Effects of adding pyraflufen in tank mixes with different POST herbicides in tree nut crops of California

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Pyraflufen is a contact herbicide that inhibits the activity of the enzyme protoporphyrinogen oxidase (WSSA mechanism of action –Group 14). This herbicide has activity on several broadleaf weed species when weeds are 4 inches tall or less, or pyraflufen can be mixed with other POST herbicides to increase efficacy and broaden the spectrum of weeds controlled. The objective of this study was to evaluate weed control performance of pyraflufen alone or combined in tank-mixture with other POST herbicides.

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Methods:

An experiment with seven treatments plus an untreated control was conducted twice during spring 2014. The first experiment was conducted in a mature prune orchard with a silt-loam soil and furrow irrigation in Glenn County, CA. At this location, the main weed species were cutleaf geranium (GERDI), and field bindweed (CONAR). The second experiment was conducted in a fallowed, non-irrigated field with a silt-clay soil located at UC Davis. The main weed species at the Davis site were tumbling pigweed (AMAGR), which was 4 inches tall, and prostrate knotweed (POLAV), which was 5 inches in diameter at application.

The experimental design was a randomized complete block with four replicates per treatment and individual plots were 10 by 15 ft. A CO2-pressurized backpack sprayer with 4 Turbo-Teejet nozzles was used to apply treatments at 20 GPA. The Glenn and Davis experiments were initiated March 12 and May 13, 2014, respectively. Evaluations were made 7, 14, 29 days after treatment (DAT) in the first experiment, and 7, 14, 21, and 28 DAT in the second experiment. Weed control was visually estimated using a scale of 0 (no weed control) to 100% (complete weed control). In the Davis experiment, green area coverage (GRNARE) was also evaluated using digital image analysis. The method consists of taking pictures perpendicular to the soil surface at a constant height (1.9 m) and determining the proportion of green color in the image using ImageJ software.

Data were analyzed in JMP 11 (SAS Institute) using analysis of variance (ANOVA), and means were separated using Tukey's test (p 0.05). Orthogonal contrasts were used to directly compare treatments with and without pyraflufen. Data from the two sites were analyzed separately because of differences in weed species present.

Results:

In the first experiment, weed control was greater than 80% up to 14 DAT in all treatments with exception of pyraflufen applied alone (table 1). Pyraflufen provided excellent control of CONAR (>98%)

and suppression of GERDI (55%) up to 14 DAT, but plants recovered later reducing weed control at the last evaluation. Overall weed control with pyraflufen applied alone was poor at 7 DAT (33%). The addition of pyraflufen to glyphosate significantly improved weed control up to 14 DAT when compared to glyphosate treatment (trt 2 vs trt 3). In contrast, the addition of pyraflufen did not improve weed control when mixed with glufosinate or paraquat as compared to those products applied alone at this site.

In the second experiment, pyraflufen provided excellent control of CONAR and AMAGR at 7 DAT, but control declined in the following evaluations (table 2). Tank-mixes of pyraflufen with glyphosate improved control of CONAR only at 7 DAT when compared to glyphosate alone. Reduced efficacy was observed in overall weed control, CONAR, AMAGR control, and GRNARE when pyraflufen was mixed with glyphosate as compared to glyphosate alone. Pyraflufen did not improve weed control when mixed with glufosinate or paraquat in this trial.

Pyraflufen applied alone provided quick burndown of CONAR at the Glenn site and CONAR and AMAGR at the Davis site; however, significant regrowth was observed by 14 DAT. Similarly, when combined with other POST herbicides, pyraflufen tankmixes had faster activity than the tankmix partners applied alone. This result was most evident at the Davis site which was treated in May under higher temperature and light conditions which contributes to faster activity of POST-applied Group 14 herbicides. The more rapid burndown observed with pyraflufen combinations usually did not result in better weed control by 14 or 28 DAT compared to the other POST herbicides applied alone. However, under more challenging conditions, pyraflufen may improve efficacy and expand the spectrum of weed control of glyphosate.

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Table 1 Weed control (%) of overall species (overall), of field bindweed (CONAR), and of cutleaf geranium (GERDI) in a prune orchard in Glenn County, CA during spring 2014.

	Treatment[1] (trade name)	rate (per A)	overall			CONAR			GERDI		
			7 DAT[2]	14 DAT	29 DAT	7 DAT	14 DAT	29 DAT	7 DAT	14 DAT	29 DAT
			%								
1	nontreated	--	0	0	0	0	0	0	0	0	0
2	glyphosate (Roundup PowerMax)	3 pt	38	88	98	8	50	80	25	58	98
3	glyphosate (Roundup PowerMax) + pyraflufen (Venue)	3 pt + 4 fl oz	79	96	98	100	100	88	83	98	100
4	glufosinate (Rely 280)	48 fl oz	89	98	90	80	89	53	84	100	100
5	glufosinate (Rely 280) + pyraflufen (Venue)	48 fl oz + 4 fl oz	95	98	90	100	98	58	95	100	100
6	paraquat (Gramoxone SL)	4 pt	98	98	80	68	78	28	100	100	100
7	paraquat (Gramoxone SL) + pyraflufen (Venue)	4 pt + 4 fl oz	98	97	73	95	80	8	100	100	100
8	pyraflufen (Venue)	4 fl oz	33	30	3	100	98	0	55	55	3
	[3]LSD (0.05)		10	4	9	15	25	23	4	11	4
	contrasts										
2 vs 3	glyphosate vs glyphosate + pyraflufen		*<0.001*	*<0.001*	0.857	*<0.001*	*<0.001*	0.502	*<0.001*	*<0.001*	0.163
4 vs 5	glufosinate vs glufosinate + pyraflufen		0.189	0.873	0.980	*0.006*	0.454	0.656	0.202	1.000	1.000
6 vs 7	gramoxone vs gramoxone + pyraflufen		0.875	0.632	*0.082*	*0.007*	0.839	*0.083*	1.000	1.000	1.000

[1]All treatments included crop oil concentrate at 1% v/v plus ammonium sulfate at 10 lbs/100 gal; [2]DAT – days after treatment; [3]LSD – least significant difference according to Tukey's test ($p<0.05$)

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Table 2 Weed control (%) of overall species (overall), field bindweed (CONAR), tumbling pigweed (AMAGR), and green area coverage (GRNARE) in a fallow area in Yolo County, CA during spring 2014.

	Treatment[1] (trade name)	rate	OVERALL			CONAR			AMAGR			GRNARE		
			7 DAT[2]	14 DAT	29 DAT	7 [1]DAT	14 DAT	29 DAT	7 [1]DAT	14 DAT	29 DAT	7 [1]DAT	14 DAT	29 DAT
		(per A)	%											
1	nontreated	--	0	0	0	0	0	0	0	0	0	55	91	68
2	glyphosate (Roundup PowerMax)	3 pt	41	80	96	18	69	86	100	100	100	10	7	1
3	glyphosate (Roundup PowerMax) + pyraflufen (Venue)	3 pt + 4 fl oz	78	76	80	95	90	50	80	81	84	4	8	7
4	glufosinate (Rely 280)	48 fl oz	86	63	50	86	73	20	97	99	94	3	13	22
5	glufosinate (Rely 280) + pyraflufen (Venue)	48 fl oz + 4 fl oz	98	76	68	97	80	30	98	97	91	1	9	17
6	paraquat (Gramoxone SL)	4 pt	70	50	45	81	75	33	99	100	100	3	24	31
7	paraquat (Gramoxone SL) + pyraflufen (Venue)	4 pt + 4 fl oz	92	60	55	95	71	23	100	100	100	2	14	20
8	pyraflufen (Venue)	4 fl oz	68	38	23	93	65	18	89	30	23	6	29	42
	[3]LSD (0.05)		15	13	16	19	19	22	11	9	10	5	8	15
	contrasts													
2 vs 3	glyphosate vs glyphosate + pyraflufen		*0.001*	0.524	*0.042*	*0.001*	*0.030*	*0.010*	*0.002*	*0.000*	*0.003*	*0.038*	0.892	0.447
4 vs 5	glufosinate vs glufosinate + pyraflufen		0.134	*0.038*	*0.033*	0.272	0.420	0.361	0.824	0.622	0.598	0.478	0.426	0.459
6 vs 7	gramoxone vs gramoxone + pyraflufen		*0.008*	0.123	0.206	0.154	0.685	0.361	0.790	0.956	1.000	0.716	*0.017*	0.141

[1]All treatments included crop oil concentrate at 1% v/v plus ammonium sulfate at 10 lbs/100 gal; [2]DAT – days after treatment; [3]LSD – least significant difference according to Tukey's test ($p<0.05$)

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