

indicate that those herd owners are providing excellent management. The extra \$521 income over feed cost would also suggest that owners of high producing herds were compensated for their efforts.

### Literature Cited

USDA, 1968. Dairy Herd Improvement Letter Vol. 44:3

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## Chemical Preservation of Alfalfa Hay for Lactating Dairy Cows

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### Story in Brief

At times it is extremely difficult to harvest alfalfa hay with the high quality desired for high producing dairy cows. In this trial, use of a chemical hay preservative was evaluated as a management technique for minimizing problems encountered in harvesting high quality hay.

Alfalfa hay from a common field was baled as follows: a) dry, at 19 percent moisture, b) wet, at 29 percent moisture, and c) wet, at 28 percent moisture with addition of chemical preservative. The product consisting of 70 percent propionic acid and 30 percent formalin was applied at the rate of 1.0 percent of hay baled.

Heating and molding during storage were prevented by the preservative. *In vitro* digestibility of dry matter in dry baled and treated hay was higher than in hay baled wet with no preservative. In a feeding trial with lactating Holstein cows, treated hay supported milk production equal to that by cows fed dry baled hay. Digestibility of total ration components was similar for dry baled hay and hay treated with chemical preservative. Thus, the commercial hay preservative used in this trial was effective in maintaining hay quality under the conditions described.

## Introduction

Alfalfa hay is an important forage to many dairymen in Oklahoma and many other parts of the world. However, weather conditions in Oklahoma sometimes do not permit adequate curing of hay, and leaf shatter in harvesting of field cured hay may result in considerable loss of nutrients.

A relatively new approach to hay harvesting involves addition of a small amount of chemical preservative to the hay at the time of baling. This permits baling at a higher moisture content than is otherwise recommended and in some instances reduces nutrient loss due to shattering of leaves during handling.

Research workers have reported hay quality to be inversely proportional to the moisture content of hay at baling and to temperature attained during storage. High temperature of hay during storage favors a chemical reaction in which hexoses and amino acids react to form indigestible components, thus lowering hay feeding value.

Various chemicals have been tested as possible preservatives for alfalfa hay. Those appearing to be of greatest value at present are ammonium isobutyrate, anhydrous ammonia, propionic acid, and propionic acid combined with formalin. The amount of these chemicals required to prevent heating and molding in baled hay is related to the moisture content of hay at baling. More chemical is required as the moisture content of hay at baling is increased. It appears that application of 1 percent by weight of any of the named chemicals is adequate for preservation of alfalfa with average moisture up to around 30 percent.

No reliable data have been reported on the merits of adding organic acid preservatives to hay at baling for feeding to dairy cows. The purpose of this trial was to evaluate the effect of adding a chemical preservative to hay at baling on its nutrient content, digestibility and feeding value for lactating cows.

## Materials and Methods

Mid-bloom alfalfa hay from a common field was baled under three different conditions as follows: a) dry control, baled at an average moisture content of about 19 percent, b) wet control, baled at 29 percent moisture content, and c) preservative treated hay, baled at 28 percent moisture with addition of 1.0 percent commercial hay preservative. This product, containing 70 percent propionic acid and 30 percent formalin, was applied with a positive pressure spray unit as the hay was picked up from the windrow and moved into the baling chamber. The specified amount of preservative was diluted 50:50 with water before application to permit more uniform distribution on the hay. Temperature during the first 3 weeks of storage was monitored by use of thermocouples placed within 30-bale stacks of each type of hay. Readings were recorded twice daily during the first 11 days and daily thereafter.



Sixteen lactating Holstein cows 7-10 weeks post-calving were used in a switchback feeding trial to compare the preservative treated hay with dry baled hay. Comparison periods were five weeks in duration. The experimental ration consisted of a concentrate mixture and alfalfa hay in a 50:50 ratio. Initial feed allowances calculated to meet NRC requirements were based on weight and age of cow, milk yield, and milk fat percentage. These allowances were reduced by 5 percent at the start of 2nd and 3rd periods to minimize weight changes.

Milk production was recorded twice daily with samples from four consecutive milkings each week composited for analysis of fat and total solids percentage. Body weights were recorded on 3 consecutive days at the beginning of the trial and at the end of each comparison period. Digestibility of ration components was determined during the fifth week of each period by using chromic oxide as an indicator.

Digestibility of dry matter in hay baled under the different conditions also was determined by an *in vitro* procedure. Seven designated bales of each type were sampled monthly during the first four months of storage for this analysis.

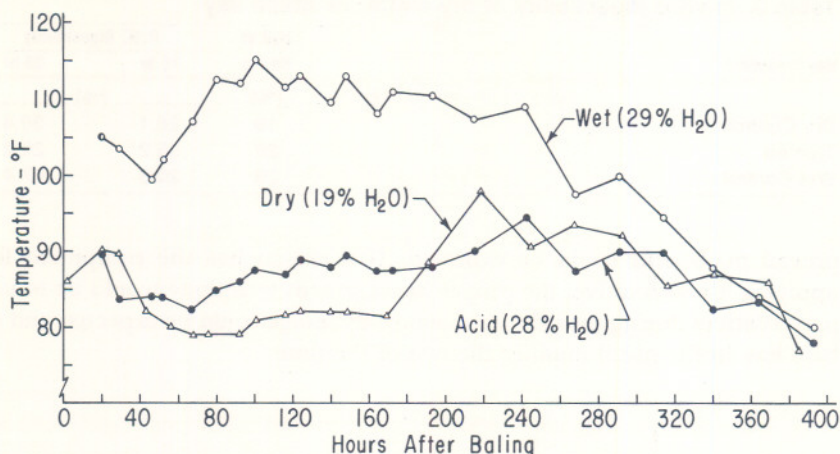
## Results and Discussion

There was no visible mold in the hay treated with commercial preservative or in the dry baled hay, whereas extensive molding was observed in the wet baled hay. The highest average temperature recorded in the stack of wet baled hay was 115 F, in contrast to 94.5 and 98 F in preservative-treated and dry hay stacks (Figure 1).

In the feeding trial, intake of grain and hay was maintained near a 50:50 ratio as planned. Both types of hay were readily accepted by the cows. Average milk yield of cows fed the chemically preserved hay was slightly higher than that of cows fed the control hay; however, there was sufficient variation within treatment groups to cause this difference not to be considered of any real significance. Milk fat and non-fat solids percentages were similar for the two groups (Table 1). The digestibilities of dry matter, neutral detergent fiber (NDF), crude protein, and organic matter were similar for treated and control hays (Table 2). Nevertheless, digestibility values for the rations were in agreement with the production data, indicating that the chemically treated hay was at least equal in quality to the control hay. *In vitro* digestibility of dry matter in dry control hay (19 percent moisture) was only slightly higher than in the chemically treated hay (Table 3). However, *in vitro* digestibility of dry matter in the wet baled hay (29 percent moisture) was considerably lower than in treated hay, indicating the effectiveness of the chemical preservative.

The commercial hay preservative used in this trial was effective in preserving hay quality under the conditions described. However, one should not expect products applied at rates providing less than an effective level of active ingredient to be of any appreciable value in preserving alfalfa hay with 28 to 30 percent moisture content at baling.

## TEMPERATURE OF HAY IN STORAGE



**Figure 1.** Temperature of hay in 30-bale stacks during storage

**Table 1.** Responses of cows to experimental rations

	Hay condition at baling	
	Dry (19% H <sub>2</sub> O); Control	Wet (28% H <sub>2</sub> O); Preservative Added
Feed intake		
Grain, lb/day	21.2	21.3
Hay, lb/day	21.1	21.2
Milk Production		
Yield, lb/day	54.3	55.1
Fat, %	3.68	3.61
NFS, %	8.50	8.62

**Table 2.** Digestibility of ration components

Component	Hay	
	Control	Treated
	%	
Dry Matter	58.2	60.4
Protein	60.4	62.7
NDF	57.0	57.6
Organic Matter	62.7	63.4

Use of an effective hay preservative can be an economical alternative for minimizing weather risks in harvesting hay. With the recommended application rate, cost of chemicals used in this trial would be around \$8.00 per ton of hay baled. In some situations, the benefit gained by using preservatives would more than offset this cost. At other times when favorable weather conditions



**Table 3. *In vitro* digestibility of dry matter in alfalfa hay**

Hay Treatment	H <sub>2</sub> O at Baling	D.M. Digestibility	
		18 hr	36 hr
	(%)	(%)	
Dry Control	19	26.1	30.4
Treated	28	25.2	29.6
Wet Control	29	20.6	27.4

prevail no benefit could be expected. If a person has the equipment for applying a preservative, the proper management technique would be to use preservatives during periods when some advantage could be expected and to bale hay in the usual manner the rest of the time.

## Effect of Prepartum Antibiotic Infusion on Mastitis Infection in Dairy Cows at First Calving

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### Story in Brief

Mastitis infection continues to be a problem in dairy herds. This report deals with research directed toward prevention of infection in cows at the start of the first lactation.

One-half of a group of heifers was infused with an antibiotic two weeks prior to the anticipated date of calving. Quarter milk samples for microbiological examination were collected within 8 days after freshening, at 13-16 days and again at 27-30 days.

Two heifers in the antibiotic infused group and 8 of the control group were found to be infected when sampled within the 8 day period after freshening. At the 13-16 day sampling period none of the infused group were infected, but 7 of the control group were infected. At 4 weeks, 2 infused heifers and 3 controls