Almond Weed Control Efficacy and Crop Safety Research

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Objectives

The overall goals of the tree and vine weed science research and extension program at UC Davis (http://ucanr.org/brad.hanson) is to provide information on weed management and herbicide issues to California growers, Pest Control Advisors, and the UC Cooperative Extension network. The almond industry is one of the key stakeholder groups for this program; however, the majority of our research is broadly applicable to, and partially supported by, other orchard and vineyard commodities in the state as well as the pest control industry.

The specific objectives of the current project (12Hort12.Hanson – Weed Management) mirror the major research areas in our program:

1. Evaluation and testing of herbicides, tank mixes, and application techniques with a focus on glyphosate-resistant weeds in orchards
2. Evaluation of herbicide injury symptoms in almond orchards and developing training tools for Farm Advisors, and pest control industry advisors and consultants
3. Support of orchard replant disease management research

Numerous field and greenhouse experiments were conducted to support orchard and vineyard growers, Pest Control Advisors, and Farm Advisors weed and herbicide research needs. Because results related to Objective 3 results are discussed separately (see the poster by Johnson et al.) and the work in Objective 2 is still in progress, this presentation focuses on our ongoing herbicide evaluation research.

Identification and verification of herbicide-resistant weeds

Weed management in California tree and vine crops is currently dominated by problems with glyphosate-resistant and glyphosate–tolerant species. To date, five species resistant to glyphosate have been confirmed: hairy fleabane, horseweed (aka marestail), Italian and rigid ryegrass, and junglerice. Several other species of concern have been identified and are under evaluation; these include three-spike goosegrass, annual bluegrass, and Palmer amaranth. Research being conducted on herbicide-resistant weeds incudes confirmation of resistance (Figures 1 and 2), determining distribution of the resistant populations (example in Figure 1), evaluation of alternative control measures, and determining the underlying physiological and genetic causes of resistance.

Figure 1. Junglerice response to a range of glyphosate rates in the greenhouse. The population on the left is a control population that is susceptible to glyphosate while some individual plants from the Kern County population in the center survived up to a 4x rate of the herbicide. The map at right demonstrates the distribution of GR junglerice in the Central Valley in a 2011-12 survey.

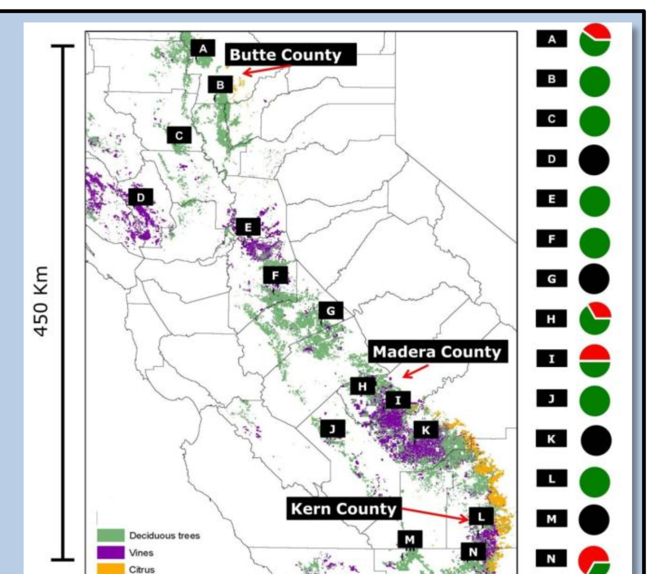


Figure 4. Distribution of GR junglerice populations in major perennial crops area of the Central Valley of California. The pie charts on the right indicate the proportion of junglerice populations classified as GR (red) and GS (green) in each location. Solid black charts indicate that no junglerice populations were tested from that location

Figure 2. Three spike goosegrass: a) seed head, b) treated with glyphosate at 2-tiller stage, c) treated with glyphosate at 15-tiller stage. Rates range from 0.25x (second to left) to 16x (far right pot in each photo). The reference rate of 1 lb ae/A is in the center of each dose response..

Herbicide performance

Several field trials were conducted to evaluate weed control efficacy in commercial almond orchards. In these experiments, research personnel applied replicated, small-plot treatments using CO2 pressurized backpack spray equipment. Weed control was visually assessed several times during the growing season and, in some cases, biomass or other quantitative data were collected. A few representative data tables and figures are shown below, but a full accounting can be read in the Almond Board Research Report. Many of these data are also presented online at: The UC Weed Science blog (http://ucanr.edu/blogs/UCDWeedScience/index.cfm) or the Almond Doctor blog (http://thealmonddoctor.com/)

Table 1. Effects of POST herbicides on cutleaf evening primrose and yellow nutsedge in an almond orchard trial near Delhi, CA in 2013.

						Cutleaf evening primrose	--------------------Yellow nutsedge--------------------					
		GPA	Rate		Timing	Control 28 DAT	Control 28 DAT	Control 56 DAT	Plant density	Large tubers	Small tubers	Total tubers
	Treatment					%	%	%	#/sq m	-- # / 4 inch dia x 6 inch deep --		
1	UTC					0.0	0.0	0.0	51.2	6.5	32.3	40.3
2	Roundup Powermax + NIS + AMS	10	32	fl oz/a	A	95.3	59.6	34.9	27.5	1.7	23.9	26.5
3	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	82.5	65.1	19.5	22.2	1.1	26.0	27.4
4	Roundup Powermax + NIS + AMS	40	32	fl oz/a	A	80.3	62.6	24.3	24.2	2.2	28.2	30.9
5	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	88.3	62.6	10.0	47.2	1.1	35.1	36.7
	Goal 2XL		8	fl oz/a	A							
6	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	83.8	62.7	10.9	32.1	2.6	22.7	26.5
	Shark		2	fl oz/a	A							
7	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	86.8	63.9	83.8	13.4	0.9	20.5	21.6
	Roundup Powermax + NIS + AMS		32	fl oz/a	B							
8	Rely 280 + AMS	20	3	pt/a	A	99.8	85.8	85.2	4.5	2.7	28.5	31.5
	Rely 280 + AMS		3	pt/a	B							
9	Gramoxone SL + AMS + MSO	20	3	pt/a	A	51.3	37.0	76.9	7.9	0.6	18.4	19.3
	Gramoxone SL + AMS + MSO		3	pt/a	B							
10	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	96.0	67.8	19.1	36.6	1.8	22.5	24.5
	Rely 280 + AMS		3	pt/a	A							
11	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	95.0	79.1	76.6	13.2	1.4	19.1	20.6
	Gramoxone SL + AMS + MSO		3	pt/a	B							
12	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	84.0	67.4	50.9	23.5	1.3	26.0	27.8
	Matrix		1	oz ai/a	A							
13	Roundup Powermax + NIS + AMS	20	32	fl oz/a	A	93.3	75.2	42.5	16.1	0.6	26.6	27.3
	Chateau		3	oz ai/a	A							
14	Roundup Powermax + NIS + AMS	20	64	fl oz/a	A	76.8	85.0	38.5	23.3	3.0	23.6	28.8
15	Roundup Powermax + NIS + AMS	20	106	fl oz/a	A	99.3	80.5	29.4	38.5	1.5	30.1	32.1
16	Rely 280 + AMS	20	3	pt/a	A	98.3	89.6	41.1	23.7	1.9	39.2	41.7
17	Summit Agro Glufosinate + AMS	20	3	pt/a	A	99.5	75.2	21.2	42.5	3.1	42.7	46.8
	Tukeys HSD (0.05)					45.7	21.7	22.7	0.6	0.9	4.3	4.5

A timing made April 26, 2013 and B timing made 28 days later.

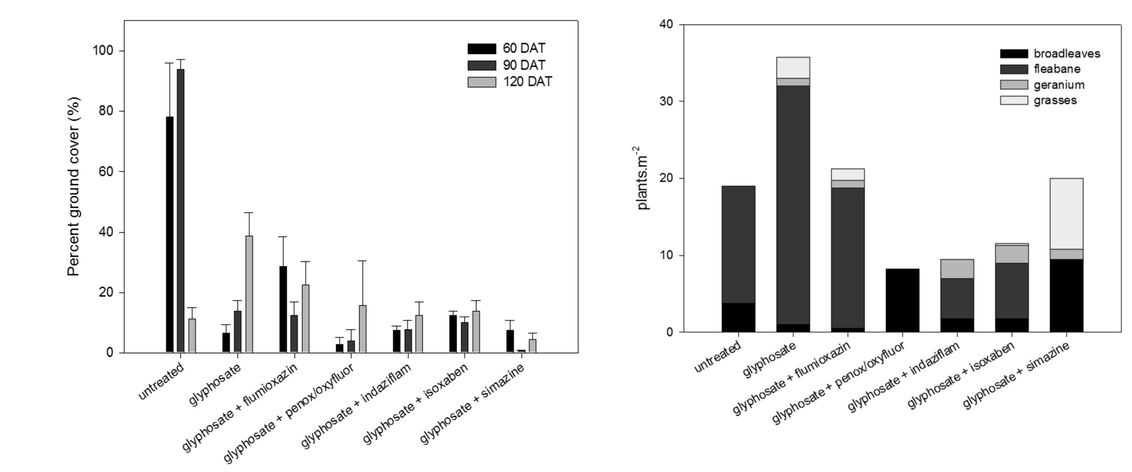


Figure 3. (above) Residual weed control with key almond preemergence programs in a commercial orchard trial near Delhi, CA. Left figure is total weed control 2, 3, and 6 months after treatment (DAT), right figure is species composition 120 DAT.

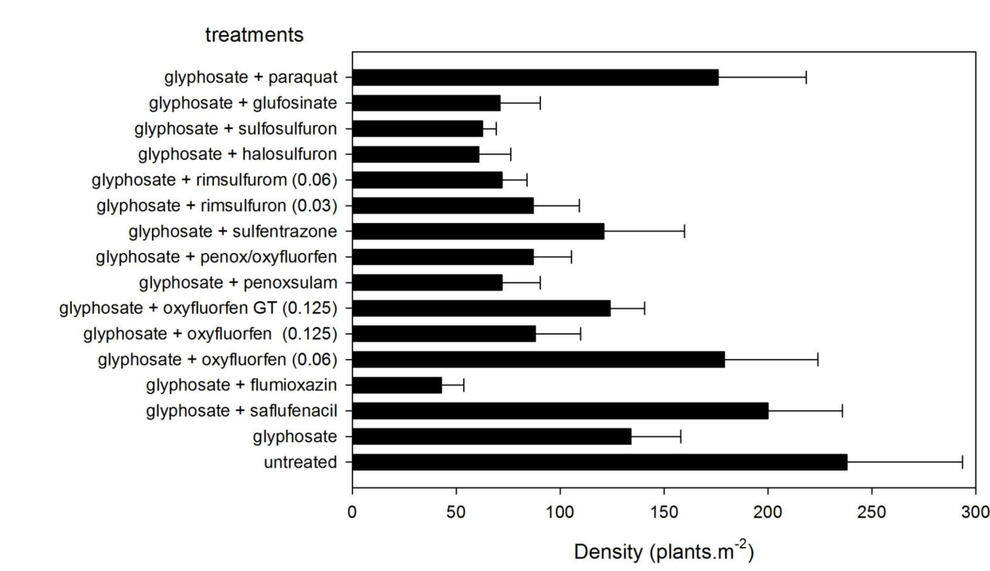


Figure. 4 (above) Yellow nutsedge density 35 DAT in an almond orchard trial near Delhi, CA in 2013.

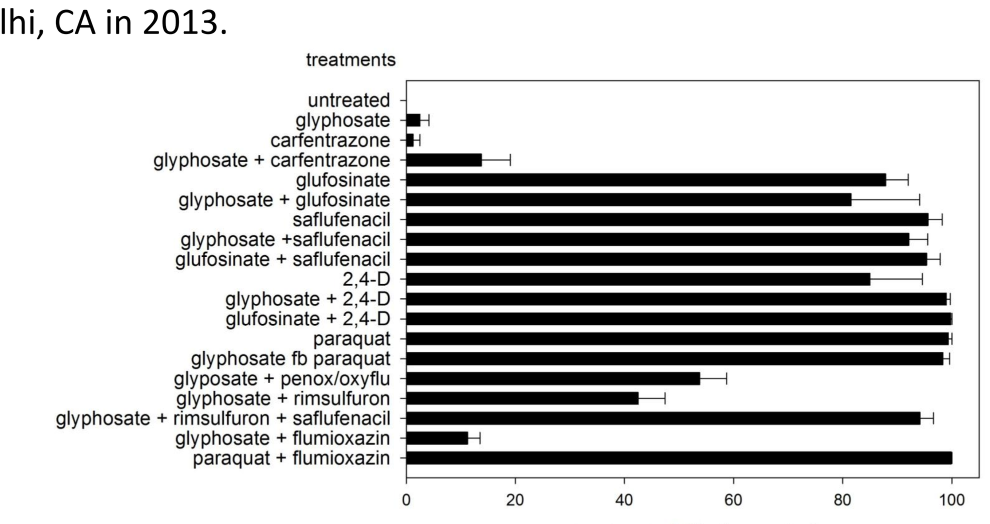
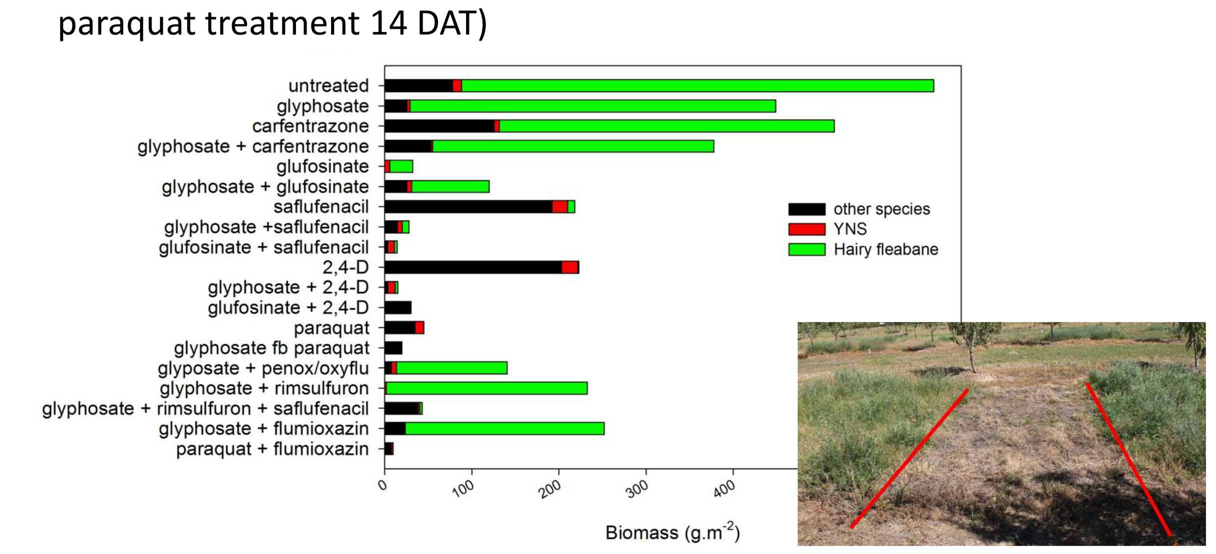


Figure. 5 (above) Hairy fleabane control 28 DAT. This site had been mowed several times and treated in early summer prior to treatment.

Figure. 6 (below) Weed biomass by species in a hairy fleabane and yellow nutsedge trial in an almond orchard. (inset photo of glyphosate fb paraquat treatment 14 DAT)



Herbicide crop safety evaluations

New herbicides and new use patterns can occasionally result in unexpected crop response or injury. Several experiments and demonstrations are underway to address herbicide crop safety concerns in almond and other tree and vine crops.

Table 2. Effects of glufosinate rate and spray coverage on almond trunk gumming and trunk diameter in an orchard trial near Arbuckle, CA in 2012-13

				Trunk gumming		Trunk diameter
Trt	Treatment	Rate	Coverage	28 DAT	56 DAT	1/22/13
		lb ia/A	GPA	0-5 scale (0=no gumming)		mm
1	Untreated	--	--	0	0	60
2	Rely 280 + AMS	1.5	10	1.0	1.7	60
3	Rely 280 + AMS	3.0	10	1.3	1.3	60
4	Rely 280 + AMS	6.0	10	1.7	2.7	58
5	Rely 280 + AMS	1.5	20	0.3	0	63
6	Rely 280 + AMS	3.0	20	0.7	1.7	58
7	Rely 280 + AMS	6.0	20	1.3	1.7	62
8	Rely 280 + AMS	1.5	40	0.3	0.7	64
9	Rely 280 + AMS	3.0	40	2.0	2.0	57
10	Rely 280 + AMS	6.0	40	2.7	3.0	59
	Fishers LSD (0.05)			1.1	1.1	12

Treatments applied directly to lower 18 inches of 2nd leaf almond tree trunks on September 6, 2012.
1.5 lb ai/A is the top label rate; 3 and 6 lbs are 2x and 4x of the top label rate, respectively.

"gumming" injury related to Rely 280 overdose trt.

Other support

In addition to support from the Almond Board of California, the UC Davis Weed Science Program is supported by other commodity boards, federal and state grant programs, and funding from the agricultural chemical industry. Thank you to all of our sponsors.