**Research Report Form** 



Researcher:	Hannah Mathers, PhD	Date:	5/10/2020	
Project Title:	Preemergence Herbicide Crop Safety			
Protocol #:	<b>18-012 PRnumbers:</b> 29056, 29005			

### 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 two species (Tables 2 and 2B) that received applications of Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) (OHP, Inc., Mainland, PA 19451) (EPA Reg. #: 59807-12) as part of protocol 18-012. Biathlon caused no unacceptable commercial injury at any rate, by rated score evaluations, even after two applications at 7 weeks apart for Pyracantha coccinea 'Thornless' and Crataegus columbiana (Table 2). Growth measures also showed no reduction in height compared to the control (table 2B). The 4X of Pyracantha and Crataegus, actually showed significant increases in height compared to the controls (Table 2B). The only growth reduction found with the two species was with the 2X rate of Biathlon with the Crataegus; however, the 4X Crataegus were the biggest plants. The phytotoxicity scores for the 2X Crataegus show no differences compared to the controls (Table 2). The difference in growth was attributed to seedling segregation for spread and not due to the treatment (Table 2B). With the Pyracantha coccinea 'Thornless' we see a less full plant at 7 WAT (reapplication) with the 2X rate which is shown in the phytotoxicity scores; however, there is no visible injury with any treatment (Fig. 2.1) including the 2X so the scores show no commercially unacceptable injury. By the end of the trial the Pyracantha coccinea 'Thornless' exhibit no visible differences across treatment (Fig. 2.2). In the course of the experiment, we found there was considerable unexplained variability in the growth of the Crataegus columbiana (Fig. 2.4). Some of the variation was due to the smaller size of the 1X rate plants. Although, selected at random the 1X plants were primarily single stemmed compared to the other treatments which meant lower GI values (Table 2B).

## **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 2. Phytotoxicity ratings on selected ornamentals at Acorn Farms, Galena, OH.

Treatment	Rate (ai) <sup>∨</sup>	1 WAT <sup>z</sup>	2 WAT	4 WAT	6WAT	1 WA2T	2 WA2T	4 WA2T
Biathlon	2.75 lb/ac	0.0 <sup>yx</sup>	0.8	0.0	0.0√	0.0	0.0	0.0
Biathlon	5.5 lb/ac	0.0 <sup>yx</sup>	0.5	0.5	0.5√	1.0	0.6	0.6
Biathlon	11.0 lb/ac	0.0 <sup>yx</sup>	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
Crataegus columbiana #1 pot – PR#29005 - Acorn								
Treatment	Rate(ai) <sup>∨</sup>	1 WAT	2 WAT	4 WAT	6 WAT	1 WA2T	2 WA2T	4 WA2T
Biathlon	2.75 lb/ac	0.0	0.0	0.0	0.3√	0.0	0.0	0.0
Biathlon	5.5 lb/ac	0.0	0.0	0.0	0.3√	0.0	0.0	0.0
Biathlon	11.0 lb/ac	0.0	0.0	0.0	0.0√	0.0	0.8	0.8
Untreated		0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pyracantha coccinea 'Thornless'- #1 pot- PR# 20056 - Acorn

z = weeks after treatment

y = Phytotoxicity Ratings based on a 0-10 scale with 0 being no phytotoxicity and 10 death with  $\leq$ 3 commercially acceptable. x = Phytotoxicity ratings followed by \*,\*\* are significantly different from control based on Dunnett's t-test ( $\alpha$  = 0.10, 0.05, respectively).

<sup>v</sup> = All rates for Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) are listed as active ingredient (ai) per ac.

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 $\checkmark$  indicates reapplication at this date

#### **Table 2B.** Phytotoxicity measures as a companion table to Table 2 above.

T = T = T = T = T = T = T = T = T = T =	Pyracantha coccin	ea 'Thornless'-	#1 pot- PR# 20056 -	Acorn
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Treatment	Rate (ai) <sup>∨</sup>	HT <sup>i</sup> W	ΑTz	HT4WA	\2T	GI <sup>t</sup> 0WA	۸T <sup>z</sup>	GI4WA2T	$\Delta^{w}HT$	ΔGI	
Biathlon	2.75 lb/ac	19.7 <sup>y</sup>	*	20.5	*	677.7		4075.8	0.8	3398.1	
Biathlon	5.5 lb/ac	16.7	*	17.8		294.6	*	2725.5	1.1	2430.9	
Biathlon	11.0 lb/ac	16.5	*	18.9		527.1		3713.4	2.4 *	3186.3	
Untreated		18.3		19.0		728.1		3039.5	0.7	2311.4	

#### Crataegus columbiana #1 pot – PR#29005 - Acorn

Treatment	Rate (ai) <sup>v</sup>	HT <sup>i</sup> WATz	HT4WA2T	GI <sup>t</sup> 0WAT <sup>z</sup>	GI4WA2T	ΔHT	ΔGI
Biathlon	2.75 lb/ac	13.8	16.3	31.4 *	289.6	2.5	258.2
Biathlon	5.5 lb/ac	14.3	16.0	132.9 *	334.4	1.7	201.5 *
Biathlon	11.0 lb/ac	14.2	18.9 *	131.3 *	484.2	4.7 *	352.9
Untreated		13.9	15.1	75.6	323.8	1.2	316.2

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 Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) are listed as active ingredient (ai) per ac.

i = HT represents Height at start of trial and at the end of the trial or 4WA2T in inches.

t = GI represents Growth index (in<sup>3</sup>) 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 " $\pi$ ". 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.

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

#### Materials & Methods/Recordkeeping

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

Protocol 18-012 was followed with no changes, including four replications with three plants per replication and four treatments. 0, 1, 2 and 4X rates of Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) and used in the 1-gallon containers (Table 2) for 48 plants per protocol (PR#: 29056 and 29005). Rates are listed in pounds of active ingredient (ai)/acre with 1X being 2.75 lb ai/ac (Table 2 and 2B). Evaluations were conducted at 1, 2, 4 and 7 weeks after treatment (WAT). A reapplication was conducted at 7WAT, and evaluations occurred 1, 2 and 4 after second treatment (WA2T). Pictures were also taken at 6WA2T but no evaluations. The two species were located at Acorn Farms Inc., 7679 Worthington Rd., Galena, OH. Weather records for Columbus, OH are presented as Acorn Farms is in the greater Columbus, OH region. All plants were grown in standard container media (85% pine bark and 15% Comtil) (Krutz 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. Applications at Acorn were conducted on May 23, 2018. All herbicides were applied within 7 days after potting as over the top applications and all were watered within 2 hours following applications.

## <u>Name(s) of Personnel Conducting Research</u>: Dr. Hannah Mathers <u>Location of Trial (city/state)</u>: Acorn Farms Inc., Galena, OH <u>Use Site (greenhouse/shade house/field container/etc.)</u>: Field container





Resea	rcher:	Hannah Mathers,	PhD	Date:	5/10/2020
Projec	t Title:	Preemergence He	rbicide Crop Safety		
Protoc	col #:	18-012	<b>PRnumbers:</b> 29056, 29005		
Crop ⊢	listory				
(	Crop Cult	tivar/Variety:	Pyracantha coccinea 'Thornless'		
F	Purchase	ed from:	Klyn Nurseries, Inc., Perry, OH		
[	Date of Transplanting:		May 16, 2018		
F	Potting Mix:		See above		
F	Pot size &	& spacing:	1-gallon pots on 1-foot centers		
(	Crop Cult	tivar/Variety:	Crataegus columbiana		
F	Purchase	ed from:	Lawyer Nursery, Inc, MT		
[	Date of T	ransplanting:	May 16, 2016		
F	Potting M	lix:	See above		
F	Pot size 8	& 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	Application Volume
<i>Biathlon</i> (Oxyfluorfen 2% + Prodiamine 0.75%)	0			Shoot expansion	
	100 lb/ac (2.75 lb a.i/ac	Granular: pre- weighed according to pot dia. and rate	05/23/2018	Shoot expansion	
	200 lb/ac (5.5 lb a.i./ac)	Granular: pre- weighed according to pot dia. and rate	05/23/2018	Shoot expansion	
	500 lb/ac (11.0 lb a.i./ac)	Granular: pre- weighed according to pot dia. and rate	05/23/2018	Shoot expansion	

## **Experiment Information**

Experimental Design: Number of Reps: Completely randomized design within species Four replicates with three plants per replicate or 12 plants/tmt/rate/species

### Photos

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

**Research Report Form** 



Researcher:	Hannah Mathers, PhD		Date:	5/10/2020
Project Title:	Preemergence Herbicide C	Crop Safety		
Protocol #:	18-012	<b>PRnumbers:</b> 29056, 29005		



**Fig. 2.1**. (Above) *Pyracantha cocc*inea at Acorn Farms Inc., Galena, OH, picture taken 7WAT (July 12/18) with Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) applied on May 23, 2018. From left to right is the 4X, 2X, 1X and Control. Note the 2X versus the control is slightly taller and less full but there is no visible injury with any treatment (Table 2). Photo taken by: H. Mathers.



**Fig. 2.2**. (Above) *Pyracantha cocc*inea at Acorn Farms Inc., Galena, OH applied with Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) on May 23, 2018. From left to right, Control, 1X, 2X and 4X. At 6WA2T there is no injury attributed to treatment (Table 2). By GI there is slight reduction in plant mass with the 2X rate (Table 2B). The control plants were bigger at the start of the trial and remained vigorous throughout the trial (Table 2B). Photo taken by: H. Mathers

Mathers Table 2 2018

**Research Report Form** 



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Project Title:	Preemergence	Herbicide Crop Safety			
Protocol #:	18-012	<b>PRnumbers:</b> 29056, 29005			



**Fig. 2.3**. (Above) *Crataegus columbiana* – PR#29005 at Acorn Farms Inc., Galena, OH applied with Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) on May 23, 2018. From top left to top right, bottom left to bottom right (2X, Control, 4X, 1X). At the trial initiation the 1X plants are smaller and single stemmed (i.e. lower GI's) indicated in their low mass index (Table 2B). Photos taken by: H. Mathers.



**Fig. 2.4.** (Above) *Crataegus columbiana* – PR#29005 at Acorn Farms Inc., Galena, OH applied with Biathlon (Oxyfluorfen 2% + Prodiamine 0.75%) on May 23, 2018. From left to right (4X, 2X, 1X, Control). At 7WAT the 4X plants are the largest and the 1X plants are still not putting on volume as they remain single stemmed (Table 2B). There was no injury associated with treatment at any rate throughout the trial period versus the control (Table 2). Photo taken by: H. Mathers.

Mathers Table 2 2018



**Research Report Form** 

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Protocol #:	18-012	PRnumbers: 29056, 29005		

### **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,  $\geq$ 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.). Symptoms were also noted if significant, and photos were conducted *in situ*.

#### **Raw Data**

Insert raw data below or send separate file containing 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 course of the experiment. Source: <u>https://www.wunderground.com/history/monthly/us/oh/columbus/KCMH/date/2018-8</u>

Date	Temperatur	e (° F)		Humidity	/ (%)		Precipitation
Мау	Max	Avg	Min	Max	Avg	Min	Total
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

# Ornamental Horticulture Program Research Report Form



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Project Title:	Preemerger	nce Herbicide C								
Protocol #:	18-012		PRnumber	<b>'s:</b> 29056,	29005					
Date	Temperatur	e (° F)		Humidity	/ (%)		Precipitation			
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			
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	Temperatur	e (° 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	/4	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			
5	93	82.2	74	94	72.4	48	0.36			

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Protocol #: 18-012 PRnumbers: 29056, 29005	
Date    emperature (° F)    Humidity (%)    Pre	
6   81   74.0   63   93   66.9   42   0.60   63   66.9	6
7 80 69.5 58 90 57.1 32 0.0	0
	0
9 89 77.0 62 84 58.1 32 0.0	00
10 91 78.9 69 87 68.9 42 0.0	00
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	00
<b>12 - 7WA I</b> Beauty 85 74.4 63 72 51.5 33 0.0	00
13 89 79.0 67 68 51.2 35 0.0	00
14 92 82.5 70 87 58.7 33 0.0	00
15 86 81.5 75 84 66.2 51 0.0	00
16         88         79.5         74         91         76.9         55         0.00	00
$\frac{17}{10} 86 78.2 70 91 59.8 33 0.24$	24
18 83 73.7 64 84 58.3 37 0.0	00
<b>19-1WAZI</b> 84 74.2 63 75 52.3 33 0.0	00
20 77 71.6 67 91 81.8 66 0.0	00
21 78 70.0 65 93 83.7 64 0.5 <sup>1</sup>	53
22 80 71.8 66 94 78.4 58 0.3 <sup>2</sup>	32
23 82 72.1 66 94 82.2 60 0.0	)1
24 81 73.5 69 97 81.8 58 1.3 <sup>1</sup>	30
25 87 77.1 69 90 68.4 51 0.0 <sup>1</sup>	00
<b>26 - 2WA2T</b> 85 75.2 66 93 68.9 46 0.0	00
27 80 73.0 67 93 67.1 46 0.2 <sup>4</sup>	24
28 80 70.7 61 81 60.4 42 0.0 <sup>4</sup>	00
29 80 71.5 61 90 66.7 39 0.0 <sup>4</sup>	00
30 81 73.0 66 93 70.8 41 0.0 <sup>3</sup>	)3
<u>31 75 71.9 68 96 86.5 76 0.0</u>	)5
Date Temperature (° F) Humidity (%) Pre	ecipitation (in)
Aug Max Avg Min Max Avg Min Tot	tal
1 75 71.2 68 93 81.8 66 0.7 <sup>3</sup>	'8
2 81 73.7 67 93 76.6 50 0.0	)1
3 84 76.2 67 93 71.4 47 0.0 <sup>4</sup>	00
4 89 79.1 69 87 66.3 39 0.0 <sup>1</sup>	)6
5 <b>89 81.0 72 91 68.2 46 0.0</b>	00
6 89 81.3 73 90 69.1 50 0.0 <sup>4</sup>	00
7 86 76.3 72 91 77.3 54 0.0 <sup>4</sup>	00
8 83 75.3 71 96 83.3 60 0.3	31
<b>9 -4WA2T</b> 85 75.0 68 93 72.9 44 0.1	1
10 81 73.5 69 96 84.3 67 0.0 <sup>4</sup>	00
11         79         72.1         68         93         83.5         60         0.04	00
12 84 73.9 61 93 65.1 44 0.1	9
13 84 73.3 64 93 70.6 46 0.0 <sup>4</sup>	00
14 84 74.7 63 93 68.6 46 0.0 <sup>4</sup>	00
15 84 75.4 67 93 75.4 51 0.0	00
16 77 73.6 70 93 84.2 76 0.24	24
<b>17 -Photos</b>  81 74.8 72  94 88.0 77  0.5	51

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