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Richard M. Luther
South Dakota State University

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**EFFECT OF SODIUM DIACETATE ON CORN SILAGE CHEMICAL
CHARACTERISTICS, PRESERVATION AND FEEDLOT
PERFORMANCE OF GROWING BEEF STEERS**

Richard M. Luther
Department of Animal and Range Sciences

CATTLE 86-9

Summary

Whole-plant corn forage ensiled at 65% moisture and stored in concrete stave silos for 200 days was fed in high-silage diets to growing beef steers. Approximately 84 tons of dry matter were stored in each of two silos. One silo contained forage which was untreated, while the other contained forage treated with sodium diacetate at 1 lb per ton of wet forage.

Differences in feedlot performance of growing steers or in various chemical characteristics between untreated and sodium diacetate-treated corn silage were small and not significant ($P > .05$). Both silages had a desirable pH (3.8) and contained over 10% lactic acid in the dry matter, indicating formation of high quality silage. Recovery of silage dry matter was 85.6% for untreated silage and 86.8% for sodium diacetate-treated silage.

(Key Words: Corn Silage, Additives, Sodium Diacetate, Cattle.)

Introduction

Formation of quality silage for livestock production is dependent on the rate and completeness of the chemical fermentation process and also on the preservation of the silage during storage. Microbial activity of bacteria present in fresh forage leads to the formation of lactic acid and other organic acids which stabilize and preserve silage during storage.

The addition of organic acids to chopped forage at ensiling to aid in preservation has been practiced for a number of years. Organic acids used in preserving crops include the mineral acids (hydrochloric, sulphuric and phosphoric) and members of the fatty acid group (formic, acetic, propionic, etc.). Sodium diacetate, a commercial product available in the salt form, aids in acidification of ensilage while permitting fermentation to occur with the production of lactic acid. Claims for the product include the reduction of mold formation, sparing of protein from fermentative proteolysis and its utility with forage of variable moisture content.

Previous research at the South Dakota Experiment Station (Cattle Feeders Day Report 84-1) showed that whole-plant corn forage treated with sodium diacetate resulted in lower fermentation temperatures and a more rapid drop in pH associated with higher lactic acid levels following ensiling compared to untreated silage. The additive had no effect on nutrient digestibility but preserved 3.4% more dry matter than untreated silage.

The objective of this research was to evaluate sodium diacetate-treated corn silage when fed to growing beef steers fed high-silage diets. The effect of the additive on chemical characteristics of the silage during feedout and on dry matter preservation was also studied.

Procedures

Whole-plant corn forage from the 1983 corn crop was harvested at 64.7% moisture with a conventional forage chopper. Loads of forage were weighed and stored alternately in two concrete stave silos (18 x 50 ft), each equipped with a blower. A Gandy applicator was installed on one blower to deliver 1 lb of sodium diacetate¹ per ton of forage. The silos were filled rapidly to a level of the silo unloader, leveled and packed.

A representative sample was collected from each load and frozen for chemical analyses. Samples of each silage were also collected twice weekly during feedout for moisture determinations and for later chemical analyses.

A feeding trial was conducted utilizing 160 Hereford, Angus and Hereford x Angus feeder steers (avg 544 lb). The cattle were purchased through a livestock auction. Initial weights were taken after 14 hours without feed and water and steers were allotted on the basis of weight and breeding to 20 pens of eight steers each. All steers were eartagged, implanted with 36 mg Ralgro² and vaccinated with a 4-way Clostridia spp. bacterin and for Bovine Virus Diarrhea (BVD), Infectious Bovine Rhinotracheitis (IBR) and para-influenza. Full weights were recorded at 28-day intervals during the experiment. Final shrunk weights were recorded following an 18-hour stand without feed and water.

Corn silage was offered to all cattle according to appetite. A protein supplement was mixed with the silage and fed at the rate of 2 lb per steer daily. The supplement was composed of 70% soybean meal (44% crude protein) and 20% ground shelled corn fortified with macro and micro minerals and vitamin A.

The silos were opened after 200 days of storage and spoiled silage removed from the surface, weighed and sampled. Feedable silage was based on the sum of feed record values kept until the silos were empty. Nonrecovered silage was obtained by difference and included losses during fermentation, storage and feedout.

Results and Discussion

Feedlot performance for the 110-day experiment is presented in table 1. The level of performance was acceptable considering that well-eared corn forage was ensiled and the resulting silage was full fed to steers without additional grain. Weight gain, dry matter consumption and feed efficiency were similar ($P > .05$) for steers fed untreated or sodium diacetate-treated corn silage.

¹Crop Cure, Domain Industries Inc., New Richmond, WI, 54017.

²International Minerals and Chemical Corporation, Terre Haute, IN, 47808.

Chemical quality factors for the experimental silages are presented in table 2. Both silages were of high quality as indicated by low pH values (3.8) and high lactic acid levels (10% of the dry matter). Differences in the various chemical measurements between untreated and sodium diacetate-treated silage were relatively small and not significant ($P>.05$). The similarity of ammoniacal nitrogen values suggests that protein degradation following ensiling and storage was also similar for the two silages. The lactic:acetic acid ratio, a measure of the efficiency of fermentation, did not differ ($P>.05$) for the untreated and sodium diacetate-treated silages.

Recovery of dry matter from silage stored in stave silos for 200 days is shown in table 3. Dry matter preservation was only slightly higher (86.8%) for the sodium diacetate-treated silage compared to the control silage (85.6%). This effect is associated with slightly lower spoilage losses in the treated silage. Dry matter recovery values for this trial are somewhat lower than have been experienced with corn silage stored in stave silos at this location. However, it is not uncommon to have dry matter losses ranging from 10 to 15% under the conditions of this experiment.

TABLE 1. EFFECT OF SODIUM DIACETATE TREATMENT OF CORN SILAGE ON FEEDLOT PERFORMANCE OF GROWING BEEF STEERS (APRIL 8-JULY 27, 1984--110 DAYS)

Item ^a	Untreated silage	Sodium diacetate-treated silage ^b
Number of steers	80	80
Avg initial wt, lb	543	544
Avg final wt, lb	803	802
Avg daily gain, lb	2.36	2.35
Avg dry matter intake, lb	17.21	17.02
Dry matter/100 lb gain, lb	731	724

^a Treatment differences for performance measurements were not statistically significant ($P>.05$).

^b Crop Cure, Domain Industries Inc., New Richmond, WI.

TABLE 2. CHEMICAL CHARACTERISTICS OF UNTREATED AND SODIUM DIACETATE-TREATED CORN SILAGES

Item ^a	Untreated silage	Sodium diacetate-treated silage ^b
Number of samples	29	29
Dry matter, % ^c	34.62	35.37
pH	3.81	3.80
Titratable acidity ^d	11.01	10.86
Ammonia nitrogen, % ^e	5.19	5.06
Percentage of dry matter		
Crude protein	8.34	8.33
Lactic acid	10.22	9.77
Acetic acid	1.78	1.77
Propionic acid	.03	.04
Butyric acid	.02	.02
Total volatile fatty acids	1.83	1.83
Acid detergent fiber	30.06	28.40
Neutral detergent fiber	52.63	53.21
Lactic:acetic ratio	5.7	5.5

^a Treatment differences in chemical characteristics were not statistically significant ($P > .05$).

^b Crop Cure, Domain Industries Inc., New Richmond, WI.

^c Toluene distillation with acid correction.

^d Milliliters .1N KOH to bring pH to 7.

^e Percentage of total nitrogen.

TABLE 3. PRESERVATION OF DRY MATTER IN UNTREATED AND SODIUM DIACETATE-TREATED CORN SILAGE^a

Item	Untreated silage	Sodium diacetate-treated silage ^b
Forage dry matter at storage, %	35.34	35.26
Dry matter stored, lb	168,702	168,019
Dry matter for feeding, lb	144,495	145,809
Percentage of dry matter stored	85.65	86.78
Dry matter as spoilage, lb	5,769	3,998
Percentage of dry matter stored	3.42	2.38
Dry matter not recovered, lb	18,438	18,212
Percentage of dry matter stored	10.93	10.84

^a Storage period = 200 days.

^b Crop Cure, Domain Industries Inc., New Richmond, WI.