Side-By-Side Evaluation of Preservation Alternatives for Alfalfa Hays

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RATIONALE & OBJECTIVES

- A trial was conducted at the University of Wisconsin Marshfield Agricultural Research Station to assess options for successful storage of moist (~25%) hay using a propionic-acid-based preservative, wrapping bales (individually) with 7 layers of plastic film, or both.

Objectives:

To address options for optimizing retention of nutrients in alfalfa-grass hays, specifically when the forage is nearing a suitable moisture for baling as dry hay (~25%), but climatic conditions prohibit attaining the final desiccation required to reach normal targets for safe storage.

STUDY DESCRIPTION

Layout:

A 2 × 2 factorial arrangement of treatments was evaluated. In this experiment, 33 bales of alfalfa-grass forage were made at 25.8 ± 2.20% moisture; bales were treated with a propionic-acid-based preservative at 0.27 ± 0.025% of wet bale weight (yes or no) or wrapped with 7 layers of plastic film (yes or no). There were 8 complete replications (blocks) of each of the 4 treatment combinations, and one additional bale made from an incomplete 9th field block. Bales were stored for 84 days before final assessment of nutritive value, DM recovery, and fermentation characteristics (wrapped bales only).

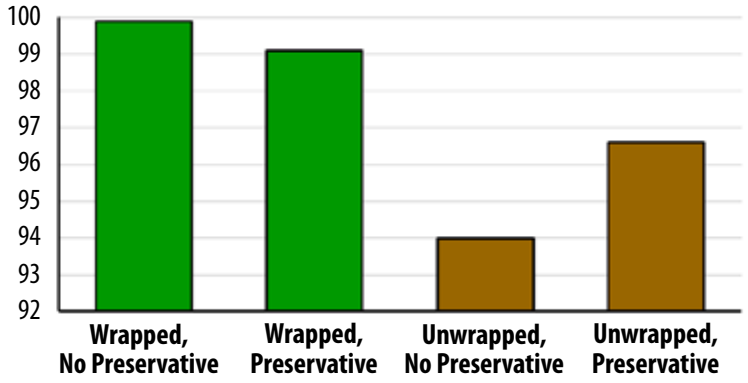
Analysis:

Data were analyzed as a randomized block design, with blocks treated as a fixed effect. Yeast and mold counts following aerobic exposure of wrapped bales were evaluated only with summary statistics because many bales exhibited non-detectable counts.

RESULTS

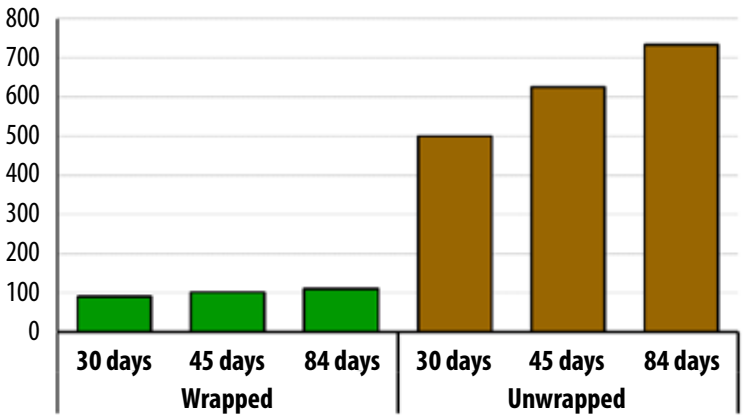
- An interaction of main effects was observed for recovery of DM after 84 days of storage, where preservative application did not affect DM recovery from wrapped bales, but improved DM recovery from unwrapped bales (Figure 1).

Figure 1. DM Recovery, %.



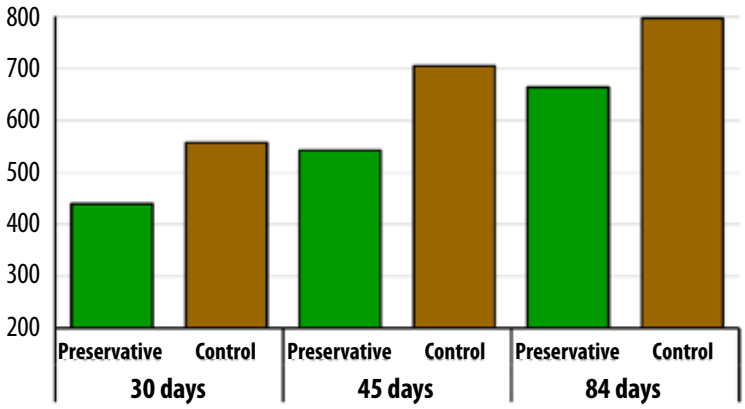
- There was no interaction of main effects for maximum internal bale temperature. Unwrapped bales exhibited greater maximum internal bale temperatures than wrapped bales (61.6 vs. 41.5°C; $P < 0.001$), but preservative application resulted in only a numerically lower temperature compared to bales receiving no preservative (50.4 vs. 52.7°C; $P = 0.362$).
- Wrapping bales in plastic film greatly reduced heating degree days > 30°C calculated after 30, 45, and 84 days in storage compared to unwrapped bales; heating units were generally accumulated in wrapped bales early in the storage period, while there were large accumulations of heating units throughout storage in unwrapped bales (Figure 2).

Figure 2. Heating Degree Days > 30°C.



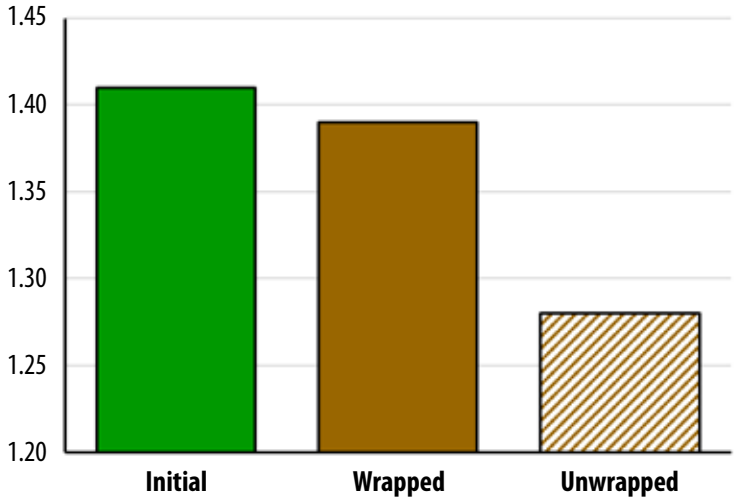
- When heating degree days were considered for the subset of unwrapped bales only, application of a preservative reduced the accumulated heating units significantly after 30 and 45 days in storage ($P \leq 0.027$), but only numerically over the entire storage period ($P = 0.154$) (Figure 3).

Figure 3. Heating Degree Days > 30°C.



- Most measures of nutritive value were affected during storage; however, negative changes in nutritive value were most limited in wrapped bales. For energy density, measured as net energy of lactation (NE_L), a 9.2% reduction was observed in unwrapped bales during storage, but only a 1.4% reduction in wrapped bales (Figure 4). The small reduction in energy for wrapped bales did not differ statistically from nil (no change).

Figure 4. NEL, Mcal/kg DM.



- Because moisture was limited (25%) within wrapped bales, there was little fermentation, with concentrations of lactic acid averaging 0.32% across all wrapped bales.
- After an 84-day storage period, plastic was removed from wrapped bales, and these bales were exposed to air for 33 days from mid-November through early December. Although the mean ambient temperature during this time period was cool (1.5 ± 6.10°C), the surface pH of preservative-treated silages was 5.95 compared to 6.13 for untreated controls; in addition, detectable yeast counts generally were greater for bales receiving no preservative (5.59 vs. 4.90 $\log_{10}$ cfu/g). These responses suggest aerobic stability was improved by preservative application.

MANAGEMENT IMPLICATIONS

- The application of plastic film onto relatively dry mixed-species forages proved extremely effective in reducing spontaneous heating during storage, as well as minimizing nutrient losses. This technique offers promise as an alternative approach to preserving forages 'almost dry enough to bale as hay', but are threatened by oncoming uncooperative weather.

Alfalfa
U.S. Alfalfa Farmer Research Initiative

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