Effects of Bacterial Inoculation on Silage

Introduction

Forage makes up 40-60% of the diet of the high producing dairy cow. Producing high quality forage translates into improved animal performance and more returns to management. With today's producer facing tighter profit margins, high quality forages are required to be harvested and fed to maximize farm profits. Part of efficient and economical forage preservation includes the use of silage additives.

The use of silage additives, as an aid in preserving forge, has become a widely adopted practice. Recent surveys estimate 70% of U.S. dairy farmers utilize some type of silage additive. Microbial additives are a significant portion of the silage additives used.

The Ensiling Process

The crop entering a silo continues to respire using oxygen and sugars to produce carbon dioxide, heat, and water. Since this process results in the loss of valuable sugars, dry matter and energy, it is desirable to keep this respiration to a minimum. This can be achieved by rapid silo filling, proper silage compaction, and efficient sealing of the silo to eliminate oxygen as rapidly as possible. Once airtight conditions are achieved, bacteria begin to ferment plant sugars. Typically, the first bacterial population to become established are air-loving bacteria. These organisms produce a mixture of end products, including acetic and lactic acid, and result in a decline in silage pH. As pH continues to decline, the more acid tolerant bacteria begin to proliferate producing lactic acid as the major end product. This results in a rapid decrease in silage pH. In an efficient fermentation the majority of plant sugars are fermented to lactic acid resulting in the maximum preservation of silage energy and dry matter.

Bacterial Inoculants

Silage bacterial inoculants are dried or inactive bacteria which when added to water or forage become active. Most contain cultures of Lactobacillus, Pediococcus, or Streptococcus that are primarily lactic acid producing. By increasing the lactic acid content of silage a faster and more efficient fermentation results, decreasing nutrient loss and producing silage with a higher feeding quality. To achieve this, the inoculant must provide an adequate number of bacteria that have a fast growth rate. Numbers of lactic acid producing bacteria on standing grasses, cereals, and legumes are typically low. In addition to adequate numbers of bacteria, the inoculant must have an adequate amount of sugar for fermentation to acid. Alfalfa, with its high buffering capacity (resistance to pH drop) and low concentration of sugars, is typically considered more difficult to ensile compared to other forages. Bacterial inoculants can provide viable lactic acid bacteria to improve the silage fermentation, silage quality and ultimately animal performance.

Research has shown that an effective inoculant results in greater numbers of favorable bacteria, more lactic acid production and faster pH drops, less protein breakdown and less energy lost. Animal responses include improved dry matter intakes, milk production and body weight gains, translating into improved profitability for the producer.

Inoculant Selection

All inoculants are not equal. Some suggestions in selecting a silage inoculant include:

1. Purchase a product with guaranteed viability.
2. Ask supplier for university research to back up inoculant claims.
3. Purchase products containing predominantly lactic acid bacteria (Lactobacillus plantarum, Streptococcus, or Pediococcus).
4. Apply products to supply at least 100,000 bacteria/g forage.
5. Apply inoculant as uniformly as possible throughout the forage.
6. Use a spraying system properly designed for inoculants.

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