

THE FORAGER

Agronomics with livestock in mind!

Strategies for Improving the Aerobic Stability of Silages...

Many factors affect the silage fermentation process. For instance, the dry matter (DM) content and buffering capacity of the crop to be ensiled, the amount of fermentable sugar available at ensiling and the type and numbers of microorganisms that dominate the fermentation process can markedly affect fermentation. However, Woolford (1990) stated that "the single most important factor which influences the efficiency with which forage crops are conserved as silage is the degree of anaerobiosis achieved in the completed silo." Rapid removal of air from the forage mass and the ability to prevent air from infiltrating the silage during storage and feedout can have profound effects on feed quality. Excessive exposure to air at the start of fermentation prolongs the metabolism of unwanted microbes that thrive in air and delays the growth of beneficial bacteria that produce lactic acid. This can lead to undesirable fermentation and a loss in nutritive value. Additionally, prolonged infiltration of air during storage or feedout into the silage can lead to aerobic spoilage. Unstable silage, when exposed to air, heats rapidly and spoils. This leads to a loss of DM and nutrients, with the potential for the production of undesirable compounds. Aerobic spoilage during storage is often responsible for the majority of total DM lost in forages conserved as silage. This [loss] may be as high as 30-40%! Even short term exposure to air results in losses. For example, DM losses from corn silage exposed to air for just one-to-two days was measured to be as high as 6% (Ranjot & Kung, 2000). Besides an economic loss of nutrients, feeding spoiled silage to ruminants also depresses nutrient intake and decreases production (Hoffman and Ocker, 1997; Whitlock et al., 2000). Preventing silage from spoiling when it is exposed to air can improve the efficiency of a farm by preserving forage as high quality silage that is also palatable to cows.

Aerobic stability is a term that nutritionists use to define the length of time that silage remains cool and does not spoil after it is exposed to air. When fermentation is completed, and silage is exposed to air during feedout or during storage (e.g. leaky silos, holes in silage bags, poorly packed silage), heating in the storage unit and/or feed bunk is initiated by yeasts (and to a lesser extent sometimes by bacteria). Yeasts that degrade lactic acid in the presence of air are a primary cause of silage spoilage.

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When animals consume spoiled silages, the exact causes of reduced intake and/or performance are not fully understood. Nevertheless, feedback from the field suggests that producers often have problems when the numbers of yeasts are more than 10^6 (1,000,000/g of silage). Under optimum conditions, yeasts can double in number in about two hours! For example, if a sample of corn silage starts with 100,000 yeast/gram, which is quite normal, this same silage could contain 1,600,600 yeasts/gram in eight (8) hours. It is quite evident that silage can spoil very rapidly when exposed to air and warm conditions. Detrimental yeasts may produce end products that might alter rumen fermentation – and the consumption of spoiled silage may impact essential nutrients that can reduce performance. At the same time, the production of undesirable end products (e.g. mycotoxins) from further spoiled silage by molds and other organisms may also be a problem. Effects on immune function may also occur in this process.

Because silages are often incorporated into TMR rations, the stability of the TMR may also be an issue on many farms. In a survey conducted in the northeast over a two-year period, more than 50% of TMRs that were sampled within one hour of being made spoiled within 12 hours (Kung, Mulrooney, Morges – unpublished, U of DE). These same rations would have spoiled much faster, had the ambient temperature been typical of an average summer day (80°-90° F). It is likely that the silages used in making these rations had already undergone some degree of aerobic exposure and spoilage prior to being mixed in the TMR. This underscores the importance of working to improve aerobic stability of silages from the get-go.

The keys to quality silage are: 1) rapidly exclude air from the forage mass; 2) promote rapid production of lactic acid and reduction of silage pH; and 3) prevent the penetration of air into the silage mass during storage.

(Edited from an article by Limin Kung, University of Delaware. Copies available from the Renaissance Agronomy and Marketing Offices.)

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