Alfalfa Baleage/Silage Preservatives: Do they Work? Are they Economical

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There are many variables with silage production including - type of silage operation (silo, bunk, tube, or wrapped bale), weather, packing or bale density, speed of covering. Therefore, no two silage crops are ever the same, which is why researchers are reluctant to give blanket statements regarding when and how to use silage inoculants. There has been a lot of good research though in recent years about the effect of silage inoculants under various management and conditions. What follows is an overview of this research and some general recommendations. Much of this overview was taken from a very good fact sheet written by Richard Muck from the USDA-ARS Dairy Forage Research Center in Wisconsin. I have listed how to download this and related publications in the reference section.

I will begin with an over how the silage inoculants work and the different types of inoculants. In short, silage inoculants work by shifting silage fermentation in a direction that better preserves the crop. That happens when the lactic acid bacteria in the inoculants overwhelm the natural lactic acid bacteria on the crop.

Two types: homofermenters and heterofermenters

There are now two main types of silage inoculants: the traditional homofermentative types, such as *Lactobacillus plantarum*, the *Pediococcus* species, and *Enterococcus faecium*; and the more recently used heterofermentative bacteria, *Lactobacillus buchneri*. A third type of inoculum combines both. combining homofermenters with *L. buchneri*, is beginning to be marketed. Homofermenters get their name because they turn 6-carbon sugar molecules into one product – **lactic acid**. Heterofermenters produce multiple products. I will mainly discuss the traditional homofermentative types since they make the most sense for alfalfa. With alfalfa the goal is to preserve crop quality as close as possible to that of the crop at ensiling, and the lactic acid bacteria produce a strong acid so they give the best chance for this to occur. One comment though, while lactic acid preserves the crop well, it is not as stable once

silage tube is opened or a plastic wrapped bale is unwrapped, therefore with alfalfa keep exposure time limited except in cold weather.

Studies with homofermenters

A review by Kung (1997) of a series of studies showed using homofermentative inoculants reduced pH on average, but not all of the time; and it lowered the pH more often in hay crops versus whole grain silages. The percentage of studies in which the pH dropped was: alfalfa silage, 58 percent; grass silage, 63 percent; corn silage, 43 percent; and small grain silage, 31 percent. In terms of dry matter recovery, it was improved in 38 percent of the trials. In the trials that showed an improvement in dry matter recovery, it improved by an average of 6 percent. When all trials were averaged, the improvement in dry matter recovery was 2-3 percent. Dry matter recovery simply means that the silage maintained it prewrapping weight during ensiling. Under poor ensiling conditions the forage is degraded and carbon dioxide is released.

The most important aspect of silage is whether there is an improvement in animal performance. In the studies that Kung reviewed 27 percent of trials showed an improvement in feed intake; 52 percent showed an improvement in weight gain; and 46 percent showed an improvement in milk production. In the trials that showed improvement, the increases in feed intake, weight gain, and milk production were typically in the range of 3 to 5 percent. Improvement in silage “shelf life” and stability were generally positive in hay crop silages and negative in corn and small grain silages.

Harvest conditions when inoculants work the best

While some forage producers use inoculants nearly all of the time – an insurance policy, others strive to use it when they suspect it will be most useful – an educated guess. In the studies outlined earlier in this article, inoculants were used no matter what the harvest condition, so results could be lower than if a forage producer used the ‘educated guess’ approach of when to use inoculants. Research points to the following conditions when positive outcomes are more likely to occur when homofermentative inoculants are used:

- In hay crop silage–wilting times 1 day or less;
- First-cut and fall-cut silage (lower wilting temperatures)

Wet or dry inoculants?

Are wet inoculants or dry inoculants the best? There appears to be no research that has specifically studied this issue. However, there is some anecdotal and common sense advice. Any inoculant works only if the bacteria are alive when they’re put on the

crop! Consequently, store them properly – generally in a cool and dry place. This is easier with inoculants applied wet because the packages are small and can be kept in a refrigerator until you need them. With the wet products, don't use chlorinated water to dilute inoculants unless the chlorine level is less than 1 ppm or unless the inoculant contains chemicals to take care of the chlorine. Chlorine can't discriminate between the bad bacteria it is meant to kill and the good lactic acid bacteria in your inoculant. Also remember that these bacteria cannot move around on their own; they depend on the forage producer to spread them uniformly across the crop. This is often easier with the wet products that can be sprayed onto the crop at the chopper. So you should choose a wet or dry product based on how well you can keep the product alive both before and while applying, and how well you can get it mixed with the crop.

Summary

Standard homofermentative inoculants (lactic acid producing inoculants are the best route to improve DM recovery and animal performance. They're a good fit for hay crop silages. There are no good economic studies to prove that prove cost effectiveness conclusively, but most researchers agree under the conditions listed above they are useful. Remember though that the most important thing is proper silage management, especially in a crop like alfalfa. Harvest at the correct stage of maturity, chop or bale at the right moisture, pack tightly or bale tightly, cover the silage or wrap the bales within as soon as possible.

Muck, Richard. Silage inoculants: What the research tells us about when and how to use them. US Forage Research Center Fact Sheet.
http://www.uwex.edu/ces/crops/uwforage/SI_silage-inoculents.pdf

Muck, R.E. 1996. Silage inoculation. Informational Conference With Dairy & Forage Industries. pp. 43-51.

Kung, Limin. A review on silage additives and enzymes.
http://ag.udel.edu/anfs/faculty/kung/articles/a_review_on_silage_additives_and.htm

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