Nitrogen retention was greater for the higher crude protein diet. Greater nitrogen retention may be the result of more available energy for growth due to slightly higher intakes and greater digestibility of the high protein diet. The influence of monensin at the two protein levels is shown in Table 6. Addition of either monensin or protein to the low protein ration enhanced digestibility of dry matter and starch. This increased energy availability may explain part of the "protein sparing" action of monensin.

Fecal pH proved to be a poor indicator of starch digestibility while fecal starch closely reflected starch digestibility (Table 7). This suggests that fecal starch may be one measurement which might be used to measure energy availability and predict feed efficiency under feedlot conditions.

Digestibility responses to monensin at the two protein levels for dry and HMC are shown in Table 8. Starch is the primary nutrient of interest from the grain being fed. The greater response to monensin with the low protein level and the dry grain in starch digestibility diets confirms earlier suggestions from feedlot trials (Gill *et all*., 1977, 1978). This indicateshat productivity response to monensin may be greater when grain has received less processing and ration protein is low.

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High Moisture Corn Additives

F. N. Owens, J. H. Thornton and K. B. Poling

Story in Brief

Six commercial additives plus propionate, monensin, formaldehyde, bentonite and NH_4 OH were added to high moisture corn (26.9 percent moisture) as it was ensiled. Material fermented in double-lined plastic bags for 10 months prior to feeding to sheep and to chemical analysis. Two materials, Chemstor III and propionic acid, inhibited fermentation and also inhibited mold growth when fermented material was exposed to air. These materials also tended to reduce ruminal fermentation. Other additives had little effect on characteristics of the grain or acceptability by growing lambs.

Introduction

Last year, a group of commercial additives for corn silage were examined (Rust *et al*., 1978) and one material was tested further as reported elsewhere in this publication by Zinn. Scientific information is limited regarding many of the commercial additives for ensiling with good quality high moisture corn. Some are added as mold inhibitors, others for their nutrient or drug activity and others to enhance or inhibit fermentation. This study was designed to examine the influence of several commercial additives for high moisture corn on fermentation characteristics, stability and acceptability by growing lambs.

Materials and Methods

High moisture corn ground through a tub grinder with a half-inch screen was ensiled in plastic bags. After fermentation, samples were chemically analyzed. Each was fed free choice to six growing lambs for 28 days to evaluate acceptability and daily gain. Stability was measured by placing samples in a humidor and recording the number of days until mold growth first appeared and when the entire sample became moldy. Digestibility in the rumen was estimated by incubating the fermented high moisture corn with rumen fluid. Total digestibility was estimated by digesting the residue, obtained after the above rumen fluid digestion, with a pepsin-HCl mixture.

Results and Discussion

All high moisture corn preserved well and had a typical fermented odor with no evidence of mold growth. Table 1 presents results for the various additives plus the initial frozen sample. Even though frozen within six hrs of grinding, some fermentation had occurred, possibly between harvest and grinding.

Compared to the fresh material, fermentation increased lactate, solubility, and stability but decreased pH. Several additives, propionate, Chemstor III (a mix of propionate and formaldehyde) and formaldehyde decreased fermentation as measured by lactate level and protein solubility. Propionate and Chemstor III markedly increased stability (Table 2) against mold growth but also tended to reduce digestibility, especially in the rumen fermentation.

Table 1. Fermentation characteristics.

Item	% Level	Final dry matter	Lactate %	pH	Total N	N sol. % of Total N	NH_3 %
Frozen	---	73.1	1.36	5.31	1.49	19.2	.024
Control	---	73.1	2.85	4.28	1.44	43.7	.080
Mold inhibitors							
Propionate	.67	72.3	2.06	4.18	1.43	38.7	.056
Chemstor III	1.0	73.1	.92	4.51	1.44	19.9	.030
Formaldehyde	.30	71.8	1.52	4.92	1.55	31.2	.058
Feed additives							
Monensin	.0032	72.3	3.59	4.19	1.45	48.7	.077
Bentonite	.50	72.0	3.09	4.13	1.47	47.4	.085
NH_4OH	1.0	72.0	3.59	4.46	1.61	43.9	.183
Commercial products							
Silagain	.05	71.9	2.79	4.18	1.46	49.5	.091
Improvall	.05	71.4	2.86	4.16	1.39	53.6	.084
Sweetzyme	.0005	71.5	2.75	4.17	1.46	53.2	.087
Silogen	.075	71.4	2.76	4.17	1.45	52.9	.082
Fresh chop	.05	72.2	2.77	4.18	1.47	50.9	.096

Table 2. Stability, digestibility and lamb performance.

Item	Stability (days to mold) First	Stability (days to mold) Complete	Sheep gain g/day	IVDMD Ruminal	IVDMD Total	Intake #/sheep/day
Frozen	3.7	6.0	99.2	77.9	84.6	2.42
Control	8.7	19.7	107.6	80.4	86.0	2.24
Mold inhibitors						
Propionate	>77	>77	118.4	78.3	83.3	2.48
Chemstor III	>77	>77	69.4	74.8	82.1	2.36
Formaldehyde	8.0	14.0	88.0	82.4	87.0	2.56
Feed additives						
Monensin	7.0	18.0	64.1	82.2	87.6	2.40
Bentonite	8.7	13.0	68.0	78.8	84.4	2.15
NH_4OH	7.3	13.3	104.7	83.3	88.9	2.11
Commercial products						
Silagain	9.0	15.0	96.3	79.1	84.7	2.13
Improvall	8.7	15.3	75.8	82.1	86.8	2.24
Sweetzyme	11.0	18.3	99.9	80.4	87.8	2.37
Silogen	7.0	12.3	56.0	82.4	86.1	2.19
Fresh chop	16.0	26.7	70.4	82.8	87.5	2.34

Several additives, monensin (which might be incorporated into rations through ensiling), bentonite (which may reduce seepage loss by absorbing water) and NH_4OH (which is a low cost means of adding supplemental protein) increased lactate and tended to decrease stability. None of the additives had statistical effects on feed intake or rate of gain by sheep. Results suggest that if high moisture corn is properly ensiled, additives produce little if any benefit or detriment. Mold inhibiting chemicals containing propionic acid are available commercially and appear very effective.

Literature Cited

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