Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 2 *Dairy Research (1984-2014)*

Article 160

1985

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Abstract

One percent sodium bicarbonate (NaHCo3) increased intake of a 50% silage - 50% grain diet, but had no effect on intake of a full-feed sorghum silage diet. The addition of concentrate (rolled milo) slightly lowered rumen pH and decreased acid detergent fiber (ADF) and starch digestion. NaHC03 had no effect on digestibility, but 2% bentonite lowered digestibility of NDF and ADF. Neither compound affected rumen fermentation characteristics.; Dairy Day, 1985, Kansas State University, Manhattan, KS, 1985;

Keywords

Kansas Agricultural Experiment Station contribution; no. 86-94-S; Report of progress (Kansas Agricultural Experiment Station); 484; Dairy; Sodium bicarbonate; Sodium bentonite; Digestion; Fermentation; Steers; Sorghum silage

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EFFECT OF SODIUM BICARBONATE AND SODIUM BENTONITE ON DIGESTION AND RUMEN FERMENTATION CHARACTERISTICS OF FORAGE SORGHUM SILAGE-BASED DIETS FED TO GROWING STEERS

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Summary

One percent sodium bicarbonate ($NaHCo_3$) increased intake of a 50% silage - 50% grain diet, but had no effect on intake of a full-feed sorghum silage diet. The addition of concentrate (rolled milo) slightly lowered rumen pH and decreased acid detergent fiber (ADF) and starch digestion. $NaHCO_3$ had no effect on digestibility, but 2% bentonite lowered digestibility of NDF and ADF. Neither compound affected rumen fermentation characteristics.

Introduction

The concept of adding buffering compounds to silages has generated considerable interest. 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 when added to high concentrate diets, but performance results with growing cattle fed high silage diets have been inconclusive. Bentonite, an aluminum silicate clay used in the feeding industry to improve pellet binding, has also been shown to aid in the transition to high concentrate diets. The following experiment was conducted to test the effects of $NaHCO_3$ and bentonite on intake, digestibility and rumen fermentation when added to 50% silage and full-feed forage sorghum silage diets.

Procedures

Six diets were offered ad libitum to rumen-fistulated steers. Three were full-feed silage and three included rolled milo such that grain comprised 50% of the dry matter (DM) intake. Two diets, one at each grain level, included $NaHCO_3$ (1% of DM) or bentonite (2% of DM) and two served as controls. All steers were given 2 pounds of a protein supplement daily (12.5% CP).

Results and Discussion

$NaHCO_3$ increased intake (table 1) of the 50% silage but not the full-feed silage diet. Steers fed the 50% silage - $NaHCO_3$ diet reached peak intake levels quickly in the adjustment period. Bentonite had no effect on the intake of either diet. Digestibilities of diets including $NaHCO_3$ were unchanged, but bentonite lowered NDF and ADF digestibility. A comparison of 50% silage and full-feed silage diets showed that added milo increased total intake, but lowered digestibility of ADF and starch.

Rumen fermentation characteristics (Table 2) were unchanged by $NaHCO_3$ or bentonite addition. Lactate concentrations were at typical low levels. Rumen pH values were high on all six diets, indicating the well-buffered conditions needed for optimum fiber digestion. Volatile fatty acid concentrations, while higher for the three 50% silage rations, were low for all six diets when compared to values from more fermentable forages and grains.

Conclusions

Bentonite proved to be of no benefit in improving intake or digestion of the diets studied. $NaHCO_3$ improved intake of the 50% silage diet, but had no effect on digestibility or rumen fermentation characteristics. Because rumen measurements did not indicate that the silage created an acidic rumen condition, it was thought that the intake response may have been a result of increased palatability.

Table 1. Effect of $NaHCO_3$ and bentonite on intake and digestibility of forage sorghum in silage-based diets.

	50% Silage			Full-Feed Silage		
Item	Control	$NaHCO_3$	Bentonite	Control	$NaHCO_3$	Bentonite
Dry matter intakes (lbs/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	60.7	61.4	61.9	61.7	58.7
NDF	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 diets>full-feed silage diets (P<.001)
[b,c] 50% Silage - $NaHCO_3$> 50% silage control (P<.001)
[d,e,f,g] Diets including bentonite < controls (P<.05)
[h] 50% grain diets < full-feed silage diets (P<.05)

Table 2. Effect of $NaHCO_3$ and bentonite on rumen fermentation characteristics of steers fed forage sorghum silage-based diets.

	50% Silage			Full-Feed Silage		
Characteristic	Control	$NaHCO_3$	Bentonite	Control	$NaHCO_3$	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 diets<full-feed silage diets (P<.05)
[b] 50% Silage diets>full-feed silage diets (P<.05)

EFFECT OF MOISTURE LEVEL AND BALE SIZE ON ALFALFA HAY QUALITY

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Summary

Third cutting alfalfa was baled in large 1-ton rectangular bales and in small conventional bales at three moisture levels, low (10%), medium (16%), and high (22%). During 120 days of storage under a roof, the high-moisture, large bales heated the most, reaching 128° F by 2 days post baling in a first peak and 133° F in a second peak by the 11th day. Moderate heating occurred in the high-moisture, small bales (108° F) and medium-moisture, large bales (103° F). Only the high-moisture, small and large bales had significant loss of dry matter during storage. Also, heating decreased the water soluble carbohydrate and increased the concentration of cell wall contents by the 120th day of storage. A three-period collection and digestion trial with lambs showed higher voluntary intakes of small-bale hays than of large-bale hays and higher intakes of high-moisture hays than of low-moisture hays. Also, the dry matter and crude protein digestibilities were lowest for the high-moisture, large bale hay. These data indicate that baling alfalfa hay in large bales at 22% moisture results in extensive heating, which negatively affects storage loss, nutrient content, and digestibility.

Introduction

Alfalfa hay has long been considered an important ingredient in dairy cattle rations. Its nutritive quality depends on the hay-making process, which is greatly affected by the uncontrollable factor, weather. Under unfavorable climatic conditions, making hay can result in substantial nutritive losses from the original crop. The losses, which may approach 50-60%, start in the field and continue through storage and feeding. Plant respiration after cutting, mechanical treatment, and leaching contribute to field losses, whereas continued respiration, microbial activity, and chemical oxidation, which all lead to heating, contribute to storage losses.

Hay-making aims at achieving a rapid loss of moisture from the cut plant and baling it with minimum losses. However, optimum moisture level for efficient handling and safe storage of alfalfa hay has not been well established yet. Difficulties arise from interacting factors such as varying climatic conditions, bale types, bale size and density, and method of storage.

To reduce weather risk, leaf loss, and increase the potential of higher quality, alfalfa hay can be baled at higher moisture. However, this may result in overheating, molding, and nutrient damage during storage. Therefore, the objectives of this experiment were to study the effects of high, medium, or