Evaluation of Select Herbicides on Non-bearing Crops

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Introduction

This study was conducted as part of the IR-4 Project to investigate herbicide phytotoxicity on two growth stages of shadblow serviceberry (*Amelanchier canadensis*), *Malus* Ginger Gold apple (Malus × Ginger Gold), Spartan apple (*Malus* × Spartan), northern pecan (*Carya illinoensis*), Spanish chestnut (*Castanea sativa*), and Blackgold cherry (*Prunus* Blackgold).

Competition from weeds impacts the growth rate and overall health of container and field grown crops, especially during establishment. Methods to control weeds include cultural, biological, and chemical control. However, it's the latter that generally is most effective and the most economical way to reduce weeds around the base of the crops. Good weed control from herbicides is dependent on placement, timing of application, and safety of the product.

Materials and Methods

Field. Shadblow serviceberry, Ginger Gold apple, Spartan apple, and northern pecan, were planted 4 ft apart within row and 14 ft between rows with 4 trees/block. Trees were watered in after planting to allow settling, and irrigated as needed throughout the trial. Treatments consisted of a nontreated control and two herbicides applied at three rates at two different growth stages: F6875 4SC [sulfentrazone + prodiamine (0.375 lb ai, 0.75 lb ai, and 1.5 lb ai)] and Tower [dimethenamid-p (.98 lb ai, 1.97 lb ai, and 3.94 lb ai)]. F6875 4SC was applied to newly planted Ginger Gold and Spartan apple 8 days after planting (DAP) and again 6 weeks after initial application (AIA). Dimethenamid-p was applied to newly planted shadblow serviceberry (4 DAP) and northern pecan (25 DAP) planting and again 6 weeks AIA (Ginger Gold and Spartan, July 29, 2015; northern pecan, August 20, 2015). Plants were irrigated with a half in. of water, 1 to 2 hours after herbicide application and all herbicide applications were applied to dry foliage. The trial was conducted using a randomized complete block design.

Container. Spanish chestnut and Blackgold cherry were potted in 1 gallon (Spanish chestnut) and 10 gallon (Blackgold cherry) containers filled with Fafard Mix 52 amended with 19-4-8 Harrell's 5- to 6-month controlled release fertilizer at 8 lb/cubic yard (medium rate). Plants were grown outdoors in full sun. Irrigation was applied immediately after planting and as needed throughout the season. Treatments consisted of two herbicides applied at three rates at two different growth stages: Tower (same rates as above) and Biathlon [oxyfluorfen + prodiamine (2.75 lb ai, 5.5 lb ai, and 11.0 lb ai)]. Both herbicides were applied on June 16, 2015 (Spanish chestnut, 1 DAP; Blackgold cherry, 4 DAP) and again 6 week AIA (July 29, 2015). Plants were irrigated with a half in. of water, 1 to 2 hours after herbicide application and all herbicide applications were applied to dry foliage. The trial was conducted using a completely randomized design with 10 single plant replications.

Results and Discussion

Field. One week after the initial application, injury was observed on all herbicide treated plants (Table 1). Visual symptoms were consistent with herbicide injury: spotting, tip burn, and chlorosis. Ginger Gold and Spartan apple trees had fewer leaves on the lower portion of the trunk. Four weeks after the first

and second application of F6875 4SC at the 2× rate, Ginger Gold and Spartan trees were similar to the nontreated. F6875 4SC applied at all rates slightly injured non-bearing apple trees, but injury was considered minor and did not affect the overall growth of the trees compared with the nontreated. For instance, final height (FH) and final growth indices (FGI) were similar among all treatments. Shadblow serviceberry treated with Tower exhibited herbicide injury, however, leaves of nontreated and treated plants were pinkish yellow at bud break and remained that color for 2 to 3 weeks. Leaves appeared desiccated with marginal tip burn following application of Tower, but injury was only significant on plants treated with Tower at the 4× rate compared with the nontreated. All other treatments were rated similar to the nontreated. Final height and FGI were similar among all treatments at the close of the trial. Northern pecan trees treated with Tower had stunted leaves, tip burn and pale yellow. Leaves of treated plants remained lighter in color throughout the trial. Final height was not affected by Tower, however, nontreated plants were smaller than herbicide treated plants, most likely due to weed competition.

Container. Spanish chestnut leaves appeared lighter in color, had purple spotting, and curled leaves one week after application of Tower (Table 2). Initial injury was more severe on plants treated with the 2× (4.7 mean rating) and 4× (4.3 mean rating) rates of Tower compared with the 1× (3.0 mean rating) rate. Injury ratings were similar among all treatments at the second application and remained similar throughout the remainder of the trial. Overall growth was not affected by Tower application. Blackgold cherry trees had initial injury one week after first application of Biathlon, however, injury was similar to the nontreated the remainder of the trial. Overall growth was not affected by Biathlon.

Results from the trial suggest the preemergent herbicides selected for this trial can cause slight to moderate injury on newly planted nonbearing crops. However, overall growth is generally not impacted. Caution should be taken if using these preemergent herbicides to avoid leaf injury and always follow label recommendations.

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Table 1. Evaluation of select herbicides on field grown non-bearing crops, 2015.

				Phytotoxicity[z]						Growth measurements End of season	
				First application[y]			Second application[x]				
Taxa	Treatment		Rate	Week 1	Week 2	Week 4	Week 1	Week 2	Week 4	Height (cm)	Growth indices (cm) [w]
Amelanchier canadensis	Non-treated	0×	-	1.1 c	1.5 c	1.9 c	1.7 c	1.2 d	1.1 c	54.2 a	35.9 a
	dimethenamid-p	1×	0.98 lb ai	3.8 b	2.6 c	2.6 bc	4.1 b	2.7 c	2.6 b	45.0 bc	34.2 ab
	dimethenamid-p	2×	1.97 lb ai	5.3 a	4.6 b	3.3 b	4.5 b	3.8 b	3.8 a	47.8 ab	32.7 ab
	dimethenamid-p	4×	3.94 lb ai	6.6 a	6.2 a	5.8 a	6.3 a	4.8 a	4.3 a	40.3 c	26.7 b
			HSD	1.4	1.3	1.6	1.1	0.8	0.8	6.7	8.1
Carya illinoensis	Non-treated	0×	-	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b	0.0 b	47.7	27.0 b
	dimethenamid-p	1×	0.98 lb ai	3.0 ab	2.4 ab	2.0 ab	2.8 a	2.9 a	2.9 a	58.9	35.3 a
	dimethenamid-p	2×	1.97 lb ai	4.7 a	4.3 a	3.7 a	3.1 a	2.6 a	2.0 a	58.0	31.8 ab
	dimethenamid-p	4×	3.94 lb ai	4.3 a	3.8 ab	4.0 a	2.9 a	2.6 a	2.5 a	56.0	30.8 ab
			HSD	4.1	3.8	3.0	1.7	1.8	1.5	13.6	7.4
Malus × Ginger Gold	Non-treated	0×	-	0.0 b	0.1 c	0.3 b	0.5 c	0.5 b	0.0 b	155.1	67.7
	sulfentrazone + prodiamine	1×	0.375 lb ai	0.7 b	1.4 b	0.9 b	1.6 b	2.4 a	2.1 a	148.3	65.9
	sulfentrazone + prodiamine	2×	0.75 lb ai	1.8 a	1.7 b	2.3 a	2.4 b	2.4 a	2.6 a	150.1	67.1
	sulfentrazone + prodiamine	4×	1.5 lb ai	1.9 a	2.8 a	2.5 a	3.4 a	2.1 a	2.5 a	151.8	69.4
			HSD	0.8	1.0	0.9	0.9	1.1	1.0	11.8	5.6
Malus × Spartan	Non-treated	0×	-	0.0 c	0.3 c	0.3 b	0.2 c	0.5 c	0.1 b	182.3	109.7
	sulfentrazone + prodiamine	1×	0.375 lb ai	0.6 bc	1.4 b	0.8 ab	1.3 b	1.3 b	0.3 b	183.7	111.7
	sulfentrazone + prodiamine	2×	0.75 lb ai	1.1 ab	2.3 ab	1.7 a	2.2 a	2.3 a	1.3 a	187.1	115.9
	sulfentrazone + prodiamine	4×	1.5 lb ai	1.5 a	2.5 a	1.7 a	2.6 a	2.6 a	1.6 a	190.0	114.7
			HSD	0.7	1.0	0.9	0.5	0.6	0.5	15.6	13.2

[z]Phytotoxicity = 0 to 10 scale (1 = no injury; 10 = complete kill).
[y]First application = herbicide applied to 10 days after planting [Malus (5 days after leafing out)] and 5 days after planting [Amelanchier(3 days after leafing out)].
[x]Second application = herbicide applied 6 weeks after first application (July 29, 2015).
[w]Growth indices = (Height + width + perpendicular width) ÷ 3.
[v]Means (within a column) with the same letters are not statistically different according to the Tukey's Honestly Significant Difference (HSD) Test $P \leq 0.05$.

Table 2. Evaluation of select herbicides on container grown non-bearing crops, 2015.

				Phytotoxicity[z]						Growth measurements End of season	
				First application[y]			Second application[x]				
Taxa	Treatment	Rate		Week 1	Week 2	Week 4	Week 1	Week 2	Week 4	Height (cm)	Growth indices (cm)[w]
Castanea sativa	Non-treated	0×	-	1.3 c	1.6 b	1.1 c	1.2 c	1.1 b	1.1 b	42.3	40.5
	dimethenamid-p	1×	0.98 lb ai	6.2 b	5.1 a	5.7 ab	2.9 b	3.2 ab	2.3 ab	45.5	40.8
	dimethenamid-p	2×	1.97 lb ai	8.2 a	5.7 a	4.0 b	3.1 bc	3.0 ab	2.1 ab	39.7	37.8
	dimethenamid-p	4×	3.94 lb ai	8.0 ab	6.9 a	3.2 a	6.0 a	4.9 a	4.0 a	32.7	32.5
			HSD	2.0	1.9	2.1	1.8	2.2	2.0	3.8	3.8
Prunus Blackgold	Non-treated	0×	-	0.5 b	0.8	0.9	1.8	1.8	1.2	209.4	117.6
	oxyfluorfen + prodiamine	1×	2.75 lb ai	1.1 ab	0.8	1.1	2.3	2.3	1.8	208	118.2
	oxyfluorfen + prodiamine	2×	5.5 lb ai	1.4 a	0.9	0.9	1.8	1.8	1.3	204.7	116.9
	oxyfluorfen + prodiamine	4×	11.0 lb ai	1 ab	1.2	1.7	2.1	2.1	1.6	204	118.7
			HSD	0.9	1.1	0.9	1.2	1.2	0.9	15.4	10.0

[z]Phytotoxicity = 0 to 10 scale (1 = no injury; 10 = complete kill).
[y]First application = herbicide applied to 10 days after planting [Malus (5 days after leafing out)] and 5 days after planting [Amelanchier (3 days after leafing out)].
[x]Second application = herbicide applied 6 weeks after first application (July 29, 2015).
[w]Growth indices = (height + width + perpendicular width) ÷ 3.
[v]Means (within a column) with the same letters are not statistically different according to the Tukey's Honestly Significant Difference (HSD) Test $P \leq 0.05$.