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K.K. Bolsen

R.N. Sonon

B. Dalke

See next page for additional authors

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Abstract

Results from 26 trials comparing fermentation, dry matter (DM) recovery, and effects on cattle performance of inoculated or nonprotein nitrogen (NPN)-treated silages vs. controls were summarized using paired t-test analysis. Inoculants consistently improved fermentation efficiency, DM recovery, feed conversion, and gain per ton of crop ensiled in both corn and forage sorghum silages. The use of NPN, particularly urea or anhydrous ammonia, adversely affected fermentation efficiency, DM recovery, avg daily gain, and gain per ton of crop ensiled, particularly for the higher moisture forage sorghums.

Keywords

Cattlemen's Day, 1992; Kansas Agricultural Experiment Station contribution; no. 92-407-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 651; Beef; Inoculant; Urea; Ammonia; Molasses; Silage

Authors

K.K. Bolsen, R.N. Sonon, B. Dalke, Ronald V. Pope, Jack G. Riley, and A. Laytimi

EVALUATION OF INOCULANT AND NPN SILAGE ADDITIVES: A SUMMARY OF 26 TRIALS AND 65 FARM-SCALE SILAGES

K. K. Bolsen, R. N. Sonon, B. Dalke, R. Pope, J. G. Riley, and A. Laytimi[1]

Summary

Results from 26 trials comparing fermentation, dry matter (DM) recovery, and effects on cattle performance of inoculated or non-protein nitrogen (NPN)-treated silages vs. controls were summarized using paired t-test analysis. Inoculants consistently improved fermentation efficiency, DM recovery, feed conversion, and gain per ton of crop ensiled in both corn and forage sorghum silages. The use of NPN, particularly urea or anhydrous ammonia, adversely affected fermentation efficiency, DM recovery, avg daily gain, and gain per ton of crop ensiled, particularly for the higher moisture forage sorghums.

(Key Words: Inoculant, Urea, Ammonia, Molasses, Silage.)

Introduction

Research with inoculant and non-protein nitrogen (NPN) silage additives using the farm-scale tower silos in Manhattan and at the Fort Hays and Southeast Branch Experiment Stations began over 17 years ago. Summarized here are results of the 26 trials and 65 farm-scale silages in which fermentation, dry matter (DM) recovery, and effects on cattle performance of inoculant and non-protein nitrogen (NPN) silages vs. untreated (control) silages were compared.

Experimental Procedures

In 23 of the 26 trials, silages were made by the alternate load method. In three of the sorghum trials (seven silages), control and treated silages were made on consecutive days. Upright, concrete stave silos were used in all but one trial, when both control and inoculated silages were made in polyethylene bags. Further details of all other procedures are given in KAES Reports of Progress 377, 394, 413, 427, 448, 470, 494, 514, 539, 567, and on page 103 of this report. Products from 11 companies were used in the corn silage trials and products from eight companies were used in the sorghum trials.

Statistical analysis of the data from the 14 corn silage trials and 12 forage sorghum trials was conducted using paired t-tests. Only overall mean comparisons were made between paired observations for the nine criteria measured.

Results and Discussion

A summary of treatment means for control and treated silages and significance levels is shown in Table 1.

The 19 inoculated corn silages had a 1.30 percentage unit higher ($P < .001$) DM recovery compared to untreated silages, and the inoculated silages supported a 1.8% more efficient ($P < .11$) gain and a 3.6 lb increase ($P < .001$) in gain per ton of crop ensiled.

[1]Former Post-doctoral student. Current address: Rabat, Morocco.

Adding anhydrous ammonia to corn silage increased pH and fermentation acids ($P < .01$), and there was a strong trend for both DM recovery and gain per ton of crop ensiled to be lower; 2.1 percentage units and 6.3 lb ($P < .07$), respectively.

Inoculating forage sorghum silages increased ($P < .01$) DM recovery, improved ($P < .04$) feed conversion, and produced 4.6 lb more ($P < .001$) gain per ton of crop ensiled. The forage sorghum silages treated with ammonia or urea had a 5.1 percentage unit lower ($P < .09$) DM recovery, and cattle fed treated silages gained .27 lb per day slower (not significant), required 1.06 lb more (not significant) DM per lb of gain, and gained 13.9 lb less ($P < .24$) per ton of crop ensiled compared to cattle fed untreated silage. The urea-molasses blend (LSA-100) had less of a negative influence on silage preservation and cattle performance.

Table 1. Summary of Treatment Means for Silage Fermentation, Dry Matter Recovery, and Effects on Cattle Performance from Inoculant and NPN Additions to Corn and Forage Sorghum Silages

Crop and silage treatment	No. of silages	DM recovery[1]	Avg daily gain, lb	Daily DM intake, lb	Feed/ gain, lb	Gain/ton of crop ensiled, lb	pH	Lactic acid	Acetic acid	Ethanol[2]
Corn:								- % of the silage DM -		
Control	15	90.2	2.41	17.05	7.10	99.1	3.82	5.31	2.49	.770
Inoculant	19	91.5	2.48	17.10	6.97	102.7	3.82	5.45	2.26	.614
Probability level	---	.001	NS	NS	.11	.001	NS	.12	.03	NS
Control	3	91.5	2.29	17.20	7.52	96.3	3.81	4.67	2.01	---
Anhydrous NH_3	3	89.4	2.22	17.55	7.84	90.0	4.19	6.13	2.47	---
Probability level	---	NS	.16	NS	NS	.07	.01	.01	NS	---
Forage sorghum:										
Control	10	83.1	1.65	13.14	8.32	70.6	3.94	5.15	2.58	1.36
Inoculant	10	85.2	1.68	12.89	7.98	75.2	3.93	5.23	2.10	1.20
Probability level	---	.01	NS	.20	.04	.001	NS	NS	.02	NS
Control	3	87.7	1.35	11.93	9.52	74.6	3.91	5.14	2.04	---
Anhydrous NH_3 or urea[3]	3	82.6	1.08	11.30	10.58	60.7	4.63	6.07	3.63	---
Probability level	---	.09	NS	NS	NS	.24	.10	NS	.08	---
Control	3	80.8	2.06	13.90	7.00	70.6	4.14	3.85	2.06	---
LSA-100	3	76.5	2.23	14.20	6.64	70.3	4.64	3.90	2.49	---
Probability level	---	.18	.06	NS	NS	NS	NS	NS	NS	---

[1]As a percent of the crop DM ensiled.
[2]Ethanol was not measured in trials conducted prior to 1984.
[3]One trial with anhydrous NH_3 and two trials with urea.