Optimizing Forage Quality through Proper Harvesting, Ensiling, and Feedout Practices

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The winter hiatus between silage seasons allows time to review some of the more important management factors that can make the difference between producing top quality forage and just having something that is "belly fill." Getting the best quality from forages is a "cradle to grave" or holistic approach – all of the small details need to be addressed. In an ideal world we would get everything right. Unfortunately, weather, equipment breakdowns, and other factors conspire to challenge that ideal. Nonetheless, it should be the goal of producers feeding silage to manage silage production to control as many variables as possible and maximize the quality of fermented forage crops. Forages are the dominant part of dairy rations and large components of most beef rations and so are one of the key determinants of overall profitability.

Once the forage has been ensiled its quality is fixed and other ration components need to be adjusted in the light of the quality of the resultant silages to achieve set production targets. In some cases, poor-quality ensiled forages may mean that production goals are not achievable and need to be reigned in, resulting in significant financial consequences. Hence, the importance of making sure that one of the key goals of all producers is to work to hone their management skills to achieve the best possible forage quality and to maximize the retention of that quality through to the consumption of the fermented forages by their cattle. A brief discussion of key management points that influence silage quality follows.

Preparation

Make sure fields are well prepared – remove stones and get the surface as flat as possible to reduce the risk of equipment damage and potential for picking up soil when cutting. Soil introduced at forage harvesting increases the buffering capacity of the forage, meaning that more acid is required to reduce pH. This can in turn increase the chances of a slow fermentation and possible clostridial fermentation, resulting in butyric silage and associated feeding, health, and fertility issues. This is compounded by the fact that soil can contain very high levels of clostridial bacteria. In some soils, levels of clostridia as high as ten billion per gram have been recorded. At this level, 20 lb of soil picked up in a ton of forage would mean the forage being inoculated with 100 million clostridia per gram! Picking up 20 lb of soil per ton may seem like a lot; however, this is only a 1% increase in the level of ash in the silage. It is quite common to see ash levels of 3% or more over the level expected for the crop ensiled.

Prior to harvest, ensure forage equipment and silos are in good repair: Downtime is costly and can seriously affect silage quality. Leaky silos can mean more air ingress, leading to more problems with heating and spoilage. Make sure silos are sized correctly in order to maintain the necessary feed-out rates (fast enough to prevent heating from occurring).

Crop Selection, Growth, and Harvest

It is important to select crop(s) and varieties suited to local conditions (e.g. soil type and climate) and to meet the overall feeding objectives (i.e. yield, protein, and energy levels). Avoid over use of fertilizer and be sure to time slurry applications correctly to ensure all the nitrogen applied is taken up into the plant and converted into plant proteins. High levels of non-protein nitrogen in the plant increase the buffering capacity of the forage, increasing the ensiling (pH) challenge and can cause some serious issues at feedout if not compensated for.

It is vital to cut the crop at the correct stage of growth for each forage crop to achieve the balance of quality and yield targeted. Chopping at optimum plant dry matter (DM) is also essential:

- Corn silage target range is 32-38% DM
- Haylage crops are best ensiled at 35-40% DM
- Cereal silages grown for energy are best cut and chopped at 38-42% DM
- Crops taken for protein (e.g. ryelage pre-heading) should be treated like a haylage

If crops are ensiled too dry they are more difficult to pack, which may lead to more air ingress, slowing the fermentation and allowing yeast and molds to grow, causing heating and spoilage. High levels of yeasts can cause the silage to heat as it comes to the exposed surface at feedout and when mixed into a TMR. Silage harvested too wet presents more of an ensiling challenge and can be prone to clostridial spoilage, especially more highly buffered haylage crops.

If there are reasons to suspect high nitrates in a corn silage crop, e.g. due to drought, setting the cutting height to 18" will significantly reduce the amount of nitrates in the silage, since nitrates preferentially accumulate in the lower parts of the plant. When harvesting forage, it is important to chop at the correct length – long enough to provide plenty of good, effective fiber yet short enough to give good compaction. For unprocessed corn silage, the theoretical length of cut (TLC) should be _ to _". If corn silage is processed (increasingly cost effective as DM goes above 30%), the TLC should be set to _". For all other crops, a TLC of _" is recommended, though that should be stepped up to _" if the silage is bagged, due to the additional mechanical processing going through the bagger. All forages should be treated with an inoculant proven effective at delivering the results targeted (see next section).

Inoculants

Inoculants are used for two primary reasons:

- To stimulate or ensure a rapid fermentation (fermentation aids)
- To inhibit aerobic spoilage (spoilage inhibitors).

Fermentation aids generally contain efficient (homofermentative) lactic acid-producing bacteria (LAB) and are mainly used on low dry matter forage crops that can have low concentrations of fermentable carbohydrates and high buffering capacities (e.g. grass, alfalfa, clover). Inoculants designed to inhibit spoilage may contain specific LAB, e.g. *Lactobacillus buchneri*, or propionic acid-producing bacteria. These products are designed for use on materials more prone to aerobic spoilage such as drier haylages (more than 35% DM), corn and cereal silages, high-moisture corn and cereal grains, and baleage. Some products combine homofermentative LAB with aerobic spoilage inhibitors to cover both up-front fermentation and feedout stability.

Things to consider when comparing silage inoculants include:

- Is there ample data for the specific product in the target crop from trials conducted at independent research facilities, such as universities, verifying their claims?
- Is the product manufactured to quality control standards and does the manufacturer have accreditation to show that manufacturing procedures are independently reviewed?
- Is the product packaged appropriately? The use of high barrier foils is preferred to exclude air and moisture, as is the use of specific preservation agents, e.g. moisture scavengers, in the product formulation.

Other factors to consider when using an inoculant include:

- Shelf life and storage conditions should be read, understood, and followed.
- Do not use expired inoculant – check for expiration date!
- Does the type of product match your expectations? Do you need a fermentation aid and/ or a spoilage inhibitor?
- Check application rates several times a day.

Silo Filling to Feedout

Forage dry matter should be checked throughout the filling process to ensure forage is being chopped at the appropriate dry matter as discussed previously. Compositing the samples taken to check DM throughout filling and then submitting a sub-sample for laboratory analysis will remove much of the mystery about the quality of the contents of the silo. Fill the silo as quickly as possible and do not leave forage sitting in wagons overnight. Bunkers and piles should be filled in 6" layers using a progressive wedge, with an angle of approximately 30˚, consolidated thoroughly, with every load packed properly. The optimum amount of packing vehicle weight needed can be calculated by multiplying the estimated tons of crop delivered to the silo in an hour by 800. Target a minimum packing density of 15 lb DM/cubic foot. The effect of various factors on packing density achieved is well demonstrated by the interactive spreadsheet available at the following web site: http://www.uwex.edu/ces/crops/uwforage/storage.htm.

If making a pile, aim for run – rise ratio of no less than 4:1 along the sides to allow for continued effective and safe packing as the silo fills and pack in all directions (not just front to back). For bunkers and piles, the packing tractors should be running throughout filling, putting emphasis on the sides as much as the middle. The mantra is, pack, pack, and pack some more. When you think you have packed enough, run for another hour.

As soon as filling is completed, the silo should be sealed effectively to exclude air. In bunkers, this is best achieved using side sheets that overlap at the top of the silo, covered with a fresh top sheet. Recently, a covering plastic with increased air barrier properties has been made available in the North American market and should be considered for ensuring minimal top spoilage losses. On bunkers and piles make sure that the top sheet is adequately weighted down using tires (touching), bales, or mesh bags filled with pea gravel.

At feedout the silage needs to be fed at a rate sufficient to prevent heating. On bunkers and piles, using a face shaver or lateral shaving with a bucket will minimize disturbance of the face and so minimize air ingress, reducing heating. Keep the exposed surface smooth and tidy and do not allow silage to sit in piles for extended periods (go straight from the face to the feed truck or mixer wagon). Any spoiled silage should be discarded, since it has been shown to negatively affect intakes and total ration digestibility even when fed at low rates. Badly spoiled silage can also lead to serious health and fertility problems, along with production losses.

Finally, ensure a nutritionist balances the ration properly based on available silage(s). Remember, once produced the quality of silage is fixed; the rest of the ration can and should be adjusted to ensure the best performance possible from the total ration. Remember, it is attention to small details that can make a difference in the quality of the silages and the production achieved from them.

See next page for Silage production Check List

Silage Production Check List

Preparation
- _ Fields
- _ Timing of use of fertilizers
- _ Equipment
- _ Silos

Crop and Variety Selection
- _ Suitable to local conditions
- _ Matches overall objectives

Harvest Timing
- _ Optimum stage of growth
- _ Optimum plant moisture level

Cutting and Chopping
- _ Cutting height
- _ Optimum TLC
- _ Processing (corn silage <30% DM)

Inoculant
- _ Proven to deliver desired results
- _ Fermentation enhancement/aerobic stability
- _ Applicator calibration

Filling and Packing
- _ Quick fill
- _ Maximum 6" layers
- _ Progressive wedge (bunkers and piles)
- _ Run: rise 4:1 (drive over piles)
- _ Packing weight adequate for forage delivery rate
- _ Packing time adequate
- _ Packing density at least 15 lb DM/ft^3
- _ Seal silo quickly and effectively

Feedout
- _ Rate adequate to prevent heating
- _ Discard spoiled silage
- _ Balance ration properly based on silage quality

Alliance® Animal Health Forage Treatment Products

- **Spoilage Inhibitors**
  - Silo Guard®*
  - Super Hay
- **Up-Front Fermentation Aids (Inoculants)**
  - ECOHAY
  - ECOSYL®*
  - Super Sile
- **Up-Front and Feed-out Stability Fermentation Aids (Inoculants)**
  - Pro-Silage Builder®
  - Pro-Silage Stabilizer™

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