations, but performance results with growing cattle fed high silage rations have been inconclusive (Reports of Progress 448 and 470). Bentonite, an aluminum silicate clay used in the feed industry as a pellet binder, has also been shown to aid in the transition to high concentrate rations. The following experiment was conducted to test the effects of sodium bicarbonate and bentonite on intake, digestibility, and ruminal fermentation when added to either 50% or 84% forage sorghum silage rations.

Experimental Procedures

Six rations were offered ad libitum to six ruminally-fistulated steers. Three rations were 84% silage and 16% supplement and three included rolled sorghum grain and supplement such that grain comprised 50% of the dry matter (DM) intake. Two rations, one at each silage level, included sodium bicarbonate (1% of the DM) or bentonite (2% of the DM), and two rations served as controls. Rations were formulated to provide 12% crude protein (DM basis) and meet vitamin and mineral recommendations (NRC, 1984).

Results and Discussion

Sodium bicarbonate increased intake (Table 43.1) of the 50% silage ration but not the 84% silage ration. Steers fed the 50% silage and bicarbonate ration reached peak intake levels quickly. Bentonite had no effect on the intake of either

[1]The sodium bicarbonate and partial financial assistance were provided by Church and Dwight Co., Inc., Piscataway, NJ.

[2]Department of Statistics.

ration. Bicarbonate had no effect on digestibility of either ration, but bentonite lowered neutral and acid detergent fiber digestibility in both rations. Adding sorghum grain increased total DM intake, but lowered digestibilities of acid detergent fiber and starch. Ruminal fermentation characteristics (Table 43.2) were unchanged by bicarbonate or bentonite additions. Lactate concentrations were at low levels. Rumen pH values were high for all six rations, which indicated that the rumens were well-buffered. Volatile fatty acid concentrations, while higher for the three 50% silage rations, were lower than expected for all six rations.

Conclusions

Bentonite did not improve intake or digestion of the rations studied. Sodium bicarbonate improved intake of the 50% silage ration, but had no effect on digestibility or rumen fermentation characteristics. Because rumen measurements indicated that the silage did not create excess acid in the rumen, it was concluded that the increased intake with bicarbonate may have been due to increased palatability.

Table 43.1. Effect of Sodium Bicarbonate and Bentonite on Intake and Digestibility of Forage Sorghum Silage-based Rations for Steers

Item	50% Silage			84 % Silage		
	Control	Sodium Bicarbonate	Bentonite	Control	Sodium Bicarbonate	Bentonite
Dry Matter Intake, lb/day[a]	16.9[b]	18.3[c]	16.5[b]	13.6	13.9	13.9
	Digestibility, %					
Dry Matter	57.0	56.8	55.1	57.6	56.8	53.6
Organic Matter	61.0[d]	60.7[d]	61.4[e]	61.9[f]	61.7[f]	58.7[g]
NDF[h]	51.5[d]	49.3[d]	45.4[e]	52.2[f]	49.9[f]	50.0[g]
ADF[h]	43.4[d]	41.1[d]	36.1[e]	48.6[f]	47.2[f]	43.5[g]
Starch[h]	78.8	78.0	76.0	84.1	82.8	87.5

[a] 50% silage rations >84% silage rations (P<.001).

[b,c] 50% silage - bicarbonate > 50% silage-control (P<.001).

[d,e,f,g] Rations including bentonite < controls (P<.05).

[h] 50% silage rations < 84% silage rations (P<.05).

Table 43.2. Effect of Sodium Bicarbonate and Bentonite on Ruminal Fermentation Characteristics for Steers Fed Forage Sorghum Silage-based Rations

Characteristic	50% Silage			84% Silage		
	Control	Sodium Bicarbonate	Bentonite	Control	Sodium Bicarbonate	Bentonite
Rumen pH [a]	6.66	6.62	6.66	6.76	6.80	6.73
L (+) Lactate (mM)	0.66	0.44	0.48	0.36	0.43	0.54
D (-) Lactate (mM)	0.42	0.13	0.48	0.12	0.28	0.38
Total Volatile Fatty Acids (mM)	71.0	76.7	71.6	70.0	71.1	68.1

[a] 50% silage rations < 84% silage rations (P<.05).

[b] 50% silage rations > 84% silage rations (P<.05).