

2020 USAFRI Research Project Objectives

Evaluation of the Efficacy of Saflufenacil Tank-Mixes and Sequential Applications Applied in Early Fall for the Control of Plantain and Field Bindweed in Alfalfa Fields New Mexico State University - Beck

Project Award: \$38,277

Justification:

- Alfalfa is the third most valuable cash crop in the United States (USDA NAAS, 2019) and is the most widely cultivated forage legume worldwide (Hatfield et al. 2017). Furthermore, roughly 40% of the nation's alfalfa crop is grown in the 11 western states, including New Mexico (Putnam et al., 2001). As of 2018, alfalfa hay remains the most valuable cash crop in the state of New Mexico with an estimated annual gross of just over \$227 million (Lauriault et al., 2019). Additionally, hay yields reflected a 5% increase, along with an increase in revenue of \$46 million, compared to 2018 for the state. The overall value of alfalfa hay is further increased by its essential contributions, as feed and forage, to livestock production which continues to lead New Mexico in overall agricultural commodities. The dairy industry contributed approximately \$1.21 billion in total milk sales with the livestock industry netting \$2.8 billion in total sales for the State of New Mexico (USDA NASS, 2018). Crop production acreage and the availability of resources for management continue to decline; however, it is still important to maximize yield and quality of all alfalfa production as much as possible during the growing season to meet the ever increasing agricultural needs of growers, producers, farmer, ranchers, dairy managers, and industry personnel throughout the state of New Mexico.

As demand for quality alfalfa continues to increase, managing weeds remains a critical and ever present component of successful production. While weeds that emerge during the initial seeding stages of alfalfa typically have the greatest impact by competing for light, water, space, and nutrients, late season weeds that populate established alfalfa fields can have a significant impact on yield through continued competition for resources throughout the growing season (Beck et al., 2017). Additionally, the presence of late-season annual and perennial weeds can lower forage quality, reduce stand longevity, cause premature stand loss or reduction, increase the incidence of disease and insect damage, and create detrimental harvesting issues.

Perennial weed populations are especially difficult to control in perennial crops like alfalfa, because management practices have to address seed production and vegetative reproductive structures which allow the plant to survive from season to season. Simple perennial weeds like plantain (*Plantago* spp.) have a hardy taproot system that allows the plant to die back and survive during non-ideal environmental conditions, then proctors tissue regrowth and re-establishment once conditions become ideal again. Broadleaf plantain (*P. major*) and buckhorn plantain (*P. lanceolata*) are particularly difficult to control weeds whose infestations are widespread in alfalfa fields throughout the western U.S. (Elmore et al., 2007; Sulser and Whitesides, 2012). Additionally, complex perennial weeds like field bindweed (*Convolvulus arvensis*) have not only a deep and hardy root system, but extensive spreading underground stems in the form of rhizomes, which further complicates management efforts (Uva et al., 1997). Like plantain, field bindweed is a hardy, invasive, drought tolerant perennial weed that is broadly distributed across all the continental western states, and in all 33 New Mexico counties (USDA Plants Database, 2017; Uva et al., 1997). Weed management on both simple and complex perennial weeds must focus primarily on injury to the root system; however, it is difficult for herbicide active ingredients to move effectively enough within the entire plant to injure a hearty root system and spreading rhizomes located deep within the soil (Elmore et al., 2007). Similarly, the use of

herbicides to control broadleaf weeds like plantain and field bindweed in a broadleaf crop like alfalfa further complicate any effective management. As a result, there are only a few registered herbicides, such as glyphosate, MCPA, and 2,4-DB that have been reported to cause injury to plantain and field bindweed in alfalfa fields in New Mexico (Beck et al., 2017; Canevari et al., 2007). Furthermore, the continued use of these select few herbicide active ingredients to manage a specific population of weeds like plantain in alfalfa over time, can also lead to the development of herbicide resistance in the target weeds (Orloff et al., 2009). As a result, research to evaluate the effectiveness of newly registered herbicides, as well as tank-mixes of older traditional herbicides with different active ingredients is greatly warranted for control of plantain and field bindweed in alfalfa.

Sharpen® (BASF Corporation) has recently acquired a label for broadleaf weed control in dormant-season alfalfa in the 17 western states (BASF Corporation, 2020). The active ingredient in Sharpen® is saflufenacil, which causes plant cell membrane damage and eventually plant death by inhibiting the production of protoporphyrinogen-oxidase. Specifically, Sharpen® can offer contact burn-down control of perennial broadleaf weeds including, but not limited to, ivyleaf morningglory (*Ipomoea hederacea*) and dandelion (*Taraxacum officinale*) during limited (dormant) season growth of alfalfa. Sharpen® was evaluated as a potential herbicide option for late-season broadleaf and buckhorn plantain control in greenhouse evaluations and crop injury was assessed in alfalfa fields in Los Lunas in 2017 and 2018. Single applications of the highest rate of Sharpen® resulted in injury to the plantain, yet they eventually recovered (Beck et al., 2018). One treatment that was added to the 2017-2018 greenhouse trial was an application of Sharpen® combined with a second active ingredient, which yielded the most herbicide injury to the plantain, but limited control (Beck et al., 2018). In 2018, and 2019, additional tank-mixes of Sharpen® with commercially available herbicides, combined with sequential applications was evaluated in Los Lunas and Las Cruces (Beck et al., 2019). These mixtures, coupled with sequential applications that also contained Sharpen®, caused noticeable injury to the alfalfa immediately following application. However, alfalfa was able to recover completely with no visible signs of injury or impact on yields by the first cutting in spring (Beck et al., 2019). While the tank-mixed and sequential applications of Sharpen® resulted in adequate control of plantain in the greenhouse and no alfalfa injury in separate field experiments, these combinations have yet to evaluate efficacy while plantain is in the field with alfalfa. In 2017 and 2018, initial herbicide applications in the field (to alfalfa only) were made in December to take full advantage of slowed alfalfa growth to help minimize potential damage and reductions in yield the following spring. Since our previous research indicates that these applications caused minimal negative impacts to yield compared to the non-treated control (Beck et al., 2018 and 2019), research needs to be conducted to evaluate the impacts of Sharpen® applications in earlier fall months (i.e. October) when final harvest cuts are made. This is also the most opportune time for maximum injury from herbicide applications in the field since perennial weeds are actively growing by shifting their growth patterns to ensure survival of the roots from the oncoming winter temperatures. Additionally, tank mixes with Sharpen® and commercial herbicide, as well as sequential applications of these mixtures, have yet to be evaluated for field bindweed control in alfalfa fields. As a result, further field research into applications of tank-mixes and sequential applications of Sharpen® combined with other active ingredients is warranted.

Objectives:

- The objectives of this project are to 1) compare the weed control performance of initial and sequential applications of saflufenacil alone or in combination with commercially available herbicide products for plantain and field bindweed under field conditions; and 2) evaluate the effects on alfalfa quality and yield as a result of the applications of single or multiple applications of saflufenacil alone or in combination with other commercially available herbicide products for plantain and field bindweed under field conditions.