Focus on Forage

Wisconsin TEAM Forage

Managing Forage in Bunker Silos

by **Craig Saxe**

Introduction

Maximizing ruminant livestock production is dependent upon, producing and storing quality forage. Once the crop has been harvested, loss of quality may occur simply because steps were not taken to correctly manage the forage during filling and storage. This fact sheet reviews bunker silo recommendations that help to maintain high quality forage.

Harvest Considerations

Forage should be harvested at the correct degree of maturity to assure desired feed quality and proper sugar content for good fermentation. Also, to reduce the risk of weather related losses, hay crops should be chopped and stored within three days of cutting.

Optimal relative forage quality (RFQ) is achieved when alfalfa is cut at or near 170 RFQ based on scissor clip or PEAQ measurements. Chop alfalfa at 3/8-inch theoretical length of cut (TLC) with 15-20% of the particles exceeding 1.5 inches long. For corn silage the recommended TLC is 3/8 inch without a processor or 1/2 to 3/4 inch with a processor.

The preferred corn silage moisture range for bunker silos is 65-70%. Begin sampling whole plant moisture when the corn kernel contains about 80% milk. Use a 0.5% per day predicted dry down rate from the sample date until 65-70% whole plant moisture is reached. Seepage of forage juice can occur if forage is harvested at moisture contents above 70%. This juice carries away a high concentration of soluble nutrients, representing a significant loss of valuable feed. For hay silage the preferred moisture is 60-65%. Clostridial fermentation is more likely in hay silage if the forage moisture is greater than 65%. Clostridial fermentation produces silage containing butyric acid and is less stable when exposed to oxygen.

What are the recommendations for filling and packing a bunker silo?

Rapid silo filling (within 3 days) increases the uniformity of forage moisture and quality in the silo, and reduces exposure of the forage to precipitation and air during filling. Rapid silo filling is accomplished by having sufficient harvest, transport and silo filling equipment capacity and adequate labor to operate the equipment. Bottlenecks to rapid filling should be identified and eliminated. When sizing storage, consider selecting several smaller units rather than one large unit so you can fill each one quickly and reduce exposure of forage to the elements.

The recommended procedure for filling a bunker silo is to spread the forage in thin layers (less then 6 inches) on the sloped filling face (in a wedge shape). Drive over each layer multiple times with one or more heavy tractors to eliminate air and ensure good packing. This "progressive wedge" technique of filling continually covers previous layers of forage, thus reducing exposure to air. Most producers underestimate the thickness of the packing layer. Holmes (2006b) has developed a spreadsheet to determine how long the filling surface needs to be to achieve a specified layer thickness.

The amount of time spent compacting the silage affects fermentation and losses at feed out. Running the tractor across the surface multiple times leads to better fermentation than when forage is only leveled with minimal compaction. In most cases this means continuously running one or more packing tractors.

Dr. Richard Muck and Dr. Brian Holmes studied bunker silo density and found the most important packing characteristics included: silage depth, tractor weight, prepacked forage layer thickness, and time packing per ton. The relationships developed from this work were incorporated into spreadsheets and can be used as a management tool to improve forage density. The spreadsheet (Holmes and Muck (2006a) and Holmes and Muck (2006b)) can be downloaded from the UW-Extension Team Forage web site (see references for site address).

How should bunker silos be covered?

Once filling is complete, immediately cover the bunker silo with an air-excluding material. Plastic films have proven to be the most effective covers when properly installed. It is estimated that covering a bunker silo with plastic can return eight dollars for every dollar spent due to reduced losses and increased animal productivity.

Craig Saxe, Agricultural Agent
University of Wisconsin Extension – Juneau County
craig.saxe@ces.uwex.edu

The sooner a bunker cover is installed, the less time forage is exposed to aerobic conditions or precipitation. Once the rear portion of the forage mass is placed and packed, the plastic cover should be installed. If precipitation is expected, rolling the plastic over the surface will also protect the sloped filling face.

Plastic bunker covers should be 6 to 8 thousandths (mil) of an inch thick. The thicker 8 mil plastic is easier to handle, more resistant to tears, and more resistant to oxygen diffusion. Plastic must be held tightly to the silage surface and sealed at the edges. When tires are used to weigh the plastic down, they should touch each other to provide a uniform weight and to prevent plastic billowing in the wind. Loose soil or sand bags have been used to give a tight seal at the edges of the plastic. Many producers are using split tires or sidewalls to avoid the difficulties of whole tires.

Shape the top surface of forage to shed water from the plastic cover. It's important to prevent run-off from flowing between the silage and bunker walls. This can be done by forming flow channels several feet from the walls and sloping toward the back of the bunker. If punctures occur in the plastic, use specially designed tape to repair the plastic. Inspect the plastic cover weekly and repair holes as needed.

A new plastic covering system was recently introduced. It uses a thin plastic layer (1.8 mil) that is significantly less permeable to oxygen than common polyethylene. In this system, low oxygen permeable plastic is placed along the walls and across the top of the forage. A heavier second layer of plastic or a tarp is used on top to protect the thinner plastic layer. A weighting material (usually sand or rock filled bags) holds the layers in place. In a study conducted by Muck (2006), this new system proved to be better at reducing dry matter loss compared to traditional plastic covering systems. Dr. Muck comments in his research findings, "Economic analysis is needed to assess the returns on this more costly covering system."

What about the fermentation process and use of inoculants?

The fermentation phase lasts 14-21 days. During this time, the forage varies in quality from day-to-day. Since cows perform best when presented uniform quality forage, avoid feeding silage during the fermentation period.

Silage fermentation naturally occurs under anaerobic conditions. An effective fermentation process is based upon a variety of factors including the types and numbers of bacteria found on the forage. Inoculants may improve this fermentation process, but before selecting inoculants first assure silage management is correct, avoiding problems such as ensiling overly dry crops, poor packing density, covering improperly or low feed out rates.

Silage inoculants are divided in two categories; homofermenters (often referred to as Lactobacillus bacteria) which produce only lactic acid and heterofermenters (often referred to as buchneri) which produce lactic acid and other products like acetic acid. Homofermenters speed the fermentation process along while heterofermenters increase the shelf life during feed out. Unfortunately, there is no good way to predict when adding microbial inoculants will be effective. In research trials, fermentation was improved 75% of the time in alfalfa silage and only 40% of the time in corn silage. Also notable, when homofermenter inoculants improved fermentation they in turn improved animal performance by 3-5%. For more detailed information on microbial inoculants please refer to other Team Forage Factsheets at: http://www.uwex.edu/ces/crops/uwforage/FocusonForage.htm

What are the recommended feed-out rates for bunker silos?

The removal rate (inches removed from the silage face per day) influences loss during the feed out period. Removal rates should not be lower than 6 inches per day in the summer and 4 inches per day in the winter. Maintaining adequate removal rates are especially critical with hay crop silages, high moisture corn and drier silages. When designing storage a good recommendation is to plan to remove at least twice the minimum recommended removal rate. This requires a design that has a smaller face area and longer bunker length. This will increase the initial cost of the bunker silo but will be quickly paid by the annual savings in dry matter loss.

Many methods of silage removal are used on farms. Perhaps the most common method is the bucket loader. The preferred method of silage removal with a bucket is to scrape the silage from the top, and allow it to fall to the floor. Another method is to undercut the silage several inches up from the floor and then slice the balance of the face into the cavity. Whatever removal practice is used, the silage face should remain tight and smooth. Avoid methods that result in dislodging the face. Creating gouges, cracks and potholes result in air penetration deep into the silage mass and lead to increased spoilage. Face cutters (rotating drums with teeth) have been recently reintroduced to remove silage from bunker and pile silos. These machines can leave a smooth relatively undisturbed silage face. For more information on face cutters, see Holmes (2003). For more information on feed out losses see Clark (2002).

Only the amount of silage that will be fed in a short period should be removed or uncovered at one time. Losses can occur due to air penetration at the exposed face and top and from loose silage lying on the floor between feedings. Plastic can be pulled back from the silage top or cut off each day. At no time should more than three days worth of silage be exposed.

What about bunker silo safety?

Safety is an issue in all phases of silage storage. During the fermentation process, silo gasses are released that can cause death. It is important to avoid working in confined spaces around the bunker silo immediately after filling.

During feed out, loader operation must be such that neither the surface stability nor the structural stability of the equipment is compromised. Avoid silage overhangs that occur when equipment is undersized for the structure. A person walking out on top of an overhang can be seriously injured if the overhang collapses. Also be careful of crust formation that occurs because of spoilage. Serious injury can occur if the silage collapses (avalanches) on someone working near the feed out face.

References

Bolton, K. and B. Holmes. 2004. Management of Bunker Silos and Silage Piles. University of Wisconsin Extension. http://fyi.uwex.edu/forage/files/2014/01/mgmt-bunkers-piles-bjh2.pdf

Clark, J. 2002. Forage Feedout Losses for Various Storage Systems. Focus on Forage. Vol 4: No. 7. http://fyi.uwex.edu/forage/files/2014/01/FeedoutLossFOF.pdf

Contreras-Govea, F. and R. Muck. 2006. Microbial Inoculants for Silage. University of Wisconsin Extension, Team Forage, Focus on Forage Factsheet Vol 8: No. 4. http://fyi.uwex.edu/forage/files/2014/01/Microbial_Inoculants-FOF.pdf

Holmes, B. 2004. Bunker Silo Facers-worth the investment? . Focus on Forage. vol 5 # 11. University of Wisconsin Extension. http://fyi.uwex.edu/forage/files/2014/01/FacerFOF.pdf

Holmes, B. 2006a. Density in Silage Storage. P. 214-237. Silage for Dairy Farms: Growing, Harvesting, Storing, and Feeding. NRAES-181. Natural Resource, Agriculture, and Engineering Service Ithaca NY.

Holmes, B. 2006b. Floor Length to Achieve Bunker/Pile Silo Filling Layer Thickness Calculator. University of Wisconsin Extension. http://fyi.uwex.edu/forage/files/2014/02/LayerThicknessCalc2-28-06.xls

Holmes and Muck (2006a). Bunker Silo Density Calculator. University of Wisconsin Extension. http://www.uwex.edu/ces/crops/uwforage/storage.htm

Holmes and Muck (2006b). Silage Pile Density Calculator. University of Wisconsin Extension. http://www.uwex.edu/ces/crops/uwforage/storage.htm

Lauer, J. 2001. Predicting Corn Silage Harvest Dates. University of Wisconsin Extension Agronomy Advice. http://corn.agronomy.wisc.edu/AA/A)29.aspx

Muck, R. 2006. Forage Handling, Preservation and Storage; Alternative Covering System for Bunker Silos. P. 4-5. U.S. Dairy Forage Research Center 2005 Research Report. http://www.ars.usda.gov/sp2UserFiles/Place/36553000/research_summaries/RS2005.pdf