2018 USAFRI Research Project Objectives

Side-by-Side Evaluation of Preservation Alterntives for Alfalfa Hays
USDA-ARS U.S. Dairy Forage Research Center - Coblentz

Project Award: $13,335

Justification:

- Alfalfa forages are important components of diets for lactating dairy cows and other livestock; however, climatic conditions in the eastern United States often are unsuitable for drying alfalfa forages adequately for storage as dry hay. Inadequate desiccation prior to baling dry hays results in respiration of sugars into CO2, water, and heat in a process referred to commonly as spontaneous heating. In severe cases, this process can further lead to spontaneous combustion causing losses of barns and hay inventories. A generation ago, the general rule-of-thumb for satisfactory storage of small, <100-lb (45-kg) bales handled manually was a moisture threshold of about 20%. Gradual improvements in baler design have emphasized larger (and frequently denser) bale packages, sometimes weighing as much as 2000 lbs (907 kg).

  While larger bale packages have greatly improved labor efficiency, they also carry the unintended consequence of increased sensitivity to spontaneous heating, further increasing the complexity of harvest management. This occurs because larger bale packages have much less surface area per unit of dry matter (DM), and therefore can't dissipate heat as easily as smaller bales. This is illustrated in Figure 1, in which spontaneous heating (measured as heating degree days > 30oC; HDD) was compared for 3-, 4-, and 5-ft (0.9,1.2, and 1.5-m) diameter round bales made over a wide range of initial bale moistures and stored outdoors on wooden pallets. Heating increased with bale moisture for all bale diameters; however, the relationships were linear for 3- and 4-ft bales, but escalated in a quadratic fashion for 5-ft bales (Coblentz and Hoffman, 2009; Journal of Dairy Science, 92:2853-2874). Currently, moisture recommendations for safe storage of dry hays packaged in large bales vary, but generally they are about 15%, which is often unattainable in the cooler and/or humid environments in many parts of the eastern United States. Furthermore, this threshold typically can't be reached without unfortunate compromises related to additional leaf shatter and loss, which is disproportionately critical to nutritive value compared to far less-fragile stems. Consequences of spontaneous heating within hays are well-known, and include losses of DM, as well as reductions in sugars, DM digestibility, protein digestibility, and energy. The potential magnitude of these losses is summarized from recent work for energy, expressed as total digestible nutrients (TDN), in Figure 2 (Coblentz and Hoffman, 2010; Journal of Dairy Science, 93:3377-3389).

Objectives:

- The objective of this research is to, in side-by-side experiments, compare BS (~50% moisture) with DH, PH, and DS (16 to 25% moisture) harvest techniques for alfalfa forages with respect to heating characteristics and DM recovery during storage, as well as nutritive value, nutrient retention, and in-vitro digestibility after a 90-day storage period.