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Preservation of alfalfa hay with a microbial inoculant

Abstract

Eleven large, round, alfalfa bales were treated with Pioneer® Brand 1155 Alfalfa Hay Inoculant and nine bales were untreated. The initial baling moistures were 14.1% (low) or 17.6% (medium). No significant differences were found in dry matter recovery or changes in acid detergent fiber, neutral detergent fiber, and acid detergent insoluble nitrogen levels during the 2-month storage period. Average temperature was highest in the medium moisture bales, but was not high enough to cause heat damage. The microbial inoculant did not improve preservation or quality of the alfalfa hay at the baling moistures used in this study.

Keywords

Cattlemen's Day, 1993; Kansas Agricultural Experiment Station contribution; no. 93-318-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 678; Beef; Alfalfa; Hay preservation; Round bales; Inoculant

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PRESERVATION OF ALFALFA HAY WITH A MICROBIAL INOCULANT[1]

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Summary

Eleven large, round, alfalfa bales were treated with Pioneer® Brand 1155 Alfalfa Hay Inoculant and nine bales were untreated. The initial baling moistures were 14.1% (low) or 17.6% (medium). No significant differences were found in dry matter recovery or changes in acid detergent fiber, neutral detergent fiber, and acid detergent insoluble nitrogen levels during the 2-month storage period. Average temperature was highest in the medium moisture bales, but was not high enough to cause heat damage. The microbial inoculant did not improve preservation or quality of the alfalfa hay at the baling moistures used in this study.

(Key Words: Alfalfa, Hay Preservation, Round Bales, Inoculant.)

Introduction

The feeding value of alfalfa is a complex interaction between growing season, plant maturity at harvest, harvest conditions, and storage environment. Of these, alfalfa quality is most vulnerable to conditions at harvest. For consistent production of high quality hay, producers must harvest within a narrow window of moisture content to minimize leaf loss in the field or quality deterioration through heating in storage. Various hay preservatives have been developed and promoted to prevent excessive heat production, mold growth, color changes, and nutrient loss in hay baled at higher moisture. Our objective was to evaluate a microbial inoculant applied to large round bales of alfalfa hay.

Experimental Procedures

The first cutting of a 7-yr-old alfalfa stand was baled in May, 1991 with a John Deere 435 large round baler. Baling started at about 4:30 p.m. and concluded by 8:30 p.m. Moisture varied from the top of the windrow to the bottom and along the length of the windrow. The baler was equipped with a tank, electric pump and two flood jet nozzles. Pioneer® Brand 1155 Alfalfa Hay Inoculant was applied at the recommended rate as the forage entered

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the throat of the baler. There were 11 inoculated bales and nine untreated (control) bales.

Each bale was weighed and core sampled in multiple locations immediately after baling and placed individually on pallets at the storage site. Two thermocouples were inserted into each bale, and temperatures were automatically monitored every 6 hours for a period of 2 months. At the end of storage, each bale was weighed and core sampled in multiple locations.

Samples were analyzed for moisture content, crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), and acid detergent insoluble nitrogen (ADIN).

Results and Discussion

Initial and final chemical composition and DM recovery of the control and inoculated hays are shown in Table 1. Actual hay moisture contents at baling were lower than targeted, and there were no significant differences ($P > .10$) in either DM recovery or changes in chemical composition among the hay treatments. As expected for a 2-month storage period, DM recovery was high for all treatments. Acid detergent insoluble nitrogen remained low, because heating was insufficient to bind protein to the cell wall. The ADF fraction increased numerically for all treatments, except the low moisture control, and NDF values increased by comparable amounts for all treatments.

Temperatures for all treatments peaked at approximately 12 to 14 days after baling (data not shown). The peak temperature was about 111°F for both the control and inoculated, medium moisture hays. As expected, the low moisture bales had lower temperatures than medium moisture bales. There was considerable variation in bale temperatures within hay treatments, but maximum, average, peak temperature for all individual bales was below 122°F. However, there was as much as a 59°F difference between two thermocouples within some bales. This indicates that "hot spots" existed within bales, and these were likely due to variation in windrow moisture.

Table 1. Initial and Final Chemical Composition and DM Recovery of the Four Alfalfa Hays

	Control				Inoculated			
	Low moisture		Medium moisture		Low moisture		Medium moisture	
Item[a]	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Moisture, %	14.2	10.1	17.5	10.9	14.0	10.5	17.7	10.8
DM recovery[b]	---	97.2	---	97.2	---	96.8	---	97.8
CP	20.7	21.2	20.8	20.7	20.9	21.2	21.0	21.3
ADF	28.9	28.5	28.4	29.5	27.8	29.1	29.2	29.6
NDF	38.3	39.6	38.8	41.8	36.9	39.8	39.4	42.3
ADIN	.48	.43	.53	.37	.51	.40	.40	.34

[a]CP = crude protein, ADF = acid detergent fiber, NDF = neutral detergent fiber, ACP = available crude protein, and ADIN = acid detergent insoluble nitrogen.
[b]As a % of initial bale wt (DM basis).