Do FAE-Producing Microbial Inoculants Improve Fermentation and Improve Digestibility of Stored Alfalfa Forage?

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RATIONALE & OBJECTIVES

- New silage inoculants contain a bacterial strain that produces ferulic acid esterase (FAE) which may aid the break down of lignin, which could increase the digestibility of alfalfa silage.
- The objective of this study was to evaluate the effects of applying an FAE-enhanced microbial inoculant compared to a conventional inoculant on alfalfa or alfalfa-bermudagrass silage.
- Mini-silos of forage were prepared in 2018 from two cuttings of alfalfa and alfalfa-bermudagrass in Georgia comparing an FAE inoculant to an equivalent inoculant without FAE capacity, along with an uninoculated control.

STUDY DESCRIPTION

Experimental units:

Miniature silos made from PVC pipe.

Locations:

Pure stand alfalfa (ALF) in Tifton, GA; an alfalfa-bermudagrass (ABG) mixture in Watkinsville, GA.

Factors:

Two cuttings: Early June and Early August.

Three inoculant treatments: 1) Pioneer 11G22, a conventional non-FAE-producing microbial inoculant (MI), 2) the FAE-producing microbial inoculants (MI+FAE) of Pioneer 11AFT for the ALF trial or Pioneer 11GFT for the ABG trial, or 3) a mist of deionized water as a control (CON).

Analysis:

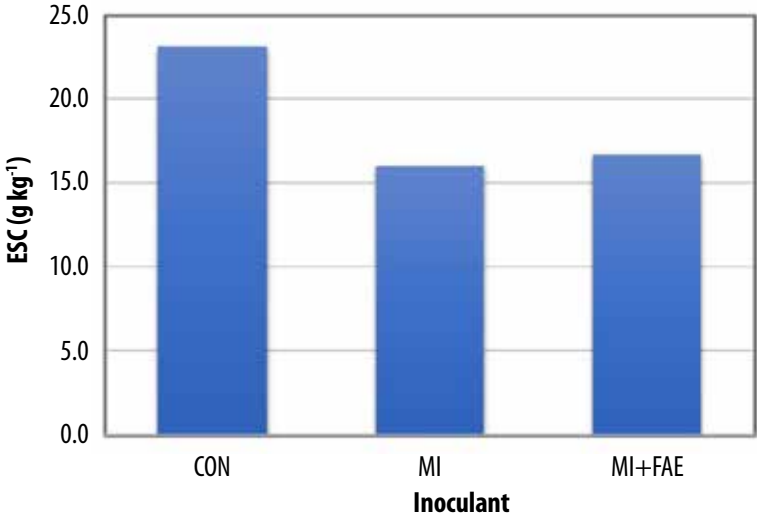
After 60-days of ensiling, silage samples were analyzed for fermentation profiles, forage quality, dry matter digestibility, and the profile of fatty acids released in simulated digestion in a rumen.

RESULTS

Nutritive Value

- Forage quality was different between the two harvests, but the MI and MI+FAE did not have any significant effect in either forage type.
- Both inoculants decreased ethanol soluble carbohydrates (ESC) in the ABG mixture relative to the control, indicating they may have undergone a more extensive degree of fermentation than the untreated control (**Figure 1**). No such differences were observed in the ALF silage.

Figure 1. In the ABG mixture, the addition of either the MI or MI+FAE inoculant lowered ESC in the resulting silage. However, there was no difference between the inoculants. No difference was observed in the ALF silage.



Fermentation Characteristics

- The pH and total volatile fatty acid (VFA) levels in both forage types were not affected by inoculant treatment (**Figures 2 and 3**, respectively).
- Though the concentration of acetic acid (**Figure 4**) and other specific VFAs were influenced by the addition of an inoculant (either the MI or MI+FAE), there were no differences detected between them in regards to their fermentation profiles.

Figure 2. Inoculant treatment did not affect silage pH in either the ALF or ABG silages.

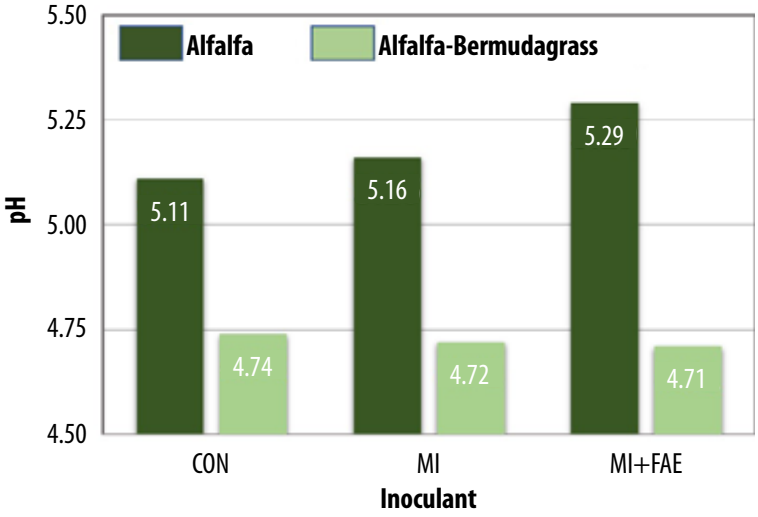


Figure 3. Inoculant treatment did not affect the total amount of VFA produced in either the ALF or ABG silages.

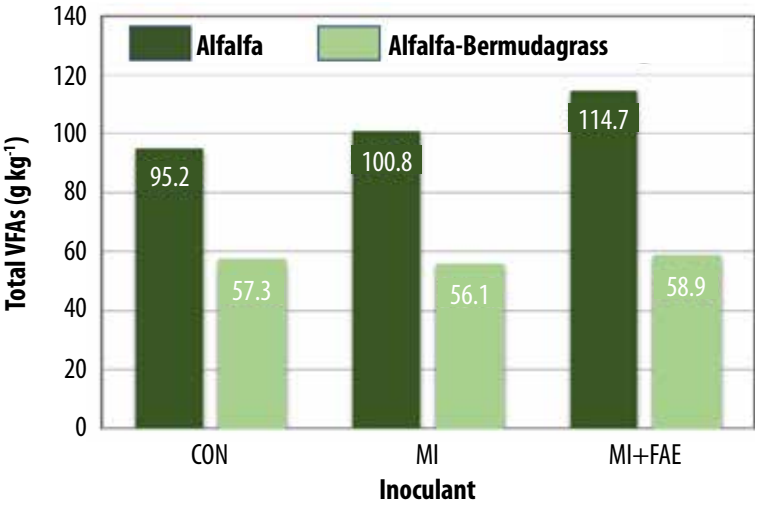
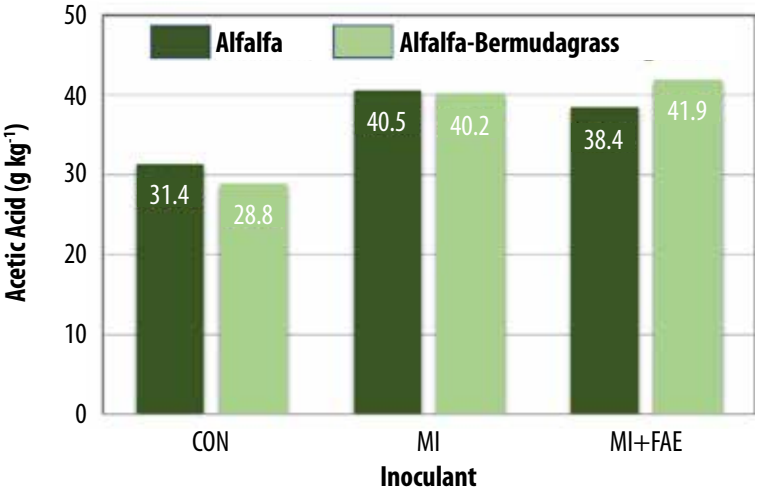


Figure 4. Addition of either the MI or MI+FAE inoculant increased acetic acid content in both the ALF or ABG silages. However, there was no difference between the inoculants.



Digestibility and Impacts on Simulated Rumination

- Inoculant treatment did not affect IVDMD$_{48hr}$ or NDFD.
- Additionally, there were no differences between the inoculant treatments in terms of ruminal pH, total VFA, production of individual VFAs, the acetate:propionate ratio, ammonia production, or gas production.

CONCLUSIONS/SUGGESTIONS

- Microbial inoculants to improve fermentation and protect forage nutritive value have value, but the FAE-producing inoculants did not perform better than the comparable non-FAE producing microbial inoculants in this study.
- Based on our results, the FAE-producing inoculant appears unlikely to improve fermentation, nutritive value, or forage digestibility relative to a similar microbial inoculant product without the capacity for FAE production.
- Additional unbiased and independent trials are needed to examine the potential for FAE-producing inoculants before they should be recommended and used, but it appears that they at least do no harm to silage fermentation and nutritive value.

Alfalfa
U.S. Alfalfa Farmer Research Initiative

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