GUEST COLUMN

Forage Preservation – Retaining Nutrients from Field to Feeder

Eugene Rodberg, Kemin Industries

Forage preservation does not begin nor end at harvest. Forage preservation is a continual process which begins when the crop is planted, continues during harvest and storage, and concludes only when the forage is consumed. These three key milestones, in the life of any forage crop, are where nutrient quality is impacted. Intervention during these milestones ensures high quality forages.

Forage management starts while the crop is in the field and exposed to environmental conditions. Rain, hail, and heat conspire to impact our final forage positively and negatively. Mold and wild yeast growth often begin while the crop is growing. Cool, wet, fall conditions favor the development of ear rots caused by *Fusarium spp*. These fungi can also produce several toxins harmful to people and livestock: vomitoxin, zearalenone, T-2 toxin, and fumonisin[1].

The second critical time for your forage crop is during harvest and storage, when microbiological stability can be impacted. While in storage, forages change substantially from the product initially harvested. In silage and hay, these changes are usually affected by microorganisms inevitably leading to changes in quality. Substantial efforts expended by both farmers and custom choppers can be lost within days, even hours, if the harvested material is not treated correctly.

Finally, during feed-out, the best crop can experience aerobic stability issues – significantly changing the complexion of even the best preserved crop. Microbes, which do not grow in the air-free environment of a well-packed silage pile, rapidly double and spoil silage once the silage is exposed to air. In 2016, information from Dairyland Laboratories, Inc., showed silage samples contained high levels of wild yeast[2]. Wild yeast lies dormant in well-preserved silage, but quickly grows in the presence of oxygen during facing, mixing, and feed-out. Wild yeast multiplies rapidly, leading to ration heating; but wild yeast growth provides a favorable environment for mold growth.

Excessive microbial growth can raise the temperature of our forages to 130-150°F, increasing dry matter loss and producing Maillard reactions, reducing dry matter and crude protein digestibility[3]. In order to control the problems inherent in forage stabilization during the storage period, attention must be given to implementation of quality control programs based on microbiological control.

Understand first that mold and wild yeast organisms are wide-spread throughout animal feed. Although mold may not be visible to the naked eye, there are numerous outward signs of mold used to indicate microbiological activity is present. Therefore, a program to prevent mold and yeast growth is needed. For this, it is necessary to consider what mold inhibitor to use among the large variety of products available on the market. The principal additives used to preserve silage are:

1. **Bacterial inoculants** are the most commonly used silage additives. Inoculants contain bacteria selected for their ability to produce lactic acid and other organic acids from sugars found in the silage. Inoculants typically contain a strain of *Lactobacillus plantarum*, which grow rapidly under a wide variety of conditions. Other species of bacteria are also chosen for their ability to enhance stability of silage during feed-out, such as *Lactobacillus buchneri*. Strains are selected and evaluated by individual manufacturers and vary greatly in their effectiveness. Choose products with independent research data to back claims of lowered pH, increased dry matter recovery, better aerobic stability, or improved animal performance.
2. **Non-protein nitrogens,** such as anhydrous ammonia and aqueous ammonia, are applied to corn silage. An alternative to ammonia is urea. These additives increase the crude protein content of the silage and can increase silage bunk life. Ammonia raises the pH of silage and kills many of the yeasts, molds, and bacteria that cause heating and spoilage. Ammonia improves dry matter and fiber digestibility by breaking down hemicellulose and other components in plant cell walls.
3. **Enzymes** reduce fiber content by breaking down components of the cell wall and begin the digestion of carbohydrates. Enzymes and products containing enzymes are usually a combination of amylases, cellulases, hemicellulases, and/or pectinases. Several inoculant manufacturers have included enzymes in their formulations; however, enzyme concentrations found in inoculant products are often much lower than in straight enzyme products.
4. **Buffered organic acids** are blends of propionic acid with other acids such as acetic acid[4]. These blends are used to reduce spoilage and increase bunk life. Both propionic and acetic acids inhibit the growth of yeasts and molds. Buffered acid blends help reduce metal corrosion and reduce potential worker safety issues. These products are added at the chopper or at ensiling, typically at rates of 0.1-1.0% (2-20 lbs/ton of wet silage). In addition to being used during ensiling, blended organic acids applied during feed-out can enhance bunk life of total mixed rations (TMR).

Forages are vitally important to dairy and beef farmers. Quality forages make a huge difference toward profitable production. Complete programs of microbiological control lead to better quality feed through the preservation of nutrients. During each step, from growing to feed-out, farmers impact feed quality. There are a wide variety of additives which can help during harvest and storage to enhance forage quality. Consult a forage specialist or agronomy consultant to select the best forage additive for your operation.

1. Alison Robertson, Iowa State University (ISU) Department of Plant Pathology; Roger Elmore, ISU Department of Agronomy; Charles Hurburgh, ISU Department of Agricultural and Biosystems Engineering, http://crops.extension.iastate.edu/cropnews/2009/10/2009-corn-quality-issues-field-molds, accessed July 13, 2016.
2. Dairyland Laboratories, Inc., April 26, 2016.
3. Collins M. and Owens V., (2002) Hay and silage preservation. R.F. Barnes, C.J. Nelson, M. Collins, and K. Moore (eds.), Forages: The Science of Grassland Agriculture, vol. 2. Ames, Iowa: Iowa State Univ. Press. P: 443-469.
4. University of Wisconsin Agronomy Website, http://corn.agronomy.wisc.edu/Silage/S004.aspx, accessed July 13, 2016.