



The Use of Additives to Improve Fermentation and Nutritive Value of Warm-Season Forage Haylage

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Haylage, baleage, and round-bale silage are all different names for the same method of preserving forage with intermediate moisture in plastic wrapped bales. The forage is baled with dry matter concentrations between hay (80-85%) and silage (30-35%) and wrapped in plastic for preservation. This preservation method has provided a feasible alternative for conserving warm-season grasses in Florida in the absence of favorable hay cutting conditions; however, the chemical composition and morphology of these grasses make them more difficult to obtain an acceptable fermentation profile, and consequently, satisfactory preservation as haylage. Despite the high yields produced by perennial warm-season grasses, high moisture and low water-soluble carbohydrate concentrations limit the success and subsequent adoption of this practice. Further, the nutritive value of these grasses decreases rapidly with increasing maturity, increasing the challenge of preserving high yields and high-quality forage.

It has been observed that haylage with an undesirable fermentation profile has decreased nutritive value and increased presence of fungi and yeast, which results in decreased animal performance. Research has been conducted at the Range Cattle Research and Education Center, Ona, FL to improve the preservation of haylage, maintain nutritive value, and decrease fungi and yeast contamination.

Wilting is the most efficient and cost-effective management practice to improve the fermentation characteristics and preservation of warm-season grasses. Increasing dry matter concentrations decreases the development of undesirable microorganisms, such as Clostridia, fungi, and yeast. The target dry matter concentration to achieve acceptable preservation is approximately 50%. Research has shown that dry matter concentrations below 40% increase the appearance of undesirable bacteria while dry matter concentrations above 65% limit the desirable fermentation process. Wilting time is highly variable and depends upon the forage species and climatic conditions. Research conducted at the Range Cattle Research and Education Center found that after 4 hours of wilting, limpgrass increased dry matter concentration from 20 to 40% in the summer, but only from 20 to 32% in the fall because of lower average temperatures. Limpgrass

also had lower dry matter concentrations after 4 hours of wilting when compared to stargrass and Jiggs bermudagrass.

Microbial inoculants can be added to haylage to increase the acidification rate by shifting fermentation towards lactic acid production rather than production of volatile fatty acids ethanol, and CO₂. However, most of the commercial inoculants were created for corn silage and the efficiency in warm-season perennial haylage has been inconsistent. A research project was conducted at Ona to test the efficiency of 7 commercial silage inoculants in Jiggs bermudagrass haylage. The results were not consistent between years and the addition of inoculants had little or no improvement in haylage nutritive value and fermentation. The microbial inoculants need sugars to be converted to lactic acid to improve haylage fermentation and the lack of sugars in warm-season perennial grasses limit the effects of microbial inoculants.

There are different types of additives called fermentation enhancers (molasses, citrus pulp, etc.) and fermentation inhibitors (propionic acid, potassium sorbate, etc.). The addition of blackstrap molasses has been an effective management practice to add sugars to haylage and improve fermentation and nutritive value. A research study was conducted adding 2% molasses (2% of the green forage, e.g. 40 lb molasses/1 ton of haylage) in the windrow right before bailing (Figure 1). The haylage treated with molasses had lower pH and greater lactic acid and digestibility. In addition, heifers fed with the molasses treated haylage had 10% increase in forage intake.

Research has also been conducted at Ona to test the effects of adding propionic acid to Jiggs bermudagrass haylage. Propionic acid is an organic acid that has been used widely in the feeding industry to increase the shelf life of feedstuffs and decrease spoilage. There is an inaccurate popular perception that propionic acid may be detrimental to livestock; however, research has shown that the commercial levels used in concentrate and forage have no negative effect in livestock. The level of 0.5% propionic acid (0.5% of the forage green weight, e.g. 10 lb propionic acid/1 ton of haylage) was very effective to decrease silage pH, increase lactic acid, and decrease mold and yeast count (Figure 2). Heifers consuming Jiggs haylage treated with propionic acid had greater forage intake than heifers consuming untreated haylage.

In conclusion, warm-season perennial grasses are not the most desirable forages to be ensiled due to limited concentration of sugars and low dry matter concentration. However, there are additives that can be included in haylage that will effectively improve nutritive value and fermentation and decrease the presence of fungi and mold.

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Figure 1. Application of blackstrap molasses on the windrow before baling the haylage.



Control (untreated)



0.5% Propionic Acid Treatment

Figure 2. Stargrass haylage control (untreated) and treated with 0.5% propionic acid, at the Range Cattle Research and Education Center, Ona, FL.