Sacramento Valley Field Crop Newsletter

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In This Issue

Submitted by:

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Hedgerow Project Update

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Hedgerows are plantings of diverse shrubs, trees, perennial grasses, and other native plants along non-cropped areas of farms like field edges. Incorporating hedgerows can provide growers with an alternative method for managing field margins without relying on pesticide applications to control insect pests and weeds along the edges of fields. Hedgerows can improve soil health and reduce soil erosion, and lower costs for maintaining field edges and permanent levees. Hedgerows provide wildlife habitat, especially for migratory songbirds, many of which feed on insect pests. They do not attract flocking birds, such as starlings, or rodents, which gravitate toward crops regardless of field-edge habitat. Research has shown that hedgerows are important for pollinators, such as native wild bees and can also increase beneficial insects and natural enemies of our crop pests. This study is the first evaluating hedgerows in California rice and provides the opportunity to learn about potential benefits to installing hedgerows along annual crop fields, including rice fields, in the Sacramento Valley. In 2024, we established a hedgerow and collected data on soil health, weed control, insect populations, and success rates of hedgerow plants.

The study site is located on a permanent levee of a field in Arbuckle, in Colusa County. The field is rotated with other annual crops, with rice being the main crop. The hedgerow area and the unplanted control area are adjacent and share the same soil type. Both the hedgerow and control areas measure 275 feet in length and 20 feet in width (Fig. 1). (continued on page 2.)

Save the Date!
Hedgerows and Soil Health Assessments Field Day!

Date: Tuesday, April 1st, 2025
Registration: 12:30 pm ~ **Program:** 1:00 pm
Location: Corner of Tule Rd & Lodi Rd, Colusa, CA 95932

In field soil health assessments will be demonstrated.
Hedgerow project results will be shared.

Email selight@ucanr.edu with questions.

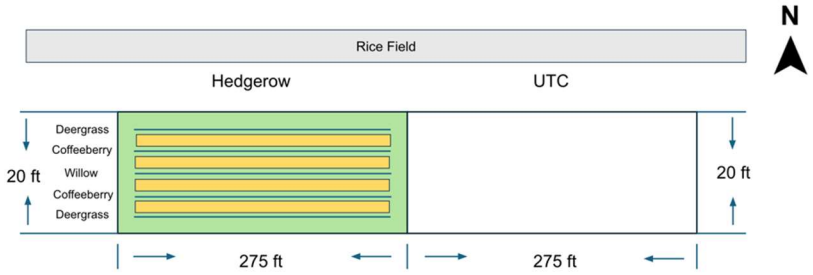


Figure 1. Demonstration setup and area. The yellow squares between the hedgerow plants represent the areas seeded with California poppies (*Eschscholzia californica*).

In April 2024, we established a hedgerow of native plant species suited to Colusa County, including:

1. Arroyo willow (*Salix lasiolepis)*
2. Coffeeberry (*Rahmnus californica = Frangula californica*)
3. Deer grass (*Muhlenbergia rigens*)
4. California poppy (*Eschscholzia californica*).

All plants were purchased from a local nursery in Butte County and were transplanted from pots. The arroyo willows were spaced 15 feet apart, the coffeeberry 7.5 feet apart, and the deer grass 5 feet apart. Since the optimal seedling time for California poppy is late winter or early spring, we delayed seeding until November 2024. California poppy seeds were hand-sown in the spaces between the hedgerow plants at a seeding rate of 15–20 pounds per acre. In November 2024, we replaced the dead hedgerow plants to ensure the hedgerow's continued effectiveness.

We selected these plants because they are native species well-suited to Colusa County. They are adapted to the soil and climate conditions of the study site and are also recommended by Rachael Long (2010) (https://ucfoodsafety.ucdavis.edu/sites/g/files/dgvnsk7366/files/inline-files/26499.pdf).

Irrigation is recommended during the first three years to ensure the survival of hedgerow species during California's dry season. Since the experiment began in April 2024, we irrigated the field twice weekly for approximately 4–6 hours through October 2024. When temperatures reached 110°F, we increased irrigation to three times per week. Additionally, we hand-irrigated individual plants that required extra water. In addition to irrigation, we fertilized the hedgerow species after transplantation in April 2024 to promote establishment and improve survivability. Urea was applied at a rate of 15 g to the deergrass and coffeeberry, and 30 g to the arroyo willow.

We studied the effects of implementing hedgerows in annual cropping systems across four key aspects: (1) soil health, (2) weed pressure, (3) insect populations, and (4) establishment success rate for hedgerows.

Soil Health

To evaluate the benefits of hedgerows on soil health, we conducted baseline soil sampling on April 4th, 2024, in both the hedgerow and the unplanted control areas. Samples were sent to the lab and analyzed for carbon, nitrogen, organic matter, and micronutrients. We collected bulk density data on April 10th, 2024 and conducted soil water infiltration data collection on November 8th, 2024.
As this study only began last year, data collection on soil health is still ongoing, and analysis has not yet been completed.

Weed Pressure

To evaluate the benefits of hedgerows on weed control, we made a pre-emergent spray to control the weeds in hedgerow area on April 2nd, 2024, before the experiment began. We used a tank mix of glyphosate + glufosinate + 2,4-D at their highest label rates and applied using a 10 ft handheld boom at 20 gallons of spray per acre. We assessed weed pressure in the hedgerow area and the unplanted control area monthly from May to September in 2024. Data collection included the percent cover of hedgerow plant species, weeds (grasses and broadleaf species), bare soil, and straw.

The first-year species composition data (Fig. 2) indicates significant differences between hedgerow plots and unplanted control areas. Specifically, we observed an increase in broadleaf weeds in the hedgerow plots over the summer, likely due to irrigation. The hedgerows also appeared to have much less residual straw, suggesting that irrigation may accelerate straw decomposition.

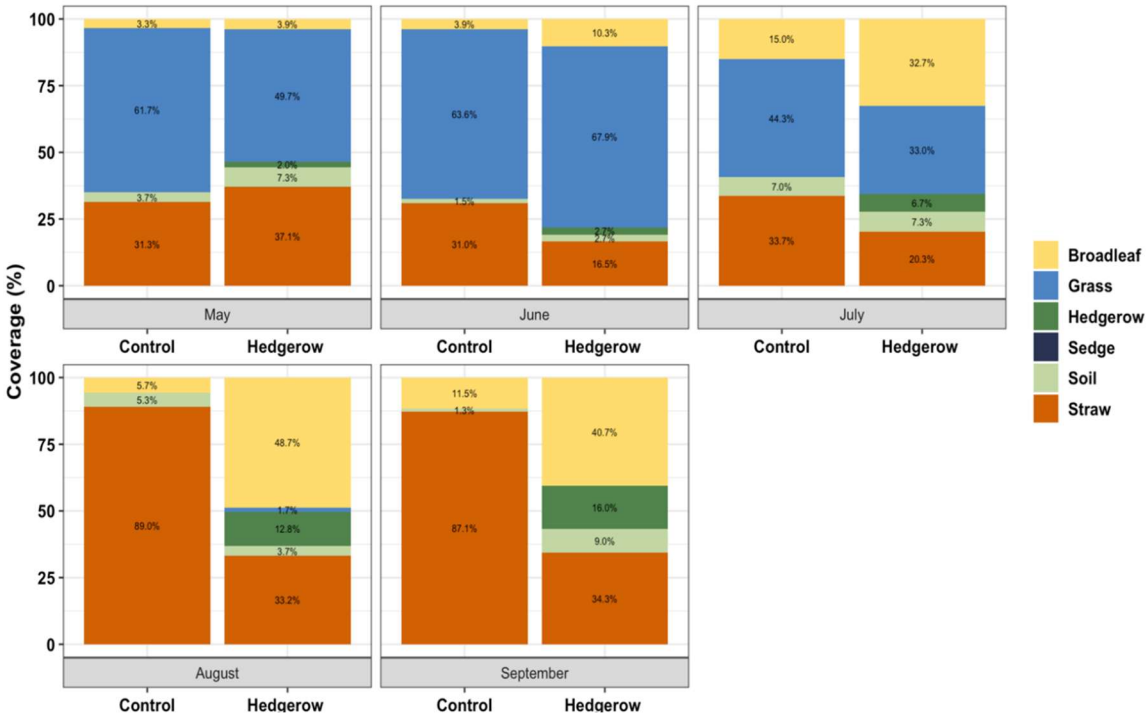


Figure 2. Percent cover in the hedgerow and untreated control of broadleaves, grasses, soil, straw, and hedgerow plants. Measurements were taken in 15 random 1 m x 1 m quadrats monthly per area starting at 1 month after planting.

Insect populations

To evaluate the benefits of hedgerows on insect populations, we used pit traps (in the ground) to collect the crawling insects and sticky traps to collect flying insects. We set up three pit traps and three sticky traps from the east, center, and west sections of the hedgerow area and unplanted control area and collected data monthly from May to September in 2024. In addition to traps, we used insect nets to sample insects from the tops of hedgerow plants, unplanted control areas, and adjacent rice fields. We conducted sweeps once each from the east, center, and west sections of both the hedgerow and unplanted control areas. We also conducted three sweeps at 40, 80, and 120 feet from the edge of both the hedgerow and unplanted control areas. Like the traps, insect sweeps were performed monthly from May to September in 2024.

As this study only began last year, data collection on insect population is still ongoing, and analysis has not yet been completed. However, we noticed an increased presence of praying mantises in the hedgerow areas, suggesting potential benefits in attracting more beneficial insects.

Establishment success rate for hedgerows

To evaluate the establishment success rate for hedgerow plants, we evaluated which plants survived the planting and established well. In May, July, and September 2024, we collected survivability data by counting the number of alive and dead plants for each hedgerow species. The survivability percentage = (the number of living plants/the total number of plants initially planted) * 100.

The first-year survivability data (Fig. 3) indicates coffeeberry appears less suitable as a hedgerow species in this particular location, potentially due to its intolerance to flooding. Willow and deer grass, however, may be better options. The hedgerow species' survival rate can be affected by the transplanting, so it is important to ensure the correct transplanting methods are used. Improper transplanting can lead to transplant shock, which may decrease plant survival. Hedgerow species could also be significantly affected by pesticide drift, particularly if pesticides are applied by air. This applies to both organic or conventional pesticides. To minimize pesticide exposure, it is important to maintain buffer zones between spray fields and hedgerows. Additionally, using larger spray droplets, applying pesticides during calm weather, and adjusting nozzle settings can help reduce drift. At this site, we collected phytotoxicity data, and found no phytotoxicity present after the adjacent rice field had an herbicide application.

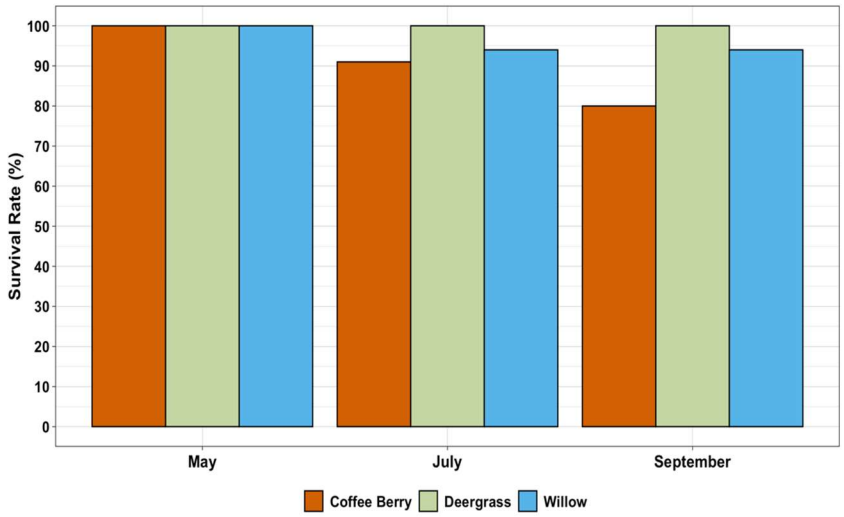


Figure 3. Percent survival of the transplanted coffee berry, deergrass, and willow at 1 month, 3 months, and 5 months after planting.

Littleseed Canarygrass Becoming Difficult to Control in Small Grains

Jorge Angeles, UCCE Weed Management Advisor, Tulare, Kings & Fresno Counties

Littleseed canarygrass (*Phalaris minor*) is a competitive winter annual grass weed that is becoming difficult to control small grain crops grown in the Southern San Joaquin Valley. In the last five years, pest control advisors (PCAs) in this region have reported weed escapes of littleseed canarygrass in both wheat and triticale. It is suspected that littleseed canarygrass in these small grain cropping systems has developed resistance to the post-emergence herbicides used to control grass weeds.

While multiple species of canarygrass exist in the Western United States, littleseed canarygrass (Phalaris minor) is the most prevalent, widespread and troublesome in small grain crops grown in the Southern San Joaquin Valley. In these small grain cropping systems, littleseed canarygrass is very prolific and competitive weed. In fields with heavy infestations of littleseed canarygrass, it is estimated that yield reductions can be greater than 50%. Littleseed canarygrass presents a significant challenge for wheat and triticale growers due to its prolonged germination period, which typically can start in October and continue through spring. This troublesome weed germinates at shallow depths (top ½ inch) alongside small grain crop seeds and from deeper depths (1–5 inches) in fields with cracked soils.

Management Issues

Since littleseed canarygrass emerges at different times throughout the growing season in small grain crops, fields will often contain weeds at varying growth stages that range from 1 leaf to tillering. The varying growth stages make it difficult to control this weed with herbicides, that must be applied at a specific growth stages. Post-emergence herbicides

used to control littleseed canarygrass in wheat include pinoxaden (Axial XL), pyroxsulam (Simplicity), fenoxaprop-p-ethyl (Puma), and mesosulfuron-methyl (Osprey). The application timing for these herbicides is between the 1-leaf and 2-tiller stages. There are fewer post-emergence herbicide options for triticale, as fenoxaprop-p-ethyl and pinoxaden are not registered for use in these crops.

Littleseed canarygrass can be controlled with pre-emergence herbicides in small grain crops, but these herbicides need to be applied before the weeds germinate. Pre-emergence herbicides may be ineffective in some soils under certain environmental conditions, as this weed can germinate through cracks in the soil. This means that pre-emergence herbicides registered for use in small grain crops, such as pendimethalin (Prowl H_2O) have limited efficacy due to the deep soil emergence of littleseed canarygrass. Residual herbicides such as trifluralin (Treflan) can be difficult to use because they need to be incorporated right after application to avoid reductions in herbicidal activity. These residual herbicides have plant-back restrictions on rotational crops like silage corn, so this needs to be taken into consideration when using these herbicide in rotational cropping systems.

Herbicide Resistance Screening Study

In the spring of 2024, littleseed canarygrass seeds were collected from a wheat field in Tipton, CA, where it was suspected that the littleseed canarygrass population had developed resistance to pinoxaden. The herbicides used in prior years in this wheat field were pyroxsulam and pinoxaden, both of which showed low to no control on littleseed canarygrass (Figure 1). An herbicide screening study was conducted at the greenhouses of Fresno State University to determine if the littleseed canarygrass population had developed resistance to the ACCase inhibitor herbicide, pinoxaden. Littleseed canarygrass seeds were grown in a greenhouse and sprayed with incremental rates of pinoxaden when the weeds reached the 2-tiller stage. The rates used in the study included replicated treatments of 1X and 2X label rates of pinoxaden (Axial XL). Weekly evaluations were conducted for 28 days after treatment, to assess the weed control efficacy of the herbicide rates. Based on the evaluations, it was determined that the pinoxaden 1X label rate did not fully control the littleseed canarygrass in the study (Table 1). The pinoxaden 2X label rate fully controlled the littleseed canarygrass (Figure 2). From the results of this study, it can be determined that the population of littleseed canarygrass from this wheat field has developed resistance to recommended label rate of pinoxaden in small grains. In 2025, herbicide screening studies will be conducted on littleseed canarygrass from this wheat field to determine if it is also resistant to ALS-inhibitor herbicides that are used in small grains such as pyroxsulam and mesosulfuron-methyl.

Final Comments

Herbicide resistance is becoming a growing issue in weed management for small grain crops in the Southern San Joaquin Valley. Nick Clark, UCCE Agronomy Advisor, and Anil Shrestha's research team from Fresno State University have led the research on confirming the herbicide resistance of common chickweed to ALS-inhibitor herbicides in small grain crops in this region. Another weed that has been well documented to have developed resistance to herbicides with different modes of action in small grain crops is Italian Ryegrass.

Although there is heavy reliance on the use of herbicides for weed control in small grain crops, it is important to effectively use all the available tools for weed control in these crops. A well-established stand and proper plant nutrition can help the crop compete effectively against weeds. A combination of mechanical cultivation and pre-plant burndown herbicides can help manage weeds after a fall rain and prior to planting. There are several pre-emergence herbicides for small grain crops in California that can be safely applied pre-plant and before crop emergence. When using post-emergence herbicides, consider rotating to herbicides with different active ingredients and modes of action to minimize herbicide resistance. For example, when controlling grass weeds in wheat, rotate between ALS-inhibitor herbicides such as pyroxsulam and mesosulfuron-methyl and ACCase-inhibitor herbicides like pinoxaden and fenoxaprop-p-ethyl. Apply post-emergence herbicides at the effective allowable rate, in combination with compatible adjuvants and herbicides, at the timing when weeds are most susceptible to herbicides and under the proper environmental conditions. Always refer to herbicide labels and available UC Cooperative Extension resources to find more information on the application timings and rates. Crop rotation can help reduce herbicide resistance by disrupting favorable conditions for certain weed species and allowing the use of herbicides with different modes of action. Overall, herbicide resistance is becoming a major concern in small grain

crops, and it is important to use multiple control strategies and a rotational herbicide program to help manage herbicide-resistant weeds and reduce the risk of herbicide resistance.

Figure 1. Littleseed Canarygrass in a wheat field after an application of pinoxaden (Axial XL). Littleseed canarygrass is suspected to have developed resistance to ACCase-inhibitor herbicides used in small grain crops.

Treatments	Rate	7 DAT	14 DAT	21 DAT	28 DAT
1. Untreated	0	0 c	0 c	0 b	0 c
2. Pinoxaden 1X (Axial XL)	16.4 fl oz/acre	20 b	23 b	24 b	26 b
3. Pinoxaden 2X (Axial XL)	32.8 fl oz/acre	35 a	45 a	99 a	100 a

Table 1. Results from the herbicide resistant screening study on littleseed canarygrass. Weekly weed control ratings (0 – 100% control) on littleseed canarygrass. Treatments sharing the same letters in each weekly weed control rating are not significantly different at the 0.05 level of significance.

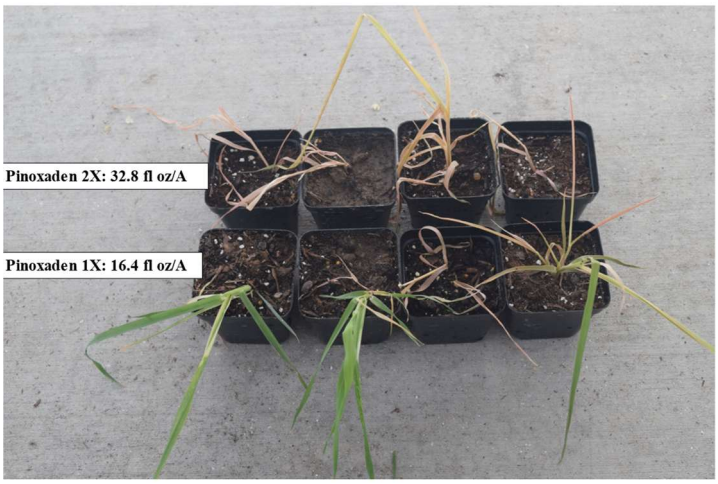


Figure 2. Herbicide resistant screening study on littleseed canarygrass at 28 days after treatment. Pinoxaden at 1X label rate did not control littleseed canarygrass at the end of the study.

Weed Control in Alfalfa: Thinking about moving away from paraquat for winter annual weeds.

Tom Getts, Weed Ecology and Cropping Systems Advisor- Lassen, Modoc, Sierra, and Plumas

"Alfalfa is a very competitive crop. A strong stand and good agronomic practices are the best defense against weeds". This is a paraphrased quote from Steve Orloff a late mentor of mine, and typically these words ring true when growing alfalfa. Being a good farmer goes a long way towards achieving effective weed control, and herbicides are but a band aid if there is a lot of bare ground between plants. With that being said, weeds are weeds for a reason. Weeds are incredibly competitive and find a way to grow even within a highly competitive crop like alfalfa. Where I work in the intermountain region, winter annual weeds are the biggest problem for growers. While the alfalfa is dormant (it dies back to the ground at high elevation) winter annuals get going in the fall, slowly growing, just waiting for the days of later winter/early spring to get an early jump competing with the queen of forages. Historically dormant season applications of a burndown herbicide combined with a soil residual herbicide applied in the fall or late winter has been the go to strategy to prevent weeds from contaminating the profitable first alfalfa cutting.

Paraquat (Gramoxone) has been the burn down material of choice, because it controls emerged broadleaves and grasses. It doesn't hurt that paraquat is not only effective, but pretty cheap. However, regulations have been creeping in, because paraquat is some pretty nasty stuff. It is good at breaking down plant cell membranes, but it is also good at breaking down *all* cell membranes including ours, which makes it a "danger poison" product and not one that you want to be exposed too. To that end many countries have banned it, and the EPA has implemented various regulations to control those who use it, specifically, requiring closed mixing systems and special training to limit exposure. This year DPR is re-evaluating the use of paraquat in California. They are currently accepting public comment about critical uses of paraquat in the state.

Considering paraquat's toxicity it may not always be something we have in the tool box for alfalfa weed management.

In terms of alternatives to paraquat there are more options for broadleaf weeds than grasses. Carfentrazone (Shark) and Saflufenacil (Sharpen) both have good burn down activity on broadleaves. Shark and Sharpen tend to burn the crop more than paraquat. Especially, Sharpen which will burn an alfalfa crop all the way back to the ground. This can be even more apparent down in the central valley where the alfalfa doesn't die back to the ground in the winter, but instead goes "dormant" (it can look quite ugly)! For both herbicides alfalfa yields tend not to be impacted, if it is a true dormant season application. The biggest issue with Shark and Sharpen is that they don't get the winter annual grasses like paraquat does. Adding one of the ACCase inhibitors like clethodim (Select) or sethoxydim (Poast) can pick up the grasses, but they don't work as well in colder weather and can have some antagonism when being tank mixed. Growers sometime lean towards key seedling alfalfa products like Imazamox (Raptor) and Imazethapyr (Pursuit) in established fields. While these can work in certain situations, they can miss certain weeds shifting the spectrum.

In previous years we have conducted many trials in the Honey Lake valley. We have been researching various alternatives to paraquat, including some experimental products that are not currently registered. In 2019 we had a 17 treatment trial where we evaluated crop safety and weed control of Shepard's Purse, and cheatgrass two of the most common weeds we deal with in the intermountain region. We looked at various combinations of residual herbicides with Shark and Sharpen compared to Gramoxone (paraquat) applied to dormant alfalfa. While all caused initial injury the crop was able to grow out of it (Figure One). In terms of weed control, by eleven weeks after treatment (before harvest) Shepard's Purse was adequately controlled by most treatments. Where the Cheatgrass was large at the time of application we only saw suppression when Gramoxone or Select was applied (Figure 2).
Weed Control Trial -2019

Alfalfa Crop Injury										
Treatment	Wk 1	Letter	Wk 2	Letter	Wk 4	Letter	Wk 7	Letter	Wk 11	Letter
Tricor DF 2/3lb + Shark 2oz	83	ab	58	abcd	8	ab	3	a	0	a
Tricor DF 2/3lb + Gramoxone 1qt	55	abc	45	bcde	10	ab	5	a	8	a
Tricor DF 2/3lb + Sharpen 2oz	86	ab	69	abc	13	ab	4	a	0	a
Velpar 1qt + Shark 2oz	80	ab	59	abcd	11	ab	6	a	3	a
Velpar 1qt + Gramoxone 1qt	56	abc	39	cde	10	ab	5	a	3	a
Velpar 1qt + Sharpen 2oz	75	ab	56	abcd	8	ab	0	a	0	a
Shark 2oz + Select 1.5pt	80	ab	84	a	21	a	13	a	8	a
Shark 2oz + Prowl 2qt	88	a	85	a	15	ab	3	a	0	a
Shark 2oz + Select 1.5pt + Prowl 2qt	88	a	74	abc	10	ab	0	a	0	a
Sharpen 2oz + Select 1.5pt	84	ab	81	ab	13	ab	4	a	0	a
Sharpen 2oz + Prowl 2qt	81	ab	79	ab	10	ab	3	a	0	a
Sharpen 2oz + Select 1.5pt + Prowl 2qt	89	a	75	abc	15	ab	8	a	5	a
Raptor 5oz + Prowl 2qt	29	cd	15	ef	10	ab	0	a	5	a
Raptor 5oz	46	bc	26	def	6	ab	5	a	11	a
Sharpen 2oz + VCX-3425 3.25oz	91	a	84	a	13	ab	0	a	1	a
Gramoxone 1qt + VCX-3425 3.25oz	78	ab	53	abcde	9	ab	4	a	0	a
Untreated	0	d	0	f	0	b	0	a	0	a

Figure One: Visual injury estimate for the alfalfa one, two, four, seven and eleven weeks after application. Letters indicate Tukey pairwise comparisons at the 95% confidence interval. Colors do not indicate differences but are included to help visualize the data.

Weed Control								
	Shepherd's Purse				Cheatgrass			
Treatment	Wk2	letter	Wk 11	letter	Wk2	Letter	Wk11	letter
Tricor DF 2/3lb + Shark 2oz	73.75	a	95	a	0	e	11	bc
Tricor DF 2/3lb + Gramoxone 1qt	73.75	ab	88	abc	86	a	44	abc
Tricor DF 2/3lb + Sharpen 2oz	86.25	ab	95	a	5	de	0	c
Velpar 1qt + Shark 2oz	88.75	ab	95	a	0	e	19	abc
Velpar 1qt + Gramoxone 1qt	62.5	ab	73	abc	88	a	65	ab
Velpar 1qt + Sharpen 2oz	86.25	ab	95	a	3	de	0	c
Shark 2oz + Select 1.5pt	80	ab	40	bcd	38	abcde	76	a
Shark 2oz + Prowl 2qt	86.25	ab	66	abc	6	de	0	c
Shark 2oz + Select 1.5pt + Prowl 2qt	88.75	abd	88	abc	48	abcde	55	abc
Sharpen 2oz + Select 1.5pt	80	abc	49	abc	55	abcd	68	ab
Sharpen 2oz + Prowl 2qt	87.5	abc	90	abc	13	cde	0	c
Sharpen 2oz + Select 1.5pt + Prowl 2qt	91.25	abc	73	abc	61	abc	66	ab
Raptor 5oz + Prowl 2qt	26.25	bc	94	ab	5	de	19	abc
Raptor 5oz	27.5	c	84	abc	22	bcde	39	abc
Sharpen 2oz + VCX-3425 3.25oz	87.5	de	84	abc	23	bcde	9	bc
Gramoxone 1qt + VCX-3425 3.25oz	58.75	de	36	cd	69	ab	40	abc
Untreated	0	e	0	d	0	e	0	c

Figure Two: Percent weed control of Shepherds Purse and Cheatgrass two and eleven weeks after application. Letters indicate Tukey pairwise comparisons at the 95% confidence interval. Colors do not indicate differences but are included to help visualize the data. All Gramoxone treatments included NIS ad 0.25% V/V and other treatments included MSO at 1% V/V.

Picture One: Larger winter annual grass weeds burned by gramoxone application but not controlled.

In 2020 We did a similar trial but made two application timings, one in the dormant season, and one after the alfalfa had broken dormancy and put on a little growth. Figure 3 shows crop injury and while there was significant injury, especially at the 2-inch growth stage, but the crop appeared to grow out of it by the time it was harvested. Tumble mustard and prickly lettuce were adequately controlled by most treatments at the dormant growth stage, where Gramoxone looked a little better at the later growth stage on prickly lettuce. (Figure 4). Cheatgrass was only effectively controlled when it was treated when it was small, and either Gramoxone or Select was included in the tank.

Alfalfa Crop Injury Rating. Dormant Treatments

Treatment	1 wk		2 wk		2 inch 1 wk after		2 inch 2 wk after		Before Cutting	
Control	0	b	0	b	0	b	0	c	3.33	a
metribuzin (tricor 75df) .67 lb	0	b	12.5	ab	0	b	0	c	2.5	a
CNV2243 16 floz	0	b	12.5	ab	0	b	0	c	5	a
metribuzin (tricor 75df) .67 lb + gramoxone 1 qt	50	ab	10	ab	0	b	0	c	2.5	a
metribuzin (tricor 75df) .67lb + sharpen 2 oz	45	ab	12.5	ab	0	b	0	c	2.5	a
metribuzin (tricor 75df) .67 lb + shark 2 oz	46.7	ab	7.5	ab	0	b	0	c	0	a
CNV2243 16 floz + gramoxone 1 qt.	32.5	ab	13.8	ab	2.5	b	0	c	0	a
CNV2243 16 fl oz + sharpen 2 oz	42.5	ab	20	a	0	b	0	c	5	a
CNV2243 16 fl oz + sharpen 2 oz + select 22 oz	65	a	10	ab	17.5	b	0	c	13.8	a
CNV2243 16 oz + shark 2oz	37.5	ab	10	ab	0	b	0	c	0	a
2 in metribuzin (tricor 75df) .67 lb + gramoxone 2 qt	12.5	b	0	b	67.5	a	25	b	2.5	a
2 in metribuzin (tricor 75df) .67 lb + shark 2 oz	0	b	0	b	82.5	a	37.5	ab	2.5	a
2 in CNV2243 4L 16 fl oz + gramoxone 2 qt.	0	b	0	b	71.3	a	32.5	ab	2.5	a
2 in CNV2243 4L 16 fl oz + Shark 2oz	0	b	0	b	82.5	a	47.5	ab	25	a
2 in CNV2243 16 fl oz + Shark 2 oz + Select 22 oz	0	b	0	b	82.5	a	55	a	3.75	a

Figure 3: Visual injury estimates for the alfalfa one and two weeks after applications, as well was before harvest. 2 in- indicates treatments made after the crop had broken dormancy, and had two inches of growth. Letters indicate Tukey pairwise comparisons at the 95% confidence interval. Colors do not indicate differences but are included to help visualize the data.

Dormant Trial: Percent Weed Control Before Harvest						
	Tumble Mustard		Prickly Lettuce		Cheatgrass	
metribuzin (tricor 75df) .67 lb	91	a	83	ab	75	a
CNV2243 16 floz	35	bc	30	abc	14	bc
metribuzin (tricor 75df) .67 lb + gramoxone 1 qt	94	a	95	a	95	a
metribuzin (tricor 75df) .67lb + sharpen 2 oz	95	a	95	a	48	abc
metribuzin (tricor 75df) .67 lb + shark 2 oz	95	a	95	a	46	abc
CNV2243 16 floz + gramoxone 1 qt.	88	ab	91	a	88	a
CNV2243 16 fl oz + sharpen 2 oz	93	a	94	a	41	abc
CNV2243 16 fl oz + sharpen 2 oz + select 22 oz	93	a	95	a	94	a
CNV2243 16 oz + shark 2oz	89	ab	64	abc	3	c
2 in metribuzin (tricor 75df) .67 lb + gramoxone 2 qt	90	a	89	ab	43	abc
2 in metribuzin (tricor 75df) .67 lb + shark 2 oz	94	a	46	abc	5	c
2 in CNV2243 4L 16 fl oz + gramoxone 2 qt.	71	ab	90	a	63	ab
2 in CNV2243 4L 16 fl oz + Shark 2oz	71	ab	68	abc	10	bc
2 in CNV2243 16 fl oz + Shark 2 oz + Select 22 oz	68	ab	70	abc	64	ab
Control	0	c	0	c	0	c

Figure 4: Percent weed control of Tumble Mustard, Prickly Lettuce and Cheatgrass before harvest. 2 in- indicates treatments made after the crop had broken dormancy, and had two inches of growth. Letters indicate Tukey pairwise comparisons at the 95% confidence interval. Colors do not indicate differences but are included to help visualize the data. All Gramoxone treatments included NIS and 0.25% V/V and other treatments included MSO at 1% V/V

Picture Two: Application of Sharpen and Metribuzin, missing Cheatgrass in the 2020 trial. Cheatgrass infested hay can make hay unsellable due to the injury caused to livestock mouths by the seedheads.

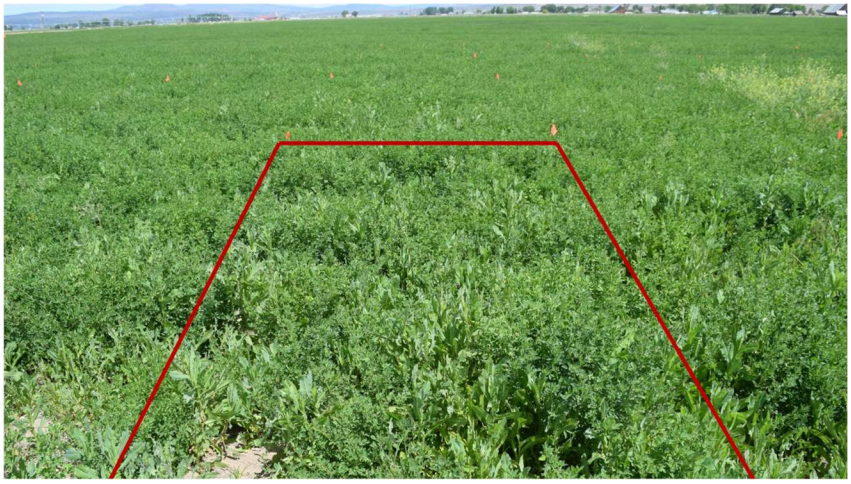
We also wanted to look at some of the later post emergent applications of Raptor (now Beyond Extra- or generic) and Pursuit in established hay. Applications were made after the crop broke dormancy and had 2-4 inches of growth. Initial stunting was observed, but the crop grew out of the injury (Figure 5). We got good control of tumble mustard in most treatments, control /suppression of cheatgrass in some treatments, and no control of prickly lettuce. (Figure 6). The high rate of Raptor offered numerically better control of Cheatgrass when 17 lb/s of Ammonium sulfate/acre were added to the tank.

Honey Lake Valley Trial: Alfalfa Injury						
	Week One		Week Two		Before Cutting	
Pursuit 3oz	25	a	7	a	7	a
Pursuit 6oz	23	a	13	a	3	a
Raptor 6oz	21	a	8	a	5	a
Pursuit 3oz + Select 16oz	23	a	13	a	0	a
Pursuit 6oz + Select 16oz	39	a	10	a	3	a
Raptor 6 oz + Select 16oz	26	a	15	a	3	a
Pursuit 3oz + AMS	30	a	15	a	5	a
Raptor 6 oz + AMS	23	a	11	a	5	a
Pursuit 3oz + Select 16 oz + Prowl 2qt	23	a	13	a	3	a
Pursuit 6oz + Prowl 2 qt. + AMS	19	a	8	a	11	a
Raptor 6oz + Prowl 2 qt. + AMS	25	a	13	a	3	a
untreated **	0		0		5	

Figure Five: Visual injury estimates on the alfalfa one and two weeks after application, as well was before harvest. Letters indicate Tukey pairwise comparisons at the 95% confidence interval. Colors do not indicate differences but are included to help visualize the data.

Honey Lake Valley: Percent Weed Control Before Harvest						
Treatment	Tumble Mustard		Prickly Lettuce		Cheatgrass	
Pursuit 3oz	78	a	20	a	17	c
Pursuit 6oz	70	a	23	a	35	bc
Raptor 6oz	95	a	10	a	69	abc
Pursuit 3oz + Select 16oz	94	a	5	a	66	abc
Pursuit 6oz + Select 16oz	71	a	15	a	51	abc
Raptor 6 oz + Select 16oz	95	a	20	a	85	ab
Pursuit 3oz + AMS	95	a	20	a	18	c
Raptor 6 oz + AMS	95	a	33	a	93	a
Pursuit 3oz + Select 16 oz + Prowl 2qt	76	a	28	a	65	abc
Pursuit 6oz + Prowl 2 qt. + AMS	95	a	35	a	64	abc
Raptor 6oz + Prowl 2 qt. + AMS	95	a	38	a	90	ab
untreated **	0		0		0	

Figure 6: Percent weed control of Tumble Mustard, Prickly Lettuce and Cheatgrass before harvest. Letters indicate Tukey pairwise comparisons at the 95% confidence interval. Colors do not indicate differences but are included to help visualize the data. All treatments included MSO at 1% V/V.



Picture 3: Raptor+AMS providing good control of the Cheatgrass and Tumble Mustard but not controlling the Prickly Lettuce.

Generally, there is no 'one to one' substitute for paraquat for weed control in alfalfa because other burndown herbicides do not control grasses. Grass control can be achieved by adding products like Raptor or Select, but because they are more expensive this can incur an increased cost. I called a pesticide dealer this February to get a quote for current prices for the burndown component of a tank mixture, and 1 qt of Gramoxone was running around $14.50, compared to Sharpen 2oz + Select 22oz costing $28.65. So just about double the cost to get activity on both grasses and broadleaf weeds. Whenever treating weeds it is also really important to make sure that the weed growth stage is at a size which may be effectively controlled. Generally larger weeds are more difficult to control and will take higher rates of product regardless which ones are used! We may being to see a shift toward more applications of residual materials applied multiple times a year, to target all weeds prior to germination.