

Researcher: Hannah Mathers, PhD **Date:** 5/8/2020
Project Title: 2018 In Season Pre-Emergent Herbicide Crop Safety
Protocol #: 18-012 **PRnumbers:** 32929

Narrative Summary (Results/Discussion)

Please keep text to one page if possible. Include summary of trial results and a brief discussion including how any changes from the protocol may have affected results. Results for multiple PRnumbers can be summarized together, but please list all PRNumbers in the header and in the summary data table.

The results presented are for one species (Table 1) that received applications of Gemini G (proflaminate 0.40% + isoxaben 0.25%) (Everris NA, Dublin, OH) as part of protocol 18-012. *Acer rubrum* measured by rated scores experienced no injury at any time during the trial (Table 1). Some injury caused by thrips was evident on the maple, but unrelated to treatment. Additionally, the growth index (GI) values concur, that no treatment adversely effected the maples compared to the control (Table 1B). There was no height reduction compared to the control (Table 1B).

Results Table

Please insert results table here. Include PRnumbers for each treatment if multiple PRnumbers are included in this summary. Please include product, active ingredient, and statistics.

Table 1. Phytotoxicity ratings on selected ornamentals at Acorn Nurseries, Galena, OH

Acer rubrum #1 pot – PR32929 – Acorn

Treatment	Rate ^v	1 WAT ^z	2 WAT	4 WAT	6WAT	1 WA2T	2 WA2T	4 WA2T
Gemini G	200 lb/ac	0.0 ^{y,x}	0.0	0.0	0.0 [√]	0.0	0.0	0.0
Gemini G	400 lb/ac	0.0 ^x	0.0	0.0	0.0 [√]	0.0	0.0	0.0
Gemini G	800 lb/ac	0.0 ^{y,x}	0.0	0.0	0.0 [√]	0.0	0.0	0.0
Untreated	--	0.0	0.0	0.0	0.0	0.0	0.0	0.0

z = weeks after treatment

y = Phytotoxicity Ratings based on a 0-10 scale with 0 being no phytotoxicity and 10 death with ≤3 commercially acceptable.

x = Phytotoxicity ratings followed by *,** are significantly different from control based on Dunnett's t-test (α = 0.10, 0.05, respectively).

^v = All rates for Gemini G (proflaminate 0.40% + isoxaben 0.25%) are listed as lb. per ac.

√ indicates reapplication at this date

Table 1B. Phytotoxicity measures as a companion table to Table 1 above.

Acer rubrum #1 pot – PR32929 – Acorn

Treatment	Rate (ai) ^v	HT ⁱ 0WAT ^z	HT6WA2T	GI ^t 0WAT ^z	GI6WA2T	Δ ^w HT	ΔGI
Gemini G	200 lb/ac	15.25	19.75	43.6	587.87	4.5	544.3
Gemini G	400 lb/ac	15.85	21.44 *	114.14 *	785.0 *	5.6 *	607.86
Gemini G	800 lb/ac	14.2 *	19.3	23.35	606.05	5.1 *	582.7
Untreated	--	15.85	19.31	39.25	522.5	3.5	483.25

y = All measures are in inches and the calculated Growth Index measures are in in³.

x = Measures followed by *,** are significantly different from control based on Dunnett's t-test (α = 0.10, 0.05, respectively).

v = All rates for Gallery SC (Isoxaben 45.45%) are listed as active ingredient (ai) per ac.

i = HT represents Height at start of trial and at the end of the trial or 6WA2T measured in inches.

t = GI represents Growth index (in³) and was calculated as GI=Pi (Ht)(r₂), where Ht. (in) was the starting or final height, respectively, r was half of the average of W1+W2 (two perpendicular measurements taken of plant diameter (in)) and Pi was "π". The GI provides a volume measure of the plant which helps with quality determinations not necessarily evident by heights and widths alone or by visual observations.

w = Δ represents delta or the change in average heights and average GI's from the start to completion of the trial.



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Materials & Methods/Recordkeeping

Please fill out the information below or attach a separate document with comparable information.

Four replications with three plants per replication, four treatments, 0, 1, 2 and 4X rates of Gemini G (prodiamine 0.40% + isoxaben 0.25%) were applied to *Acer rubrum* in field 1-gallon containers (Table 1) for 48 plants per protocol (PR#: 32929). Rates are listed in pounds /acre with 1X being 200 lb ai/ac (Table 1). Evaluations were conducted at 1, 2 and 4 weeks after treatment (WAT). A reapplication was conducted at 6 WAT, and evaluations occurred 1, 2, and 4 weeks after second treatment (WA2T). All plants were located at Acorn Farms, Galena, OH. All plants were grown in standard container media (85% pine bark and 15% Comtil) (Kruz Bros. Central Ohio, LLC, Groveport, OH) and fertilized with The Anderson's 18-6-12 + minors, slow-release 8-9-month formulation and over-head irrigation. The trial was initiated on 05/23/2018 at Acorn Farms. All herbicides were applied within 7 days after potting as over the top applications.

Name(s) of Personnel Conducting Research: Dr. Hannah Mathers
Location of Trial (city/state): Acorn Farms, Galena, OH
Use Site (greenhouse/shadehouse/field container/etc.): Field container

Crop History

Crop Cultivar/Variety: *Acer rubrum*
Purchased from: Lawyer Nursery, Inc., MT
Date of Transplanting: May 9, 2018
Potting Mix: Nursery mix
Pot size & spacing: 1-gallon pots on 1-foot centers

Product(s) applied prior to start of experiment:

Product	Rate	Application Type	Date of Application	Crop Growth Stage
Gemini G	0			Shoot expansion
	200 lb/ac	Granular: pre-weighed according to size of plot and rate	05/23/18	Shoot expansion
	400 lb/ac	Granular: pre-weighed according to size of plot and rate	05/23/18	Shoot expansion
	800 lb/ac	Granular: pre-weighed according to size of plot and rate	05/23/18	Shoot expansion

Experiment Information

Experimental Design: Completely randomized design with species
 Mathers Table 1 2018

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Number of Reps: Four replicates with three plants per replicate or 12 plants/tmt/rate/species

Photos

Please embed photos here or send jpg, tiff, or bmp.



Fig. 1.1. (Above) Gemini G (prodiamine 0.40% + isoxaben 0.25%) applied to *Acer rubrum* located Acorn Farms, Galena, OH. This photo was taken six weeks after the second treatment (6WA2T) from left to right (0, 1, 2 and 4X). Note the 2X and 4X plants are taller and had more mass versus the control. We assume these growth increases with the higher rates of Gemini G were due to less thrip injury which traditionally destroys the apical dominance on maple. Photo taken by: H. Mathers.

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Fig. 1.2. (Above) *Acer rubrum* located at Acorn Farms, Galena, OH. This photo was taken at 4WAT and shows the level of growing point distortion caused by thrips on these maple control plants. Injury was not attributed to Gemini G (proflumicarb 0.40% + isoxaben 0.25%) and thrip injury was also unrelated to treatment as the controls and 1X plants were severely impacted by thrips than the 2x or 4X rates. Photo taken by: H. Mathers.

Data Collected

Please describe data collected and scoring system. Also include the dates data were collected.

All rated score evaluations of phytotoxicity (defined in report) were measured on a 0 to 10 scale where 0 represented no phytotoxicity, ≥ 3 represents commercially unacceptable injury and 10 represented plant death (Barolli et al., 2005; Collins et al. 1999; Duray and Davies, 1989; Mathers and Case, 2010; Samtami et al., 2007). This rated score is a standard measure accepted in all major weed and horticultural science journals with each interval representing a 10% increase in injury over the whole plant (ex. 3 would be 30% injury and 5 would be 50%, etc.). Starting and ending heights, and two perpendicular measurements of diameter were taken per plant. These measures were used to calculate Growth index (GI) (in^3) as $GI = \pi (Ht)(r^2)$, where Ht. (in) was the starting and ending

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height, r was half of the average of W1+W2 [two perpendicular measurements taken of plant diameter (in)] and Pi was “π”. The GI provides a volume measure of the plant which helps with quality determinations not necessarily evident by heights and widths alone or by visual observations. Symptoms were also noted if significant, and photos were conducted *in situ*.

Raw Data

See attached excel files

Environmental conditions during the experiment:

Insert temperature, precipitation and/or irrigation, and relative humidity with a minimum of high, low and average daily temperatures. Or send separate file with this information.

Include a statement about any significant weather or environmental events during the experiment.

Source: <https://www.wunderground.com/history/monthly/us/oh/columbus/KCMH/date/2018-8>

Date	Temperature (° F)			Humidity (%)			Precipitation
	Max	Avg	Min	Max	Avg	Min	Total
May 1	81	64.6	45	68	38.2	17	0
2	85	73.0	59	60	46.8	36	0
3	80	74.1	69	87	61.1	47	0
4	82	70.8	60	84	63.5	42	0.09
5	68	60.8	51	93	71.5	50	1.8
6	77	64.4	56	90	65.9	27	0
7	72	62.1	52	93	63.4	38	0.06
8	79	64.8	49	80	52.0	32	0
9	83	73.9	56	84	49.1	28	0
10	80	72.0	64	90	55.8	29	0.17
11	78	66.5	57	83	60.3	46	0
12	85	72.7	62	78	57.5	40	0
13	86	72.2	59	87	67.4	46	0
14	84	74.4	64	90	66.7	46	0
15	86	73.7	66	100	75.5	35	0
16	78	68.2	62	93	82.2	62	0.66
17	80	71.7	61	87	69.8	52	0.05
18	74	69.7	66	84	70.9	61	0.03
19	81	73.5	66	87	71.7	56	0.09
20	78	70.1	66	93	76.1	54	0.01
21	82	69.4	61	94	75.9	52	0.08
22	81	71.8	66	96	80.1	58	0.82
23 -Start	77	67.6	63	87	69.0	43	0.04
24	83	70.7	55	84	51.9	29	0
25	87	74.4	58	87	52.6	29	0
26	84	73.8	65	100	71.9	25	0
27	89	78.0	68	97	70.2	45	1.57



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Date	Temperature (° F)			Humidity (%)			Precipitation
28	91	80.0	68	93	64.9	40	0
29	89	80.0	69	90	61.5	40	0
30 -1WAT	85	77.4	71	93	74.5	55	0
31	86	77.2	71	87	75.9	53	0.28

Date	Temperature (° F)			Humidity (%)			Precipitation (in)
Jun	Max	Avg	Min	Max	Avg	Min	Total
1	81	73.2	68	87	77.5	62	0.42
2	83	73.5	67	90	74.0	53	0.00
3	83	73.6	65	90	65.5	29	0.00
4	76	68.2	59	78	50.8	31	0.08
5	67	62.1	59	96	78.3	49	0.00
6 -2WAT	68	59.4	50	93	68.3	45	0.57
7	81	67.5	53	83	62.2	45	0.00
8	84	71.4	66	93	75.9	47	0.00
9	87	72.9	66	93	76.6	46	0.54
10	82	73.7	67	93	76.2	56	0.44
11	73	70.5	67	87	81.6	73	0.00
12	80	71.8	65	93	84.4	67	0.02
13	86	74.3	69	97	84.1	57	0.42
14	83	71.8	58	87	55.3	27	1.11
15	86	74.7	61	84	55.2	32	0.00
16	88	77.6	68	85	67.1	49	0.00
17	91	81.8	70	93	68.8	50	0.04
18	93	84.1	73	87	62.8	45	0.00
19	87	80.6	75	90	75.3	63	0.00
20 -4WAT	87	77.2	72	93	81.5	55	0.38
21	74	70.1	66	94	88.3	76	0.15
22	84	74.4	69	93	79.9	49	1.67
23	79	72.5	68	90	75.7	60	0.22
24	83	75.7	69	84	63.7	46	0.03
25	79	71.7	63	87	69.1	52	0.00
26	83	70.1	64	93	80.3	54	0.00
27	83	72.8	67	93	80.5	58	0.99
28	86	75.9	68	90	70.3	48	0.05
29	88	79.5	68	90	67.6	46	0.00
30	91	81.4	69	90	63.8	36	0.00

Date	Temperature (° F)			Humidity (%)			Precipitation (in)
Jul	Max	Avg	Min	Max	Avg	Min	Total
1	94	82.8	71	87	63.7	43	0.00
2	90	78.9	74	85	73.8	55	0.00
3	92	80.7	71	93	71.4	48	0.00
4	92	81.2	74	91	75.3	50	0.94



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Date	Temperature (° F)			Humidity (%)			Precipitation
5	93	82.2	74	94	72.4	48	0.36
6	81	74.0	63	93	66.9	42	0.66
7	80	69.5	58	90	57.1	32	0.00
8	86	72.4	59	78	54.0	31	0.00
9	89	77.0	62	84	58.1	32	0.00
10	91	78.9	69	87	68.9	42	0.00
11	84	74.9	64	78	53.4	37	0.00
12 -7WAT Reapply	85	74.4	63	72	51.5	33	0.00
13	89	79.0	67	68	51.2	35	0.00
14	92	82.5	70	87	58.7	33	0.00
15	86	81.5	75	84	66.2	51	0.00
16	88	79.5	74	91	76.9	55	0.00
17	86	78.2	70	91	59.8	33	0.24
18	83	73.7	64	84	58.3	37	0.00
19 -1WA2T	84	74.2	63	75	52.3	33	0.00
20	77	71.6	67	91	81.8	66	0.00
21	78	70.0	65	93	83.7	64	0.53
22	80	71.8	66	94	78.4	58	0.32
23	82	72.1	66	94	82.2	60	0.01
24	81	73.5	69	97	81.8	58	1.30
25	87	77.1	69	90	68.4	51	0.00
26 -2WA2T	85	75.2	66	93	68.9	46	0.00
27	80	73.0	67	93	67.1	46	0.24
28	80	70.7	61	81	60.4	42	0.00
29	80	71.5	61	90	66.7	39	0.00
30	81	73.0	66	93	70.8	41	0.03
31	75	71.9	68	96	86.5	76	0.05

Date	Temperature (° F)			Humidity (%)			Precipitation (in)
Aug	Max	Avg	Min	Max	Avg	Min	Total
1	75	71.2	68	93	81.8	66	0.78
2	81	73.7	67	93	76.6	50	0.01
3	84	76.2	67	93	71.4	47	0.00
4	89	79.1	69	87	66.3	39	0.06
5	89	81.0	72	91	68.2	46	0.00
6	89	81.3	73	90	69.1	50	0.00
7	86	76.3	72	91	77.3	54	0.00
8	83	75.3	71	96	83.3	60	0.31
9 -4WA2T	85	75.0	68	93	72.9	44	0.11
10	81	73.5	69	96	84.3	67	0.00
11	79	72.1	68	93	83.5	60	0.00
12	84	73.9	61	93	65.1	44	0.19
13	84	73.3	64	93	70.6	46	0.00
14	84	74.7	63	93	68.6	46	0.00



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Date	Temperature (° F)			Humidity (%)			Precipitation
15	84	75.4	67	93	75.4	51	0.00
16	77	73.6	70	93	84.2	76	0.24
17 -Photos	81	74.8	72	94	88.0	77	0.51