Research Report Form



Researcher:	Hannah Mathers, PhD		Date:	8/22/2016
Project Title:	Preemergence Herbicide Crop	Safety		
Protocol #:	15-009 PF	Rnumbers: 31781, 31788, 31802	, 31805, 31	822, 31826, 31813, 31779

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 eight species (Table 1) that received applications of Dimension 2EW (Dithiopyr 24%) (Dow AgroSciences, LLC), (Indianapolis, IN, 46268) as part of protocol 15-009. Dimension 2EW caused no unacceptable commercial injury at any rate, even after two applications at 6 weeks apart for Berberis thunbergii 'Concord' or Thuja occidentalis 'Holmstrup' and for Pieris japonica 'Red Mill' after one application. Damage did become unacceptable for Pieris after the second application with stems becoming very brittle and breaking easily at all branch collars. Although beyond the scope of this report, it was observed in spring 2016 that all of the 4X and many of the 2X treated plants had died in overwintering. Of all eight species spraved with Dimension, the most severely injured were Cornus florida, followed by Syringa lacinaiata, Spirea japonica 'Tor' and Ilex meserveae. The Cornus florida were suffering with a suspected powdery mildew infection at Klyn's; however, there was a definite treatment impact of increasing powdery mildew severity with increasing rate of Dimension. After the first Dimension 2EW treatment the Cornus florida were commercially unacceptably injured (>3) at all rates by 4WAT (Table 1). The Cornus were stunted with chlorotic spotting, becoming necrotic spotting as the experiment continued. The second application at 6 WAT only increased injury further with many of the 4X plants dying by 2 WA2T (Table 1). The Syringa lacinaiata were not unacceptably injured at the 1 and 2X rates when the Dimension 2EW was reapplied (6WAT); however, they were at the 4X rate (Table 1). The second application increased injury severely at all rates. The Syringa were stunted and chlorotic with necrosis in the growing points. The Spiraea japonica 'Tor' were not unacceptably injured at the 1X rate when the Dimension 2EW was reapplied (6WAT); however, they were at the 2 and 4X rates. Injury was fairly consistent after the 2nd application increasing only slightly at the 4X rate by 6WA2T. The damage to the Spiraea japonica 'Tor' consisted of a delay in onset of growth, and subsequent stunting throughout the trial. The injury to the *llex meserveae* was above acceptable for all rates by 4WAT (Table 1); however, injury did not increase, again, after the second application to above commercially acceptable, except for the 4X rate (Table 1). As with the Spirea, Ilex had delayed onset of growth in the spring which followed through the trial and caused delayed sprouting and branching with increasing rates of Dimension 2EW applied. The Hibiscus 'Plum Crazy' was the only species evaluated that seemed to grow out of its injury. Injury on the new shoots at the beginning of the trial had been severe. When the second application was conducted the 1X rate was not unacceptably injured. By the end of the trial the *Hibiscus* 1X and 2X were showing only minimal injury and the 4X was only slightly above unacceptable (3.6) (Table 1).

p 2



Researcher:	Hannah	Mathers, Phl	D			Da	ate: 8/2	<u>2/2016</u>	
Project Title:	Preemen	rgence Herbio	cide Crop Sa	fety					
Protocol #:	15-009	-	PRn	umbers:	31781, 3178	8, 31802, 318	805, 31822,	31826, 318	13, 31779
Results Tabl	<u>e</u>			с I					
Please insert re	esults table	here. Include	PRnumbers	for each tr	eatment if m	ultiple PRnu	mbers are u	ncluded in t	his
summary. Plea	se include p	product, activ	e ingredient	, and statist	tics.				
Table 1. Phyt	otoxicity on	selected ornar	mentals at two	o locations N	Aathers Enviro	onmental, Gał	hanna, OH an	d Klyn Nurse	eries,
Perry, OH									
Berberis thun	dbergii 'Conc	cord' #3 pot – I	PR# 31781 - N	/lathers Envi	ronmental				
Treatment	Rate (ai) ^v	1 WAT ^z	2 WAT	4 WAT	6WAT	1 WA2T	2 WA2T	4 WA2T	6 WA2T
Dimension	0.5 lb/ac	0.0 ^{yx}	0.0	0.0	0.0√	0.0	0.0	0.0	0.0
Dimension	1.0 lb/ac	0.0 ^{yx}	0.0	0.0	0.0√	0.0	0.5	1.0	1.3
Dimension	2.0 1b/ac	0.0 ^{yx}	0.0	0.0	0.0√	0.6	1.0	1.5 *	1.8 *
Untreated		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cornus florida	#2 pot - PR	# 31788 - Klvn	Nurseries						
Treatment	Rate(ai) ^V	1 W/AT	2 W/AT	<i>Δ</i> \λ/ΔΤ	6 W/AT	1 \M/A2T	2 W/A2T	/ \//A2T	6 W/A2T
Dimension	$0.5 \ln/ac$	10	20 *	35 *	3.8√ *	54 **	60 **	4 10 **	43 **
Dimension	0.3 lb/ac	1.0	2.0	5.5 63 **	3.0v ∕ ∩√ **	56 **	0.0 6.8 **	т .2 66 **	80 **
Dimension	1.0 ID/ac	1.0 3.0 *	2.5	0.J 8.2 **	4.0v 7 3√ **	0.0 83 **	0.0 80 **	0.0 **	0.0 **
Untreated	2.0 10/ac	0.0	0.3	1.0	03	24	2.8	9.0 1 <i>4</i>	0.3
		0.0	0.0		0.0	2.7	2.0	1.7	0.0
Hibiscus Plum	n Crazy' #3 p	ot - PR# 31802	- Kiyn Nurse	ries					
Treatment	Rate(ai)*	1 WAT	2 WAT	4 WAT	6 WAT	1 WA2T	2 WA2T	4 WA2T	6 WA2T
Dimension	0.5 lb/ac	1.4	6.0 **	1.8 *	1.0✓	0.8	0.0	0.0	0.0
Dimension	1.0 lb/ac	6.3 **	8.5 **	4.4 **	3.4√ *	3.8 *	3.8 *	2.5 *	1.8 *
Dimension	2.0 1b/ac	<i>1.1</i> ^{^*}	8.5 **	7.8 **	5.9√ **	6.5 **	6.5 **	3.2 **	3.6 **
Untreated		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
llex X meserve	<i>ae '</i> Blue Sta	<i>llion'</i> #1 pot - I	P R# 31805 - K	lyn Nurserie	S				
Treatment	Rate(ai) ^v	1 WAT	2 WAT	4 WAT	6 WAT	1 WA2T	2 WA2T	4 WA2T	6 WA2T
Dimension	0.5 lb/ac	1.0	1.0	4.8 **	1.3√	0.0	0.0	0.0	2.0 *
Dimension	1.0 lb/ac	1.0	1.0	4.9 **	3.5√ *	3.0 *	2.0 *	2.0 *	3.0 *
Dimension	2.0 1b/ac	1.0	1.0	5.2 **	4.3√ **	4.2 **	4.0 **	3.0 **	4.0 **
Untreated		0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Pieris japonie	ca 'Red Mill'	#2 pot – PR# 3	31822 - Mathe	ers Environn	nental				
Treatment	Rate(ai) [∨]	1 WAT	2 WAT	4 WAT	6 WAT	1 WA2T	2 WA2T	4 WA2T	6WA2T
Dimension	0.5 lb/ac	0.8	1.6	1.1	0.3√	0.3	3.0 *	3.0 *	3.3 *
Dimension	1.0 lb/ac	0.9	2.0 *	1.5 *	1.1✓	1.5 *	4.0 **	4.0 **	5.5 **
Dimension	2.0 1b/ac	3.1 *	3.1 *	2.8 **	1.5 ✓ *	1.8 *	6.0 **	6.0 **	7.2 **
Untreated		0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Spiraea japo	<i>nica</i> 'Tor' #3	pot – PR# 318	326 - Mathers	Environmer	ital				<u> </u>
Treatment	Rate(ai) ^v	1 WAT	2 WAT	4 WAT	6 WAT	1 WA2T	2 WA2T	4 WA2T	6WA2T
Dimension	0.5 lb/ac	0.0	0.0	1.8 *	1.0√	2.0 *	2.8 *	3.0 *	3.0 *
Dimension	1.0 lb/ac	0.0	0.0	3.3 *	3.3 ✓ *	3.3 *	3.8 *	3.1 *	3.1 *
Dimension	2.0 1b/ac	0.0	0.0	4.7 **	4.0 ✓ **	4.0 **	5.7 **	5.0 **	6.0 **
Untreated		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syringa lacin	<i>aiata</i> #2 pot	. – PR# 31813 ·	- Mathers Env	vironmental				<u>.</u>	<u>.</u>
Treatment	Rate(ai) ^v	1 WAT	2 WAT	4 WAT	6 WAT	1 WA2T	2 WA2T	4 WA2T	6WA2T
Dimension	0.5 lb/ac	0.0	2.4 *	3.0 *	1.2√	3.0 *	3.4 *	3.0 *	4.0 **
Dimension	1.0 lb/ac	2.6 *	3.6 *	5.5 **	2.2√ *	4.2 **	5.8 **	4.0 **	5.0 **
Dimension	2.0 1b/ac	3.2 *	4.4 **	6.8 **	3.5√ **	5.1 **	8.1 **	6.0 **	7.0 **
Mathers Table	1 2015	1	1	1	1	1		1	1
manners rable	1 2015								



Research Report Form

Re	esearcher:	Hannah	Mathers, PhI)			Da	ate: 8/22	2/2016	
Pr	oject Title:	Preemen	Preemergence Herbicide Crop Safety							
Pr	otocol #:	15-009	15-009 PRnumbers: 31781, 31788, 31802, 31805, 31822, 31826, 31813, 3177						13, 31779	
			1	1						
	Untreated		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Thuja occider	ntalis 'Holm	strup' #2 pot –	PR# 31799 -	Mathers Env	vironmental				
	Treatment	Rate(ai) ^v	1 WAT	2 WAT	4 WAT	6 WAT	1 WA2T	2 WA2T	4 WA2T	6 WA2T
	Dimension	0.5 lb/ac	0.0	0.0	0.0	0.0√	0.0	0.0	0.0	0.0
	Dimension	1.0 lb/ac	0.0	0.0	0.0	0.0√	0.0	0.0	0.0	0.0
	Dimension	2.0 1b/ac	0.0	0.0	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	0.0

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 (α = 0.10, 0.05, respectively).

^v = All rates for Dimension 2EW (Dithiopyr) are listed as active ingredient (ai) per ac.

✓ indicates reapplication at this date

Materials & Methods/Recordkeeping

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

Protocol 15-009 was followed with no changes including four replications, with three plants per replication and four treatments 0, 1, 2, 4 X rates of Dimension 2EW were grown in the pot sizes listed in the Table 1, for 48 plants per protocol (PR#: 31781, 31788, 31802, 31805, 31822, 31826, 31813, 31779). Rates are listed in pounds of active ingredient (ai)/acre with 1X being 0.5 lb ai/ac (Table 1). Evaluations were conducted at 1, 2, 4, and 6 weeks after treatment (WAT). A reapplication was conducted at 6WAT and evaluations occurred 1, 2, 4 and 6 weeks after second treatment (WA2T). Six species were located at Klyn Nurseries, Inc., Perry, OH. Two species, Pieris and Berberis were grown at Mathers Environmental Science Services, LLC, Gahanna, OH. The location of each species is listed in Table 1. 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 were conducted soon after covers are removed from polyhouses, May 13, 2015 at Klyn's and June 3, 2015 at Mathers'. On May 13 the weather in Perry, OH was cloudy and cool, the wind was NE at 5 mph and it was 47°F. On June 3 in Gahanna, OH at the time of application it was clear, sunny and 63°F wind was 2 mph. All plants were freshly upshifted two weeks or less before the applications at Klyn and Mathers' 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>: Klyn Nurseries, Inc., Perry, OH & Mathers Enviro. Sci. Serv., LLC, Gahanna, OH <u>Use Site (greenhouse/shadehouse/field container/etc.)</u>: Field container

Crop History

Crop Cultivar/Variety:	Berberis thundbergii 'Concord'
Purchased from:	Studebaker Nursery, New Carlisle, OH as 2 gallon pots
Date of Transplanting:	May 27, 2015
Potting Mix:	See above
Pot size & spacing:	3 gallon pots on 1 foot centers





Researcher:	Hannah Mathers	s, PhD Date: 8/22/2016
Project Title:	Preemergence H	Ierbicide Crop Safety
Protocol #:	15-009	PRnumbers: 31781, 31788, 31802, 31805, 31822, 31826, 31813, 31779
<u> </u>		
	itivar/variety:	
Purchase	ed from:	Grown at Klyn Nurseries, Inc., Perry, OH
Date of T	Fransplanting:	May 5, 2015
Potting N	/lix:	See above
Pot size	& spacing:	2 gallon pots on 1 foot centers
Crop Cul	ltivar/Variety:	Hibiscus 'Plum Crazy'
Purchase	ed from:	Planted 08/02/13 in field at Klyn Nurseries, Inc., Perry, OH
Date of T	Fransplanting:	Dug, cut back, placed in containers May 12, 2015
Potting N	/lix:	See above
Pot size	& spacing:	3 gallon pots on 1 foot centers
Crop Cul	ltivar/Variety:	Ilex X meserveae 'Blue Stallion'
Purchase	ed from:	Grown at Klyn Nurseries, Inc., Perry, OH as liners
Date of T	Fransplanting:	May 5, 2015
Potting N	/lix:	See above
Pot size	& spacing:	1 gallon pots on 1 foot centers
Crop Cul	ltivar/Variety:	Pieris japonica 'Red Mill'
Purchase	ed from:	Willoway Nurseries, Huron, OH as #1 containers
Date of T	Fransplanting:	May 20, 2015
Potting N	/lix:	See above
Pot size	& spacing:	2 gallon pots on 1 foot centers
Crop Cul	ltivar/Variety:	Spiraea japonica 'Tor'
Sourced	from:	Grown at Klyn Nurseries, Inc. in #2 container since May 13, 2014
Date of T	Fransplanting:	May 5, 2015
Potting N	/lix:	See above
Pot size	& spacing:	3 gallon pots on 1 foot centers
Crop Cul	ltivar/Variety:	Syringa lacinaiata
Sourced	from:	Propagated at Klyn Nurseries, June 15, 2013; upshifted June 9, 2014 to #1
Date of T	Fransplanting:	May 12, 2015
Potting N	/lix:	See above
Pot size	& spacing:	2 gallon pots on 1 foot centers
Crop Cul	ltivar/Variety:	Thuja occidentalis 'Holmstrup'
Sourced	from:	Grown at Klyn Nurseries as #1 containers since 04/21/2104
Date of T	Fransplanting:	May 5, 2015
Potting N	/lix:	See above
Pot size	& spacing:	2 gallon pots on 1 foot centers



Researcher: Hannah	Mathers, PhD			Date: 8/22/20	16
Project Title: Preeme	rgence Herbicide Crop S	afety			
Protocol #: 15-009	PR	numbers: 31781	<u>, 31788, 31802, 3</u>	<u>31805, 31822, 3182</u>	26, 31813, 31779
Product(s) applied prior	to start of experiment	:			
Product	Rate	Application Type	Date of Application	Crop Growth Stage	Application Volume
<i>Dimension 2EW</i> (Dithiopyr 24%)	0			Shoot expansion	25 gal/ac
<u>2 at MESS</u> : Pieris japonica 'Red Mill and <i>Berberis</i> <i>thundbergii</i> 'Concord'	S '				
	2 pints (0.5 lb a.i/ac	Liquid - applied via CO ₂ backpack	06/03/2015	Shoot expansion	25 gal/ac
	4 pints (1.0 lb a.i./ac)	Liquid - applied via CO ₂	06/03/2015	Shoot expansion	25 gal/ac
	4 pints (1.0 lb a.i./ac)	Liquid - applied via CO ₂ backpack	06/03/2015	Shoot expansion	25 gal/ac
Dimension 2EW (Dithiopyr 24%) Other 6 species Klyn Nurseries	0 <u>at</u>			Shoot expansion	
	2 pints (0.5 lb a.i/ac	Liquid - applied via CO ₂ backpack	05/13/2015	Shoot expansion	25 gal/ac
	4 pints (1.0 lb a.i./ac)	Liquid - applied via CO ₂ backpack	05/13/2015	Shoot expansion	25 gal/ac
	4 pints (1.0 lb a.i./ac)	Liquid - applied via CO ₂ backpack	05/13/2015	Shoot expansion	25 gal/ac



Research Report Form

Researcher:	Hannah Mathers, PhD			Date:	8/22/2016	5
Project Title:	Preemergence Herbicide (Crop Safety				
Protocol #:	15-009	PRnumbers: 31781	, 31788, 31802,	31805,	31822, 31826,	31813, 31779
Exporimont In	formation					

Experiment Information

Experimental Design:	Completely randomized design with species
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. (Left) **Berberis** thundbergii 'Concord' at Mathers Environmental, Gahanna, OH, picture taken 6WAT with **Dimension 2EW** left to right control, 1X, 2X and 4X. Note there is no injury at any treatment level. Photo taken by: H. Mathers



taken by: H. Mathers

Fig. 1.2. (Left) *Pieris japonica* 'Red Mill' at Mathers Environmental, Gahanna, OH, taken 6WAT with Dimension 2EW left to right control, 1X, 2X and 4X. Note all plants are slightly stunted versus control but not unacceptable commercially. Photo

Research Report Form



Researcher:	Hannah Mathers, PhD	Da	nte: 8/	22/2016
Project Title:	Preemergence Herbicide Crop Safet	V		
Protocol #:	15-009 PRnur	nbers: 31781, 31788, 31802, 318	05, 31822	2, 31826, 31813, 31779



Fig. 1.3.A (Above) and **B.** (Lower right) **A.** *Pieris japonica* 'Red Mill' at Mathers Environmental, Gahanna, OH, taken 4WA2T with Dimension 2EW left to right - control, 1X, 2X and 4X. Note all plants are still slightly stunted versus control especially the 4X rate; however, all were considered injured beyond commercially acceptable. Only the control is showing the red foliage the cultivar is known for and consistent large leaves. B. At 6WA2T during measuring, stems were observed as very brittle and easily broken. With further examination callus proliferation could be seen at the branch



collars especially with the 2 and 4X rates. Photos taken by: H. Mathers.

Research Report Form



Researcher:	Hannah Mathers, PhD		Date	e: 8/2	22/2016
Project Title:	Preemergence Herbicide Ci	cop Safety			
Protocol #:	15-009	PRnumbers: 31781	, 31788, 31802, 31805	5, 31822	, 31826, 31813, 31779



Fig. 1.4. (Above) There was no injury caused by Dimension 2EW even after two applications at any rate with *Thuja occidentalis* 'Holmstrup' at Klyn Nurseries, Perry, OH. On the far left is the 4X rate, moving to the right 2X, 1X and far right is the control. Photo taken by: H. Mathers.



Fig. 1.5. A. (Left) and B. (Right) A. Is a front view of *Cornus florida* at 6WA2T applied with Dimension 2EW from



at Klyn Nurseries, Perry, OH left to right – control, 1X, 2X and 4 X rate. **B.** Shows a side view with the 4X rate in the foreground and 2X, 1X and control moving into the foreground. Both views illustrate the

severe injury to the *Cornus* from the 2X and 4X rates of Dimension but also the 1X. Photos taken by: H. Mathers.





Researcher:	Hannah Mathers, PhD			Date:	8/22/2016
Project Title:	Preemergence Herbicide C	rop Safety			
Protocol #:	15-009	PRnumbers: 31781	, 31788, 31802,	31805,	31822, 31826, 31813, 31779



Fig. 1.6. (Above) *Cornus florida* at 2WAT applied with Dimension 2EW at Klyn Nurseries, Perry, OH showing from left to right in the photo: 1X rate, control, 4X and 2X rates. The injury to the *Cornus* from the 4X rates of Dimension is evident. However, the complication of the suspected powdery mildew infection increasing the severity of symptoms with increasing Dimension dosage is also evident with the 1X, 2X and 4X rates compared to the control. Photo taken by: H. Mathers



Fig. 1.7. *Syringa lacinaiata* at 2WA2T applied with Dimension 2EW at Klyn Nurseries, Perry, OH showing from left to right in the photo: 0X i.e. control, 1X, 2X and far right the 4X rate. The injury to the *Syringa lacinaiata* from the 2X and 4X rates of Dimension are evident as foliage yellowing and decreased growth. Photo taken by: H. Mathers.

Research Report Form



Researcher:	Hannah Mathers, PhD		Date:	8/22/2016
Project Title:	Preemergence Herbicide Crop Safety			
Protocol #:	15-009 PRnum	pers: 31781, 31788, 31802	, 31805, 31	822, 31826, 31813, 31779



Fig. 1.8. *Syringa lacinaiata* at 6WA2T applied with Dimension 2EW at Klyn Nurseries, Perry, OH showing from left to right in the photo: 0X i.e. control, 1X, 2X and far right the 4X rate. The \$X plant has not been removed from its container as it is so poorly rooted in the pot. The injury to the Syringa lacinaiata from the 2X and 4X rates of Dimension are evident; however, even the 1X rate has more discoloration. Photo taken by: H. Mathers.



Fig. 1.9. A, B and C. A. (Left) *Spiraea japonica* 'Tor' at 6WA2T applied with Dimension 2EW at Klyn Nurseries, Perry, OH showing from left to right in the photo: 0X i.e. control, 1X, 2X and far right the 4X rate. The 4X plant is severely stunted which is shown clearer **B.** (Bottom left) which is a top view of 2X (Left) vs 4X rate (Right). **C.** (Bottom right) However, the injury to



the Spiraea japonica 'Tor' from even the 1X rate compared to the control which is more evident in the top view shown in C. is quite significant. The impact of the

Dimension was delayed shoot expansion as rate increased with only a few shoots just starting to elongate with the 4X rates shown in B. Photos taken by: H. Mathers.

Research Report Form



Researcher:	Hannah Mathers, PhD		Date:	8/22/2016	
Project Title:	Preemergence Herbicide Crop Safety				
Protocol #:	15-009 PRnumbe	rs: 31781, 31788, 31802.	, 31805, 1	31822, 31826, 3	1813, 31779



Fig. 1.10. A, B and C. A. (Above) *llex X meserveae* 'Blue Stallion' at 2WA2T applied with Dimension 2EW at Klyn Nurseries, Perry, OH showing from left to right in the photo: 0X i.e. control vs 4X rate. The 4X plant is stunted and chlorotic to commercially unacceptable levels. **B.** (Top right) is a top view from left to right of 0X, 1X, 2X and 4X rates of Dimension at 6WA2T. Delayed shoot expansion is evident with the 4X rate and to a lesser degree with the 2X rate. **C.** (Bottom right) is a front view of the



Ilex X meserveae 'Blue Stallion' at 6WA2T showing more clearly the stunting effect the Dimension has had at 2X and 4X. Photos taken by: H. Mathers



Fig. 1.11. A and B. (Left) *Hibiscus 'Plum Crazy'* at 2WAT applied with Dimension 2EW at Klyn Nurseries, Perry, OH **A.** (far left) shows from left to right the control OX vs 4X. Note the leaf distortion with the 4X plant and broken stem. B. indicates the stems at the crowns with the 4X rate are quite brittle and easily

broken. Photos taken by: H. Mathers





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Protocol #:	15-009	PRnumbers: 31781, 31788, 31802, 1	31805, 31	822, 31826, 31813, 31779



Fig. 1.12. A and B. A. (Above left) *Hibiscus 'Plum Crazy'* at 2WA2T applied with Dimension 2EW at Klyn Nurseries, Perry, OH from left to right the control OX, 1X, 2X and 4X rate. Note the branches of the 2X are weakly attached and fallen over blocking the view of the 4X plant. B. provides a better view of the 4X which is severely injured. Photos taken by: H. Mathers



Fig. 1.13. A and B. A. (Above left) *Hibiscus 'Plum Crazy'* at 6WA2T applied with Dimension 2EW at Klyn Nurseries, Perry, OH from left to right the control OX, 1X, 2X and 4X rate. Note by the end of the trial there are few differences between the control, 1X and 2X; however, the 4X is still decreased in growth and has recently become infested with what appears to be a leaf skeletonizer. Photos taken by: H. Mathers



Research Report Form

p 13

Researcher:	Hannah Mathers, PhD			Date:	8/22/2016
Project Title:	Preemergence Herbicide Cr	op Safety			
Protocol #:	15-009	PRnumbers: 31781.	31788, 31802	, 31805,	31822, 31826, 31813, 31779



Fig. 1.14. *Hibiscus 'Plum Crazy'* at 6WA2T applied with Dimension 2EW at Klyn Nurseries, Perry, OH only the control plants flowered. 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, \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*.



Researcher:	Hannah Mathers, PhD				Date:	8/22/2016	6
Project Title:	Preemergence Herbicide	Crop Safety					
Protocol #:	15-009	PRnumbers	31781, 317	88, 31802,	31805, 3	1822, 31826,	31813, 31779

Raw Data

Insert raw data below or send separate file containing raw data.

See attached excel files

Research Report Form



Researcher:	Hannah Mathers, PhD					Date:	8/2	2/2016	5	
Project Title:	Preemergence Herbicide C	rop Safety								
Protocol #:	15-009	PRnumbers:	31781,	31788,	31802,	31805,	31822,	31826,	31813,	31779

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.

Environmental Conditions in Gahanna, OH. Source: http://www.accuweather.com for plants at MESS

Events in	Date (yr. 2015)	Hi/Low	Precipitation/ Irrigation	Average
June 2015		729/509		
initiation	vveu 0/3	73759	0 11/ 0.511	10/00
	Thu 6/4	81°/60°	0 in/ 0.5in	78°/58°
	Fri 6/5	86°/62°	0.25 in/ 0.25in	79°/59°
	Sat 6/6	79°/61°	0 in/ 0.5in	79°/59°
	Sun 6/7	85°/56°	0 in/ 0.5in	79°/59°
	Mon 6/8	79°/61°	0.09 in/ 0.5in	80°/60°
	Tue 6/9	76°/57°	0.03 in/ 0.5in	80°/60°
1WA1T	Wed 6/10	91°/58°	0 in/ 0.5in	80°/60°
	Thu 6/11	92°/67°	0 in/ 0.5in	81°/60°
	Fri 6/12	93°/70°	0.04 in/ 0.5in	81°/61°
	Sat 6/13	90°/69°	0.17 in/ 0.4in	81°/61°
	Sun 6/14	91°/69°	0.10 in/ 0.4in	82°/61°
	Mon 6/15	87°/71°	0.44 in	82°/62°
	Tue 6/16	83°/71°	0.87 in	82°/62°
2WA1T	Wed 6/17	72°/61°	0.44 in	82°/62°
	Thu 6/18	87°/69°	0 in/ 0.5in	82°/62°
	Fri 6/19	76°/67°	0.01 in	83°/63°
	Sat 6/20	73°/67°	2.00 in	83°/63°
	Sun 6/21	86°/68°	0 in	83°/63°
	Mon 6/22	86°/64°	0 in/ 0.5in	83°/63°
	Tue 6/23	85°/67°	0 in/ 0.5in	84°/64°
	Wed 6/24	83°/61°	0 in/ 0.5in	84°/64°
	Thu 6/25	77°/66°	0.27 in	84°/64°
	Fri 6/26	78°/67°	0.65 in	84°/64°
	Sat 6/27	71°/58°	0.55 in	84°/64°
	Sun 6/28	75°/58°	0.03 in/ 0.5in	84°/64°
	Mon 6/29	66°/60°	0.40 in	84°/65°
	Tue 6/30	77°/60°	0.35 in	85°/65°
Events in July 2015	Date (yr. 2015)	Hi/Low	Precipitation/Irrigation	Average Hi/Low
4WA1T	Wed 7/1	78°/59°	0 in/ 0.5in	85°/65°
	Thu 7/2	74°/62°	0 in/ 0.5in	85°/65°
	Fri 7/3	76°/61°	0 in/ 0.5in	85°/65°
	Sat 7/4	79°/59°	0 in/ 0.5in	85°/65°
	Sun 7/5	79°/61°	0 in/ 0.5in	85°/65°
	Mon 7/6	84°/64°	0 in/ 0.5in	85°/65°
	Tue 7/7	84°/69°	0.55 in	85°/65°
	Wed 7/8	70°/62°	0.17 in	85°/66°
	Thu 7/9	78°/67°	0.02 in/ 0.5in	85°/66°



Researcher:	Hannah Mathers, Ph	D	Date: 8/22/2016				
Project Title:	Preemergence Herbi	cide Crop Sa	fety				
Protocol #:	15-009	PRn	umbers: 31781, 31788, 3180	2, 31805, 31822, 31826, 31813,	31779		
		740/000		050/000			
	Fri 7/10	74°/66°		85°/66°			
	Sat 7/11	82°/60°		85°/66°			
	Sun 7/12	80°/65°	2.25 in	85°/66°			
	Mon 7/13	74°/66°	0.18 in	85°/66°			
014/447	1 ue 7/14	83°/66°	0.72 in	85°/66°			
6WA11 Reapply	Wed 7/15	73°/59°	0 in/ 0.5in	85%66			
	Thu 7/16	81°/53°	0 in/ 0.5in	85°/66°			
	Fri 7/17	86°/66°	0.64 in	85°/66°			
	Sat 7/18	91°/70°	0 in/ 0.5in	85°/66°			
	Sun 7/19	87°/70°	0.67 in	85°/66°			
	Mon 7/20	86°/68°	0 in/ 0.5in	85°/66°			
	Tue 7/21	85°/65°	0 in/ 0.5in	85°/66°			
1WA2T	Wed 7/22	80°/60°	0 in/ 0.5in	85°/66°			
	Thu 7/23	83°/61°	0 in/ 0.5in	85°/66°			
	Fri 7/24	86°/59°	0 in/ 0.5in	85°/66°			
	Sat 7/25	86°/64°	0 in/ 0.5in	85°/66°			
	Sun 7/26	84°/69°	0.08 in/ 0.5in	85°/66°			
	Mon 7/27	87°/70°	0 in/ 0.5in	85°/66°			
	Tue 7/28	91°/70°	0 in/ 0.5in	85°/65°			
2WA2T	Wed 7/29	91°/70°	0.05 in/ 0.5in	84°/65°			
	Thu 7/30	85°/69°	0 in/ 0.5in	84°/65°			
	Fri 7/31	87°/62°	0.03 in/ 0.5in	84°/65°			
Events in August 2015	Date (yr. 2015)	Hi/Low	Precipitation/ Irrigation	Average Hi/Low			
/laguet 2010	Sat 8/1	84°/61°	0 in/ 0 5in	84°/65°			
	Sun 8/2	88°/63°	0 in / 0.5 in	<u>84°/65°</u>			
	Mon 8/3	85°/63°	0 29 in	<u>84°/65°</u>			
		85°/61°	0 in/0.5 in	84°/65°			
	Wed 8/5	84°/60°	0 in / 0.5 in	<u>84°/65°</u>			
	Thu 8/6	70°/60°	0.06 in/0.5 in	<u>84°/65°</u>			
	Fri 8/7	84°/59°	0 in/0.5 in	84°/65°			
	Sat 8/8	87°/61°	0 in 0.5 in	<u>84°/65°</u>			
	Sun 8/9	84°/66°	0.02 in/ 0.5in	84°/65°			
	Mon 8/10	85°/69°	0.75 in	84°/65°			
	Tue 8/11	82°/65°	0 in/ 0.5in	84°/65°			
4WA2T	Wed 8/12	79°/61°	0 in/ 0.5in	84°/65°			
	Thu 8/13	80°/56°	0 in/ 0.5in	84°/65°			
	Fri 8/14	85°/60°	0 in/ 0.5in	84°/64°			
	Sat 8/15	86°/65°	0 in/ 0.5in	84°/64°			
	Sun 8/16	88°/66°	0 in/ 0.5in	84°/64°			
	Mon 8/17	88°/66°	0.50 in	84°/64°			
	Tue 8/18	82°/69°	0 in/ 0.5in	84°/64°			
	Wed 8/19	86°/70°	1.18 in	84°/64°			
	Thu 8/20	77°/60°	0.04 in	84°/64°			
	Fri 8/21	80°/56°	0 in/ 0.5in	84°/64°			



Researcher:	Hannah Mathers,	PhD		Date: 8/22/2016		
Project Title:	Preemergence Her	rbicide Crop Sa	fety			
Protocol #:	15-009	PRn	umbers: 31781, 3178	8, 31802, 31805, 31822, 31826, 31813, 31	779	
	Sat 8/22	81°/59°	0 in/ 0.5in	84°/64°		
	Sun 8/23	84°/59°	0.23 in	83°/64°		
	Mon 8/24	76°/59°	0 in/ 0.5in	83°/63°		
	Tue 8/25	68°/56°	0 in/ 0.5in	83°/63°		
6WA2T Trial completion	Wed 8/26	68°/57°	0 in/ 0.5in	83°/63°		

Environmental Conditions in Perry, OH. Source: http://www.accuweather.com for plants at Klyn's

Events in	Date (yr. 2015)	Hi/Low	Precipitation/ Irrigation	Average
Perry, OH				HI/LOW
Trial initiation	Wed 5/13	50°/38°	0 in/ 0.5in	68°/47°
	Thu 5/14	59°/33°	0 in	68°/48°
	Fri 5/15	78°/47°	0.29 in/ 0.25in	69°/48°
	Sat 5/16	71°/61°	0 in/ 0.5in	69°/48°
	Sun 5/17	80°/60°	0.10 in/ 0.5in	69°/49°
	Mon 5/18	80°/68°	0.28 in/ 0.25in	70°/49°
	Tue 5/19	72°/51°	0 in/ 0.5in	70°/49°
1WA1T	Wed 5/20	53°/43°	0 in	70°/50°
	Thu 5/21	60°/46°	0 in	71°/50°
	Fri 5/22	63°/43°	0.01 in/ 0.5in	71°/50°
	Sat 5/23	N/A	N/A	71°/51°
	Sun 5/24	81°/53°	0 in/ 0.5in	72°/51°
	Mon 5/25	84°/66°	0 in/ 0.5in	72°/51°
	Tue 5/26	85°/69°	0.09 in/ 0.5in	72°/52°
2WA1T	Wed 5/27	82°/61°	0.49 in	73°/52°
	Thu 5/28	74°/55°	0 in/ 0.5in	73°/52°
	Fri 5/29	84°/56°	0.02 in/ 0.5in	73°/53°
	Sat 5/30	82°/55°	0.82 in	74°/53°
	Sun 5/31	58°/46°	1.00 in	74°/53
Events in	Date (yr. 2015)	Hi/Low	Precipitation/ Irrigation	Average
June 2015				Hi/Low
	Mon 6/1	53°/46°	0.01 in	74°/54°
	Tue 6/2	64°/48°	0 in/ 0.5in	75°/54°
	Wed 6/3	73°/46°	0 in/ 0.5in	75°/54°
	Thu 6/4	79°/58°	0 in/ 0.5in	75°/54°
	Fri 6/5	76°/59°	0 in/ 0.5in	75°/55°
	Sat 6/6	66°/49°	0 in/ 0.5in	76°/55°
	Sun 6/7	82°/46°	0.01 in/ 0.5in	76°/55°
	Mon 6/8	78°/63°	0.29 in/ 0.25in	76°/56°
	Tue 6/9	71°/59°	0.12 in/ 0.5in	77°/56°
	Wed 6/10	87°/61°	0.38 in/ 0.5in	77°/56°
4WA1T	Thu 6/11	75°/61°	0.04 in/ 0.5in	77°/56°
	Fri 6/12	88°/60°	0.39 in/ 0.5in	77°/57°



Research Report Form

Researcher: Hannah Mathers, PhD Date: 8/22/2016 Project Title: Preemergence Herbicide Crop Safety Protocol #: 15-009 **PRnumbers:** 31781, 31788, 31802, 31805, 31822, 31826, 31813, 31779 Sat 6/13 74°/58° 0.27 in/ 0.5in 78°/57° 83°/64° 78°/57° Sun 6/14 0.05 in/ 0.5in Mon 6/15 80°/69° 78°/58° 0.12 in/ 0.5in Tue 6/16 73°/59° 78°/58° 0.10 in/ 0.5in 78°/58° Wed 6/17 72°/54° 0 in/ 0.5in Thu 6/18 78°/66° 0.06 in/ 0.5in 79°/58° Fri 6/19 70°/58° 0 in/ 0.5in 79°/59° Sat 6/20 79°/58° 0 in/ 0.5in 79°/59° Sun 6/21 77°/65° 0 in/ 0.5in 79°/59° Mon 6/22 85°/67° 0.26 in/ 0.5in 79°/59° Tue 6/23 79°/59° 0.87 in 80°/59° 6WA1T 73°/54° Wed 6/24 0 in/ 0.5in 80°/60° Reapply 72°/53° 80°/60° Thu 6/25 0 in/ 0.5in Fri 6/26 72°/54° 0 in/ 0.5in 80°/60° Sat 6/27 71°/61° 1.78 in 80°/60° Sun 6/28 66°/54° 0.09 in 80°/60° Mon 6/29 74°/54° 0.02 in/ 0.5in 80°/60° 81°/61° 71°/60° Tue 6/30 0.06 in Average **Precipitation/Irrigation** Events in Date (yr. 2015) Hi/Low Hi/Low July 2015 Wed 7/1 70°/62° 0.23 in/ 0.5in 81°/61° **1WA2T** Thu 7/2 81°/61° 72°/55° 0 in/ 0.5in Fri 7/3 73°/49° 81°/61° 0 in/ 0.5in Sat 7/4 72°/51° 81°/61° 0 in/ 0.5in Sun 7/5 76°/53° 81°/61° 0 in/ 0.5in Mon 7/6 78°/57° 81°/61° 0 in/ 0.5in Tue 7/7 85°/60° 0.07 in/ 0.5in 81°/62° **2WA2T** Wed 7/8 69°/60° 0 in/ 0.5in 81°/62° Thu 7/9 72°/62° 1.30 in 81°/62° Fri 7/10 71°/58° 81°/62° 0.17 in/ 0.5in Sat 7/11 76°/53° 81°/62° 0.06 in/ 0.5in Sun 7/12 78°/60° 81°/62° 0.03 in/ 0.5in Mon 7/13 82°/61° 0.04 in/ 0.5in 82°/62° Tue 7/14 80°/68° 0.02 in/ 0.5in 82°/62° Wed 7/15 69°/54° 82°/62° 0.01 in/ 0.5in Thu 7/16 74°/48° 0 in/ 0.5in 82°/62° Fri 7/17 84°/60° 82°/62° 0.01 in/ 0.5in Sat 7/18 85°/74° 0 in/ 0.5in 82°/62° Sun 7/19 88°/69° 82°/62° 0 in/ 0.5in Mon 7/20 78°/64° 0 in/ 0.5in 82°/62° Tue 7/21 75°/60° 0 in/ 0.5in 82°/62° Wed 7/22 73°/58° 0 in/ 0.5in 82°/62° 4WA2T 76°/56° Thu 7/23 0 in/ 0.5in 82°/62° Fri 7/24 79°/60° 0 in/ 0.5in 82°/62° 84°/64° Sat 7/25 0 in/ 0.5in 81°/62°



Researcher:	Hannah Mathers, PhD			Date: 8/22/2016	
Project Title:	Preemergence Herbi	cide Crop Sa	ıfety		
Protocol #:	15-009	PRn	numbers: 31781, 31788, 31802	2, 31805, 31822, 31826, 3	1813, 31779
P					_
	Sun 7/26	80°/64°	0 in/ 0.5in	81°/62°	
	Mon 7/27	82°/58°	0 in/ 0.5in	81°/62°	
	Tue 7/28	85°/60°	0 in/ 0.5in	81°/62°	7
	Wed 7/29	89°/63°	0.03 in/ 0.5in	81°/62°	7
	Thu 7/30	82°/72°	0 in/ 0.5in	81°/62°	7
	Fri 7/31	84°/67°	0 in/ 0.5in	81°/62°	7
Events in	Date (yr. 2015)	Hi/Low	Precipitation/Irrigation	Average	7
August 2015				Hi/Low	
	Sat 8/1	79°/62°	0 in/ 0.5in	81°/62°	7
	Sun 8/2	89°/62°	0 in/ 0.5in	81°/62°	7
	Mon 8/3	77°/62°	0.38 in/ 0.5in	81°/62°	7
	Tue 8/4	80°/65°	0 in/ 0.5in	81°/62°	7
6WA2T					7
Trial	Wed 8/5	75°/65°	0 in/ 0.5in	81°/62°	
completion					