2018 USAFRI Research Project Objectives

Sustainable Management of Waterhemp in Established Alfalfa for Dairy Systems
University of Wisconsin-Madison - Renz

Project Award: $39,200

Justification:

- Dairy production systems rely on alfalfa as a key component in their ration. Alfalfa provides a high yielding and quality forage as well as key ecosystems services as part of a rotation with annual crops. One of the under-valued services is weed control as it has been documented that alfalfa stands can reduce weed populations if managed correctly (e.g. Clay and Aguilar 1998, Goplen et al 2017). In the Midwestern and Eastern United states, few annual weeds can compete with alfalfa stands and do not germinate unless alfalfa stand density is below recommended levels or the alfalfa is stressed due to lack of precipitation or pest (insect disease) damage. What few annual weeds that emerge are not able to produce viable seeds due to the frequent harvest interval present in a dairy system (every 28-35 days). For example giant ragweed, a highly competitive annual weed that is capable of germinating throughout the spring had emergence reduced by 59% when grown under alfalfa compared to corn and didn't produce any viable seeds in a research project in Minnesota (Goplen et al. 2017). Unfortunately established alfalfa systems are currently being invaded by waterhemp (Amaranthus tuberculatus (Moq.) J. D. Sauer) a weed species that has the potential to germinate and produce viable seed within this competitive forage system.

  Waterhemp, while present in the region for over a century has been documented to be rapidly spreading throughout the United States. In Wisconsin, while this plant has been present for over 150 years, it has recently been observed to be expanding its range with populations now in over 80% of counties, with 40% of the observations being reported in the last four years (Renz 2018). This plant is similar to other pigweed species (red-root, smooth) but can germinate later into the growing season (Werle et al. 2014) even if under established plant canopies (Steckel et al. 2003) and compete against established crops and produce viable seed (Wu and Owen 2014). While the harvest frequency of alfalfa grown for use in dairy systems have historically prevented annual species from competing with alfalfa, recent observations across multiple states suggest waterhemp has the potential to behave differently. This past year reports from multiple crop consultants documented productive alfalfa fields with significant waterhemp biomass in the second and third harvests in established alfalfa fields that resulted in viable seed production (personal communication, Wisconsin Extension Educators in Clark and Outagamie County). According to the consultants these fields had adequate stand densities with no visible stresses that would have facilitated emergence. Similar reports of spread have been received in other Midwestern and Eastern United States (e.g. Hager 2016).

  It is not known what the impact of waterhemp invasions have on forage quality and productivity and resulting milk production from established alfalfa fields. Weeds harvested often increase yields and can be utilized as a forage, but reduce forage quality (Cosgrove and Barrett 1987). While recent research suggests the level of reduction can be offset by the added biomass in milk production, weed biomass must be a minor component (<15%) of the total forage biomass (Renz et al. 2018). In addition, waterhemp may impacts alfalfa stand density which could reduce long-term alfalfa stand life.

  Research is needed to determine the potential impact of waterhemp on milk production and alfalfa stand density as well as assess control options. Residual herbicides applied prior to waterhemp emergence have been recommended in other production systems (Bradley 2013). While several options are registered for use in established alfalfa (acetochlor, flumioxazin, metribuzin, and pendimethalin) it is not clear when to apply them to maximize control of waterhemp. In annual production systems

(soybeans, corn) applications are typically applied at planting or just prior to waterhemp emergence, but labels restrict applications in established alfalfa to during green-up in the spring or after each harvest. The optimal timing for waterhemp control is not known in established alfalfa. While waterhemp emergence in annual crop systems is known (late May to early June), the dense canopy of established alfalfa may delay emergence. This has been observed with other annual weed species (Goplen et al. 2017) Applications during alfalfa green-up would provide early season control but may breakdown prior to the end of the season, thus not providing season-long control. While applications after the first harvest has the potential to provide season long control with some products, it may not control early emerging waterhemp plants which could produce significant biomass throughout the season. While adding post emergent herbicides would provide control of emerged plants, many populations are resistant to commonly used products with postemergent activity (imazamox, imazethapyr, and/or glyphosate) (Heap 2018). Therefore these options cannot be relied on for management. While it is possible that neither spring timing will provide complete control, one may provide sufficient control to eliminate impact on milk production.

The lack of agronomic knowledge on how to manage this new pest to established alfalfa justifies further work. As waterhemp expansion is a regional issue we propose to evaluate the effectiveness of labeled residual herbicides at controlling waterhemp in established alfalfa for dairy systems across four states and determine how treatments/timings impact forage quantity and quality and resulting milk production. As many producers rely on alfalfa to reduce weed populations for subsequent crops we will also assess the ability of treatments to prevent seed production. These efforts will provide valuable information that will allow producers to optimize waterhemp management in alfalfa production systems.

Objectives:

- The objectives of this project are to 1) Determine the optimal timing to apply residual herbicides in spring to maximize season-long waterhemp control; 2) Determine how treatments/timing influence forage quality and yield and estimate how these factors impact milk production; 3) Quantify if waterhemp populations reduce alfalfa stand density, and if effective waterhemp control from residual herbicides can alleviate this impact; and 4) Evaluate if waterhemp seeds are produced in an alfalfa field that is managed for dairy production, and if any residual herbicide treatments/timings prevent seed production.