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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 northern pecan (*Carya illinoensis*), Spanish chestnut (*Castanea sativa*), Montmorency cherry (*Prunus Montmorency*), and black chokeberry (*Photinia melanocarpa*).

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 is 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 preemergent herbicides is dependent on placement, timing of application, and safety of the product.

Materials and Methods

Field. 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 Tower herbicide (dimethenamid-p) applied at three rates: 0.98 lb ai, 1.97 lb ai, and 3.94 lb ai. Dimethenamid-p was applied to newly planted northern pecan June 14, 2016 [15 days after planting (DAP)] and again six weeks after initial application (AIA). Plants were irrigated with a half inch of water, 1 to 2 hours after herbicide application, and all herbicide applications were applied to dry foliage. Trial

was conducted using a randomized complete block design.

Container. Spanish chestnut, Montmorency cherry, and black chokeberry were potted into 1 gal (Spanish chestnut and black chokeberry) and 10 gal (Montmorency 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 three herbicides applied at three rates at two different growth stages: Tower (same rates as above); Biathlon [oxyfluorfen + prodiamine (2.75 lb ai, 5.5 lb ai, and 11.0 lb ai)]; and Gallery [isoxaben (1.0 lb ai, 2.0 lb ai, and 4.0 lb ai)]. Herbicides were applied May 26, 2016 (1 DAP) and again six weeks AIA (July 13, 2016). Plants were irrigated with a half inch of water, 1 to 2 hours after herbicide application, and all herbicide applications were applied to dry foliage. Trial was conducted using a completely randomized design with 10 single plant replications.

Results and Discussion

Field. Overall, pecan trees did not have a high success rate regardless of treatment (Table 1). One week after the initial application, injury was observed on all herbicide-treated plants, but not significant compared with the nontreated. Visual symptoms were consistent with herbicide injury—spotting, tip burn, and chlorosis. Northern pecan trees treated with Tower had stunted leaves, tip burn, and pale yellow leaves. The leaves of treated plants remained lighter in color throughout the trial. Final height was not affected by Tower.

Container. Spanish chestnut leaves appeared lighter in color, had purple spotting, and curled leaves one week after application of

Tower (Table 1). Initial injury was more severe on plants treated with the 2× and 4× rates of Tower compared with the 1× rate. Tower applied at the 4× rate at the initiation of the trial severely injured the plants compared with the nontreated. Injury was noticeable in trees treated with Tower throughout the entire project. Overall growth (size of the plant) was not affected by Tower application. Montmorency cherry trees had initial injury 1, 2, and 4 weeks after first application of Biathlon following the 4× rate. However, ratings were similar to the nontreated for the remainder of the trial. Overall growth was not affected by Biathlon. Following initial application of Dimension, black chokeberry treated plants (1×, 2× and 4× rates) had curled leaves compared with the nontreated, which had no injury. Symptoms were greater following application (initial and second) but dissipated over time.

At the end of the trial, there were no visible symptoms regardless of treatment. Overall growth was not affected by Dimension application. Black chokeberry plants treated with Tower (1×, 2× and 4× rates) had a few curled leaves, but the majority of the leaves had signs of tipburn compared with the nontreated. Symptoms of treated plants were greater following the second application compared with the nontreated. However, at 2 and 4 weeks after the second application, only

the plants treated with the high rate (4×) were significant compared with the nontreated, but dissipated over time. At the end of the trial, there were no visible symptoms regardless of treatment. Overall growth was not affected by Tower applied at the 1× rate, but plants treated with the higher rates (2× and 4×) were significantly smaller than the nontreated. After initial application of Gallery, black chokeberry plants (1×, 2× and 4× rates) had curled leaves with a few showing signs of tipburn. Symptoms were present throughout the entire project. Generally, the symptoms were significantly greater than the nontreated. However, at the end of the project only the highest rate (4×) resulted in a higher rating than the nontreated. Overall growth was not affected by Gallery application.

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 recently planted, non-bearing crops.

| Treatment | Rate | Phytotoxicity ^z | | | | | | | | | Growth indices (cm) ^y | | | | | |
|-----------------------------------------|------|--------------------------------|-----|----------------|-----|-------|-----|---------------------------------|-------|-------|----------------------------------|----|-----|---|------|----|
| | | First application ^y | | | | | | Second application ^x | | | | | | | | |
| | | 1 WAT ^w | | 2 WAT | | 4 WAT | | 1 WAT | 2 WAT | 4 WAT | | | | | | |
| <i>Carya illinoensis</i> (PR# 28224) | | | | | | | | | | | | | | | | |
| Non-treated | 0× | 0 | 0.0 | a ^u | 0.0 | a | 0.0 | a | 1.1 | a | 0.9 | a | 0.0 | a | 21.4 | a |
| dimethenamid-p | 1× | 0.98 lb ai | 0.7 | a | 1.0 | a | 1.7 | a | 1.0 | a | 1.0 | a | 0.6 | a | 24.2 | a |
| dimethenamid-p | 2× | 1.97 lb ai | 0.4 | a | 1.6 | a | 2.5 | a | 1.3 | a | 1.2 | a | 0.5 | a | 27.5 | a |
| dimethenamid-p | 4× | 3.94 lb ai | 1.2 | a | 1.5 | a | 2.5 | a | 1.8 | a | 1.8 | a | 1.5 | a | 24.8 | a |
| <i>Castanea sativa</i> (PR# 28202) | | | | | | | | | | | | | | | | |
| Non-treated | 0× | 0 | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | a | 0.0 | b | 38.5 | a |
| dimethenamid-p | 1× | 0.98 lb ai | 2.0 | ab | 1.6 | ab | 1.4 | ab | 2.6 | a | 1.3 | a | 1.7 | a | 41.7 | a |
| dimethenamid-p | 2× | 1.97 lb ai | 1.8 | ab | 3.0 | a | 3.0 | a | 2.7 | a | 2.2 | a | 2.7 | a | 45.9 | a |
| dimethenamid-p | 4× | 3.94 lb ai | 3.6 | a | 3.6 | a | 2.8 | a | 3.6 | a | 2.2 | a | 2.7 | a | 40.2 | a |
| <i>Photinia melanocarpa</i> (PR# 32595) | | | | | | | | | | | | | | | | |
| Non-treated | 0× | 0 | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | a | 50.9 | a |
| dithiopyr | 1× | 0.5 lb ai | 2.0 | a | 1.6 | a | 2.3 | a | 2.8 | a | 1.2 | a | 0.0 | a | 49.1 | a |
| dithiopyr | 2× | 1.0 lb ai | 1.5 | a | 1.7 | a | 2.1 | a | 2.8 | a | 1.3 | a | 0.0 | a | 46.2 | a |
| dithiopyr | 4× | 2.0 lb ai | 2.2 | a | 1.7 | a | 1.9 | a | 2.8 | a | 1.5 | a | 0.6 | a | 50.1 | a |
| <i>Photinia melanocarpa</i> (PR# 32596) | | | | | | | | | | | | | | | | |
| Non-treated | 0× | 0 | 0.2 | c | 0.2 | b | 0.0 | b | 0.0 | c | 0.0 | b | 0.0 | b | 56.9 | a |
| dimethenamid-p | 1× | 0.98 lb ai | 1.6 | ab | 2.6 | a | 1.6 | a | 2.2 | b | 1.0 | b | 1.1 | b | 47.5 | ab |
| dimethenamid-p | 2× | 1.97 lb ai | 1.1 | bc | 2.1 | ab | 1.7 | a | 1.8 | b | 1.2 | b | 1.2 | b | 44.4 | b |
| dimethenamid-p | 4× | 3.94 lb ai | 2.2 | a | 3.3 | a | 2.3 | a | 4.0 | a | 3.1 | a | 3.8 | a | 32.5 | c |
| <i>Photinia melanocarpa</i> (PR# 32597) | | | | | | | | | | | | | | | | |
| Non-treated | 0× | 0 | 0.1 | b | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | b | 50.9 | a |
| isoxaben | 1× | 1.0 lb ai | 1.6 | a | 1.4 | ab | 1.7 | a | 2.5 | a | 1.0 | a | 0.3 | b | 47.2 | a |
| isoxaben | 2× | 2.0 lb ai | 2.5 | a | 1.9 | a | 1.0 | ab | 1.5 | a | 0.4 | ab | 0.0 | b | 51.5 | a |
| isoxaben | 4× | 4.0 lb ai | 2.7 | a | 2.6 | a | 1.6 | a | 2.3 | a | 0.7 | a | 1.0 | a | 47.0 | a |
| <i>Prunus sp.</i> (PR# 29054) | | | | | | | | | | | | | | | | |
| Non-treated | 3 | 0 | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | b | 0.0 | a | 0.0 | a | 36.9 | a |
| oxyfluorfen + prodiamine | 1× | 2.75 lb ai | 0.0 | b | 0.1 | b | 0.8 | ab | 1.1 | ab | 0.2 | a | 0.0 | a | 35.4 | a |
| oxyfluorfen + prodiamine | 2× | 5.5 lb ai | 0.4 | b | 0.0 | b | 1.1 | a | 2.2 | a | 0.6 | a | 0.0 | a | 36.1 | a |
| oxyfluorfen + prodiamine | 4× | 11.0 lb ai | 1.6 | a | 1.5 | a | 1.4 | a | 1.7 | a | 0.3 | a | 0.0 | a | 36.8 | a |

^zPhytotoxicity: 0 to 10 scale (0 = no injury; 10 = complete kill).

^yFirst application: May 26, 2016, 1 day after transplanting (Castanea, Photinia, Prunus); June 14, 15 days after planting Carya (1 day after leafing out).

^xSecond application: herbicide applied 6 weeks after first application [July 13, 2016 (Castanea, Photinia, Prunus); July 28, 2016 Pecan].

^wWAT: weeks after treatment.

^yGrowth indices: (Height + width + perpendicular width) ÷ 3.

^uMeans (within a column) with the same letters are not statistically different according to the Tukey's Honestly Significant Difference Test $\alpha=0.05$.