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Animal Science Reports

1983

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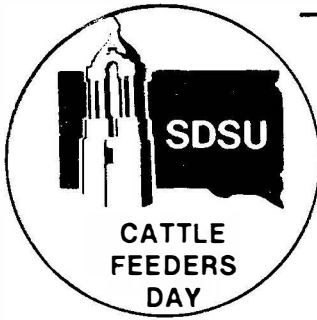
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Recommended Citation

Nothnagel, J. G.; Luther, R. M.; Palmer, F.; and Embry, L. B., "Untreated and Microbial-Inoculated Corn Silage in High Silage Rations for Growing Cattle" (1983). *South Dakota Cattle Feeders Field Day Proceedings and Research Reports, 1983*. Paper 6.
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UNTREATED AND MICROBIAL-INOCULATED CORN SILAGE IN HIGH SILAGE RATIONS FOR GROWING CATTLE

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CATTLE 83-5

Summary

A total of 192 steer calves of mixed breeding and averaging 521 lb were used in a 105-day feeding trial. The design of the trial involved two silage and six protein supplement treatments with two replications per silage-supplement combination. Twelve pens of cattle were fed silage inoculated with *Lactobacillus plantarum* fermentation product¹ at the rate of 1 lb per ton of forage. Silage moisture content as stored was 62%. The diets were supplemented with either a corn-based supplement (9.2% crude protein) or supplements containing various protein sources (11.3% crude protein). The values averaged across protein supplement treatments for average daily gain, dry matter consumption and feed efficiency for steers fed untreated silage were (lb) 2.28, 14.32 and 634, respectively. The values for steers fed microbial-inoculated silage were 2.29, 14.35 and 630.

Digestibility and nitrogen retention were measured in a 5-day total collection study utilizing six steers (422 lb) per corn silage treatment. Dry matter intake and percent dry matter and crude protein digestibilities were 11.3 lb, 71.3% and 67.9%, respectively, for untreated silage. Intake and digestibilities for the microbial-inoculated silage were 12.1 lb, 70.1% and 65.7%, respectively. Nitrogen retained as a percentage of consumed was 49.7% for the untreated silage and 48.9% for the microbial-treated silage.

Dry matter recovery values for feedable silage were 90.7% and 93.3%, respectively, for the untreated and the microbial-inoculated silages. Results of these studies indicated no significant differences ($P > .05$) in feedlot performance, nutrient utilization or dry matter preservation between the untreated and the microbial-inoculated corn silages.

Introduction

Results of research reported previously (CATTLE 81-3) indicated that corn forage inoculated with a *Lactobacillus acidophilus* fermentation product¹ had lower temperatures during

1

Pioneer Hi-Bred International, Microbial Products
Division, Durant, Iowa.

silage formation than untreated silage. In the same study, lactic and volatile fatty acid levels were also higher for the treated silage. However, dry matter recovered for feeding was only slightly higher for the treated silage. Digestibility of dry matter, crude protein and organic matter by cattle was similar for treated and the untreated silages.

Feedlot studies (CATTLE 82-1) were conducted with untreated corn forage or forage inoculated with a Lactobacillus acidophilus fermentation product¹. In that study, the forage was ensiled at about 42% moisture, which was much lower than generally recommended. Results indicated that growth and feed efficiency were about the same for untreated and inoculated silages under the conditions of the experiment.

The purpose of this experiment was to determine the effect of inoculating corn forage which was more optimal in moisture content than that in the 1982 study with a Lactobacillus plantarum fermentation product¹. The response to inoculation was compared with untreated silage in terms of feedlot performance of growing steers fed high-silage rations. Preservation of silage dry matter, chemical quality and utilization of nutrients were also determined.

Procedures

Corn forage was harvested with a conventional field chopper from September 29 to October 5, 1981. The forage at ensiling averaged 61.4% moisture in the untreated silo and 61.6% in the treated silo. A forage blower was installed at each of two concrete stave silos (18 ft x 50 ft) and loads of chopped forage were unloaded alternately between the silos. One forage blower was equipped with a Gandy fertilizer applicator calibrated to dispense the microbial inoculant at a rate of 1 lb per ton of forage. Silo 1 contained 247.5 tons of untreated wet forage and Silo 2 contained 248.8 tons of inoculated silage. Both silos were equipped with unloaders and were filled once to the height of the unloader.

Feedlot Trial

A total of 192 head of Hereford, Angus and crossbred feeder steers averaging 521 lb were used in the experiment. The cattle were purchased from a local auction and transported to the Beef Cattle and Sheep Nutrition Unit. On arrival, they were fed baled grass hay. The following day, the cattle received alfalfa haylage with limited corn grain supplemented with minerals and vitamin A. About 2 weeks prior to the start of the trial, the cattle were given a full feed of corn silage. The steers were randomly allotted on the basis of weight and breed group to 24 pens with 8 per pen. Initial, intermediate and final weights were recorded following an 18-hour stand without feed and water.

1

See footnote page 1.

The steers were weighed at 28-day intervals during the 105-day feeding period. All steers were ear tagged and given injections of Clostridium chauvoei-septicum-novyi-sordelli bacterin and injections for red nose and bovine virus diarrhea. The steers received a 36 mg implant of Ralgro and were treated with a pour-on product to control external parasites.

Two pens of cattle fed each silage treatment received one of six protein supplements (A-F). The supplement study was part of a research project dealing with sources of protein for beef cattle and sheep (see CATTLE 83-9). The silages were fed in quantities such that accumulation of refusals was minimal. Supplemental protein sources were used for five treatments and compared to a corn-based supplement as a control with all fed at the rate of 10% of diet dry matter. Silage diets supplemented with the control supplement contained 9.2% crude protein; all other diets contained about 11.3% crude protein. The silages were supplemented with minerals, trace mineral salt and vitamin A to provide 10,000 IU per pound. Monensin and tylosin were added to the supplements at rates of 300 g and 80 g per ton, respectively.

Feed intake, an indicator of acceptability of the silages, was monitored daily. The cattle were fed according to appetite and the diet was maintained at 90% of the diet dry matter as silage and 10% of the diet as supplement dry matter. A feeding schedule was developed to indicate the amount of feed on an as-fed basis that would be required to meet the desired dry matter ratios. Feed refused was weighed, recorded and sampled for dry matter determination at the end of each weigh period.

Digestion-Nitrogen Balance Trial

A 5-day total collection study utilized 12 steers (average weight, 423 lb). The steers were adapted for 3 weeks to the untreated and microbial-inoculated silages used in the feeding trial. Six steers were used per silage treatment. The steers were placed in metabolism crates and allowed 7 days to become adjusted to the crates. Collection of feces and urine followed conventional procedures. Silage and supplement were fed twice a day in equal proportions. Composition of the supplement is shown in table 1. Feed samples and refusals, feces and urine were analyzed according to approved procedures. Digestion coefficients for dry matter and crude protein were calculated. Utilization of nitrogen for productive purposes was measured as percent retained of nitrogen consumed.

Silage Preservation

Forage samples were collected as each load was ensiled. As silage was removed for feeding, additional samples were taken each week. Approximately 2 to 3 lb of material were placed in double plastic bags, evacuated, closed with a fastener and immediately frozen. Dry matter determinations were made by oven drying (forage stored) and toluene distillation (silage fed).

Spoiled silage was separated from feedable silage and nonrecoverable silage calculated as the difference between forage ensiled and amount for feeding and spoilage losses.

TABLE 1. SUPPLEMENT USED IN DIGESTION-NITROGEN BALANCE TRIAL

Ingredient	Percent
Soybean meal	58.00
Ground corn grain	28.68
Ground limestone	2.00
Dicalcium phosphate	6.23
Trace mineral salt	5.00
Vitamin A	10,000 IU/lb

Results and Discussion

Feedlot Trial

The relationship of supplemental protein sources with the corn silage treatments was examined statistically. There was no statistical interaction between silages and protein sources for feedlot performance. The data for silage treatments have been summarized by supplement groups and presented in table 2.

Supplement group A received a corn-based protein supplement. Feed intake, gains and feed efficiency were lower with both the untreated or treated silages for this group of cattle as compared to groups receiving protein supplements. There were only small differences in performance between the experimental silages within each supplement treatment group. When the data were averaged across all supplemental groups, feedlot performance was nearly identical for the untreated silage and the microbial-inoculated silage. Statistical treatment of the data indicated no significant differences ($P > .05$) between silage treatments.

Digestion-Nitrogen Balance Study

Results of this experiment are shown in table 3. Dry matter and nitrogen intake was slightly but not significantly ($P > .05$) higher for steers fed the microbial-inoculated silage. Digestibility of dry matter and crude protein was about the same for the two silage treatments. Nitrogen utilization as indicated by percent retention of nitrogen consumed was 49.7% for untreated silage and 48.9% for treated silage. Differences in fecal and urinary nitrogen excretion and retained nitrogen were not significant ($P > .05$).

TABLE 2. UNTREATED AND MICROBIAL-INOCULATED CORN SILAGE FOR FEEDLOT STEERS
(JANUARY 9 TO APRIL 24, 1982 - 105 DAYS)

	Supplement Groups						Average
	A	B	C	D	E	F	
<u>Untreated Silage</u>							
No. animals	16	16	16	16	16	16	96
Initial wt, lb	521.5	523.5	520.5	520.0	520.5	520.5	521.1
Final wt, lb	699.0	782.0	776.5	763.0	760.5	781.5	760.4
Avg daily gain, lb	1.69	2.47	2.44	2.32	2.29	2.49	2.28
Avg daily ration, lb ^a	12.37	14.90	14.50	14.22	14.90	15.04	14.32
Feed/100 lb gain, lb ^a	733	605	595	614	652	605	634
					b		
<u>Microbial-Inoculated Silage</u>							
No. animals	16	16	16	16	16	16	96
Initial wt, lb	522.5	520.0	523.0	520.5	522.0	520.0	521.3
Final wt, lb	711.5	767.5	779.5	771.5	776.0	765.5	761.9
Avg daily gain, lb	1.81	2.35	2.45	2.39	2.42	2.34	2.29
Avg daily ration, lb ^a	13.02	14.18	14.80	14.69	14.95	14.48	14.35
Feed/100 lb gain, lb ^a	723	603	606	608	618	620	630

^a Dry matter basis.

^b *Lactobacillus plantarum* fermentation product applied at 1 lb per ton of forage.

TABLE 3. DIGESTIBILITY AND NITROGEN RETENTION WITH STEERS FED UNTREATED AND MICROBIAL-INOCULATED CORN SILAGE

Item	Untreated	Microbial- ^a inoculated
No. of animals	6	6
Average wt, lb	422	424
Dry matter intake, lb	11.3	12.1
Nitrogen intake, g	91.5	94.3
<u>Digestibility, %</u>		
Dry matter	71.28	70.10
Crude protein	67.88	65.66
<u>Nitrogen balance, g/day</u>		
Fecal excretion	29.4	32.5
Urinary excretion	16.6	15.7
Retained	45.5	46.1
Percent retained of consumed	49.7	48.9

^a Lactobacillus plantarum fermentation product applied at 1 lb per ton of forage.

Silage Preservation

Recovery of dry matter for the untreated and microbial-inoculated silages is presented in table 4. The percentage of dry matter available for feeding was 90.72% for the untreated silage and 93.32% for the treated silage. Recovery was based on dry weight of "forage in" and "silage out" of the silo. There was little or no spoilage over the storage period of about 3 months. Dry matter losses in the nonrecoverable fraction include those losses occurring during the fermentation process. The small differences in this fraction would be considered within the normal range under the silage management conditions employed in this study. Samples of each silage were collected for chemical profile analyses. The results of these determinations have not been completed and will be published at a later date.

TABLE 4. DRY MATTER RECOVERY OF CORN SILAGE AS AFFECTED BY A MICROBIAL SILAGE INOCULANT

	Untreated	Microbial- inoculated ^a
Total dry matter stored, lb	191,171	191,196
Total dry matter fed, lb	173,426	178,427
As a percent of dry matter stored	90.72	93.32
Dry matter losses		
Spoilage	negligible	negligible
Not recovered, lb	17,745	12,769
As a percent of dry matter stored	9.28	6.68

^a Lactobacillus plantarum fermentation product applied at 1 lb per ton of forage.