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Effect of bacterial inoculants on the preservation and nutritive value of whole-plant corn silages

Abstract

Inoculated and control corn silages were compared using pilot-scale silos. Inoculated silages (Pioneer inoculant 1174 and 1132) had significantly higher lactic to acetic acid ratios, and numerically lower values for DM loss, acetic acid, ethanol, and ammonia-nitrogen than the control silage¹ evidence that both inoculants produced a more efficient fermentation. Although the inoculated silage rations had higher DM intakes than the control, nutrient digestibilities were similar for the three silages. These results are consistent with numerous studies that compared untreated and inoculant-treated silages over a wide range of crops and ensiling conditions in our research during the past several years.

Keywords

Cattlemen's Day, 1995; Kansas Agricultural Experiment Station contribution; no. 95-357-S; Report of progress (Kansas State University, Agricultural Experiment Station and Cooperative Extension Service); 727; Beef; Silage; Inoculant; Preservation; Corn

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EFFECT OF BACTERIAL INOCULANTS ON THE PRESERVATION AND NUTRITIVE VALUE OF WHOLE-PLANT CORN SILAGES¹

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Summary

Inoculated and control corn silages were compared using pilot-scale silos. Inoculated silages (Pioneer inoculant 1174 and 1132) had significantly higher lactic to acetic acid ratios, and numerically lower values for DM loss, acetic acid, ethanol, and ammonia-nitrogen than the control silage—evidence that both inoculants produced a more efficient fermentation. Although the inoculated silages had higher DM intakes than the control, nutrient digestibilities were similar for the three silages. These results are consistent with numerous studies that compared untreated and inoculant-treated silages over a wide range of crops and ensiling conditions in our research during the past several years.

(Key Words: Silage, Inoculant, Preservation, Corn.)

Introduction

Adding selected strains of lactic acid bacteria (LAB) has become common practice in silage-making. These are intended to dominate the fermentation phase of the ensiling process. However, numerous characteristics of the forage to be ensiled—species, DM content, water-soluble carbohydrate content, and buffering capacity—interact with epiphytic (naturally occurring) and inoculant microbes to determine the outcome of the fermentation. The objective of this study was to continue to document the effect of commercial bacterial

inoculants on preservation and nutritive value of whole-plant corn silages.

Experimental Procedures

In August of 1992, irrigated whole-plant corn (Pioneer 3377) was chopped at the 90% milk line stage of kernel development with a FieldQueen forage harvester and ensiled in 12 pilot-scale silos.

Four silos received each of the following treatments: 1) control (no additive); 2) Pioneer® brand 1174 silage inoculant; and 3) Pioneer® brand 1132 corn silage inoculant. The inoculants were applied in liquid form and supplied 1.0×10^5 colony-forming units (cfu) of LAB per g of fresh crop. Because of the limited amount of silage, sheep were used as model animals. After 90 days of storage, each silage was fed to eight wether lambs in a 20-day voluntary intake (VI) and digestion trial. Rations contained 90% silage and 10% supplement (DM basis). The pre-ensiled forage contained 1.2×10^6 cfu of epiphytic *Lactobacillus* per g and 1.3×10^6 yeasts per g on a fresh basis.

Results and Discussion

The results are shown in Table 1. The data are consistent with several of our previous inoculant studies using laboratory-scale, pilot-scale, and farm-scale silos. The 1174- and 1132-treated silages had significantly higher lactic to acetic acid ratios and numerically lower values for acetic acid, ethanol, ammonia-

¹Financial assistance and the two inoculants were provided by Pioneer Hi-Bred International, Inc., Johnston, Iowa.

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nitrogen, and DM loss than the control silage—evidence that the inoculants produced a more efficient fermentation and improved preservation efficiency. Although DM intake were higher for the inoculated silage rations than for the control, nutrient digestibilities were similar for the three silages.

Based upon results from several earlier studies (KAES Report of Progress 651, page 101), we would expect the better preserved, inoculated silages in this study to produce more weight gain in beef cattle or milk in dairy cattle per ton of crop ensiled than untreated (control) silage.

Table 1. Effect of Pioneer Brand 1174 and 1132 Silage Inoculants on the Preservation Efficiency and Nutritive Value of Whole-plant Corn Silage

Item	Treatment		
	Control	1174	1132
<u>Silage Preservation and Chemical Analyses</u>			
Silage DM, %	37.0	36.6	36.8
DM recovery, % of the DM ensiled	95.3	95.9	96.0
pH	3.83	3.82	3.82
Aerobic stability, hours	>120	>120	>120
	—————% of the silage DM —————		
CP	7.31	7.37	7.50
NDF	41.8	41.9	43.3
ADF	26.1	25.5	26.3
Lactic acid	5.95	6.49	6.85
Acetic acid	2.31	2.09	2.01
Ethanol	.46	.41	.40
Ammonia-nitrogen	.10	.08	.08

Sheep Metabolism Trial

Voluntary intake, g/metabolic

	—————Digestibility, % of the ration —————		
DM	69.7	69.2	70.0
CP	66.2	67.4	66.5
NDF	55.1	56.2	57.2
ADF	54.1	52.5	54.7

^{a,b}Means on the same line with different superscripts differ (P<.10).