Sacramento Valley Field Crops Newsletter

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In This Issue

Submitted by:

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Common ALS inhibitor herbicides not controlling common chickweed in small grains?

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In the fall of 2020, PCAs in the southern San Joaquin Valley were urging me to visit small grain fields where common chickweed was escaping control by ALS inhibitor herbicides pyroxsulam (Simplicity CA) or tribenuron (Express). When I observed the fields, I had all of the normal questions about herbicide application and weed control. What weeds are present in the sprayed versus unsprayed area? How was the weather and soil moisture in the period around the application? What was the application rate and dilution? How was the herbicide put on? These questions helped me and the PCA assess if there was any management or environmental cause for poor control of the chickweed.

Figure 1. Common chickweed in small grain crop uncontrolled after ALS inhibitor herbicide application. Absent of other weeds.

Most notably in these fields, common chickweed showed no signs of injury in the sprayed area, while a multitude of weeds were present in the unsprayed areas under power lines where the helicopter could not safely reach (Figures 1 & 2). Weather and application records did not indicate any obvious problems that would diminish herbicide efficacy on the chickweed specifically. So we asked around to see if anybody else was experiencing a similar problem. It turned out a field several miles away had a company herbicide trial inside it. Pyroxsulam and tribenuron treatments were among the plots in the trial in this field, and lo and behold the common chickweed was not controlled. This prompted a call to our statewide Weed Science Specialist, Brad Hanson, with a request to observe the field with us and go over the whole litany of operator and environmental cause questions again. After that visit we decided to set up a trial of our own within one of the fields where chickweed was escaping control with the ALS inhibitor herbicides.

With the help of former UCCE Weed Science Advisor, Jose Dias, we set up a replicated herbicide trial that included 2X and 4X applications of tribenuron and pyroxsulam with an untreated control for comparison. Four weeks after the application, we returned to evaluate the chickweed for herbicide control. We found that tribenuron did reduce the chickweed growth relative to the untreated control, and there was a dose response where the 4X rate reduced the canopy more. We also observed that pyroxsulam did not reduce the chickweed canopy relative to the untreated control regardless of application rate (Figure 3). Based on our test we concluded that we could not rule out the possibility of ALS inhibitor herbicide resistance in common chickweed.

Figure 2. Edge of field where helicopter missed herbicide application. Cheeseweed, shepherd's-purse are present.

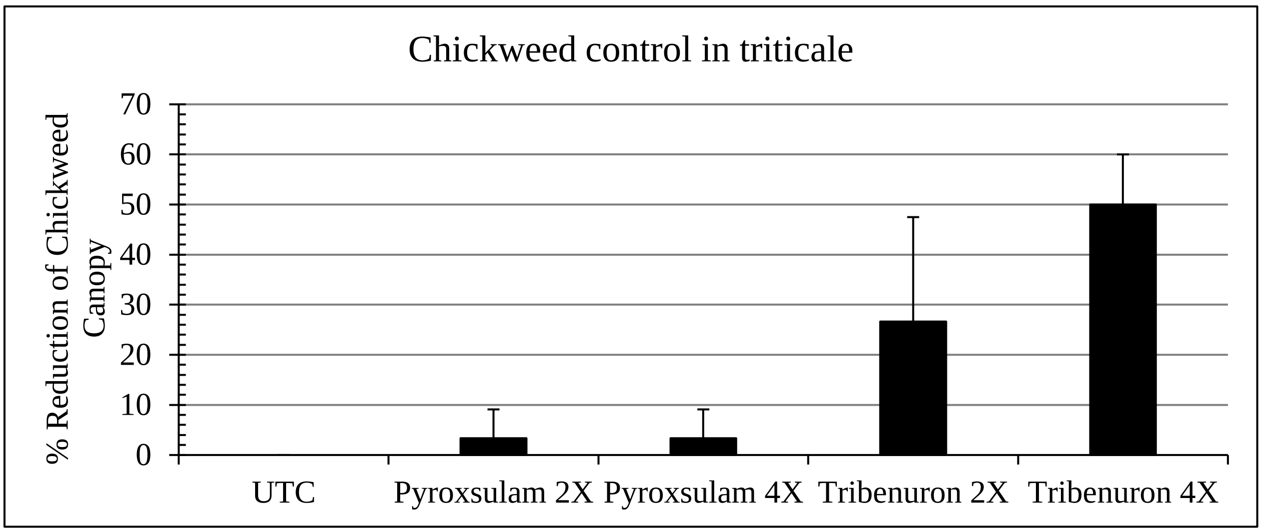


Figure 3. Results from in-field herbicide rate study on chickweed control. Tribenuron showed some activity by reducing the chickweed canopy but pyroxsulam did not. Error bars represent one standard deviation. Bars under the same lowercase letter are not significantly different at α = 0.05 according to a Tukey HSD test.

Following our failure to rule out herbicide resistance, we collected mature chickweed seeds from plants in the fields where the ALS herbicide escapes occurred and from an organic pistachio orchard with no history of ALS inhibitor herbicide application. At that point, we had two populations of chickweed seeds: 1) from fields where we suspected herbicide resistance and 2) from a field where we expected herbicide susceptibility. With the help of Fresno State University student, Paola Villicana, and professor, Anil Shrestha, we planted the chickweed seeds in pots in the greenhouse and prepared them to be sprayed with tribenuron and pyroxsulam under optimal conditions for control. Figure 4 shows an example of results observed in that study. Table 1 shows weekly data of common chickweed control from the susceptible and herbicide escape populations. It also shows whether or not the plants eventually flowered. We sprayed up to 8X the label rate of each herbicide, and four weeks after application we preliminarily concluded that ALS inhibitor herbicide resistance is likely present. Further, the development of flowers on treated plants suggests reproduction of herbicide resistant plants is possible.

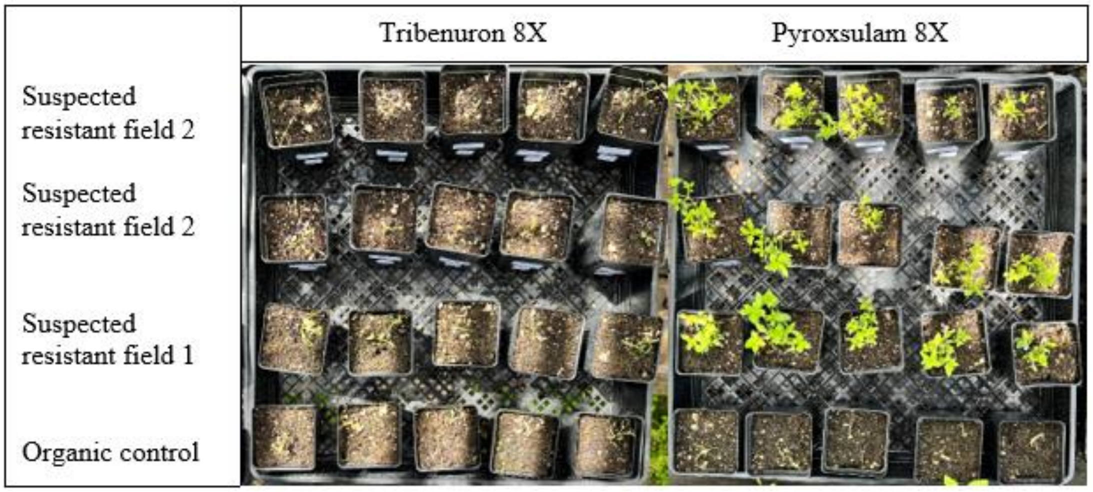


Figure 4. ALS inhibitor herbicide to control chickweed in a greenhouse study. Plants from suspected resistant fields were reduced and some killed by tribenuron at 8X the label rate, although lower rates did not control the weed as well. Plants from suspected resistant fields were not controlled or killed by pyroxsulam up to 8X the label rate.

Table 1. Weekly mortality and reproduction of chickweed after ALS herbicide application.

Seed source	Herbicide	Rate	Mortality wk1	Mortality w2	Mortality w3	Mortality w4	Flower
Organic	Tribenuron	0x	0%	0%	0%	0%	100%
		0.5x	0%	0%	90%	100%	0%
		1x	0%	0%	90%	100%	0%
		2x	0%	0%	90%	100%	0%
		4x	0%	0%	94%	100%	0%
		8x	0%	0%	90%	100%	0%
	Pyroxsulam	0x	0%	0%	0%	0%	80%
		0.5x	0%	0%	10%	100%	20%
		1x	0%	0%	90%	100%	40%
		2x	0%	0%	90%	100%	40%
		4x	0%	0%	90%	100%	60%
		8x	0%	0%	90%	100%	0%
Escape	Tribenuron	0x	0%	0%	0%	0%	100%
		0.5x	0%	0%	9%	45%	40%
		1x	0%	0%	1%	26%	73%
		2x	0%	0%	0%	64%	47%
		4x	0%	0%	7%	86%	20%
		8x	0%	0%	9%	98%	0%
	Pyroxsulam	0x	0%	0%	0%	0%	93%
		0.5x	0%	0%	0%	0%	100%
		1x	0%	0%	0%	0%	100%
		2x	0%	0%	0%	0%	100%
		4x	0%	0%	0%	0%	100%
		8x	0%	0%	0%	0%	100%

We are currently repeating the greenhouse study in an attempt to verify our results, and we will also include mesosulfuron (Osprey), another commonly used ALS inhibitor herbicide in small grains, in our study. Additionally, we are applying for funding to learn about the extent to which ALS resistant chickweed occurs in California. Please be on the lookout in spring of 2024 for a survey asking for your input about experience controlling or not controlling chickweed in small grains. In the meantime, there are several things you can do to ensure acceptable weed control in small grains.

- Good stand establishment with adequate plant nutrition makes the crop competitive against weeds
- Use mechanical cultivation of weeds after a fall rain or pre-irrigation prior to sowing.
- Consider pre-plant burndown or pre-emergent residual control. Several herbicide products are registered for these uses in CA.
- Several other non-ALS herbicides with known activity against chickweed are registered in CA, such as pyraflufen, dicamba, and carfentrazone.
- Rotate crops *and* herbicide active ingredients to avoid evolution of herbicide resistance. Remember that sometimes the trade name for an active ingredient or herbicide with a similar mode of action can be different depending on the crop for which it's labeled.

Lessons from Dealing with Italian Ryegrass in California Small Grains

Konrad Mathesius, UCCE Agronomy Advisor, Sacramento, Solano, and Yolo Counties

Italian ryegrass (*Lolium muliflorum*, in this article I'll refer to it as "ryegrass") is an aggressive weed species that has developed resistance to several different herbicides in California.

In the last few years, while some of the projects have provided valuable data, one could argue that I've gained as much information via some of the mistakes that have been made. What better way to improve your farming than by letting me make the mistakes for you? Below are some of the top things I would recommend that growers keep in mind when dealing with ryegrass.

Do not overlook a stale seedbed

Wet conditions in the South Sacramento Valley in October of last year (2021) left a lot of the fields damp for an extended period of time, shortening the time growers had to complete field operations. For several reasons, a burndown was skipped in favor of coming back with an early in-season spray in my trial site. However, by the time the spray window rolled around (in late January), the weather had dried out and much of the ryegrass was well established and had created fierce competition with the crop (wheat, planted in mid-December). This dramatically reduced tillering and thus greatly reduced overall yield potential.

The lesson: The best chance to control ryegrass (and most other weeds) is at the seedling stage. Growers should not overlook burndown treatments, particularly when dealing with weeds that are strong candidates for the development of herbicide resistance.

Label treatment windows are for ideal conditions

The downpour of rain in October and the damp weather in November/December eventually did a complete 180 and turned into one of the longest dry periods that this part of the state had ever seen. By the time the wheat was mature enough to metabolize an in-season spray, much of the ryegrass had already been experiencing drought conditions for a few weeks. With some herbicides, the impact of drought-driven conditions may be less dramatic, but with others, a drought period may be much more problematic. In the

2022 trials, even though the spray was applied within the acceptable window for all the different herbicides used, the drought conditions rendered one of the herbicides used completely useless (Axial). This occurred despite the fact that herbicide had been used in the previous year on that same acreage with almost complete control as a burndown.

A ground view of heavy Italian ryegrass pressure after drought conditions reduced the efficacy of the Axial treatment in the 2021-2022 herbicide field trials.

The lesson: Postemergence herbicides should be sprayed on healthy, well-irrigated, actively growing weeds. Drought conditions will harden plants and allow for active ingredients to degrade. Know what the spray windows are on the label, but also consider the conditions when deciding when to apply. Within reason, herbicide sprays should be prioritized when weighed against other farm activities, this will improve the chances of the sprays having the intended effect and will help slow the selection for moderately resistant individuals that may be in the population.

Herbicide efficacy can vary from one region to another

I was initially surprised by the results from this year's herbicide trial. Osprey performed relatively well. I know from experience that there are populations of ryegrass that are resistant to Osprey in the Dixon area and in parts of the Montezuma Hills. The grower clarified that he had never used Osprey on his acreage (near Esparto). Thus, it's difficult to make sweeping generalizations about the efficacy of herbicides used in the trial in the control of ryegrass.

The lesson: In addition to diversifying your herbicide program across seasons and within the season, familiarize yourself with what works where and be on the lookout for possible resistant populations. In some cases, escapes may be related to weather or other factors. If you do have escapes, don't be too quick to use the 'R-word' (resistance), but it's helpful to know what has and hasn't been used and what is or is not effective in your area. Above all: take good notes and share your observations with your local Farm Advisor.

Consider integrating mechanical controls into your weed control program

Previous studies have indicated that mechanical control of ryegrass is only about half as effective as an herbicide burndown, but mechanical cultivation can help remove herbicide-resistant individuals from the seed bank. A double cultivation, spaced several days apart, using a field cultivator can remove the first flush of weeds from a field and can be followed-up with a burndown spray as new seedlings emerge. But again, don't skip the burndown.

On the other end of the timeline, harvest weed seed control (HWSC) may be useful in California. HWSC is a term for several practices that capture or destroy weed seed at harvest, before it can be returned to the weed seed bank. Studies to determine shatter rates (the amount of weed seed that has fallen off the plant at harvest) indicate that shatter rates of ryegrass in California are similar to those in areas where harvest weed seed control trials have been successful (~40% shatter at harvest).

Where all of this could become problematic is in the case of early rains where no burndown can be applied. If the weed species are dramatically ahead of the crop on the growth curve, it will likely mean that more of the weed seed has shattered by the time the crop is ready for harvest.

The lesson: mechanical controls, pre-plant and at harvest, combined with a diversified herbicide program will provide the best possible control. Cultivation is helpful in slowing the development of resistance, but should not jeopardize a burndown spray. Growers should pay close attention to environmental conditions that may impact shatter rates such as early rainfall prior to planting or high winds near harvest.

For more information on this research check out the [Sacramento Valley Field Crops Blog]

New Winter Cover Crop Cost Study Released

UC Cooperative Extension has released a new cost study. The study, "Estimated Costs for a Winter Cover Crop in An Annual Crop Rotation," is available here: https://coststudyfiles.ucdavis.edu/uploads/pub/2022/09/28/2022covercropsbenefits.pdf

This cost study can be used to determine the costs per acre of managing cover crops from planting to termination.

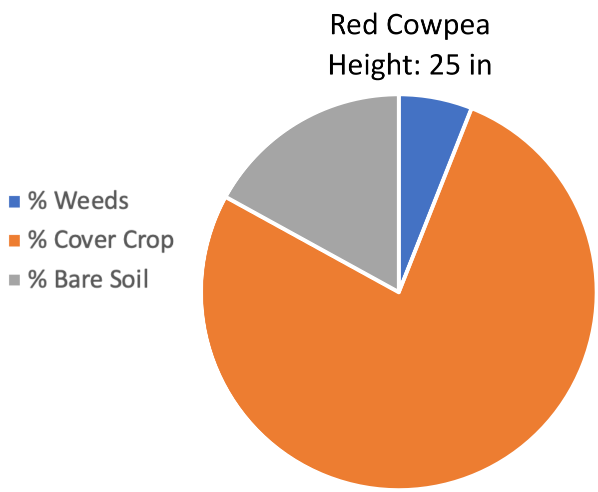
Contact Sarah Light selight@ucanr.edu with any questions

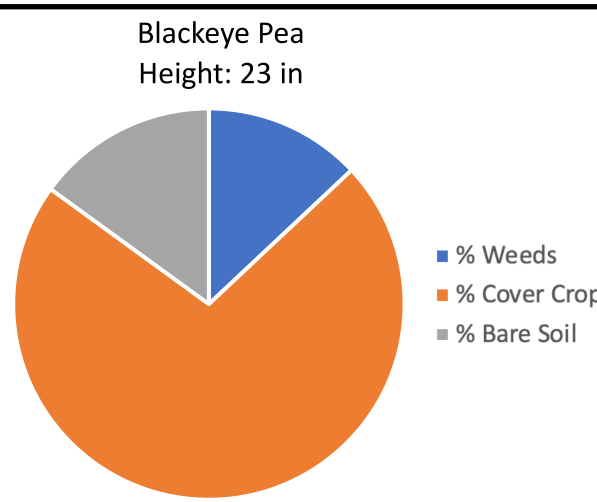
Summer Cover Crop Performance in the Sacramento Valley

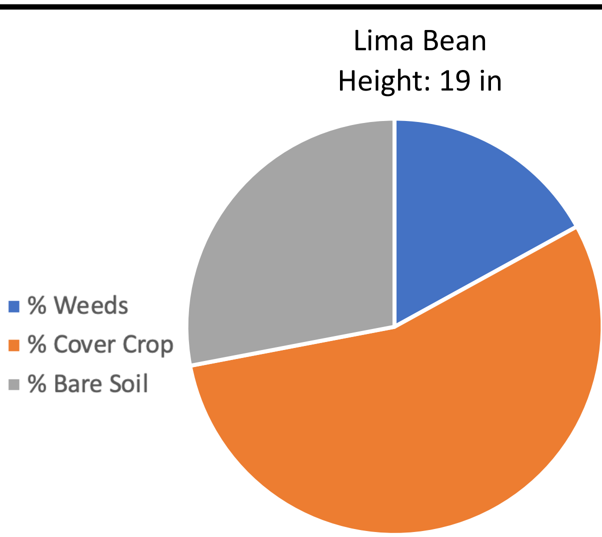
Sarah Light, Agronomy Advisor, Sutter-Yuba and Colusa Counties

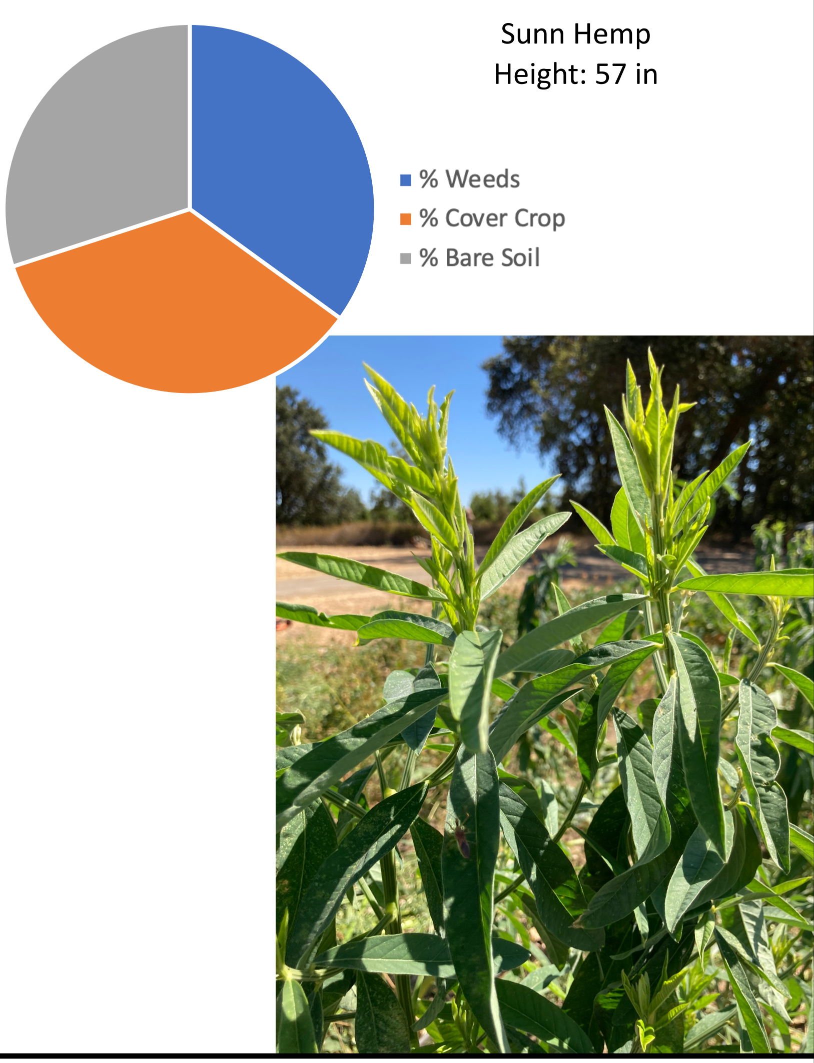
Single bed plots were planted with a push planter on June 27, 2022. Percent Cover (cover crop, weeds, bare soil) and height were collected on August 24th, 2022. Photos were taken on the same day. Planting depth was not adjusted by species and seeding rate was dependent on seed size and planter seed plate. This was intended as a demonstration of species performance in the region.

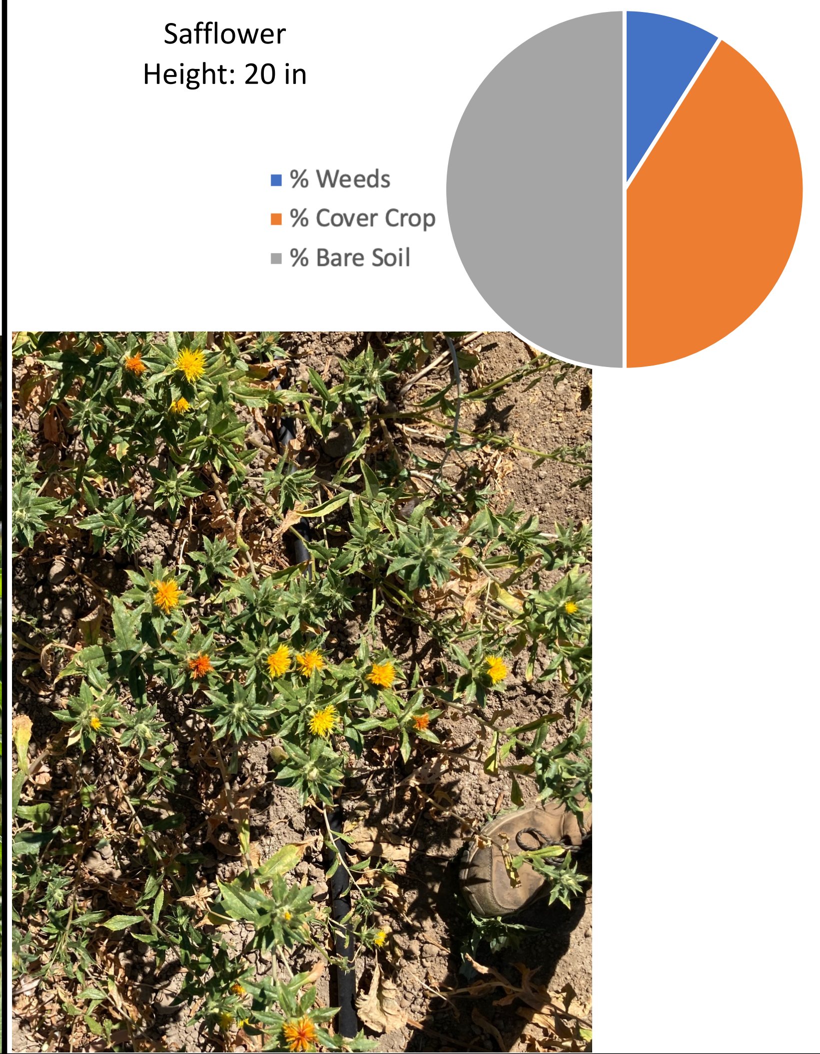
Two lines of surface drip were placed on top of each bed after planting and plots were irrigated up. Approximately 7 inches of water was applied in total for the season. The plots received between 3 and 3.5 inches of water at planting, and the remaining water was applied following that as needed. Water was shut off completely on August 5th.

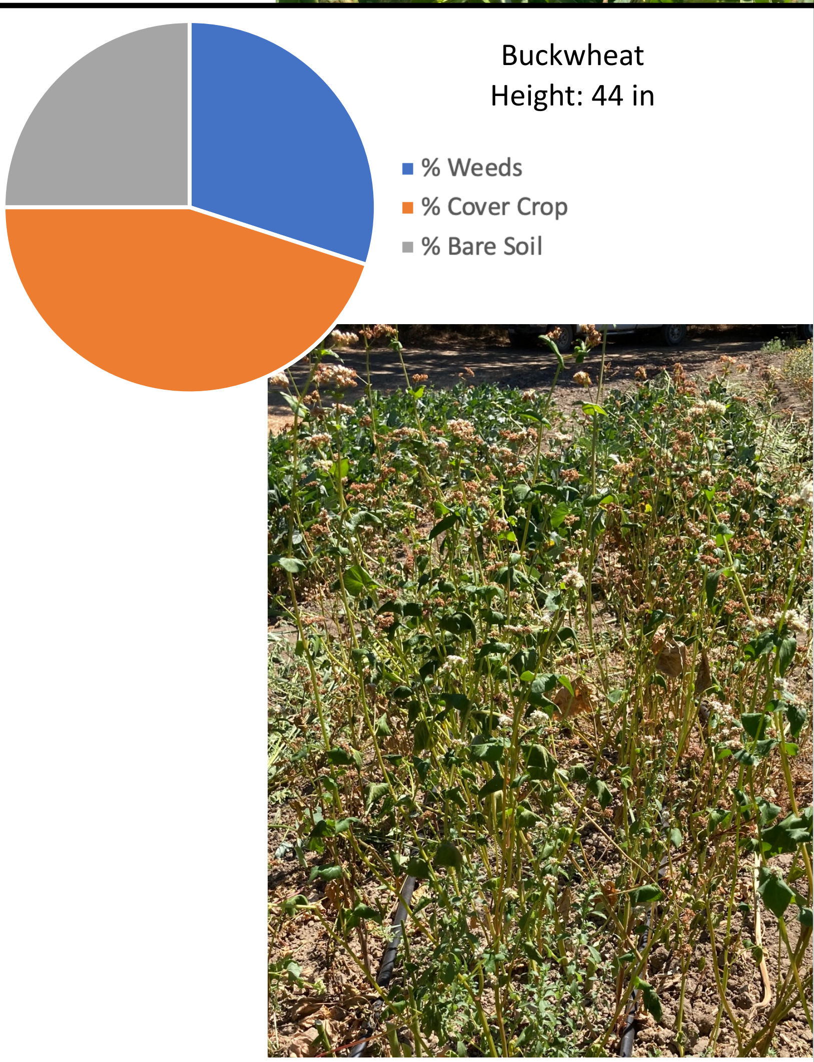


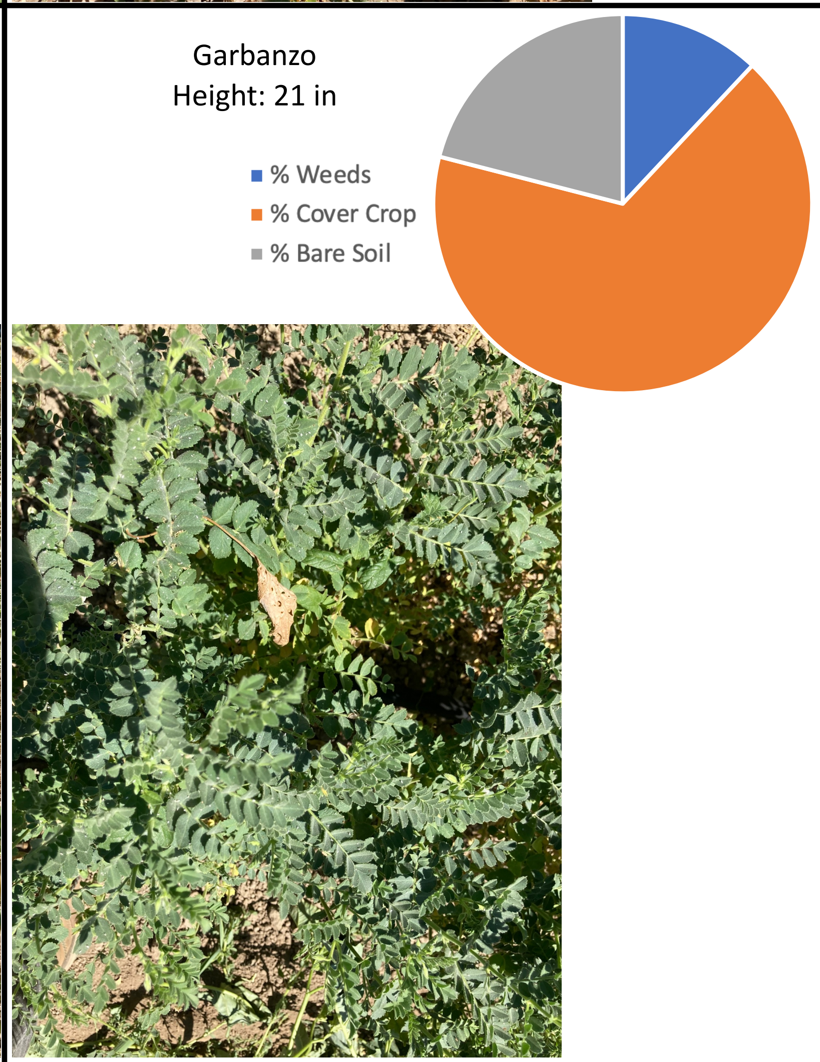




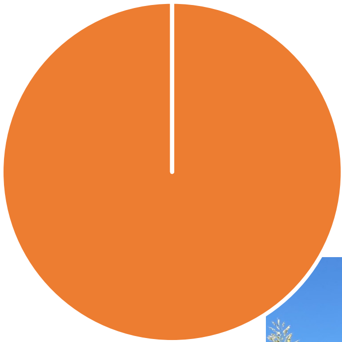

Sunn Hemp
Height: 57 in
% Weeds
% Cover Crop
% Bare Soil


Safflower
Height: 20 in
% Weeds
% Cover Crop
% Bare Soil

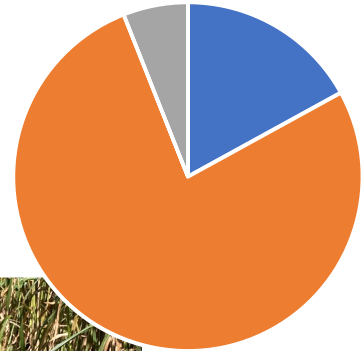

Buckwheat
Height: 44 in
% Weeds
% Cover Crop
% Bare Soil


Garbanzo
Height: 21 in
% Weeds
% Cover Crop
% Bare Soil

Piper Sudangrass
Height: 86 in

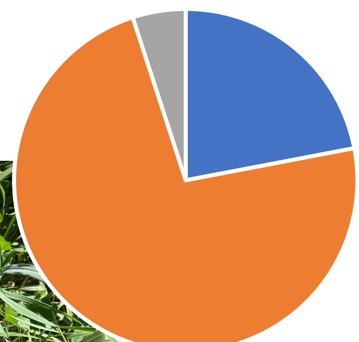


Grain Sorghum
Height: 28 in



Sorghum x sudangrass
Height: 84 in

Teff Grass
Height: 21 in



White Proso Millet
Height: 43 in

Japanese Millet
Height: 54 in