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INOCULANTS IN ENSILED FORAGES

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Ensiled forages provide excellent feed and are a staple in dairy cow rations. It is essential to properly harvest and store the forages, since rations will be impacted by the quality of silage for the duration of their feed out. One way to promote improved ensiling and feed out is through inoculants. Silage inoculants are commonly used at forage harvest to enhance the ensiling process or to improve stability of the forage at feed out.

There are five types of fermentation that occur during ensiling depending upon the quality of the forage entering the bunker or bag: homolactic, heterolactic (glucose), heterolactic (fructose), yeast and *Clostridia*. Homolactic fermentation utilizes glucose from the forage, resulting in one end product: lactic acid. This differs from heterolactic fermentation which results in multiple end-products from the fermentation of sugars from the forage including: lactic acid, ethanol and carbon dioxide from glucose fermentation and lactic acid, acetic acid, mannitol and carbon dioxide in fructose fermentation. Yeast and *Clostridia* are the least desirable types of fermentation, since lactic acid is not an end-product. The silage produced has a higher pH and greater chance of continued fermentation.

Lactic acid is the preferred end-product. It decreases the pH of the silage and prevents further fermentation of the carbohydrates and breakdown of protein in the forage, which results in lower quality silage at feed out. The type of fermentation that has taken place may be evaluated by a simple smell test. Properly ensiled forage, through homolactic fermentation, has little to no smell; whereas heterolactic fermentation has a slight vinegar smell due to the production of

acetic acid. Forages that have undergone fermentation by yeast have an alcohol smell and *Clostridial* fermentation produces a rancid butter or baby vomit smell.

Silages fermented properly, with sufficient levels of lactic acid, remain stable for many months. However, when feed out begins, exposure of surfaces to oxygen restarts the fermentation process. Most inoculants utilize bacteria that produce lactic acid to ensure sufficient drop in pH once fermentation is complete to preserve the forage. The forage must also be covered to exclude oxygen from the bunker or bag. This ensures that proper fermentation occurs and a stable feed product is produced. Research has shown that combining heterolactic and homolactic fermentation provides a balance of quickly lowering silage pH through the homolactic bacteria and increasing forage stability at feed out through inclusion of heterolactic bacteria.

While inoculants may provide benefits to prevent forage storage loss, the following points must be heeded to provide the greatest opportunity for positive results:

- Check that the inoculant is labeled for use with the forage being ensiled.
- Mix with cool water, as warmer water temperatures may decrease inoculant efficacy.
- Test water quality for potential negative impacts on inoculant efficacy (ex:chlorinated water kills bacteria).
- Ask salesperson to provide independent research results demonstrating that the product works.
- Apply at a rate of at least 100,000 cfu/g of wet forage for lactic acid bacteria.
- Apply at chopper for greater surface area contact and better dispersion in the silage.
- Remember, inoculants are an aid, not a replacement for good management.

Although inoculants provide benefits such as improved fermentation and greater stability at feed out, there is no substitute for good management. Harvest silage at the proper moisture level and maturity, insure sufficient compaction at storage and exclude oxygen during storage. With proper management, an inoculant provides insurance in case an unexpected event occurs. While inoculants may be beneficial in less than optimal silage preservation conditions, they cannot guarantee a perfect and complete fix.

Be selective in deciding whether inoculants fit into each individual management scheme. Choose which inoculant is the best option, because the most expensive may not be the most effective. On the other hand, the least expensive option may not provide sufficient bacteria to properly assist with fermentation. Work with a nutritionist to determine the need for an inoculant or type of inoculant that best fits the demands. Improving the overall management of silage pays dividends by reducing feed loss and improving quality, which may then be quantified by improvements in cow health and production.