2017 USAFRI Research Project Objectives

The Impact of Tedding on the Economic Production of Alfalfa Silage
University of Wisconsin - Digman

Project Award: $20,869

Justification:

- Although the mechanization of alfalfa silage production is relatively mature, new management strategies have been adopted recently to improve forage quality. One such strategy employs placing cut crop in a wide-swath to hasten field curing (Digman et. al, 2011). Rapid drying improves silage quality by reducing losses from plant processes that continue after cutting and risk of crop loss due to weather. Wide-swaths had not been historically utilized by producers as the process introduces a raking or merging field operation. However, wide-swaths have become more common and acceptable as the merging step also increases the productivity of modern, larger forage harvesters.

  Unfortunately, producers have not been able to take full advantage of drying alfalfa in wide swaths because their mowers are unable to lay the crop down over the entire cutting width. The ratio of the cutting to swath width is termed the cut-to-swath-width-ratio (CSR). A typical example is a 16-ft mower that produces an 8-ft swath. This configuration yields a 50% cut to swath ratio. As a result, only 50% of the potential sun's energy (solar insolation) is utilized to dry the crop. In fact, the mowers that can achieve the best CSR are the machines that have the smallest cutting width typically found in older machines and modular, mounted mowers (e.g., triple-mowers). These machines can improve the solar capture to about 70% in which case 30% of the drying energy has yet to be captured.

  Some producers have recognized this deficiency and have adopted tedding to capture that last 30%; however, this comes at the expense of an additional field operation and potential for field losses associated with spreading the crop out (Shinners, 2016). While tedding is popular in production of grass hay, the losses associated with alfalfa hay have been observed to be substantially higher (Savoie, 1988). These losses and the need for additional field operations have led researchers to conclude that tedding is cost-prohibitive in the production of alfalfa hay (Rotz, 1994). However, losses observed are substantially lower if tedding and raking is performed in wetter hay such as in the production of silage.

  This research seeks to answer the question of the utility of tedding in the production of alfalfa silage. The past work to-date has not considered tedding for production of silage where the wetter crop should be less susceptible to loss. Further, the adoption of wide-swath drying and larger, self-propelled forage harvesters already requires the merging field operation regardless of tedding. Again, this would not have been considered in previous analyses and the acceptance of these practices should improve the economy of tedding. Further, modern tedders are wider and more productive than considered in past economic models. Conversely, tedding could negatively impact alfalfa silage production costs. Tedding adds a field operation and associated costs. Additionally, the benefits of tedding will be diminished by the shorter overall drying time associated with silage production. In this work, we propose to test these variables through computer simulation and field trials to determine the impact tedding has on the quality and overall economics of the production system.

Objectives:

- The objectives of this project are to 1) Provide an experiential learning opportunity for undergraduate agricultural engineering students in forage systems; 2) Study the impact of tedding on the economics of alfalfa silage production using the USDA's Integrated Farming Systems Model (IFSYM) and compare the results of the model to field observation, and 3) Determine the field operating costs and efficiencies of modern tedders and summarize results into a decision tool that would allow producers to determine if tedding fits into their operation.