

2021 USAFRI Research Project Objectives

Improving the Feed Value of Alfalfa with an Improve Method to Measure Fiber Digestibility University of California-Davis - Hackmann

Project Award: \$52,717

Justification:

- Alfalfa is a key ingredient in rations of many livestock, yet its feed value is notoriously hard to predict. One reason is digestibility of neutral detergent fiber (NDF), the largest nutritive component, varies widely. The potential digestibility of NDF varies by >35% across varieties, maturities, and cuttings. Compounding this problem, measurement of digestibility itself is difficult to carry out. Digestibility is often measured by incubating sample in rumen fluid in vitro, but microbes in rumen fluid differ across cows, diet, and time. Within one lab, NDF digestibility of the same sample can differ by >5% from one measurement to the next. Variability can persist even after using control samples or treated (pre-incubated) rumen fluid. Across labs, digestibility can vary by >15%, even when using similar measurement methods. To reduce this variability, we need a better method to measure NDF digestibility.
- Our long-term goal is to improve feed value of alfalfa by providing farmers with better tools to predict its digestibility. Our hypothesis is we can more consistently measure digestibility by replacing rumen fluid with pure cultures of bacteria. Rumen fluid contains a complex mixture of microbes that constantly changes. By contrast, pure cultures contain just single species and are stable. Another benefit of pure cultures is that any lab can purchase them - they are available from vendors around the world - making measurements easy to reproduce across labs.
- Previous studies show the promise of measuring digestibility with pure cultures. Namely, two different studies showed that pure cultures can digest NDF in alfalfa, and at times digestibility equaled or exceeded that with rumen fluid. Though useful for proof of concept, these studies were narrow in scope, using just one variety of alfalfa and cow for rumen fluid. To bring the idea of using pure cultures to reality, we will benchmark digestibility measurements against rumen fluid more exhaustively (with more alfalfa samples and sources of rumen fluid). We will find and then prescribe conditions for measuring digestibility with pure cultures that can be used by labs across the world. One large commercial lab (Cumberland Valley Analytical Services) has already expressed interest and is collaborating with us in our work.
- The expected outcome of this project is a more precise laboratory method for measuring digestibility of alfalfa. The potential impacts will be several. Most immediately, we expect the project to improve prediction and consistency of the feed value of alfalfa. Current predictions of feed value (e.g., RFV) are unreliable, blindfolding farmers to the real quality of their products. With measurements of digestibility from our project, farmers will be able to better predict feed value and deliver a more consistent product to the buyer. Long term, we expect the project to lead to outright improvement in feed value. Digestibility (or reduced lignin) is already a target of genetic selection. With measurements of digestibility from our project, such selection can be done more precisely, improving feed value.

Objectives:

- The objectives of this project are to 1) measuring NDF digestibility of 10 hays with pure cultures and 2 different sources of rumen fluid; and 2) adjusting measurement conditions until pure cultures give precise and accurate digestibility values.