

## 2021 USAFRI Research Project Objectives

### Identification of Rhizobium Inoculants Tailored for Performance with New Alfalfa Varieties and Diverse Soil Types North Dakota State University - Geddes

Project Award: \$74,325

#### Justification:

- Alfalfa plants form root organs called nodules to house rhizobia which transform inert nitrogen from the atmosphere into useable forms for the plant. This ability is key to the sustainability and yield of alfalfa crops, often used in farmer's rotations to fortify the soil with sustainable nitrogen and improve soil health. Rhizobium inoculants are applied to alfalfa seeds to ensure they take advantage of this relationship. The best inoculants maximize the amount of nitrogen that is provided to their legume partner, a trait called effectiveness. But rhizobia in nature vary substantially in their ability to do this. Different crop varieties can respond very differently to different strains of rhizobia. Therefore as new varieties are developed it is important to identify a well matched rhizobium partner that will maximize yield under nitrogen-replete conditions. Another important issue faced when using legumes in agriculture is their nodulation by natural strains that are more competitive than inoculant strains but are less effective symbiotic partners resulting in suboptimal yields. This results from a better predisposition of natural strains to thrive in their native soil environments. This phenomenon has been dubbed "the rhizobium competition problem"<sup>1</sup>. Despite these problems, most inoculant products for farmers tend to consist of a single strain expected to perform with diverse varieties and in radically different soil-types and environmental conditions.
- In this project, we aim to employ new methodology to allow rapid assessment of elite rhizobium inoculant strains tailored for performance with new alfalfa varieties and diverse soils across the state of North Dakota. We will do this with the following objectives: 1) Assess the state of the rhizobium competition problem in alfalfa by sampling diverse alfalfa crops from across the state. 2) Establish a library of rhizobia for identification of elite strains. 3) Use a new high-throughput approach to identify elite rhizobium partners for new alfalfa varieties and different soil types. This project could result in new rhizobium inoculants that maximize alfalfa yield by optimizing symbiotic nitrogen fixation.

#### Objectives:

- The objectives of this project are to 1) assess the state of the rhizobium competition problem in alfalfa by sampling diverse alfalfa crops from across the state; 2) establish a library of rhizobia for identification of elite strains; and 3) use a novel "Pasmid-ID" approach to identify elite rhizobium partners for new alfalfa varieties and different soil types.