PLUMAS - SIERRA

Farm Advisor's Update

University of California
Agriculture and Natural Resources

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As the winter winds down to an end, I wanted to provide you with a quick update on some of the research trials I have been working on. As you prepare to make weed control application to your alfalfa field, it might be worthwhile taking a look at the first article. The other two articles are about research efforts to control Canada and Scotch thistle. Some of the methods described in these articles are not labeled uses of the pesticide. Before making any pesticide application make sure to read the label, to make sure it is a legal use. You can also call me for clarification of what uses are currently labeled and what uses are experimental.

Lastly, if you make annual applications of insecticides to control alfalfa weevils, I would implore you to consider switching up the mode of action you use. Alfalfa weevil pyrethroid resistance has been confirmed in parts of the Intermountain Region. If we continue to only rely on pyrethroids to control alfalfa weevils, we will lose the effectiveness of that tool. For more information check out the newsletter article from last spring.

Winter Annual Weed Control in Alfalfa (Avoiding Crop Injury with Roundup)

Weed control is an ongoing challenge for any agricultural producer, from alfalfa growers to cattle ranchers. Whatever the system is, the principles of weed control tactics stay the same. The old gardener's saying "one year seeding, equals seven years weeding" should not be taken lightly by anyone who owns or has a long-term lease on their land. What plant species go to seed in the middle of your field or on the edge of your field will have an impact on future weed pressure. Reducing the number of seeds in the soil seedbank should be the major focus of weed management within agronomic production. While some weed seeds, like cheatgrass, may only last a handful of years in the soil, other seeds with hard coats, like lambsquarters, can last for decades.

Weeds can be particularly problematic in forage production for a variety of reasons. First and foremost, weeds capture resources (sunlight, water, nutrients, and space) which could be utilized by the crop for growth. More weeds equal less crop growth, but not necessarily less overall tonnage to be harvested. However, alfalfa is considered the "queen of forages" for a reason: it's high protein content and digestibility make it a prime feed for livestock. Diluting alfalfa forage with weedy plant species can reduce the quality of the forage, reduce protein values, and reduce the marketability of the product produced. Looking at the California hay report in October of 2018, weedy hay was being sold for $35-$100 less per ton on the California market. It is important to control weeds to maintain profitability in hay production.

Photo 1: Shepherd's crook stem after Roundup application.

Weeds can generally be lumped into various categories: winter annuals, summer annuals, biennials and perennials. While all weeds in each category will not necessarily be controlled by the same tactics, each category of weeds can typically be targeted at the same time.

For many producers, the most problematic species in production are often the winter annual weeds, which will contaminate the most profitable first cutting. In conventional alfalfa, targeting these weeds is most often done with applications of herbicide during alfalfa dormancy. Common herbicides include photosystem two inhibitors Hexazinone (Velpar), Metribuzin (Tricor DF, Dimetric 75) and Diuron (Karmex). These three products all have long residual activity which can help limit the amount of weed seed germination throughout the season. However, long residual activities can limit crop rotation options for one or more years. Dormant season applications made early before germination of many winter annual species do not require a tank mix partner. Later applications in the late winter are often tank mixed with Gramoxone (paraquat) to burn down emerged weeds.

In the past four years, two other burn down options for broadleaf weeds have been registered for alfalfa in California: the PPO inhibitors Shark (carfentrazone) and Sharpen (saflufenacil).

Photo 2: Understory of 8-inch 44 oz. Roundup application before harvest. Chlorosis and necrotic stems in the understory.

These products both have good activity on winter annual broadleaf species, but do not have activity on winter annual grasses. Adding a methylated seed oil is important for both of these products to get good burn down activity. Shark and Sharpen are both products that have caution as the signal word, compared to Gramoxone which has danger as the signal word. They require less PPE than Gramoxone requires and could be good alternative burn down products, if you do not have many winter annual grasses. More information about Sharpen and Shark use in alfalfa can be found on the Alfalfa Symposium website, or in last year's newsletter. After alfalfa has broken dormancy, application of any of the products mentioned above will cause crop injury and a significant reduction in yield.

In Roundup Ready alfalfa, Roundup can be a very useful tool to control emerged annual and perennial weeds after alfalfa has broken dormancy. However, in 2014, Steve Orloff documented injury to Roundup Ready alfalfa, after applications of Roundup were followed by a frost in the spring. Various replicated field trials confirmed that there was injury potential if frost occurred after Roundup

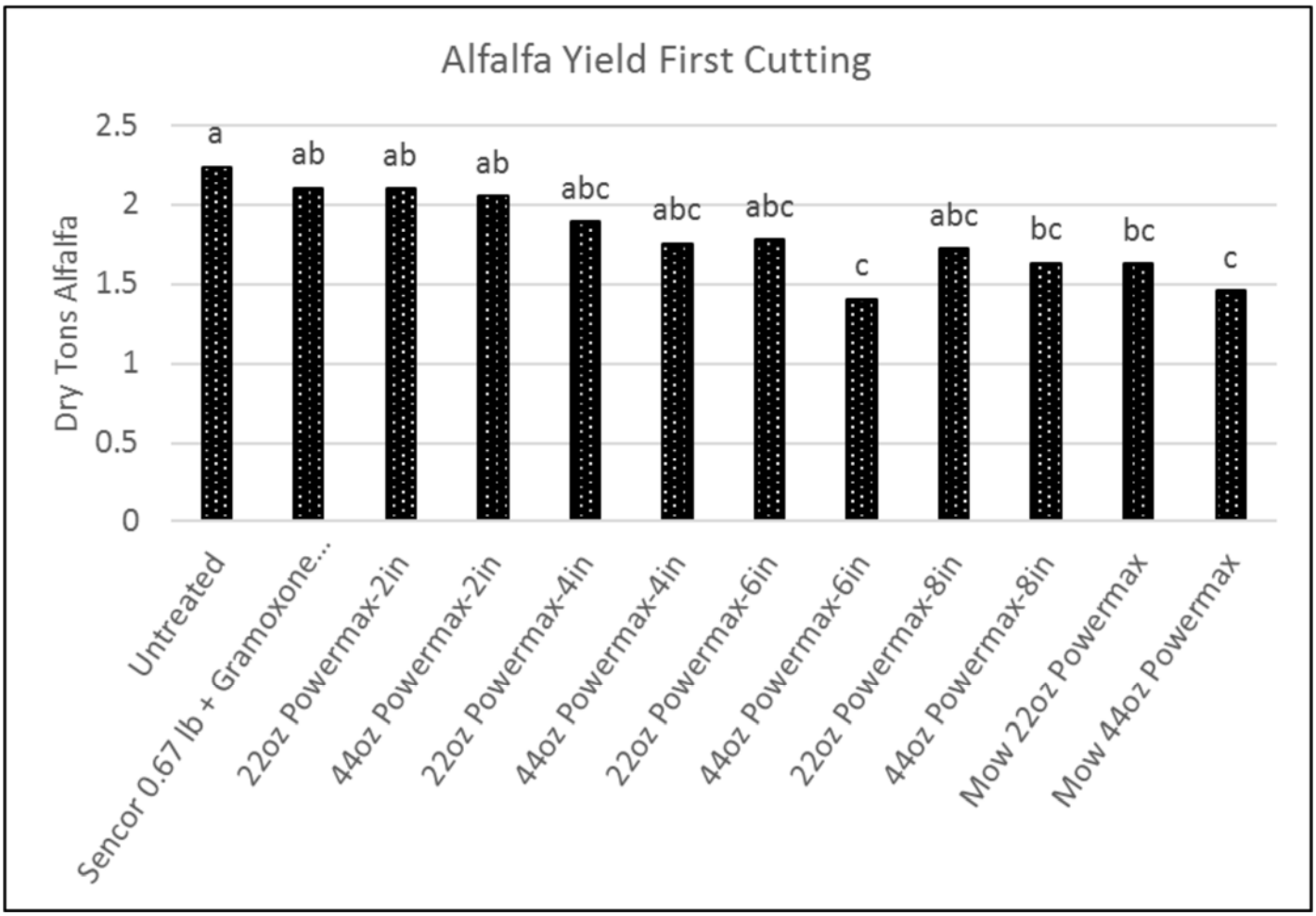


Figure 1: Yield in tons per acre for the first cutting harvest. Letters indicate a significant difference in yield at the 95% confidence interval. ("Mow" treatments were mowed with a rotary lawn mower at 4 inches in height to set the alfalfa back before application.)

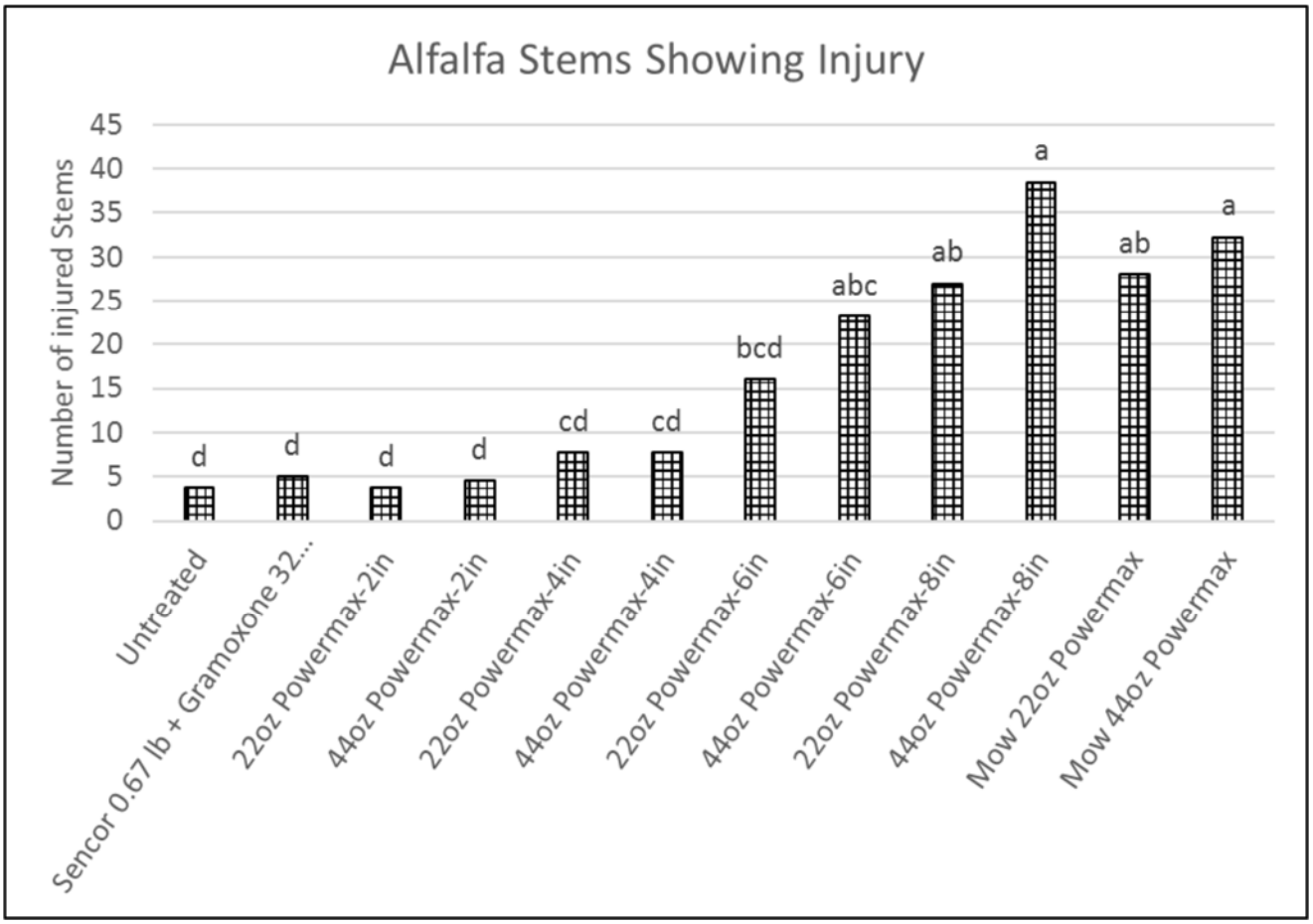


Figure 2: Average number of stems showing injury per square meter in each plot. Letters indicate a significant difference in injured stem numbers at the 95% confidence interval.

applications. Injury manifested as individual stems dying and curling over into a shepherd's crook, typically a week or two after application (Photo 1). Stems continued to curl over and die in the understory of the alfalfa stands for weeks. In certain instances, height reductions and chlorosis were noted, and alfalfa yield reductions were documented. Trials were conducted in the Honey Lake Valley in the spring of 2016 and 2017 (as well as many more throughout the Intermountain Region). The goals of the studies were to confirm agronomic practices that prevented crop injury, as well as trying to discover the mechanism of the injury.

In the field trials, it was found no injury was observed when applications of Roundup were made before alfalfa had grown 2 inches tall after breaking dormancy. However, injury was observed in alfalfa which was treated after the alfalfa had grown 4 inches or taller. More injury occurred to alfalfa which had been treated at a larger growth stage, and with higher rates of herbicide. Current recommendations to minimize crop injury are to make applications of Roundup before the alfalfa crop is taller than 2 inches. However, as Roundup does not have residual activity, combining Roundup with a product that has residual activity may be necessary to provide good weed control, because more weeds may germinate after an early application.

In the trials, injury to alfalfa was not consistent between all study sites and years. However, certain field locations did have a significant amount of injury. In 2017, one field trial in the Honey Lake Valley showed significant results.

Photo 3: Untreated plot before harvest, much less chlorosis and fewer necrotic stems in understory.

Applications of Roundup were made at two rates 22 oz/acre and 44 oz/acre to alfalfa at the 2, 4, 6, and 8 inch growth stage (a mowed treatment was also included, where the alfalfa was mowed to 2 inches and allowed to regrow to 6 inches at the time of application). Results from the trial can be seen in Figure 1 (yield in the first cutting) and Figure 2 (number of injured stems per square meter before first cutting). Generally, more injury occurred when applications were made to a taller crop with higher rates of Roundup. The 44 oz. rate significantly reduced crop yield at the 6 and 8 inch application height compared to the untreated check. At the 6 inch application height, a 0.8 of a ton yield reduction was observed compared to the untreated check.

More research is planned for 2019 to investigate the mechanism of the crop injury, as well as other agronomic practices to avoid crop injury after application. (Additional information can be found on the Alfalfa Symposium website or in the Lassen County Weed Reports.)

Purple Flowers, Pokey Leaves and Deep Roots: Canada Thistle Control Trial

Cirsium Arvense is a plant with many common names. When I was visiting the southern hemisphere, the locals called it Californian thistle! Most people here put the blame on our neighbors to the north calling it Canada thistle, but neither are right. It is originally from southeastern Europe, but has been introduced to every continent except Antarctica. Unlike other noxious thistles, such as Scotch or Musk, Canada thistle is a perennial species with an extensive spreading root system. While individual stems can produce up to 5,000 wind-dispersed seeds, patches often come from a single plant spreading by the roots. It is problematic in agricultural fields, along ditch banks, and in wildlands.

Photo 4: Plots treated with Milestone 7 oz. seven months after treatment. Notice the sparse stunted triticale plants.

Controlling Canada thistle takes a two-pronged approach: preventing seed production and killing the deep root system. Controlling the top of the plant through mowing or cultivation may prevent seed production, but will not kill the roots. A single cultivation can actually break up the roots, spreading the weed and making the problem worse. Some livestock will chew on Canada thistle, but most avoid it, and, like mowing, this does not address the root system.

Photo 5: Plots treated with Roundup Powermax 2 qt. 10 months after treatment. The triticale had been cut for hay, and some of the plants regrew to put on seed. Good Canada thistle control.

Systemic herbicides are often used for Canada thistle control to kill the roots. For most herbicides, applications just before the plant reaches the bud stage, or in the fall before the first frosts, are the most effective. I had heard reports of Shark (carfentrazone) being included in tank mixes for improved Canada thistle control. While Shark is a good burndown/contact product for small weeds, I wasn't sure if it would be worth putting in the tank with other systemic herbicides for thistle. A small replicated field trial was set up to look at Shark in combination with various other products used on Canada thistle: 2,4-D*, Clarity (dicamba)*, and Roundup Powermax (glyphosate). From previous research, aminopyralid is very active on Canada thistle, so Milestone and GrazonNext were included in the study. (*An off-label application for some herbicide treatments).

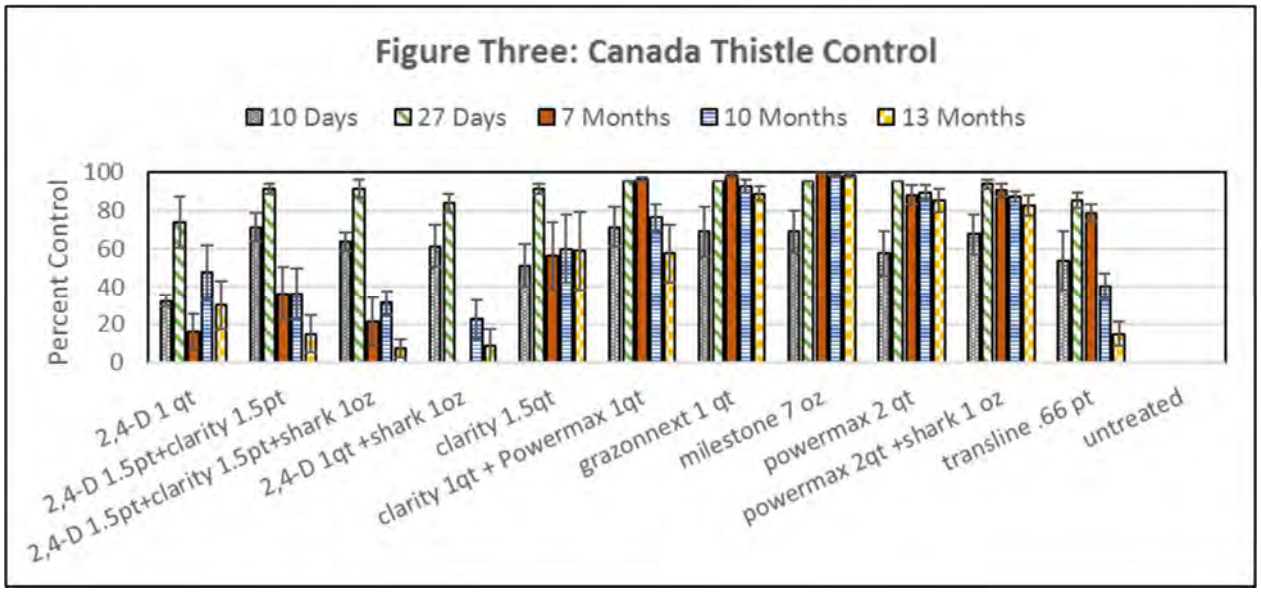
The site was located in the Intermountain Region of California at 4,900 feet elevation. It was a very uniform stand of thistle as the field previously had been fallow, and the grower was planning on cleaning up the thistle with two years of triticale, cultivation, and multiple herbicide applications (a good plan). Thistle plants ranged from 3-5 inches tall and 4-7 inches in diameter. As the site had seen no moisture over the summer, thistle plants were stunted and not actively growing. It was going be a good test because the systemic herbicides typically work

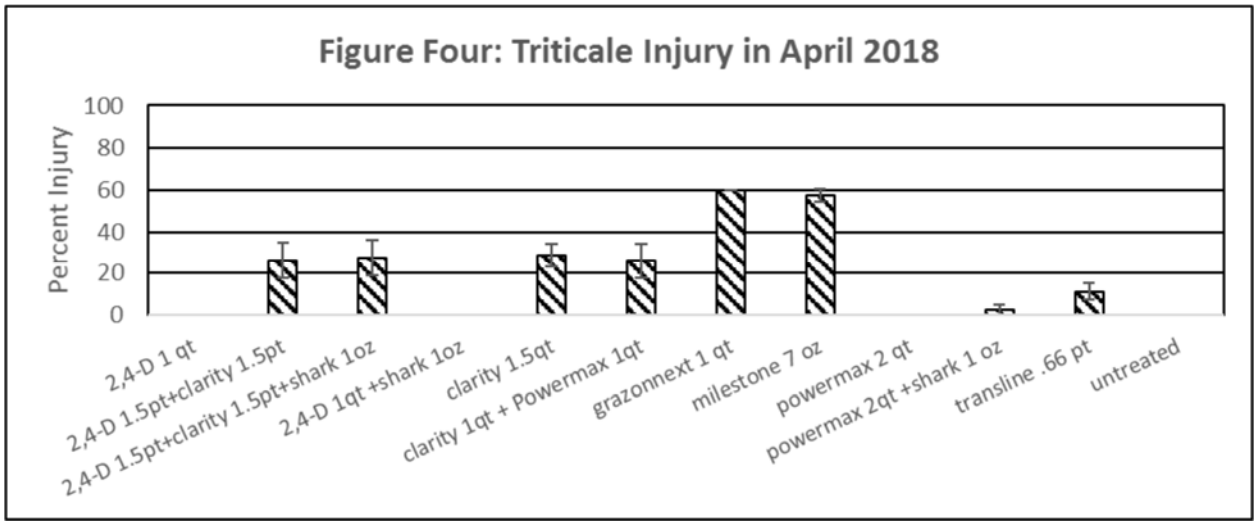
better on actively growing plants. Applications were made in mid-September of 2017, and triticale was planted in mid-October, one month after application. Thistle control was assessed periodically following applications (Figure Three). Assessment of triticale injury was taken 7 months after application (Figure Four).

All treatments (except 2,4-D alone) gave at least 85% control 27 days after treatment, burning the thistle down to the ground that fall. The following spring, treatments that contained Roundup Powermax, or aminopyralid (Milestone and GrazonNext) gave at least 90% control. Combinations of 2,4-D, Clarity, and Shark did not provide thistle control the following growing season. Shark tank mixed with Roundup did not offer better control than Roundup alone. By October of 2018, 13 months after treatment, only Milestone gave better than 95% thistle control. Roundup, Roundup+Shark and GrazonNext, were the only treatments that gave greater than 80% control. Adding Shark to the tank did not appear to increase Canada thistle control for any treatment.

While aminopyralid gave the best Canada thistle control, it is not labeled for use in small grain production. There is information on the Milestone and GrazonNext labels indicating one full year must occur before grain can be seeded, and a bioassay must be conducted before seeding

Photo 6: Untreated check 10 months after treatment. Thick Canada thistle stand left where no herbicide was applied.





broadleaf crops. Likewise, the crop rotation interval for Clarity was not followed in this study for the rates tested. Crop injury was visually assessed in all treatments (Figure Four). Treatments that contained Clarity were slightly stunted and thinned. In treatments that contained aminopyralid (Milestone/GrazonNext), the stunting and thinning was much more severe (Photo 4). It is always important to read and follow the label, not just because it is the law, but to prevent crop injury.

Roundup could be a good choice for Canada thistle control if you are planning on planting a crop after application. Products that contain aminopyralid can be a good option for selective thistle control in perennial grass pastures. However, whatever herbicide is utilized, multiple applications and follow up spot treatments may be needed for effective control.

Photo 7: Plots treated with 2,4-D looked very similar to the untreated check 13 months after treatment.

Update: Scotch Thistle Control in the Spring and Fall

Scotch thistle is a very difficult-to-control biennial (sometimes annual or perennial) weed species which is problematic in pastures, rangeland, and field edges. Long soil seed life makes this thistle species very difficult to control. Multiple people have expressed this is the most difficult weed to control in northeastern California. Research has shown that applications made at the rosette stage of the plant's life cycle are much more effective than applications made to bolting plants. Applications are sometimes made to fall rosettes, however, most research has focused on the spring rosette application. This study set out to test various herbicides which have long soil residual activity for fall and spring applications to the basal rosettes. Industry standards of Telar and Milestone were tested. Other products of interest included Grazon-Next (Milestone+ 2,4-D), Method (aminocyclopyrachlor) and Esplanade (indaziflam). All herbicides tested have grazing labels, except Method and Esplanade, which currently do not have a grazing label.

Photo 8: Untreated check 21 months after fall applications.

Fall applications were made in October of 2016 to thistle rosettes from 3-12 inches in diameter. Spring applications were made in May of 2017 to rosettes which ranged from 4-22 inches in diameter. All treatments were replicated four times in the study. The study was rated periodically throughout 2017 and 2018 for Scotch thistle control and the cover of more desirable vegetation. The site consisted of a thistle patch with a understory of annual grasses with a smattering of other species.

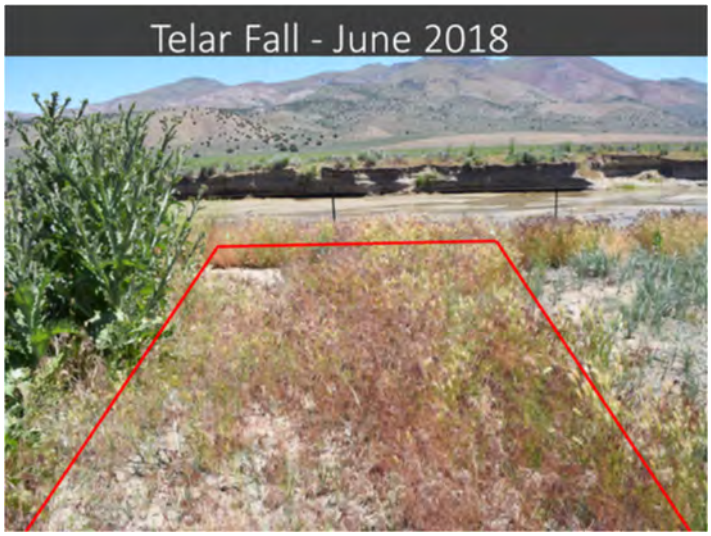


Photo 9: Milestone 21 months after fall applications. Some thistle growing in plot..

Scotch thistle control from fall applications can be viewed in Figure 5. Initially, all fall treatments gave pretty good thistle control during the growing season of 2017 (except 2,4-D+Dicambia, which does not have much soil residual activity). By the end of summer in 2018, only Telar and Esplanade+Method gave more than 85% thistle control 23 months after treatment. Where

thistle was suppressed, it was replaced with increases in annual grasses and bareground (Figure 6). Except in the Method+Esplanade plot, which suppressed the annual grasses releasing perennial species present. In some cases, perennial grasses were released (Photo 11), where in other cases perennial broadleafs were released, such as short white top (Photo 13).

Scotch thistle control from spring applications can be viewed in Figure 7. Most treatments initially gave good burn down of the thistle plant 6 months after treatment. By 6 months after treatment, applications of Milestone, Telar alone, and Method gave greater than 85% thistle control. In 2018, 16 months after treatment, Milestone, GrazonNext, and a couple rates of Method gave at least 89% Scotch thistle control. Like the fall treatments, where Scotch thistle was suppressed, there were increases of annual grasses and bareground. Esplanade+Method, suppressed the annual grasses releasing other perennial species (Photo 15).

This study showed good Scotch thistle control with various treatments when applications were made at the rosette stage. While many of the treatments have started to break, others are still offering good thistle control. The plots will continue to be monitored throughout the 2019 growing season. It will be interesting to see if annual grasses and thistles are still suppressed in the Method +Esplanade plots.

A second research trial was implemented in 2018 to investigate the potential of Method and Esplanade applied to bolted Scotch thistle plants. Previous research has shown applications of Telar to bolted Scotch thistle can help prevent seed production, and should be included in the tank for applications to larger plants. Application of Milestone and 2,4-D did not inhibit seed production when applied to bolted plants. Seed heads were collected from the study in 2018 to determine if Method could be another product which may inhibit seed production after application to bolted plants.

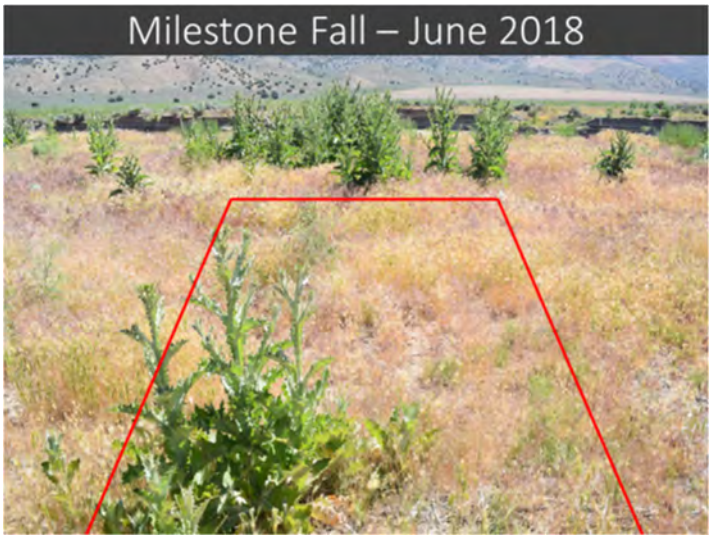


Photo 10: Milestone 21 months after fall applications. Some thistle growing in plot..

Photo 12: Good thistle control in GrazonNext treatment 14 months after spring applications.

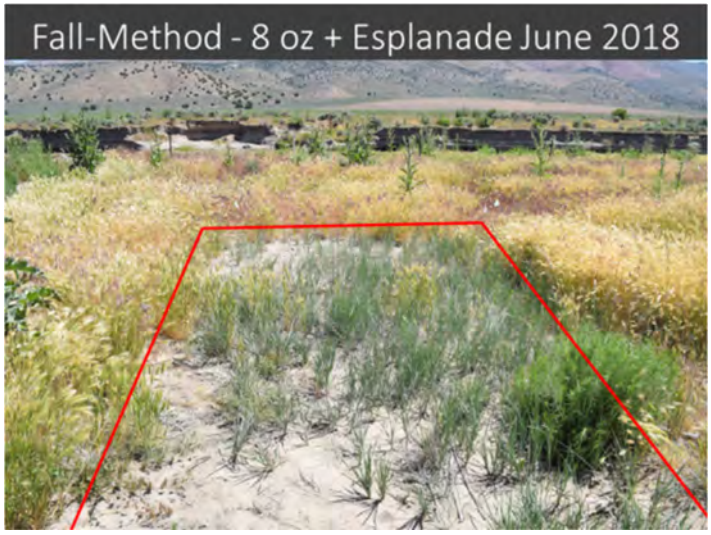


Photo 11: Released perennial grass in Method + Esplanade plot 21 months after applications.

Photo13: Released short white top in Method + Esplanade plot 21 months after applications.

The best time to control Scotch thistle is when it is small and there are few plants. Physical methods, such as digging small plants with a shovel, can be effective. Once thistle patches have grown, utilizing herbicides may be more economical. But just like with physical methods, controlling small plants will be easier, more effective, and more economical, than waiting until the plants have grown large. Scotch thistle is an A rated pest, and you are required to control if it grows on your property! Always make sure to read and follow the label when using any pesticide.

Photo 14: Poor thistle control in 2,4-D+Telar plot 14 months after spring application.

Photo 15: Good thistle control and release of perennial grass from spring applications of Method+Esplanade 14 months after treatment.

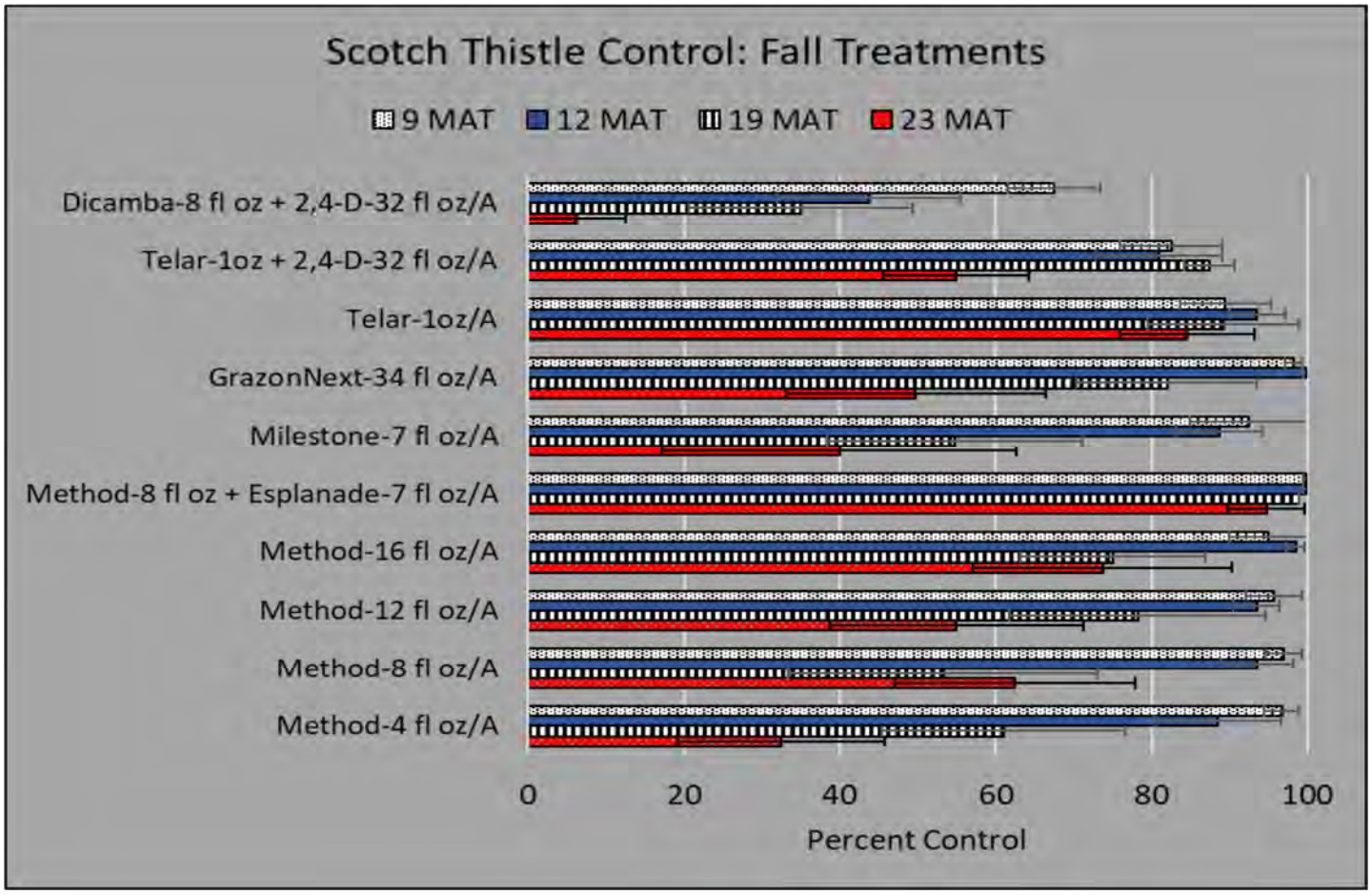


Figure 5: Scotch thistle control from fall applications to rosettes 9, 12, 19, and 23 months after application. Error bars indicate standard error.

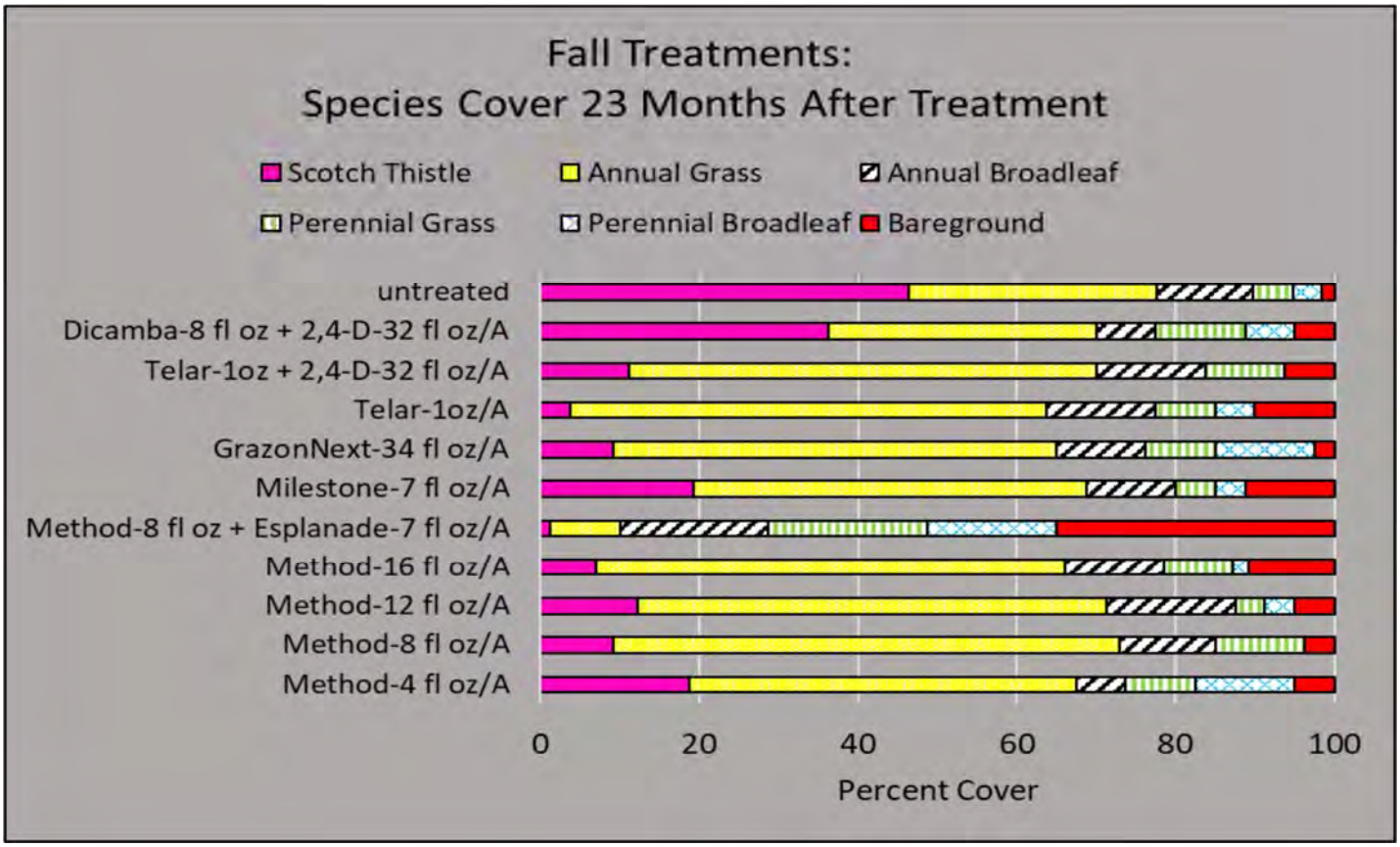


Figure 6: Species cover after fall applications 23 months after treatment.

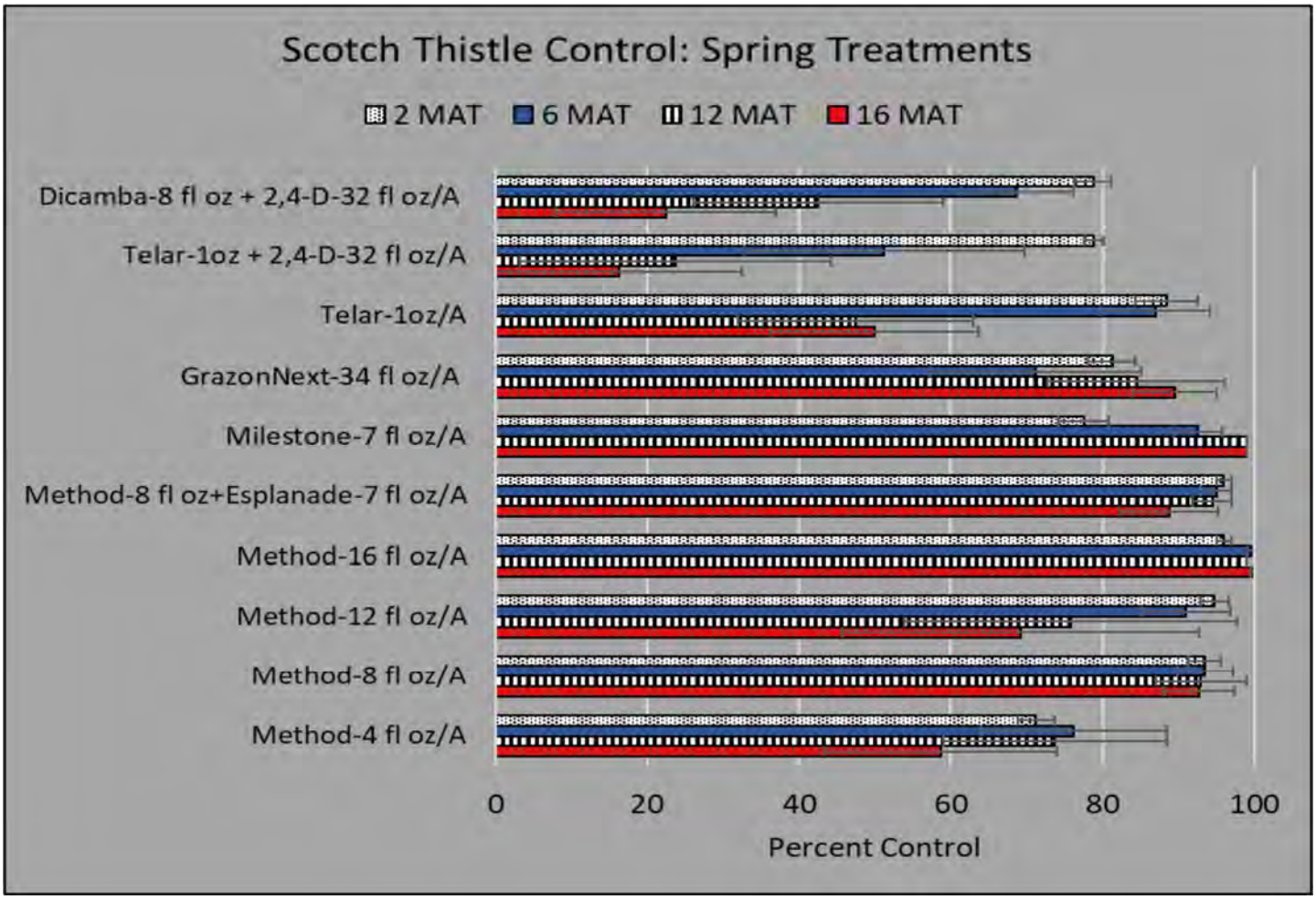


Figure 7: Scotch thistle control from spring applications to rosettes 2, 6, 12, and 16 months after application. Error bars indicate standard error.

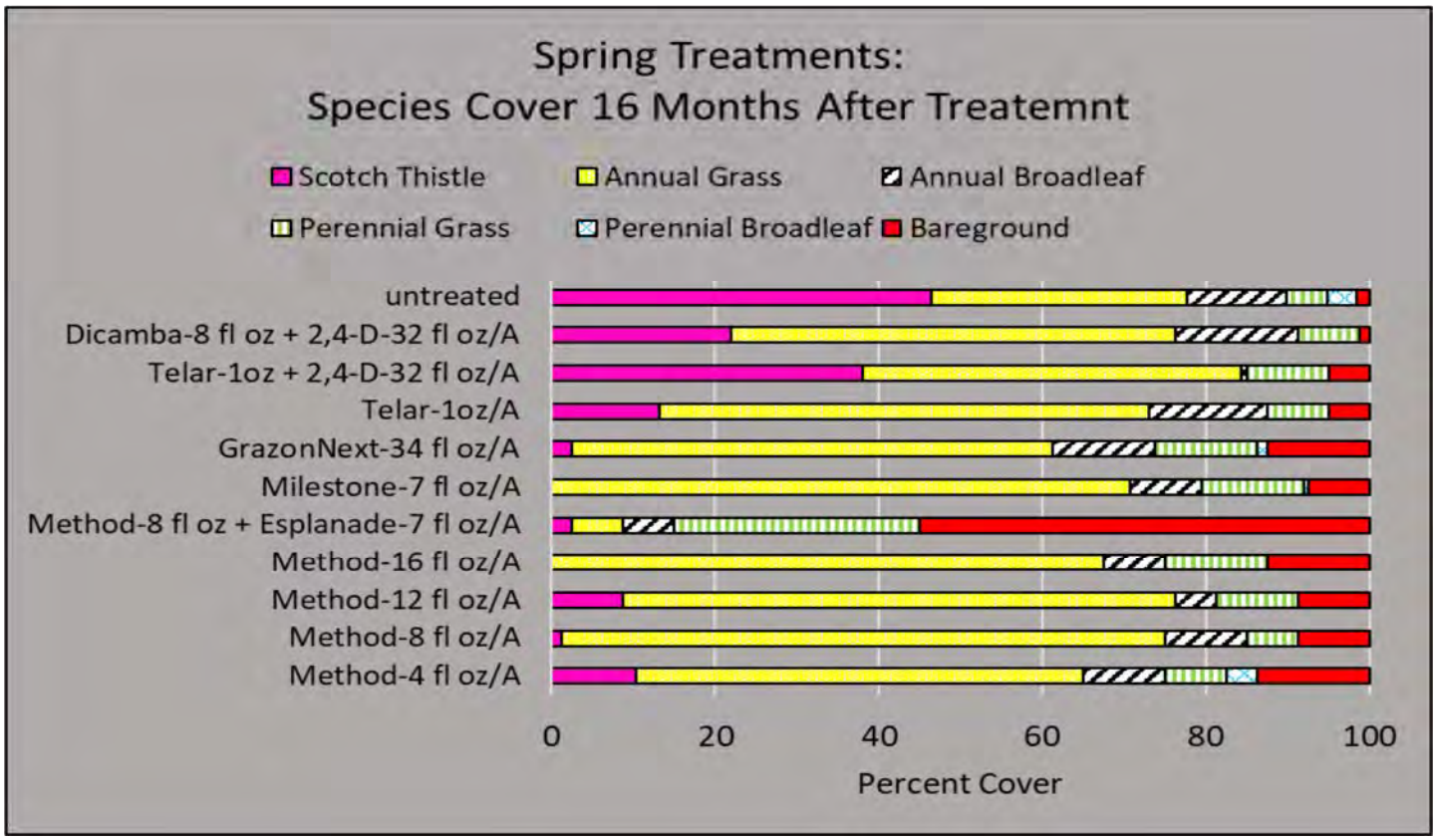


Figure 8: Species cover after spring applications 16 months after treatment.

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