

2018 USAFRI Research Project Objectives

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

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Project Award: \$13,173

Justification:

- Our team proposes research to evaluate the impact of microbial inoculant treatments for alfalfa and alfalfa-grass mixtures on storage fermentation characteristics, nutritive value, and digestibility. Alfalfa is one of the most widely grown crops in the United States, contributing over 44 million tons from 11.8 million acres in 2017. It is widely used in foragebased livestock production because of its high forage quality. Alfalfa hay is characterized by 61 to 65% total digestible nutrients (TDN) and 15 to 18% crude protein (CP). Although alfalfa hay and haylage is a great base for rations because of its high forage quality and lowered supplementation needs, the use of alfalfa can be challenging in southeastern agriculture.

The humid southeastern US is characterized by unpredictable summer storms during the peak forage growing season, often making hay production a challenge for producers. Advancements in equipment and lowered costs have led to an increased interest in the use of silage or baleage as a forage preservation method. This practice allows for harvesting forage more independently of weather conditions because higher moisture at baleage reduces drying time while preserving forage quality.

A key component to the production of high quality alfalfa silage is a high level of bacterial fermentation. Like many legumes, alfalfa has naturally lower levels of carbohydrates when compared with other crops commonly used for silage (i.e. corn) which may inhibit fermentation if alfalfa is not managed properly. Microbial inoculants have traditionally been used to improve silage fermentation, decrease dry matter losses, and improve the stability of ensiled forage. Evidence suggests that using microbial inoculants may increase the stable storage time before feeding, further reducing losses.

Manufacturers claim that microbial inoculants inhibit mold growth and improve aerobic stability using a common probiotic, *Lactobacillus plantarum*, to produce organic acids (e.g. lactic, acetic, and propionic acids) that minimize fungal growth within the bale, despite little scientific literature to support these claims. Recently, however, there is promising research into new microbial products that contain bacterial strains that produce a fibrolytic enzyme, ferulic acid esterase. This enzyme is used to break down lignin and research suggests that the new product enhances microbial preservation of forage and improved animal performance (e.g. gains) in sheep.

The efficacy of commercially available microbial inoculants is key to the sustainability of alfalfa in the southeast, contributing to each of the four pillars of sustainability: environmental, economic, cultural and social. The development and use of effective microbial inoculant options can decrease the amount of forage lost to spoilage due to poor fermentation, thereby improving harvest efficiency and reducing forage waste and post-harvest storage losses. If spoilage can be reduced through microbial inoculants, baleage production has the potential to become a much more profitable system.

If ferulic-acid esterase (FAE) producing bacteria can decrease the amount of lignin and neutral detergent fiber and increase the digestibility of the forage in the animal rations. Improving the digestibility of the forage by treatment with FAE-producing can ultimately reduce the amount of animal waste associated with feeding and animal supplementation. Reductions in animal waste

can help to improve the environmental sustainability of the forage production and animal feeding operations. Further, improving the digestibility of already high-quality alfalfa forage can decrease the need for grain supplementation in cattle feeding operations.

Finally, improving the harvest efficiency and forage quality associated with the production of alfalfa baleage or silage by treatment can increase the value of alfalfa, which could lead to an increase in acres planted in grass-legume mixtures. An increase in acreage planted in legume crops decreases the amount of nitrogen supplementation needed, which reduces the amount of synthetic nitrogen fertilizer, diesel fuel, and number of passes over the field. Therefore, we hypothesize that treating alfalfa silage with a microbial silage inoculant producing FAE may improve fermentation characteristics, reduce mold, and improve digestibility and nutritive value of stored alfalfa forage.

Objectives:

- The objectives of this project are to 1) Determine the impact of treatment with an FAE-enhanced microbial inoculant on silage fermentation characteristics, nutritive value, and dry matter digestibility when produced from either: a) a pure-stand alfalfa, or b) an alfalfa-bermudagrass mixture at different harvest times throughout the growing season.