GUEST COLUMN

# Converting a Small Grain Crop Into High-Quality Silage

***Larry Roth, Provimi***

Small grains (e.g., wheat, oats, barley, rye, triticale) are receiving greater agronomic and feeding interests. Their growth and fermentation characteristics differ from traditional silage crops (e.g., corn, sorghum). Converting small grains into a high-quality fermented feed requires attention to a variety of management factors. They are typically higher in protein and mineral content and tend to have a buffering effect, causing a resistance to decreasing the feed pH to the point necessary to achieve stable fermentation. Additionally, mowing these crops with a disc-type mower may result in soil contamination, increasing risk of a clostridia fermentation.

Management factors to be considered when creating high-quality small grain silage:

1. **Harvest at correct stage of maturity.** Harvest small grains for silage at the head emergence stage. Structure and composition quickly change as the plant matures from head emergence through soft-dough stage. Stems will stiffen, with increased fiber and lignin content, to support the developing grain head. As the plant matures, starch content in the grain head will increase to offset some of the quality loss due to the decline in fiber digestibility. Sugar content necessary for proper bacterial fermentation will decrease as the plant matures. Rapid advancement in maturity is often a challenge, with small grains maturing in summer-like conditions. Late-summer-planted small grains will mature at a more gradual rate, due to shortening daylight hours and cooler temperatures in the fall, and have greater sugar content and less lignification.
2. **Harvest at correct moisture.** Make sure moisture content is correct for your silage storing structure. Suggested moisture targets are 55-65% for bunkers and bags, and 50-60% for tower silos. Excess moisture can result in seepage and potentially a clostridia-type fermentation, producing high levels of butyrate, especially if soil is accidentally incorporated into the silage. Harvesting prior to soft-dough stage may result in moisture too high for proper fermentation unless field-wilted to 65% moisture or drier. Dry forages can result in undesirable packing densities trapping air in the feed, which fosters yeast and mold growth.
3. **Chop to correct particle length.** At targeted moisture ranges, aim for a theoretical particle length of ½-¾˝. A longer length may be possible with wetter forages, and a shorter length may be necessary with drier forages to obtain a desirable packing density.
4. **Use proper inoculant.** Research suggests proper inoculation with lactic acid-producing bacteria can foster a rapid increase in lactic acid production to decrease pH below 5.0, preserving dry matter (DM) and nutrients, and helping to control clostridia. Specially selected *Lactobacillus lactis* bacteria have reduced clostridia-type fermentations with very wet forage under research conditions. The adage, "Whichever side gets there first with the most, wins" certainly applies to the contest between native bacteria, yeasts, and molds residing on the forage and the introduced, inoculating bacteria added to encourage a proper fermentation.
5. **Size storage structure correctly.** Consider forage density per cubic foot, square feet of exposed haylage face, and then forage needed per day. Silage removal from the bunker or pile face should be 6˝ or more per day to minimize spoilage of the forage.
6. **Fill the silage structure rapidly.** Minimizing the time period between initiation of filling and sealing of the bunker, bag, or tower silo reduces DM and nutrient losses, as well as reduces the potential layers of spoilage due to breaks in filling the storage structure.
7. **Pack properly.** Proper packing reduces air trapped in forage, which is important for minimizing yeast and mold growth. A good packing guideline is to provide 800 lbs of packing weight for every ton of forage delivered per hour to obtain a packing density of 15 lbs DM/ft$^3$ or greater. Therefore, if you are harvesting 100 tons/hr, you need 80,000 lbs of packing weight on the silo 100% of the time the feed is being delivered. Increased packing density allows for greater forage storage in the same structure, enhances DM and nutrient retention, and facilitates better face management as the haylage is fed out.
8. **Properly seal forage.** A proper seal will exclude oxygen to discourage yeast and mold growth, while at the same time providing an ideal environment for lactic acid-producing bacteria to grow. In addition, a proper seal will protect forage from rainfall and sunlight. Plastic improperly weighted down may flap in the wind and actually draw oxygen into the forage. Oxygen-limiting barriers and proper tire-to-tire contact on the plastic can achieve significant returns on investment through DM and nutrient retention, as well as reduce the outer layer of spoiled, moldy haylage needing to be removed before feeding.
9. **Proper feed-out management.** In addition to the removal of 6˝ of silage face daily to reduce forage spoilage, care should be taken to reduce excessive feed lifting which could result in cracks allowing air to enter the forage remaining in the storage structure. Loose forage remaining on the ground at the silage face should also be minimized to reduce yeast and mold growth. Remember, any time air is introduced into silage, yeast and mold growth will occur and cause heating, protein destruction, and loss of DM and nutrients. Additionally, feed pH will rise as yeast metabolizes lactic acid, which will allow clostridia spores to break dormancy, increase in number, and produce butyrate, potentially in amounts sufficient to reduce feed intake. Clostridia organisms will also break down protein to ammonia, as well as create the less savory amines, cadaverine, and histamine.

The overall goal of forage management is to produce a healthy, vigorous crop and then quickly ferment the forage to achieve a stable silage with minimal loss of DM and nutrients, producing a feed which will be aerobically stable upon feed-out with low levels of potentially harmful wild yeasts and molds. An excellent source of forage management information is the University of Wisconsin Extension Forage website at fyi.uwex.edu/forage.