AVOID STINKY SILAGE! CURTAIL CLOSTRIDIA

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The effect of bacteria of the genus Clostridium in the spoilage of silage is well documented. Typically, silages that undergo clostridial fermentation stink. Specifically, the type of Clostridium spp. that cause problems during ensiling include C. tyrobutyricum y butyricum (lactate fermenter) and C. sporogenes (carbohydrate and protein fermenter) and their activity diminishes the feeding value of the silage. Clostridium is found naturally in the soil and during mechanical harvest and chopping forages get contaminated. Clostridium grows in the silage while oxygen is absent (anaerobic) and forms endospores. The main signs that a clostridial infection took place during ensiling (besides the stench) are high levels of butyrate, acetate and ammonia (N-NH3) and a decrease in the level of lactate. These bacteria prefer a relatively high pH (>4.5) and wet conditions (<30% dry matter (DM), Figure 1). Clostridium converts lactic acid into acetic acid and there is a corresponding increase in the silage pH, thus allowing aerobic bacteria to continue spoiling the silage.

Animal Health and Performance

For these reasons, we may expect a reduction in dry matter intake (DMI) and performance of the ruminant animal. The butyric acid content of silages that underwent clostridial fermentation needs to be considered when balancing a ration because it may cause health problems in the animal. Butyric acid will be converted to ß-hydroxybutyrate in the rumen, which is one of the ketone bodies. We know that if a ruminant animal consumes enough butyric acid (50-100 g/head/d) ketosis of dietary origin may be induced. The butyric acid content in top quality silages is less than 0.1% DM. The content of butyric acid in silages infected with Clostridium ranges from 2.5% to 8% of the DM. If we assume that a silage with clostridial infection has a butyric acid content of only 2.5%, then it is easy to visualize how the consumption of 5 kg of silage DM contributes 125 g of butyric acid, which may be enough to increase health problems and reduce animal performance.

Soluble Protein

Silages that underwent clostridial fermentation are characterized as having soluble protein levels higher than 55% (measured in the lab as N-NH3). High levels of soluble protein in the diet, which were not properly balanced, may cause a decrease in reproductive performance by lowering the conception rate or an increase in embryonic death. Furthermore, silages infected with Clostridium contain high levels of aminated compounds (putrescine, cadaverine, histamines, etc.) due to amino acid breakdown. These aminated compounds and the butyric acid are the ones responsible for the stench of the silage. In addition, they are toxic to ruminal bacteria and may contribute to the reduction in DMI.

Prevention

How may we prevent clostridial infections?
1. Make sure to minimize forage contamination with soil during harvest and chopping.
2. Ensure that the forage to be ensiled contains the proper moisture level. When ensiling grasses such as rye grass, the DM content must be in the range of 32-37%.
3. Proper packing will help as well. Packing needs to have a density >16 lbs/ft3.
4. The use of inoculants, such as Biomax® MP or Biomax® 5, are the best allies in the prevention of stinky silage due to Clostridium infection. Lactic acid producing bacteria (LAB) are usually much quicker to establish themselves than Clostridium.

Using Inoculants

The use of Biomax® products will increase lactic acid production followed by a rapid decline in silage pH (Figure 2). This will inhibit the development of Clostridium bacteria that produce butyric acid, as shown in Figure 4. Figure 5 shows the critical pH needed to stop the development of Clostridium bacteria according to the DM level of the ensiled material. For corn and grass silage with a DM content of 30% the pH must be under 4.4 to inhibit the development of Clostridium. For legumes, such as alfalfa, the critical pH must be below 4.7. Silage inoculated with Biomax® products will heat up less (Figure 6) and will preserve higher levels of true protein. The use of homo-fermentative inoculants, such as Biomax® 5 or Biomax® MP, will help insure that there will be a lower production of acetic acid, butyric acid and ethanol therefore improving silage DM recovery.
Inoculating with Biomax® 5 or Biomax® MP improves the nutritional value of silage and animal performance.