Extension
UNIVERSITY OF WISCONSIN–MADISON

Summer feed storage and feed bunk management

Hot summer weather can be hard on feed ingredients and total mixed rations (TMRs). It is vital that feed quality and aerobic stability be maintained during this challenging season. Doing so will minimize nutrient losses while optimizing cow intakes which are often compromised due to heat stress challenges. Fermented forages rich in starch (i.e. corn silage and high-moisture corn) and diets containing high levels of moisture or wet by-products (i.e. wet brewer's grain) are more vulnerable to having poor aerobic stability. "Aerobic stability" is a common nutrition term defined as the length of time that a feed ingredient lasts before heating up or spoiling when it is exposed to air. Feeds like the ones mentioned above become especially unstable when they are exposed to oxygen in combination with high humidity and temperatures. These conditions allow for the rapid growth of yeasts which use nutrients and lactic acid as sources of energy. The growth of yeasts sets off a chain reaction that starts with heating and leads to the loss of volatile acids, a rise in pH, the growth of undesired molds, and ultimately, instability. The objective of this article is to review the causes of and solutions for poor aerobic stability in silage and TMRs.

Silage

Producing aerobically stable silage requires a combination of adequate harvest and storage management, as well as good feed-out practices. With corn harvesting season coming soon, it is important to review and consider some of these practices. Removal of oxygen through adequate packing and sealing is essential for silage preservation. Adequate packing density also improves fermentation and reduces storage losses. Harvesting late maturity (>40% dry matter) or coarsely chopped silage should be done with caution as these practices may harm the packing process. Poor packing will retain more oxygen within the silo and lead to poor aerobic stability at feed-out. The rate at which oxygen penetrates the silage face at feed-out is inversely proportional to packing density. Higher packing densities have lower rates of oxygen penetration.

Inoculating silage with heterofermentative microbial inoculants may also improve the aerobic stability of corn silage and high-moisture corn. The heterofermentative bacteria most frequently used in silage inoculants is *Lactobacillus buchneri*, which converts lactate to acetate and 1,2-propanediol. Typical fermentation responses to *L. buchneri* inoculation are presented in Table 1.

Table 1. Effect of *Lactobacillus buchneri* (>100,000 cfu/g of fresh forage) on fermentation profile of corn silage.[1]

Item	Control	Inoculated
pH	3.70	3.88
Lactate, % of DM	6.59	4.79
Acetate, % of DM	2.18	3.89
Yeast, log cfu/g	4.18	1.88
DM recovery, %	95.5	94.5
Aerobic stability, h	25	503

[1]Adapted from Kleinschmit and Kung (2006).

New combinations of inoculants containing *L. buchneri* are also showing promising research results. For example, researchers are investigating the combination of *L. buchneri* with *L. diolivorans* since the latter can convert 1,2-propanediol into propionate. Both acetate and propionate have antifungal properties that inhibit yeast and mold growth. It is important to remember, however, that many of the issues related to poor aerobic stability are a result of poor management practices. These practices must be addressed to maximize the benefits of using a microbial inoculant.

Feed-out practices that allow for air infiltration into the silage face also reduce aerobic stability. Some commonly observed malpractices include an uneven silage face, a slow feed-out rate, removing plastic from a given section of the silo too soon, and letting silage removed from the silage face sit for long periods of time.

Total Mixed Rations (TMR)

Poor aerobic stability of the TMR can have adverse effects on its nutritive value as well as animal intake. To avoid these issues, TMR temperatures in the feed bunk should be monitored throughout the day. If the TMR is getting hot, the first step is to determine the cause of the heating. Feeding two times per day instead of a single feeding could be a good

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alternative to minimize spoilage. This practice fits well with lower meal intake patterns observed by lactating cows under heat stress.

It is also advised that spoiling feeds be excluded from the TMR. For example, wet brewer's or wet distiller's grains can have high yeast counts and spoil rapidly if not preserved. Including these feedstuffs in the TMR during the summer may make the TMR more susceptible to heating and spoiling. Another option to prevent the TMR from spoiling is the addition of buffered acid or preservative products (buffered acetate or propionate; or preservatives such as sodium benzoate). When applied to the TMR, these products have potential to inhibit yeast proliferation and improve TMR stability.

Best Management Practices

Remove enough feed to prevent spoilage. Air penetrates about 35 inches/d in the silo, regardless of how well- packed and preserved the silo is. Research has shown the optimal removal rate should be at least 12 inches in summer to prevent heating and spoiling (Muck and Holmes, 2006). Also, avoid removing too much plastic during warm weather which allows air to penetrate further into the silage. To avoid falls from the silage edge, make sure to use a tether if needing to get closer to the silage edge than the height of the silage face.

Only remove enough feed for each day's feeding. Carefully remove silage to avoid excess that will not be fed that day and will spoil. If feeding multiple times a day, also remove silage multiple times a day. Leaving feed out will cause greater feed loss, costing you money. Let us look at an example. Suppose you have a 12-foot-tall by 36-foot-wide bunker silo containing corn silage, and you remove 12 inches. Densities vary and typically average around 40 as fed pounds per cubic foot. This is approximately 9 tons as fed. If we estimate the corn silage price at $30/ton as fed, this is worth approximately $270. Put another way, every inch that is removed is worth $22.50. While it may not sound like much, even one extra inch removed per day and allowed to spoil is worth over $8,200 annually. Haylage prices are even higher at about $60/ton as fed. If assuming 12 inches is roughly 9 tons of feed, each inch removed is valued at $45 or over $16,400 per year. This is a combined value of over $24,600 annually that is left spoiling on the ground. Advance planning to use smaller piles, silos or bags during summer is a good way to minimize spoilage at the silage face. If the feed face is too large to keep up with, consider splitting it for future years.

Use a facer instead of a bucket. This tool will provide a smoother face, reducing air pockets and overhangs. Spoilage can occur inside these air pockets and overhangs are a risk for feed avalanches.

Check bags and bunker silo plastic regularly. Tears and holes can occur in the plastic, exposing the feed to oxygen. Make sure to check plastic regularly and repair damaged plastic. Determining the damage's cause can also be helpful. Additional steps may need to be taken to reduce damage caused by animals such as re-evaluating where you place bags, fencing, or other methods.

Monitor feed for spoilage. Molds and mycotoxins need to be managed carefully. Early detection is key to prevent further losses and make the best management decisions. Work with your herd's nutritionist to determine an appropriate action plan once a problem is identified.

Feed more frequently and during cooler times of the day. Plan when to feed the herd so it coincides with when cows are most likely going to eat. Early morning and later in the evening are better times to feed to take advantage of when cows are cooler and more comfortable. Similarly, you could consider pushing feed up, feeding more during these cooler times of the day, and less during peak temperatures. Finally, consider delivering smaller batches of feed more frequently to minimize spoilage.

Summary

Maintaining aerobic stability is critical to preserving the nutritive value of silages and TMRs, and to avoiding a reduction in intake by dairy cows. Adequate harvesting and feed-out practices, combined with the use of heterofermentative microbial inoculants, are key to protecting your silage investment. The implementation of effective feed bunk management practices, like decreasing feed delivery size but increasing delivery frequency, is also advised.

References

- Kleinschmit, D.H. and L. Kung Jr. 2006a. A meta-analysis of the effects of Lactobacillus buchneri on the fermentation and aerobic stability of corn and grass and small-grain silages. J. Dairy Sci. 89:4005-4013.
- Muck, R.E. and B.J. Holmes. 2006. Bag Silo Densities and Losses. Trans ASABE 49:1277-1284.