CWSS Research Update and News

Information on Weeds and Weed Control from the California Weed Science Society

Volume 14, Number 2 December 2019

In This Issue

Introduction

Whitney Brim-DeForest, Editor

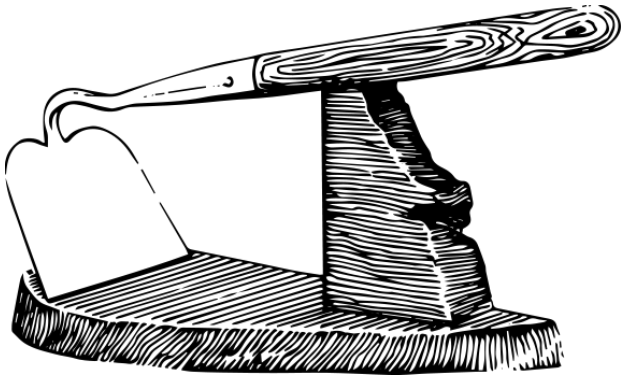
The next California Weed Science Society meeting will be January 22-24, 2020, in beautiful Monterey Bay, at the Portola Hotel and Spa. If you haven't yet registered, do so soon, before registration rates go up!

This issue covers a variety of topics, including an introduction to our 2018 Student Scholarship Winners (2019 winners will be featured in the next issue), an update from our steering committee on attendees from the last conference (2019), as well as an introduction to your CWSS Board of Directors. Research topics include summer weed control in orchards, as well as the pendimethalin use in orchards and vineyards.

As always, we are looking for contributions to this research update—the next deadline is June 15th for the summer issue.

I look forward to seeing you at the conference in January!

-Whitney



2018 Student Scholarship Award Recipients

Celeste Elliot, CWSS Office Manager

In 2018, the society awarded 10 scholarships in the amount of $1000 each. The society also awarded scholarships in 2019, we will have profiles forthcoming in another issue. The 2018 student award recipients include:

Alex Ceseski (*Photo left*) – University of California, Davis
Ph.D. student under Dr Kassim Al-Khatib, UC Davis

I'm working on elucidating the genetic and/or metabolic mechanisms of ALS-inhibitor resistance in smallflower umbrella sedge (*Cyperus difformis*), a major weed of California rice. I have already found that ALS cross-resistance is widespread throughout the region, and that several ALS-resistant populations of smallflower are also resistant to propanil. Knowledge of the incidence and distribution of this cross- and multiple-resistance can help growers make informed choices in their herbicide program.

I am also developing a drill-seeding program for California rice that utilizes existing cultivars planted at depths below one inch. My working hypothesis is that deeper seeding puts the rice below the weed seedbank, allowing for a postplant-preemergence burndown application of glyphosate or another economical broad-spectrum herbicide. This technique could result in reduced per-acre herbicide costs and reduced selection pressure for resistance to current rice herbicides to develop. It may also be a useful technique in fields with infestations of weedy (red) rice, which is tolerant to current rice herbicides. Currently I am evaluating a cultivar that shows promising emergence and stand development at up to 2-inch seeding depth.

Patrick Dotsy *(Photo right)* – California Polytechnic State University, San Luis Obispo

This fall I will be a senior at Cal Poly San Luis Obispo. I am majoring in Agricultural Business with a minor in fruit science under my advisor, Dr. Lynn Hamilton. I plan to obtain my PCA license upon graduation and be a crop protection sales representative for Corteva Agriscience (the newly merged DowDupont).

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Liberty Galvin (*Photo left*) – University of California, Davis

Liberty Galvin is a PhD student working under Kassim Al-Khatib in the Horticulture and Agronomy graduate group at University of California, Davis. She is conducting research to determined best management practices for reducing pervasiveness of weedy rice in California rice crops. Currently, she is exploring the range of biophysical conditions necessary for breaking dormancy, germination, and emergence of five genetically distinct weedy rice biotypes. In the future Liberty hopes to work in an extension and outreach setting with the goal of becoming a communication intermediary between the creators and implementers of research outcomes.

Steven Haring (*Photo right*) – University of California, Davis

Steven Haring is currently a PhD student at UC Davis working with Dr. Brad Hanson. He is studying weed ecology with the goal of developing integrated weed management programs for almond orchards. After graduation, Steven hopes to work in an extension or outreach career that will allow him to collaborate with growers and improve their farm operations.

Mikayla Harmer (*Photo left*) – California State University, Chico

I will be attending Chico State in the fall as a Land Resource Management major. My career goals include working on/developing an invasive weed management program at the county agriculture office in our area, or for the BLM recreation department.

Haejung Kim (*Photo right*) – Mt. San Antonio College

Haejung Kim is a horticulture student at Mt. San Antonio College in Walnut, CA. After working as a motion graphics designer for 13 years, she is now pursuing her love of plants and the outdoors. She is studying to become a PCA in the near future.

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Andrew McHaney (*Not Pictured*) – California Polytechnic State University, San Luis Obispo

Andrew McHaney is going into his fourth year at California Polytechnic University San Luis Obispo as Agricultural and Environmental Plant Science major. He has spent a lot of time over the last few summers working on the Central Coast interning as a Pest Control Advisor Trainee. This year he has had a lot of experience in the application and recommendation writing processes for herbicide sprays. Besides sprays he has also had experience with Integrated Pest Control techniques and looks forward to heading back to Cal Poly in the fall to get well rounded exposure to all aspects of crop production.

Drew Wolter (*Photo left*) – University of California, Davis M.S. Student, Horticulture and Agronomy Graduate Group

I am pursuing a Master of Science in Horticulture and Agronomy from the University of California, Davis. I study and work as a graduate student researcher under Dr. Brad Hanson where I seek to better understand the biology and control of *Eleusine tristachya*, a poorly understood but increasingly noxious weed in California orchard systems. My professional goal is to serve my community as a Cooperative Extension Farm Advisor, specifically working with orchard and vineyards, and acting as a liaison between our state's farmers and academic researchers.

CWSS Meeting Demographics 2019

Lynn Sosnoskie, CWSS Steering Chair, Cornell University

In January 2019, the CWSS held its annual meeting (January 23rd-25th) at the Hyatt Regency in downtown Sacramento. A total of 505 people attended the meeting; 161 of the attendees responded to a survey distributed at the business luncheon designed to identify who was attends the CWSS, their reasons for participating in the event, and how they would like to access the meetings in the future.

Of the 161 respondents, 29% were PCAs, 19% were growers or applicators, 16% were manufacturing reps, 13% worked for state or county regulatory agencies, 9% worked for the University of California or for the California State University systems, 5% were state associated applicators, and the remaining respondents fell into other professional categories (see Figure 1).

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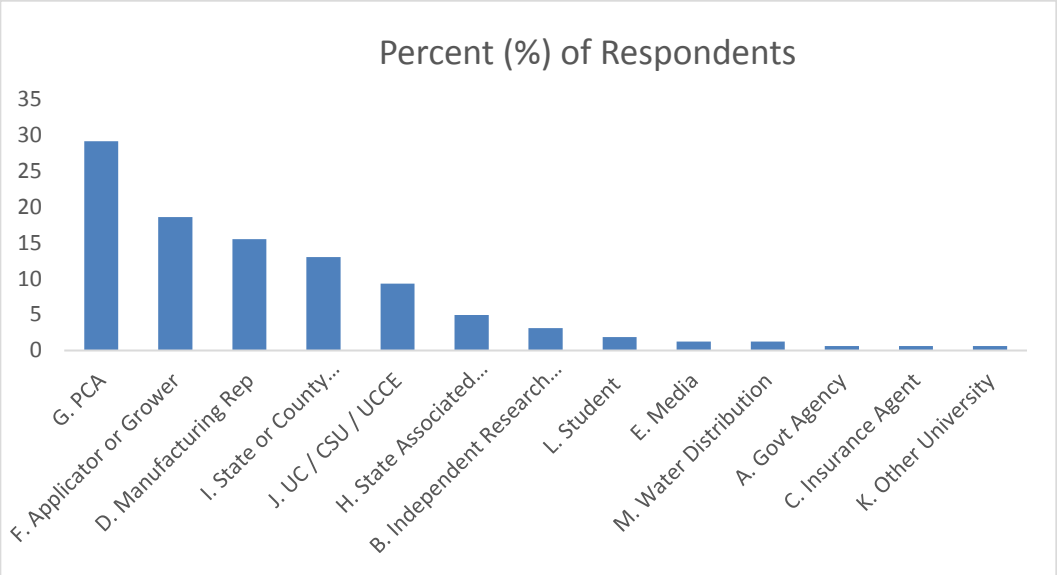

Figure 1. Percent of survey respondents affiliated with various industries

With respect to age and experience, 55% of the survey respondents were 56 years of age, or older, and 57% had more than 21 years in the industry. Twenty-nine percent of respondents were between 36 and 55 years old; 13% were younger than 35. Two percent of respondents chose not to answer (Figure 2). Eighteen percent of respondents had between 11 and 20 years of experience and 19% had less than ten. Six percent of respondents chose not to answer (Figure 3).

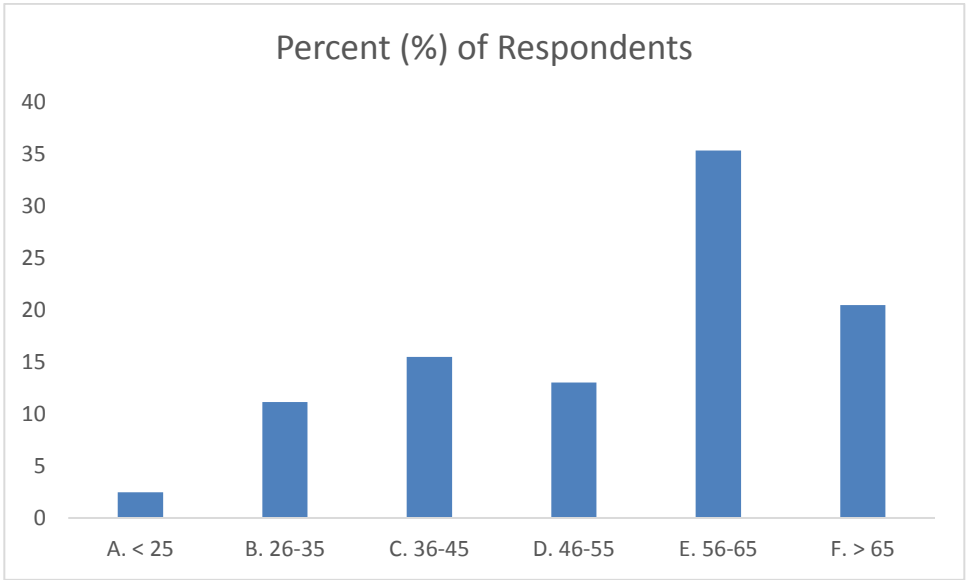

Figure 2. Percent of survey respondents according to age groups (years)

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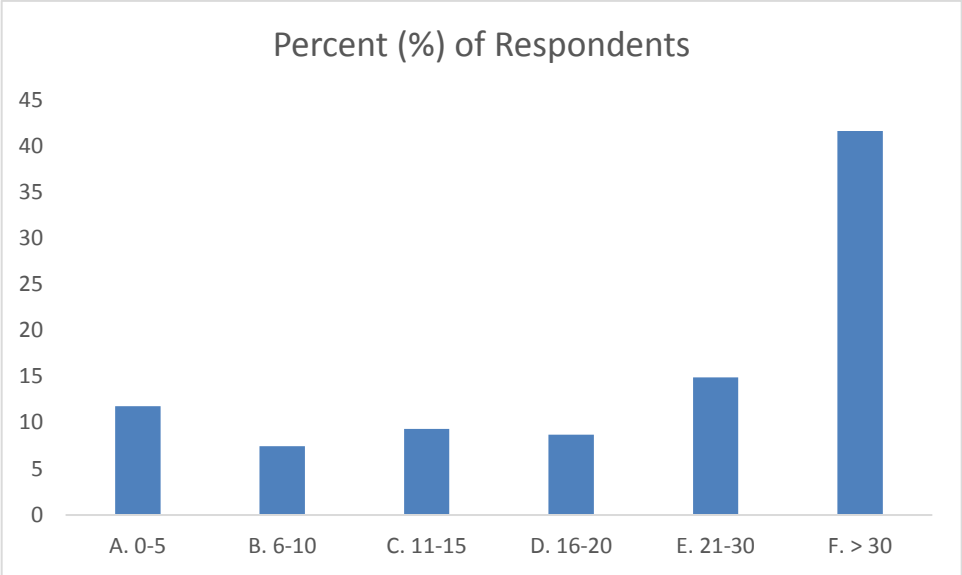

Figure 3. Percent of survey respondents according to years of experience

The key reasons for attending the CWSS conference were to obtain continuing education (CE) credits (69% of respondents) and to network with colleagues (51% of respondents) (data not shown; values exceed 100% because respondents could provide multiple responses). Conference attendance (62%) and e-mail (56%) were the survey respondents preferred means for receiving weed science related information followed by print media/journals/newsletters (36%) and social media platforms (5%) and podcasts (5%) (Figure 4). Email (87% of respondents) was the top preferred tool for communicating, directly, with fellow weed science professionals, followed by personal meetings (73%), phone calls (55%), text messages (38%), and social media (9%) (Figure 5).

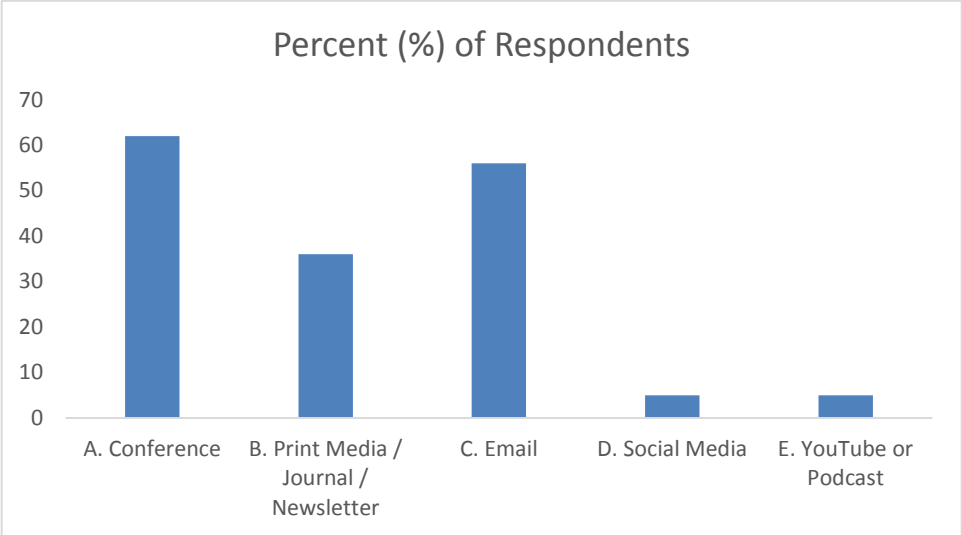

Figure 4. Survey respondents preferred means for receiving weed science related information (values exceed 100% because respondents could provide multiple responses)

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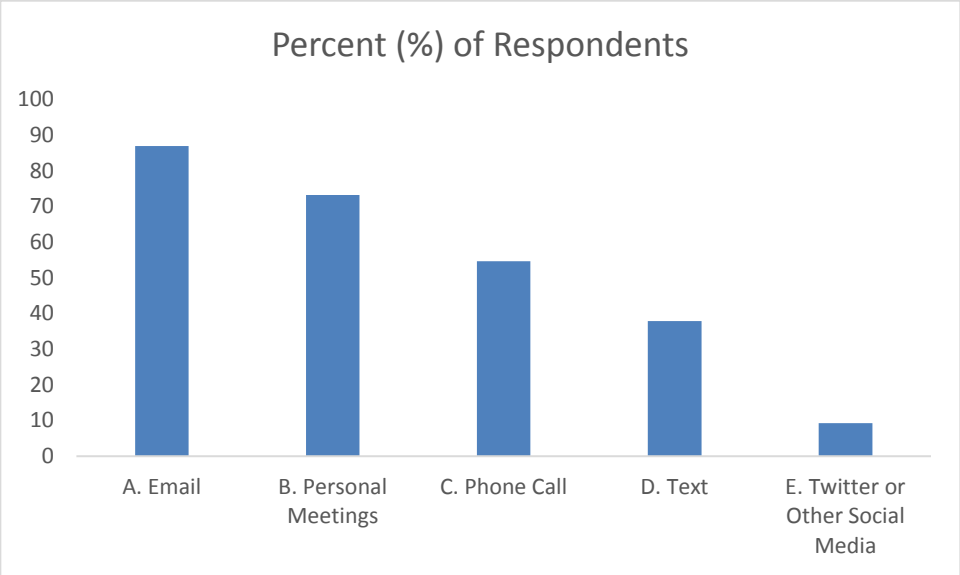

Figure 5. Survey respondents preferred means for communicating, directly, with fellow weed science professionals (values exceed 100% because respondents could provide multiple responses)

In summary, 5050 people were registered for the 2019 CWSS conference, but only 161 (32%) of the attendees completed the attendance survey. Consequently, we have limited information concerning the demographics of conference participants and their preferences regarding information delivery. Attendees who did complete the survey appeared to appreciate the CWSS for the information and accompanying CE credits that the conference provided, in addition to networking opportunities. With respect to future technologies and access to the CWSS annual meeting, 55% of the survey respondents indicated that they would like to be able to access conference sessions on their own time (potentially through archived video recordings of the presentations) and 33% noted that they would be interested in having the meeting live-streamed.

Season-long Summer Grass Weed Control in California Orchard Crops with Sequential Herbicide Programs

Caio Brunharo, Assistant Professor Weed Science, Oregon State University; Brad Hanson, UCCE Weed Science Specialist, UC Davis

Summer grass weed species are becoming more troublesome in orchards in the Central Valley of California. Junglerice, feather fingergrass, sprangletop and threespike goosegrass, to name a few, are summer grass weed

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species that germinate (or in some cases, resume growing) when the soil temperatures start to rise in the spring, develop during the summer and complete their life cycle in the fall. With such a life cycle, summer grass weed species reach their maximum biomass accumulation late summer/early fall – coincidently when harvest operations are taking place - if previous weed management approaches were inefficient. To make matters worse, some of the mentioned weed species have some degree of glyphosate resistance/inherent tolerance.

Table 1. Sequential treatments, rates and application timing.

Trt #	Treatment	Rate	Application timing
1	Nontreated	-	-
2	Indaziflam (Alion)	3.5 fl oz/A	Winter
3	Indaziflam (Alion)	3.5 fl oz/A	Winter
	Pendimethalin (Prowl H2O)	4 qt/A	Winter
4	Indaziflam (Alion)	3.5 fl oz/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Spring
5	Indaziflam (Alion)	3.5 fl oz/A	Winter
	Pendimethalin (Prowl H2O)	4 qt/A	Spring
6	Indaziflam (Alion)	3.5 fl oz/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Spring
7	Penoxsulam/Oxyfluorfen (PindarGT)	2 pt /A	Winter
8	Penoxsulam/Oxyfluorfen (PindarGT)	2 pt /A	Winter
	Pendimethalin (Prowl H2O)	4 qt/A	Winter
9	Penoxsulam/Oxyfluorfen (PindarGT)	2 pt /A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Spring
10	Penoxsulam/Oxyfluorfen (PindarGT)	2 pt /A	Winter
	Pendimethalin (Prowl H2O)	4 qt/A	Spring
11	Penoxsulam/Oxyfluorfen (PindarGT)	2 pt/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Spring
12	Flumioxazin (Tuscany)	10 oz/A	Winter
13	Flumioxazin (Tuscany)	10 oz/A	Winter
	Pendimethalin (Prowl H2O)	4 qt/A	Winter
14	Flumioxazin (Tuscany)	10 oz/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Spring
15	Flumioxazin (Tuscany)	10 oz/A	Winter
	Pendimethalin (Prowl H2O)	4 qt/A	Spring
16	Flumioxazin (Tuscany)	10 oz/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Winter
	Pendimethalin (Prowl H2O)	2 qt/A	Spring

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A common weed control program in tree nut orchard crops in California consists of a winter preemergence/postemergence herbicide tankmix application, followed by a burndown application in the spring with a postemergence herbicide, and then an additional burndown herbicide application before harvest. The spring postemergence herbicide application is crucial because it controls the escapes from the winter treatment.

However, because most of the burndown herbicides have no residual activity (e.g. glyphosate, glufosinate, paraquat) or relatively short residual activity (e.g. oxyfluorfen), weeds that germinate after the spring treatment may still develop during the summer. Finally, in the summer, the weeds will grow larger and become less prone to control either because of their size or because of resistance to common summer POST herbicides (i.e. glyphosate). In this context, season-long weed management strategies become crucial to prevent weeds from interfering with irrigation systems or harvest operations in orchard crops in California.

For several years, our group has discussed the concept of using sequential preemergence herbicide programs in tree nuts as a way to specifically target these summer emerging weeds. The basic idea behind the sequential approach is to apply a second PRE herbicide shortly before germination of the summer species rather than trying to achieve summer weed control by using higher rates of PRE herbicides applied in the winter. This approach more specifically targets those summer-emerging species and may at the same time provide economic and environmental benefits by reducing over-treatment.

To evaluate this concept in the real world, we conducted two field trials in walnuts in Tulare County, California, from December 2017 to August 2018. The treatments consisted of a December application of one of three common preemergence herbicides. On top of this, pendimethalin was tankmixed with the December treatment, applied as a sequential treatment in March, or split with part of the pendimethalin treatment applied in December and part in March. (Table 1). The foundation herbicide programs were indaziflam (Alion), penoxsulam/oxyfluorfen (PindarGT) and flumioxazin (Tuscany). At both application timings, glyphosate + glufosinate was added to the preemergence treatments to ensure that all weeds evaluated originated from seed and not from regrowth. Junglerice was the predominant summer weed species at both sites. Junglerice control was evaluated monthly and aboveground biomass was collected in August before trial termination.

Visual estimates of junglerice control in August 2018, approximately 5 months after application, data suggest a clear trend in improved junglerice control when pendimethalin was partnered with all three of the foundation programs (Figure 1). Although not always statistically better, the sequential treatments usually were numerically better than when pendimethalin was added as a tankmix partner to the winter foundation program. Not surprisingly, summer grass control was best with all three winter foundation herbicides when followed with the high rate of pendimethalin (Prowl 4 qt/A) in the spring. Junglerice biomass data mirrored the visual weed control data (Figure 2).

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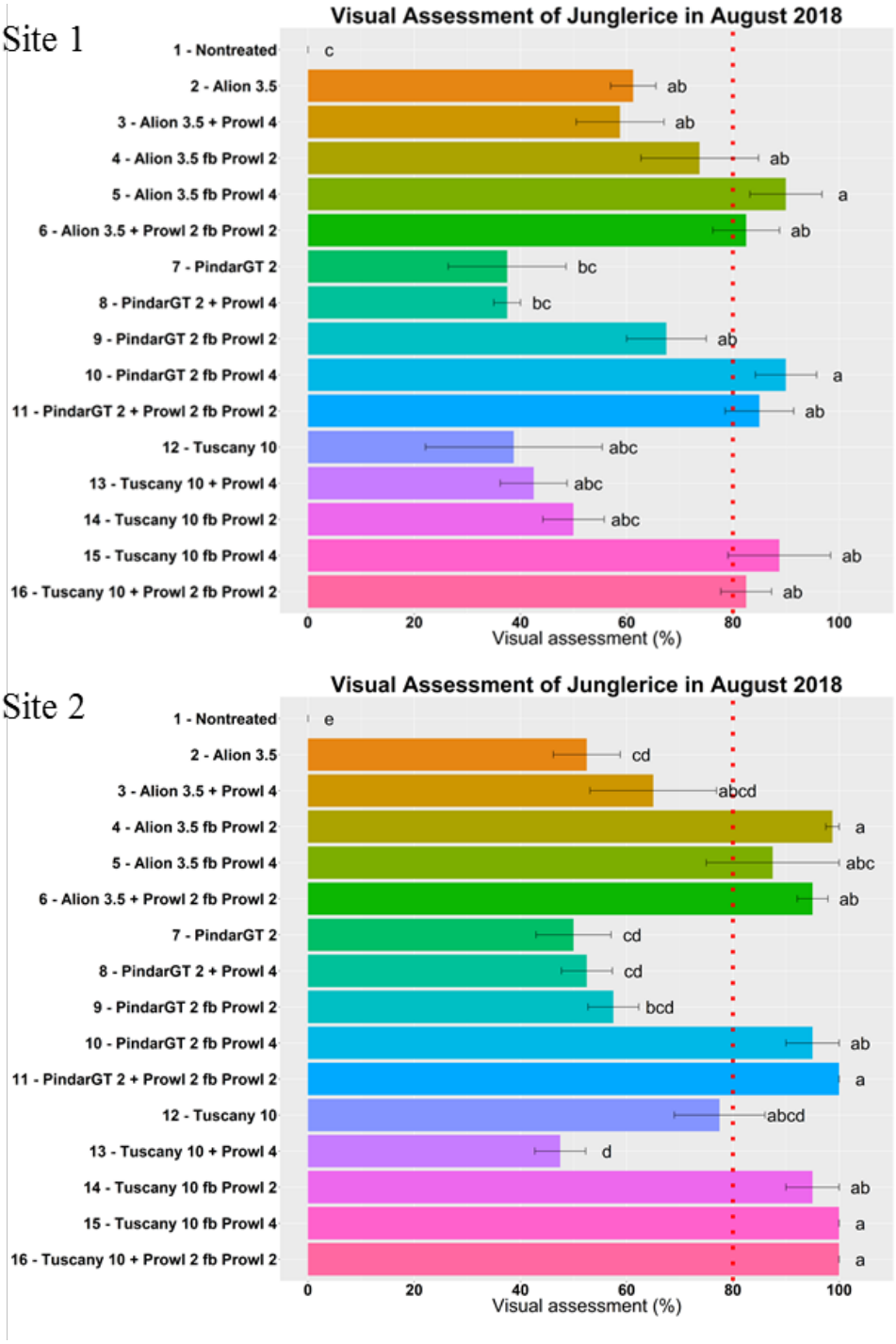

Figure 1. Visual control of junglerice 150 days after a sequential application of pendimethalin in two field experiments in Tulare County CA in 2018. Letters indicate statistical differences among treatments with HSD Tukey test (α = 0.0032). For clarity, trade names are shown. "fb" means "followed by".

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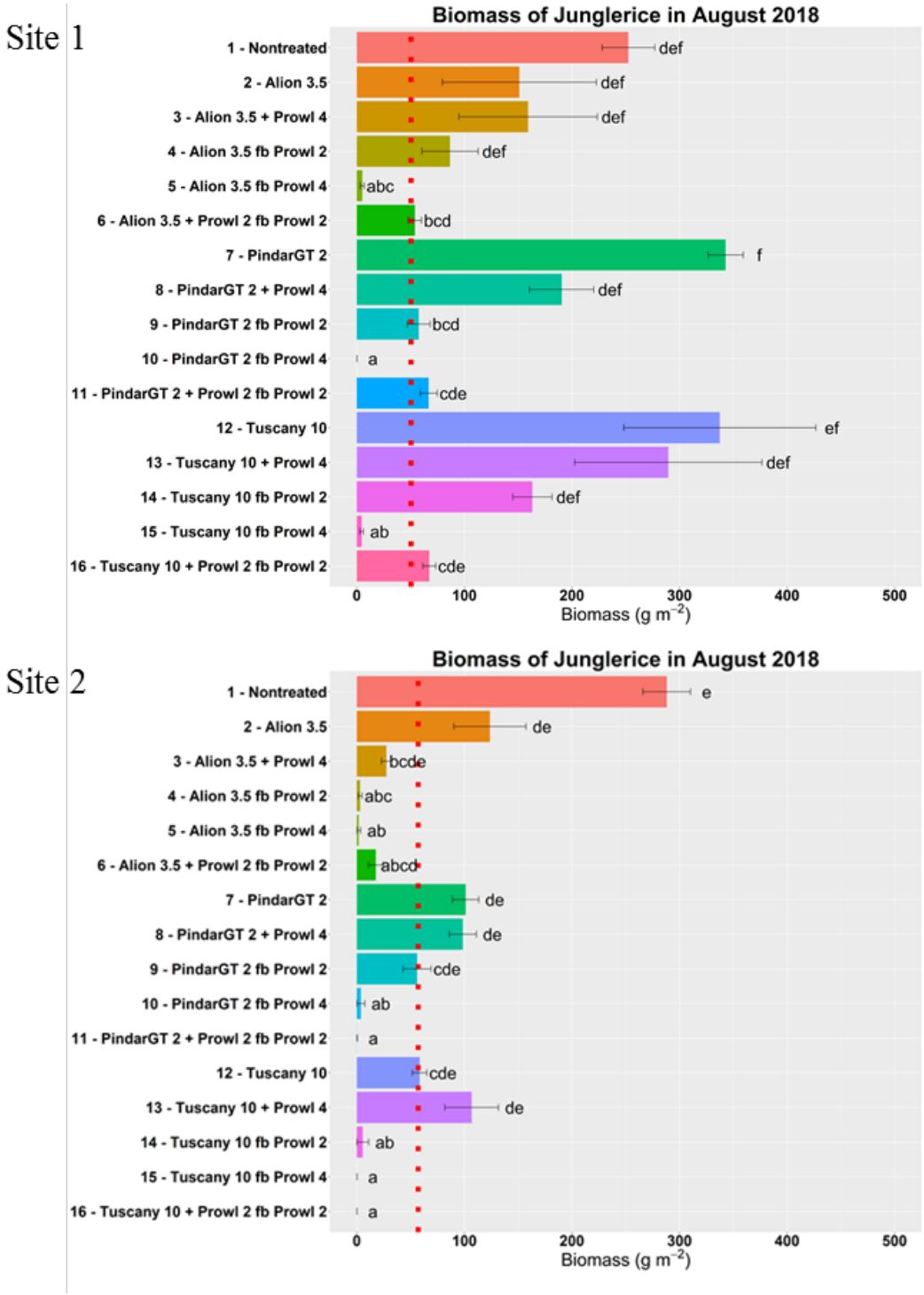

Figure 2. Biomass of junglerice 150 days after a sequential application of pendimethalin in two field experiments in Tulare County CA in 2018. Letters indicate statistical differences among treatments with HSD Tukey test (α = 0.0032). For clarity, trade names are shown. "fb" means "followed by".

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Figure 3. Untreated (Panel A) and treatment #5 (Panel B) 150 days after spring treatment.

In addition to individual treatment comparisons, we also conducted a statistical contrast analysis with the junglerice biomass data. A contrast analysis is basically a comparison between groups of selected treatment(s) and may be helpful to answer specific and big picture questions. Our initial research questions were:

(1) Does the addition of pendimethalin reliably enhance junglerice control?

(2) Can a sequential application of the lower rate of pendimethalin (Prowl 2 qt/A in winter plus Prowl 2 qt/A in spring) perform as well as a single pendimethalin application with the higher rate (Prowl 4 qt/A) in the winter? (*same total herbicide load*)

(3) Can the lower pendimethalin rate (Prowl 2 qt/A) in the spring perform as well as the higher pendimethalin rate (Prowl 4 qt/A) in the winter for control of summer-emerging grasses? (*reduced total herbicide load*)

The results of our contrasts analysis are shown in Table 2. We observed that the addition of pendimethalin to the system (either in the winter or spring) enhance junglerice control, reducing the average biomass of this weed to 181.8 g m^{-2} (>70% enhanced control – Contrast 1). From Contrast 2, we observed that a sequential application of lower rates of pendimethalin (Prowl 2 qt/A in winter + Prowl 2 qt/A in spring) provides a better control of junglerice than a single application of the higher rate of pendimethalin (Prowl 4 qt/A) in the winter. Lastly, from Contrast 3, we observed that the lower rate of pendimethalin applied in the spring actually outperformed the higher rate of pendimethalin applied in the winter with regard to control of summer grass weed species.

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Table 2. Contrast analysis of treatment groups.

Contrasts between treatment groups				
Contrasts	Research question	Mean difference	CI [Lower;Upper]	P-value
		g m^{-2}	g m^{-2}	
Contrast 1	"Yes pendimethalin" vs "No pendimethalin"	-181.8	-236.1; -127.5	<0.001
Contrast 2	"Sequential" vs "Single higher in winter"	-150.3	-219.0; -81.7	<0.001
Contrast 3	"Lower rate in spring" vs "Higher rate in winter"	-110.6	-179.2; -41.9	<0.001

When considering only the summer-emerging grasses, the lower rate of pendimethalin (Prowl 2 qt/A) in the spring generally outperformed the higher rate of pendimethalin (Prowl 4 qt/A) applied in the winter but was not always as good as the sequential treatment. Because the higher rate of pendimethalin in spring provided excellent control and the lower did not, this is not likely due simply to early-germinating junglerice. Instead, under heavy weed pressure, the spring treatment with the lower rate is not quite enough without the winter component.

The experiments conducted in this research focused primarily on the control of summer grass weed species, and the weed community present in specific fields will determine the adequate herbicide treatment to be adopted. In areas where summer weed species are the major issue, shifting some or all of the pendimethalin component of the herbicide program may significantly improve performance relative to the winter-only PRE approach. However, in areas where winter grass weed species (e.g. annual bluegrass, Italian ryegrass) are also troublesome, the sequential pendimethalin application may be more appropriate. Additionally, a key to performance of the sequential programs will be effective incorporation of the spring treatment with either a spring rainfall event or sprinkler/microsprinkler irrigation so careful and timely management will be important. However, the bottom line is that we can, in some instances, improve or maintain weed control outcomes using the same or less herbicide by carefully considering the biology of the weed, our weed control goals, and the weed management tools at our disposal.

Performance of Pendimethalin (Prowl H2O ®) in Different Irrigation Systems used in Orchards and Vineyards

Adewale Osipitan, Post-Doctoral Scholar; John Roncoroni, UCCE Weed Science Advisor; Bradley D. Hanson, UCCE Weed Specialist
University of California Cooperative Extension and Department of Plant Sciences, Davis, CA

Preemergence herbicides typically are applied in orchard and vineyard production systems as a "strip spray" using a tractor-mounted our pull-behind sprayer to spray a few feet on either side of each tree or vine row. Compared to agronomic crops where large spray booms and higher application speed acre commonly used, operator time and equipment hours represent a greater proportion of the per-acre cost of chemical weed control in orchard and vineyard crops. A few herbicides registered in California tree and vine crops allow application via the irrigation system (chemigation). This low-cost herbicide application technique could be useful in some situations, particularly as part of a sequential program for season-long weed control. However, little information is available on how to most effectively use herbicide chemigation in orchards and vineyards and how weed control efficacy compares to standard application techniques.

An initial preliminary experiment was conducted in summer 2019, at the UC Davis Plant Sciences Field Facility to compare the relative performance of pendimethalin (Prowl H_2O®) applied through spraying or chemigation in surface-drip, suspended-drip and micro-sprinkler irrigation systems common in California permanent crops. The experiment was laid out in a randomized complete block design with a split-plot arrangement (Table 1).

Table 1. Pendimethalin (Prowl H2O®) treatment list.

Trt No	Irrigation system	Herb Appl	Prowl rate (qt/A)	Rep 1	Rep 2	Rep 3	Rep 4
1	Drip on surface	NA*	0	101	215	306	408
2	Drip on surface	Chemigate	3	102	214	307	409
3	Drip on surface	Chemigate	1.5 fb 1.5	103	212	308	410
4	Drip on surface	Spray	3	104	213	309	407
5	Drip on surface	Spray	1.5 fb 1.5	105	211	310	406
6	Drip suspended	NA	0	106	205	311	402
7	Drip suspended	Chemigate	3	107	204	312	401
8	Drip suspended	Chemigate	1.5 fb 1.5	108	202	313	405
9	Drip suspended	Spray	3	109	203	314	403
10	Drip suspended	Spray	1.5 fb 1.5	110	201	315	404
11	Micro-sprinkler	NA	0	111	210	301	413
12	Micro-sprinkler	Chemigate	3	112	209	302	411
13	Micro-sprinkler	Chemigate	1.5 fb 1.5	113	208	303	415
14	Micro-sprinkler	Spray	3	114	207	304	414
15	Micro-sprinkler	Spray	1.5 fb 1.5	115	206	305	412

* No herbicide application; control

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The main plot treatments were three irrigation systems designed to mimic orchard micro-sprinkler and drip systems or a vineyard irrigation system suspended above the ground from the trellis. The sub-plot treatments were combinations of pendimethalin application method (spray or chemigation) and rates in four replications (Table 1). Each sub-plot was 50ft long and 5ft wide and herbicide rates were calculated based on the visible wetted area on the soil surface. The sub-plots within the micro-sprinkler main plots were separated by 5ft to prevent overlapping of treatments. The irrigation was initiated on July 23, with subsequent irrigation on July 24, 27 and 29 that ensured up to 15 inches depth of moist soil, sufficient to promote weed growth. The drip systems have eleven 1 GPH emitters per sub-plot while the micro-sprinkler system has two 19 GPH emitters per sub-plot. The emitters in the suspended-drip system were about 2 ft above the soil surface. Herbicide treatments were applied on July 30 (Table 2). The spray treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 GPA at 35 PSI through two TeeJet TTI11002 flat fan nozzles and incorporated with the main plot irrigation system. The chemigation treatments injected into the field distribution manifold and applied in the plots through 1 GPH emitter (drip treatments) or 19 GPH (micro-sprinkler treatments). The herbicide injection period was about 20 minutes and irrigation continued for an additional 40 minutes after application to flush lines and incorporate the herbicide. Subsequently, plots were irrigated for 2 hrs twice per week. A second application of pendimethalin was made on August 23 (24 days after first application), to complete the 1.5 qt/A split application (Table 1) and this application followed the same process described above. Weed control data were collected 14, 24, and 45 days after first application of pendimethalin. For visual weed control assessment, 0 represents no visible control of weeds and 100 represents complete absence of weeds within 0.25 m^2 quadrant. The dominant weeds in the research field were broadleaves, including field bindweed (*Convolvulus arvensis* L.), common lambsquarters (*Chenopodium album* L.), common purslane (*Portulaca oleracea* L.) and jimsonweed (*Datura stramonium* L.).

Table 2. Herbicide application data.

1st application date	July 30, 2019	**2nd application date**	August 23, 2019
Air temperature (F)	76	Air temperature (F)	84
Relative humidity (%)	62	Relative humidity (%)	51
Wind speed and direction	4.9 MPH South	Wind speed and direction	5.4 MPH South
Cloud cover (%)	91	Cloud cover (%)	91

Because the experiment was conducted in late summer in a fallowed annual crop field, weed pressure was primarily small-seeded summer broadleaf weeds and field bindweed. Pendimethalin treatments controlled these weeds 45-100% at 45 days after treatment (Figure 1). In general, weed control with conventionally-sprayed plots was greater than through chemigation even though incorporation was less than ideal. Of the chemigated plots, the micro-sprinkler irrigation system allowed a broader control of weeds with pendimethalin, presumably due to better distribution uniformity (Figure 2). The suspended drip system was slightly better than the surface drip system (Figure 1 and 3). Within the 45-day time period evaluated a single application of pendimethalin at 3 qt/A provided greater weed control, than the split application at 1.5 qt/A, particularly when applied through chemigation (Figure 1 and 3).

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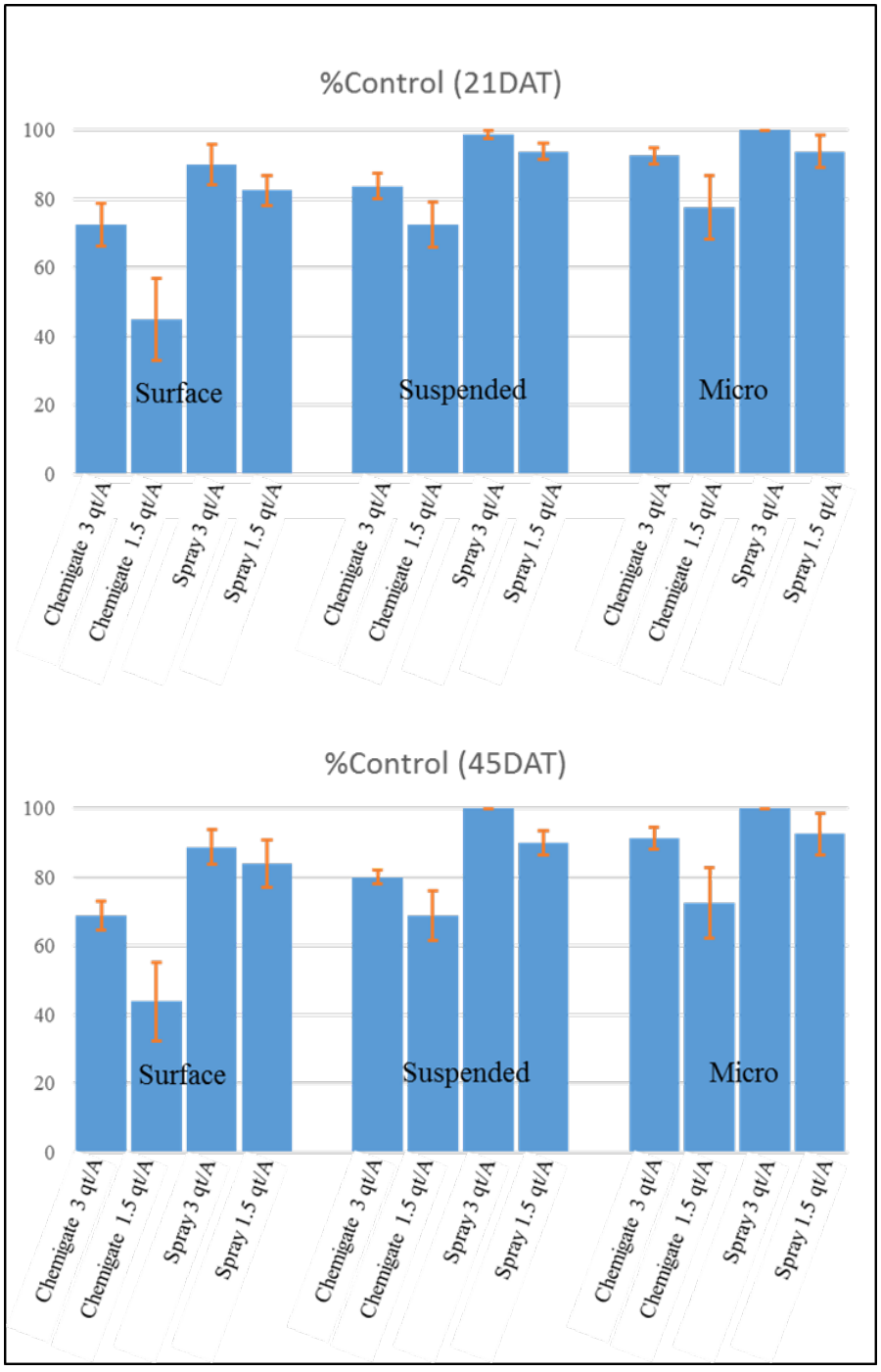

Figure 1. Weed control by pendimethalin (Prowl H_2O®) at 21 and 45 days after treatment in different irrigation systems using different rates and application methods, at UC Davis field facility in 2019. The dominant weed species were field bindweed, common lambsquarters, common purslane and jimsonweed.

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In spite of the modest level of summer broadleaf weed control from these applications as a stand-alone approach, there appears to be some potential fit for chemigation in California orchard and vineyard crops as part of a herbicide program. In particular, a relatively low rate of pendimethalin applied via the irrigation system in the spring might provide substantial supplemental weed control in the immediate area wetted by the irrigation system (Figure 4) where dissipation of the foundation herbicide would be greatest. Additionally, the chemigation approach may also have some fit as part of the sequential herbicide approaches we have evaluated in recent years for control of glyphosate-resistant summer grasses.

This 2019 pilot experiment will be repeated in 2020 at an early spring timing more appropriate for supplemental control of summer weeds in orchard and vineyard production systems.

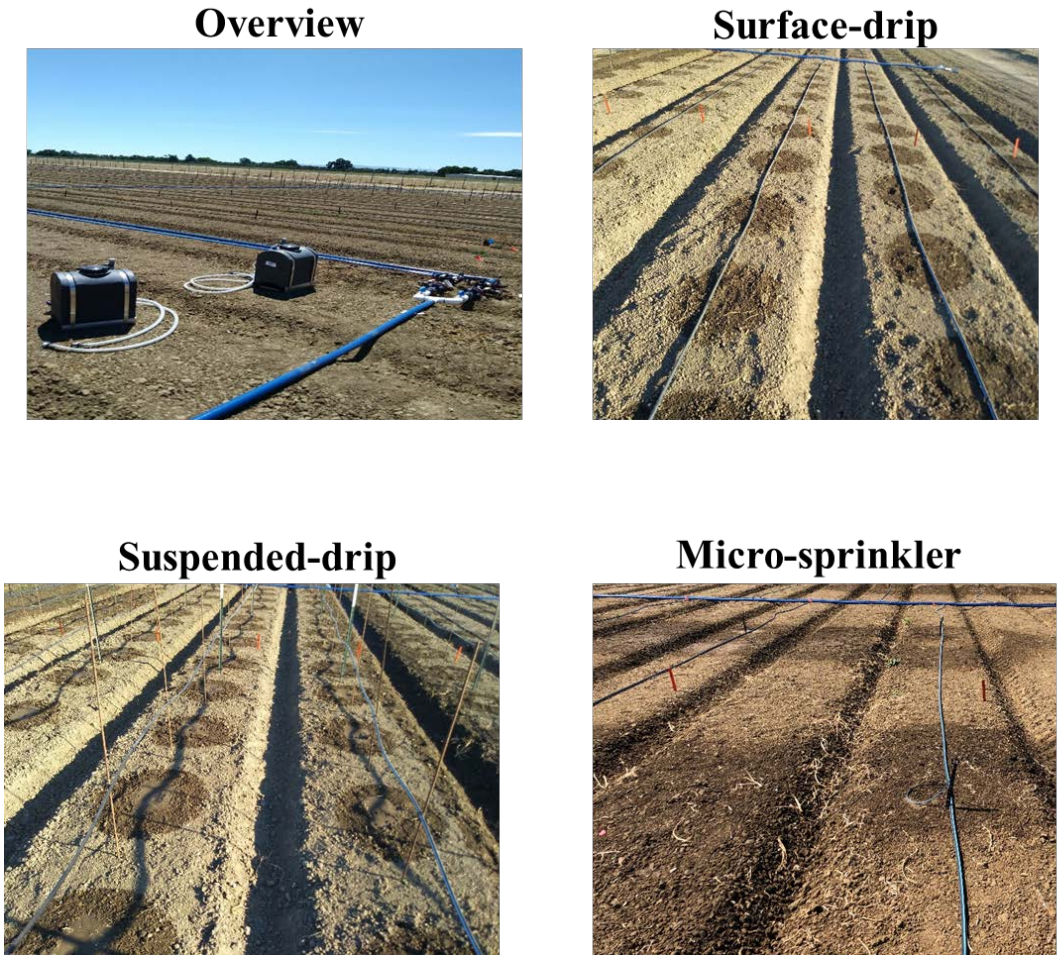

Figure 2. Pendimethalin chemigation field trial and wetted area from three irrigation systems. Clockwise from upper left: field overview and irrigation/chemigation manifold, surface drip system, micro-sprinkler system, and trellis-suspended drip irrigation system.

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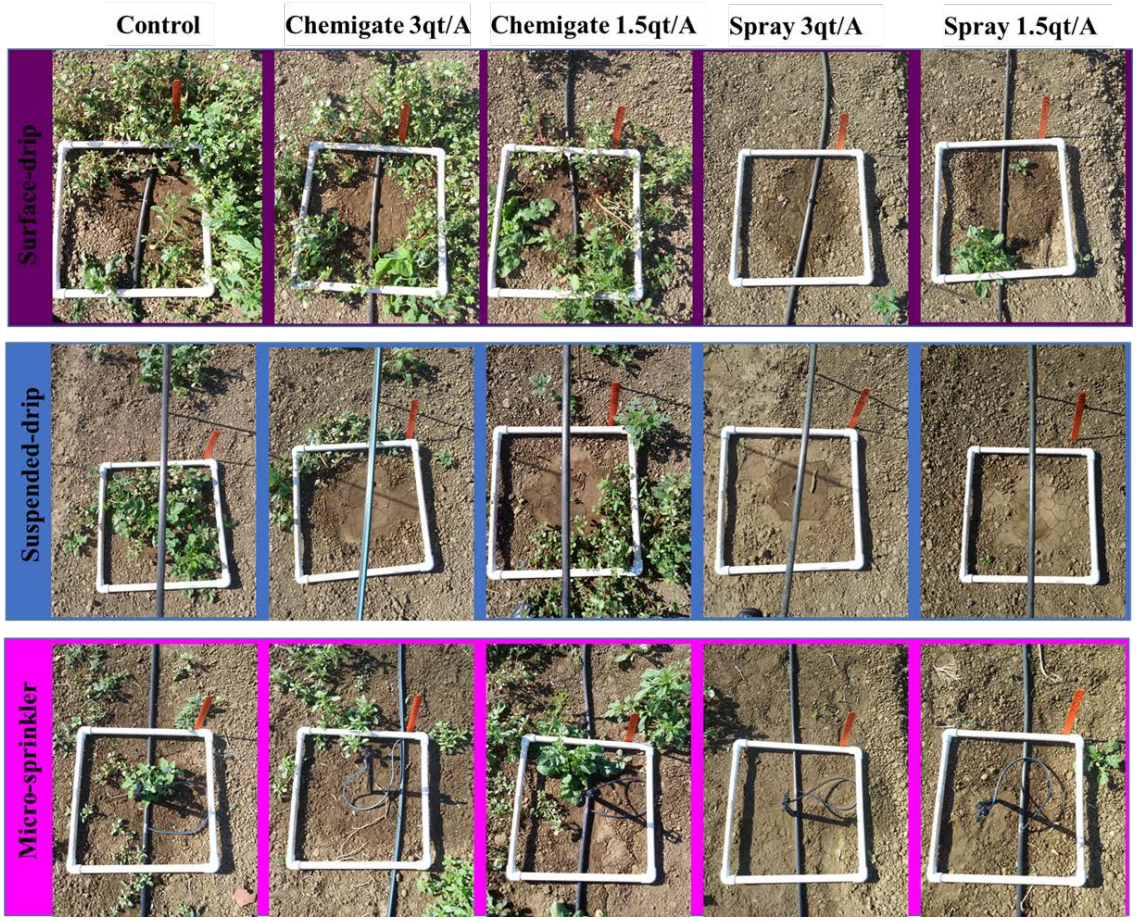

Figure 3 (Left). Photos of weed control by pendimethalin (Prowl H_2O®) at 21 days after treatment in different irrigation systems using different rates and application methods, at UC Davis field facility in 2019. The dominant weed species were field bindweed, common lambsquarters, common purslane and jimsonweed.

Figure 4 (Right). Example of potential opportunity for supplemental summer weed control with orchard chemigation treatments. Residual weed control typically fails first in the wetted zone due faster herbicide degradation

Meet the California Weed Science Society Board 2019!

Brad Hanson – *President*

Brad is a Cooperative Extension Weed Specialist in the Plant Sciences Department at UC Davis. His statewide research and extension program focuses on weed management in orchards and vineyards with a special focus on herbicide performance, crop safety and herbicide-resistant weeds.

Brad earned his undergraduate degree in agriculture at Iowa State University and his M.S. and Ph.D degrees in weed science at the University of Idaho. Before joining the faculty at UC Davis in 2009, Brad led a weed and nematode research program at the USDA-ARS lab near Fresno, California. His previous weed research positions include a postdoctoral fellowship at Colorado State University, a staff position at Oregon State University, graduate student research in Idaho, and herbicide research internships in Iowa and South Dakota.

In addition to his weed management responsibilities with the University of California, Brad directs the IR-4 Davis Field Research Center, chairs the Departments Field Research Facility committee and recently completed a term as Vice Chair for Outreach and Extension in the Plant Science Department. In weed science, he serves in various capacities in the California Weed Science Society, the Western Society of Weed Science, and the Weed Science Society of America including for the past six years as an associate editor for the journal Weed Technology.

Phil Munger – Vice President/Program Chair

Phil grew-up in northern Ohio and worked at a nearby agricultural research farm. He obtained his Bachelor of Science Degree in Agronomy at Ohio State University, and a Master of Science and Ph.D. in Agronomy/Weed Science at Texas Tech University and Texas A&M University, respectively.

Phil joined BASF Corporation as a Field Research and Development Rep located in South Texas. During his career at BASF, Phil worked in R&D in Raleigh, North Carolina, and in field R&D in California, the Pacific Northwest and in the southwestern U.S. Phil also worked in BASF's Global Development Group in Limburgerhof, Germany and managed the company's research station that was located in Dinuba, California.

Phil retired from BASF in 2016 and currently conducts independent research in the southern San Joaquin Valley.

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Anil Shrestha – *Secretary*

Anil graduated with a MS and a PhD in Crop Science from Cornell University and Michigan State University, respectively. After graduation he worked as a postdoctoral fellow at the University of Guelph, Canada where his work focused on the biology and ecology of weeds in cropping systems. He worked for University of California's Statewide IPM Program as a Weed Ecologist from 2002 to 2008. Anil joined the Plant Science Department at Fresno State in 2008 as an Associate Professor and weed science. Currently he is a Professor of Weed Science and the Chair of the Viticulture and Enology Department at Fresno State. His work has focused on weed management in both conventional and organic cropping systems as well as non-crop areas and has been involved in research on herbicide-resistant weeds collaboratively with University of California Cooperative Extension personnel, private industry, growers, and land managers. He has been a recipient of California Weed Science Society's (CWSS) Award of Excellence in 2014, Weed Science Society of America's (WSSA) outstanding teacher award in 2016, and is a Fellow of the American Society of Agronomy (ASA). Currently he also serves as ASA's Liaison to WSSA and as an advisory committee member of Western IPM Program. He has been a member of CWSS since 2002 and is very active in promoting Fresno State student participation at the CWSS annual meetings.

Joe Vasios – *Past-President*

Joe is a graduate of Colorado State University with a PhD in Weed Science. Joe has worked for UPL NA for the past seven years as an Aquatics Territory Manager, and recently transitioned to the Western Technical Service Manager role. In his current role, he is responsible for Technical Support for UPL's agricultural products in the Western US. In addition to participating on the CWSS Board of Directors, Joe has also served on the boards of The Aquatic Plant Management Society, PAPA, and the Western Aquatic Plant Management Society.

Dave Blodget – *Finance Director*

Dave's experience in the aquatic plant management industry has spanned over thirty-nine years. As an Area Manager with Baker Petrolite, Dave led a team of specialists supporting the irrigation canal market in the U.S. and internationally. As the Pacific Southwest Aquatic Specialist for SePRO, Dave was responsible for providing technical and business support of SePRO's aquatic solutions for water and irrigation districts, professional applicators, government resource managers and our agent and distribution partners. Currently, Dave is the Western US Regional Manager- Aquatics for Alligare LLC supervising a team of two Aquatic Specialists and overseeing MAGNACIDE™ H herbicide internationally. Dave is a Pest Control Advisor in California, Arizona and Oregon. Dave has served for 4 years on the Board of Directors for El Dorado Irrigation District, with 2 years as Board President. He has been an active member of CA Weed Science Society since 1980 and is currently the Finance Director. A native to northern California, Dave graduated from the California State University, Chico with a B.S. Degree in Agricultural Business.

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Eli Kersh – *Director of Sponsorship & Exhibitors*

Eli is a licensed Pest Control Adviser in California and has worked in the aquatic plant management industry as an applicator, a private consultant, and as a manufacturing technical representative. Eli spent many years working in and traveling to remote wilderness areas of Alaska and Canada as a fishing and kayaking guide. Through these and other experiences he developed knowledge and skills that led him to seek an academic path geared towards the Outdoors. He received his undergraduate degree from UC Santa Barbara in 2007 where he majored in Geographic Information Science. After several years working as an independent GIS analyst for Fire & Police Departments, Indian Tribes, and other agencies, he returned to school in 2011 to obtain a master's degree in Limnology with an emphasis in Lake Management. Eli completed his thesis on Eutrophication of Lakes and Vegetation Management in 2013. Combining his education, skills and experiences, Eli worked as an Environmental Service Manager for a Lake Management company and is now working as an Aquatic Specialist for Alligare, LLC.

Lynn Sosnoskie – *Steering Director*

Lynn is a native of Pennsylvania and most recently served as the Agronomy and Weed Science Advisor with the University of California, ANR. She received her BS from Lebanon Valley College in Pennsylvania, her MS in Plant Pathology from the University of Delaware and her PhD in Weed Science at The Ohio State University. Since her PhD, Lynn has served in research and extension positions at University of Wisconsin-Madison, University of Georgia-Tifton, Washington State University-Wenatchee, and University of California-Davis, and has emerged as one of the leading weed scientists in the US. Topics of her research and extension interview seminars concerned glyphosate-resistant Palmer amaranth and the biology, ecology, and management of bindweed.

Tom Getts – *Director and Student Liason*

Over the past three years, Tom has been involved in CWSS as a presenter, and session chair of the Forestry, Range and Natural Areas session. Tom graduated from Colorado State University, with a Bachelor's in Forestry and a Master's in Weed Science. For the past three years he has been working as the Weed Ecology and Cropping's Systems advisor for UC cooperative extension in Lassen, Modoc, Sierra and Plumas counties. His current research and extension program focus on invasive weeds control and agronomic production within the intermountain area. When he is not working, you can often find Tom with a fly rod in hand exploring the regions' local fisheries.

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Gilbert del Rosario – *Director of Public Relations*

Gilbert serves as the Turf & Ornamental Market Development Specialist for Corteva Agriscience™, the Agriculture Division of DowDuPont™. In this role, he supports the national sales organization with technical training to improve efficacy and optimize product positioning and sales of established and future products in the T&O business. He serves both internal and external audiences including end-users, distributor partners, and research and extension specialists.

Previously, he served as the territory manager for the southern portion of California in the ornamental horticulture, and specialty products markets and an account manager for a national distributor partner. His experience includes weed management in row crops, vegetation management, and range & pasture. He holds a bachelor's degree in Agricultural Economics from Oklahoma State University and a master's degree in Landscape Architecture from Cal Poly Pomona. He has been a speaker on weed control at industry conferences including CWSS, PAPA and CAPCA and Sports Turf Management Association (STMA), and has been a frequent contributor to Weed Watch in Landscape Management Magazine.

He holds a Qualified Applicators License (QAL) as well as a Pest Control Advisor (PCA) license and serves as public relations chair for the California Weed Science Society Board of Directors.

Whitney Brim-DeForest – *Director of Non-Conference Education*

Whitney is the County Director for University of California Cooperative Extension Sutter-Yuba, and the UCCE Rice and Wild Rice Advisor for Sutter, Yuba, Placer, and Sacramento counties. She holds a M.S. and PhD from UC Davis, and a BA from Brown University. She has been working in rice for more than 15 years, and her current research and extension activities focus on identification and management of weeds in rice and wild rice systems.

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CWSS Research Update and News

Send research updates and news articles to Whitney Brim-DeForest, Non-conference Education Director
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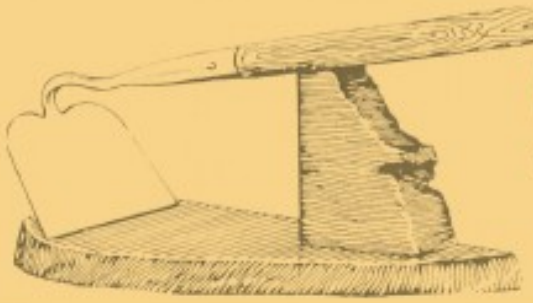

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