

2020 USAFRI Research Project Objectives

Integrated Weed Management Impacts on Stand Establishment to Maximize Yield and Quality of Alfalfa University of California Cooperative Extension - Dias

Project Award: \$22,311

Justification:

- Several different factors can limit yields including weed interference. Previous research has shown that weed interference can suppress established alfalfa yield (Wilson 1981) and impact stand densities (Becker et al. 1998). Similarly, Dowdy et al. (1993) reported a 30 to 47% increase in established alfalfa plant density (over a 5-yr period) as a result of weed removal with herbicide applications. Another critical aspect of high yielding alfalfa is stand establishment techniques, particularly weed management. Weeds are often considered the most significant pest in new alfalfa stands as seedling alfalfa grow slowly making it vulnerable to weed competition (Blecker et al. 2011). Additionally, weed management during establishment can influence production for many years as competitive effects of weeds during early growth have been reported to extend into the first and second year, as well as throughout the life of the stand (Canevari et al. 2007).
- Since the recommended planting timing in the Central Valley region is in the Fall, winter annuals are generally the most problematic weeds during establishment (Canevari et al., 2007). Nonetheless, farmers often miss the ideal fall planting window (for example due to late cotton harvest, residue destruction and incorporation); thus, spring alfalfa plantings can also occur and the summer annual weeds can also become a threat. Therefore, weed management, especially during the year of establishment, is a critical and ever-present management practice for successful alfalfa establishment and production (Blecker et al. 2011).
- **Weed Resistance and Weed Shifts.** Glyphosate-resistant (GR) alfalfa varieties first became commercially available in 2005, which offered producers new option for weed management in alfalfa cropping systems (Bradley et al. 2010). However, GR varieties have not been universally embraced, largely due to the sensitivity of export and organic markets for hay and seed, thus the need for additional options remains. Several studies have compared glyphosate efficacy with conventional alfalfa herbicide standards since the release of GR alfalfa, and more consistent weed control is normally observed with the use of glyphosate (McCordick et al. 2008; Tiedemann et al. 2006), especially for the management of perennial weeds. However, the evaluation of conventional herbicide alternatives and their efficacy in GR alfalfa is still an important method for managing or preventing the evolution of glyphosate resistance weed biotypes in GR alfalfa cropping systems (Bradley et a. 2010). In 2005, when GR alfalfa was released, there was a total of seven weed species characterized with glyphosate resistance in the U.S. (Heap 2020). As of 2020, seventeen weed species have been characterized with glyphosate resistance in the U.S.; and seven GR weed species have been confirmed in CA, which are rigid ryegrass (*Lolium rigidum* G.) in 1998; Horseweed (*Conyza canadensis* L.) in 2005; Hairy fleabane (*Conyza bonariensis* L.) in 2007; junglerice (*Echinochloa colona* L.) in 2008; Italian ryegrass (*Lolium perenne* ssp. *Multiflorum*) in 2008; annual bluegrass (*Poa annua*) in 2013 and most recently Palmer amaranth (*Amaranthus palmeri* S. Watson) in 2015 (Heap 2020). Norsworthy et al. (2012) stated that the use of multiple effective sites of action is a key strategy to decrease selection pressure on a single herbicide and delay potential issues with herbicide-resistant weeds. Orloff et al. (2009) outlined methods to avoid weed shifts and weed resistance in GR alfalfa.
- Therefore, it is important to investigate and understand how we can effectively and proactively

implement the use of multiple effective sites of action in the chemical weed management program of GR alfalfa systems.

- Diversification of weed management practices is another key strategy to delay potential issues with herbicide-resistant weeds (Norsworthy et al. 2012). Additionally, cultural weed management practices such as planting date and seeding rate have the potential to be used in combination with herbicides in an effective proactive integrated weed management (IWM) program. For example, Stoller et al. (1987) concluded that soybean row spacing, plant density and planting date (among some other management practices such as the use of herbicides) can all be used to maximize the ability of soybean to compete with weeds. Few researchers investigate the impacts of alfalfa seeding rates on weed control and alfalfa productivity, and the ones who did get variable outcomes. For example, Bradley et al. (2010) concluded that seeding rate generally had little effect on weed density, with the exception of large crabgrass, and no benefits on forage yields or nutritive value. Conversely, Glaspie et al. (2011) concluded that higher seeding rate often resulted in greater alfalfa and total forage yield (alfalfa + weeds), decreased weed biomass, and increased alfalfa density. Conversely, time of seeding is known to have a large effect on stand establishment in alfalfa. Research conducted in California has shown that planting in the fall produces 20-30 higher yields in the first year than spring planting (Mueller et al. 2007). Little information is available; however, on the impacts of planting date on weeds interference and suppression in GR alfalfa systems.
- Integrated Weed Management Strategy. The importance of developing IWM strategies to maximize weed management, improve yields and delay herbicide resistance issues in GR alfalfa is a critical need. There is a lack of agronomic knowledge on the combined effects of planting date and different herbicide programs on weed management and forage responses, which justifies further work. This research will provide valuable information that will allow producers to optimize weed management during alfalfa establishment. This approach combines cultural methods (time of seeding) with chemical methods (herbicide strategies) to improve and evaluate integrated weed management methods to maximize yield and quality of alfalfa.

Objectives:

- The objectives of this project are to 1) determine the effects of planting date (early fall [mid-Sep], late fall (mid-Nov) or early to late spring [late-April]) and herbicide program on weed control, nutritive value, and yield within the establishment year of a fall-seeded GR alfalfa system; 2) determine the economic feasibility and return of each management strategy; and 3) quantify the negative impacts of weed interference on alfalfa yield and quality when no control tactics are employed.