NEW TWISTS TO BUTYRIC ACID IN HAYLAGES AND PREVENTION

Preventing clostridial growth and the production of deleterious fermentation byproducts such as butyric acid, iso-butyric acid, amines, ammonia etc. is critical to insure high quality haylage crops. Until only recently it seemed that we knew how to prevent the prevention of butyric acid production in haylages. The first key to preventing clostridial fementation and or the production of butyric acid and amines was proper dry matter. Wilting small grain silages and haylages to moisture levels of 65% or less, i.e minimum dry matter of 35% or greater supposedly assured clostridial fermentations would be prevented and hence so would butyric acid and other undesirable by-products. Preventing contamination of haylage crops with excessive soil (and manure) has also been considered critical to preventing clostridia. “Ash” poses several challenges. First it is a source of undesirable micro-organisms. Second, the ash itself is a buffer, requiring more acid produced in order to reach the same terminal pH. Other key practices to preventing clostridia and butyric acid production would include filling and packing haylage crops as fast as possible to prevent prolonged plant respiration from depleting the necesaary sugars to fuel an adquate fermentation.

Even when producers use best management practices, there is a preponderance of research documenting the benefit of using both bacterial inoculants and or combinations of bacteria and enzymes to help improve the fermentation of haylages and lessen the risk of clostridial fermentation.

Recently however we see more and more instances of low to moderate levels of butyric acid and other evidence of clostridial fermentations even in relatively dry haylages (over 35% dry matter) that are low in ash (10-12%) that were harvested correctly, packed well and sealed well and even inoculated. Why? There have been several hyposthesis including the heavy use of manure, manure water or nitrogen fertilizer on cereal grain silages. Could there be other factors though that producers might address to help reduce the risk and severity of clostridial growth in their haylage crops?

Several recent research trials have shown that clostridial spore count can actually increase in silage between ensiling and feedout. Theoretically this is impossible since clostridia should not grow in silage which is below a pH of 5. This is of particular interest since there are repeated observations in ID and WA where haylages fermented extremely well to low pHs (4.7 or lower) initially, yet at feedout significant levels of butyric acid was detected. It has always been assumed that pHs below 5 would inhibit clostridial growth. There is more and more evidence is showing that there may be clostridial growth post fermentation in well fermented silages.

First, there is eveidence that certain strains of clostridia at least are able to grow aerobically under the proper conditions. Perhaps these low levels of butyric acids are the result of aerobic spoilage post fermentation ? This may or may be be the source of the butyric acid we find at feedout after the silage has been exposed to air. There is a second scenario proposed which might be more likely. That scenario is that post fermentationm there is exposure of the haylage to oxygen before or during feedout. As a result, there is a proliferation of yeast. These yeast consume lactic acid while also depleting the oxygen within the haylage. As a result, the pH of the haylage rises and an anaerobic condition is re-established. Now, we have the perfect conditions for clostridia

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First, anaerobic conditions are favorable to clostridia. Second, the lack of available sugar for bacteria that would be more desirable and typically compete with the clostridia prevent competition from desirable lactic acid bacteria. Third, the higher temperatures of haylages ensiled during temperatures favor the clostridia growth even more. We want to remember that high temperatures in silage crops do help improve the rate of lactic acid bacterial growth, but, they also favor the growth of clostridia. Studies have shown that when all other conditions are the same, ensiling feed under the exact same conditions result in no clostridial growth at 65 degrees but significant butyric acid production when ensiled at 85 degrees.

What should or can producers do to help prevent clostridial growth and butyric acid given all we know now?

1) Ensile haylage crops as dry as possible. Consider raising the minimum dry matter standard to above 35% dry matter.
2) Given the higher dry matter target, consider shortening length of cut to a maximum of 3/8 of an inch. Some producers are shortening LOC to ¼ in order to obtain a better pack and to also prevent additional heating during fermentation.
3) Raise cutter bar height, use flat knives that do not draw up soil and ash, avoid excessively hard raking or activities which increase dust and add ash.
4) Use dust control agents or even water down areas around silos during filing to prevent contamination of silage at the silage pit or pile. Practice as good of silage hygiene at filling as possible, avoiding driving needlessly from soil and manure areas to on top of the silage while packing.
5) Fill silos rapidly and pack well.
6) Cover and seal as soon as possible and maintain anaerobic conditions.
7) At feedout, minimize exposure to air by using tools such as facers or rakes, always shave the face sideways vs digging out the silage, if shaving is impossible make certain feeders work the face down and never lift the silage at removal.

Silage additives do have a role in limiting clostridia in haylage crops. Producers should always use at least a good, lactic acid bacteria applied via liquid at the chopper so as to supply 100,000 cfus of labs per gram of ensiled material. The inoculant should also contain enzymes to help increase sugars for fermentation.

Given the new implications of aerobic spoilage in allowing clostridial growth post ensiling producer may want to consider using newer combination inoculants from companies such as Pioneer, Lallemand and EOS Ag Products all which combine the benefits of labs plus bacteria proven to improve aerobic stability, proven to reduce the possibility of increased clostridial spore count during fermentation and also proven to prevent yeast interactions which might allow clostridial growth post fermentation. As producers continue to go to drier haylages these combination inoculants have an increased value and will become more and more valuable.

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