Red Raspberry Tolerance to Mesotrione

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Two field experiments were conducted to evaluate the effects of mesotrione (Callisto) at different rates alone and in combination with s-metolachlor (Dual Magnum) and fomesafen (Reflex).

Methods

Experiment 1 - was conducted on a young stand of privately-owned raspberries near Talbot, OR. Raspberry rows were 10 ft apart with a spacing of 24 inches between plants (hills). Plots were 10 ft in length with 5 hills per plot, and with 4 replications of each treatment in a randomized block design. A maintenance herbicide tankmix of paraquat + simazine was applied by the grower on March 1. All other treatments were applied to both sides of the row, creating a treatment zone approximately 3.3 ft wide, on 28 March. Phytotoxicity (necrosis, chlorosis) and floricane damage was evaluated at 1 and 2 WAT. The grower mistakenly burned the primocanes to the ground shortly after the evaluation at 2 WAT, as is typically done, which eliminated further evaluations of primocane injury. Due to low overall production, raspberries were only harvested once (22 June) from all hills within each plot and 25-berry subsamples were taken to determine average berry weight.

Experiment 2 - was conducted in a field of 10-year-old raspberry plants (var. 'Willamette') at OSU's North Willamette Research and Extension Center in Aurora, OR. Plots were 10 ft long with 8 hills per treatment, and with 4 replications of each treatment arranged in a randomized block design. An in-row, pre-emergence herbicide was applied by the grower to the entire raspberry planting about two months prior to the experimental treatments. Herbicide treatments were applied on 7 May in a 3 ft wide swath on each side of the plant row. Plots were irrigated with overhead sprinklers 3DAT to incorporate the herbicides, and otherwise were drip irrigated throughout the growing season. Phytotoxicity was evaluated 1, 2, and 4 WAT. Fruit yield and berry weight were determined from one hill per plot on 21 June. Primocane length and diameter were measured on 6 Aug.

Results and Discussion

Experiment 1 - Mesotrione applied alone or with s-metolachlor caused very little damage to at 1 WAT. At 2WAT, slight and moderate necrosis was noted on primocanes and floricanes, respectively (Table 2). The tankmix of mesotrione plus fomesafen was particularly injurious to raspberry primocanes. Damage recorded to floricanes at harvest was likely symptomatic of root rot and dieback due to the unusually long wet spring. Similarly, yields were so low at harvest that data were insignificant, and this plot was abandoned after the 2012 season.

Experiment 2 – All mesotrione treatments had higher incidence and greater severity of necrosis and chlorosis than did the untreated plots (Table 3), but only those primocane leaves that came in direct contact with the spray solution were affected. Symptoms of phytotoxicity increased from 1WAT to 4WAT. Herbicide treatment did not appear to have an effect on yield, berry weight, or number of primocanes (Table 3). Neither were length and diameter of primocanes significantly different between treatments (data not shown).

Table 1. Herbicide application data.

	TALBOT	AURORA
Date	March 28, 2012	May 7, 2012
Crop stage	Leafing out, some primocanes visible	Primocanes 8-12", floricanes just prior to bloom
Herbicide/treatment	Callisto, Dual Magnum, Reflex	Callisto, Dual Magnum, Reflex
Application timing	PRE, leafout	POST, pre-bloom
Start/end time	11:45AM-12:15PM	09:30AM-11:00AM
Air temp/soil temp (2")/surface	51	76
Rel humidity	69%	42%
Wind direction/velocity	SSW 7-10	NW 2-3
Cloud cover	100%	None
Soil moisture	Very wet	Moist
Plant moisture	Damp	Dry
Sprayer/PSI	BP/30 PSI	BP/40 PSI
Mix size	2100 mls	1250 mls
Gallons H20/acre	20	30
Nozzle type	1-XR8003	1-9503EVS
Nozzle spacing and height	24" above ground	18" above ground
Soil inc. method/implement	Light rain, overhead 2DAT	Overhead 3DAT

Table 2. Effect of mesotrione and tankmixes on raspberry injury and yield near Talbot, 2012. Means followed by same letter do not differ (P≤0.05).

	Herbicide	Rate	1 WAT			2 WAT			Harvest		
			Necrosis (primocanes)	Chlorosis (primocanes)	Floricane damage	Necrosis (primocanes)	Chlorosis (primocanes)	Floricane damage	Vines /10 ft of row	Yield /plot	Avg. berry wt
		lbs ai/A	*scale of 0-10*						*no.*	*g*	
1	mesotrione	0.094	0.0 a	0.8 a	0.0 a	1.0 a	2.9 b	3.1 b	7.0 a	390 a	2.8 a
2	mesotrione	0.188	0.4 a	0.6 a	1.0 a	1.5 a	3.5 b	5.8 c	5.8 a	371 a	2.4 a
3	mesotrione+ s-metolachlor	0.094 1.91	0.3 a	0.9 a	0.0 a	2.4 ab	3.4 b	4.3 bc	5.8 a	133 a	2.6 a
4	mesotrione+ fomesafen	0.094 0.5	3.0 b	0.0 a	4.0 b	3.5 b	0.4 a	4.1 bc	5.8 a	98 a	1.9 a
5	nontreated[a]		0.0	1.1 a	0.0 a	0.0 a	0.0 a	0.4 a	6.0 a	153 a	2.8 a

[a] Grower applied paraquat + simazine applied prior to experiment and well before primocanes emerged on 1 March.

Table 3. Effect of treatments on injury[a] to raspberries and yield near Aurora, 2012. Means followed by same letter do not differ (P≤0.05).

	Herbicide	Rate	1 WAT		2 WAT		4 WAT		Harvest		
			Necrosis	Chlorosis	Necrosis	Chlorosis	Necrosis	Chlorosis	Primocane s/ hill	Yield /plant	Avg. berry wt
		lbs ai/A	*scale of 0-10*						*no.*	*g*	
1	mesotrione	0.094	1.0 b	8.8 c	7.8 b	8.5 c	7.5 bc	8.0 d	9.0 a	585 a	3.3 a
2	mesotrione	0.188	2.0 b	9.5 c	8.8 bc	8.8 c	8.2 cd	7.8 cd	8.8 a	1082 a	3.1 a
3	mesotrione+ s-metolachlor	0.094 1.91	1.8 b	9.0 c	9.0 c	8.0 c	8.8 d	6.0 bc	8.2 a	788 a	3.2 a
4	mesotrione+ fomesafen	0.094 0.5	5.2 b	3.5 b	8.0 bc	4.8 b	7.0 b	5.0 b	9.0 a	595 a	3.3 a
5	nontreated[b]		0.0 a	0.0 a	0.5 a	0.0 a	0.5 a	0.5 a	10.2 a	597 a	3.1 a

[a] Incidence = percentage of plants showing symptoms.

[b] Grower applied an in-row pre-emergent herbicide applied approximately 2 months prior to experiment.

Figure 1. Chlorosis on emerged primocanes 1WAT (left) and 4WAT (right) from treatment with 0.094 lb ai/A Callisto at the Aurora site. **Figure 2.** Chlorosis 2WAT (white line) from 0.094 lb ai/A Callisto plus 1.91 lb ai/A Dual Magnum versus untreated plot at the Talbot site.

Summary

Mesotrione is known to have both pre- and post-emergence activity and causes either loss of chlorophyll (chlorosis) or death (necrosis). In Experiment 2, the primocanes were 8-12 inches tall and leafed out at the time of application and, hence, susceptible to the postemergence activity of the herbicide. The current registered label for Callisto gives use directions for caneberries (raspberry and blackberry) that state to make a directed, pre-bloom application. Yet, given the symptoms seen in Experiment 2, caneberry growers may want to consider making a directed application of Callisto prior to primocane emergence instead.

Weed Control in Hazelnuts

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Methods

The experiment was located on a privately-owned hazelnut orchard in Lane County, OR on woodburn silt loam soil (pH 6.1, OM 3.8%, CEC 20.8 mew/100g soil). Plots were 20 ft long and 10 ft wide with one tree at the center of each plot. Weeds present at the site included annual bluegrass (mainly), toad rush, hare barley, groundsel, mallow, chickweed, and annual ryegrass. Herbicides were applied 1 May and weed control was evaluated at 3WAT and 5WAT. Glyphosate was applied by the grower after the final evaluation.

Results and Discussion

Hare barley and annual ryegrass density were highly variable between plots and therefore initial control estimates were not possible for these species. Hare barley density was much greater at the second rating. Glyphosate alone provided good to exceptional weed control for all species. Glyphosate/paraquat plus simazine provided nearly complete control of all weedy vegetation. Indaziflam +glyphosate provided excellent control as recorded in past trials. Neither oxyflourfen at 1.5 lb ai/A nor saflufenacil at 0.04 lb ai/A provided adequate weed control. No injury to the hazelnut trees was observed for any treatment.

A secondary objective of this trial was to evaluate potential resistance of annual ryegrass to glyphosate. The annual ryegrass density was very low overall, with only one or two individuals per plot, but there was no evidence of glyphosate resistance in the annual ryegrass that was present. Had annual ryegrass been resistant to glyphosate, we could predict that glufosinate plus indaziflam would have provided the best weed control.

Table 1. Herbicide application data.

Date	Tuesday, May 01, 2012
Crop stage	Completely leafed out
Herbicide/treatment	All
Start/end time	10:15-11:45AM
Air temp	58
Rel humidity	57%
Wind direction/velocity	1.5 to 7.6 SE
Cloud cover	50%
Soil moisture	Wet from night rain
Plant moisture	Damp
Sprayer/PSI	CO_2 BP 30 PSI
Mix size	2100 4 plots
Gallons H20/acre	20
Nozzle type	3-XR8003 on both sides of tree row (10 ft band)
Nozzle spacing and height	20/24
Incorporation/rainfall events	Light drizzle began 30 min after the last treatment was applied. All glyphosate treatments had $\geq$1 hr before drizzle began. Substantial rainfall occurred the week following application to incorporate the herbicide.