Research Report Form



Researcher:	Hannah Mathers, PhD		Date:	2/23/2021	
Project Title:	V-10233 76WG Crop Safet	y with Directed Sprays			
Protocol #:	19-021	PRnumbers: 315	54		

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 3) that received applications of V-10233 76 WDG (flumioxazin 33.5% + pyroxasulfone 42.5%) (NuFarm Americas, Alsip, IL) as part of protocol 19-021. Crataegus phaenopyrum (PR#: 31554) measured by rated scores suffered above commercially acceptable injury (>3) from V-10233 at the 2X and 4X rate. The 1X plants had a total of 6 deaths of the 12 original plants. Four of these were dead before the reapplication. Additionally, one plant in the 2X died after the 2nd application, but no plants died in the 4X treatment (Table 3B). It is unclear if death, especially in the 1X plants, was from the V-10233 or because the 1X plants were weaker and smaller at the trial initiation (Table 3B). There was statistically significant injury versus the control with all dates and treatments (Table 3). Injury became commercially significant for all treatments after the second application (Table 3). Before the 2nd application the 1X plants experienced scores above commercially acceptable for injury (>3), due to the death (i.e., scores of 10) of four plants at 4WAT. The 4X treatment was also significant two times before the reapplication. Once at 1WAT, and once at 4WAT. Although the shoots of all treatment plants were covered (Fig. 3.1) and treatments were directed to plant bases, it appears V-10233 should not be used on Crataegus. Crataegus is known as a difficult species to store in winter-controlled atmosphere (CA) storages, due to root desiccation issues. Although, these plants were not from a CA storage, they were delivered to MESS as bareroot plants. Even with plants being randomly assigned to the levels of V-10233 treatments, the 1X plants at trial initiation, were significantly smaller. Perhaps these 1X plants were also suffering from some root desiccation which caused transplant shock and death of six 1X plants. Other than the losses in the 1X plants, the 1X surviving plants grew well and scored 0's or 1's throughout; however, the values in Tables 3 and 3B are averages of six not 12 plants. The surviving 1X plants did increased more in height and growth index (GI) than the control plants (Table 3B) (Fig. 3.3). At the end of the trial the 2X and 4X plants had negative delta GI's and minimal height increases (Table 3B). Since PPO herbicides such as in V-10233, have an impact of plant heme production, and some heme proteins do exist in roots, the PP0 inhibitor may have caused additional stress on the roots of Crataegus. The impact of the 2X and 4X causing severe injury that impacted growth is unquestionable; however, the 1X treatment effects may not be completed due to the V-10233 (Table 3 and 3B). If it truly was a treatment effect why did no 4X plants die and only one plant in the 2X?

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 3. Phytotoxicity on selected ornamentals at Mathers Environmental Science Services (MESS), LLC, Gahanna, OH

 Crataegus phaenopyrum - #2 pot- PR# 31554 - MESS

Treatment	Rate(ai) ^v	1 V	/AT ^z	2 V	/AT	4 W/	٩T	1W	A2T	2W	A2T	4 W	A2T
V-10233 76 WDG	7.5 oz	2.7	*	2.7	*	4.7√	*	4.3	*	4.3	*	5.3	*
V-10233 76 WDG	15 oz	2.6	*	2.8	*	2.8√	*	4.1	*	5.2	*	4.3	*
V-10233 76 WDG	30 oz	3.0	*	2.8	*	3.1√	*	4.3	*	4.8	*	4.0	*
Untreated		0.0		0.0		0.0		0.3		0.9		0.4	

Mathers Table 1 2017

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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).

 \checkmark indicates reapplication at this date

^v = All rates V-10233 76 WDG (flumioxazin 33.5% + pyroxasulfone 42.5%) are listed as active ingredient (ai) per ac.

Crataegus phaenopyrum - #2 pot- PR# 31554 - MESS D											
Treatment	Rate (ai) ^v	HT ⁱ WATz	HT4WA2T	GI ^t 0WAT ^z	GI4WA2T	Δ ^w HT	ΔGI	Dv.A			
V-10233 76 WDG	7.5 oz	13.8 ^y	19.3	198.5	515.8	5.5	317.3	6/6*			
V-10233 76 WDG	15 oz	13.8	15.2 *	321.1	312.7 *	1.4	Neg. *	1/11			
V-10233 76 WDG	30 oz	17.6	17.8	367.9	331.8 *	0.2	Neg. *	0			
Untreated		16.7	20.0	466.4	537.9	3.3	71.5	0			

Table 3B. Phytotoxicity measures as a companion table to Table 3 above.

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 of V-10233 76 WDG (flumioxazin 33.5% + pyroxasulfone 42.5%) 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

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.

 $w = \Delta$ 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.

Four replications with three plants per replication, four treatments, 0, 1, 2 and 4X rates of V-10233 76 WDG (flumioxazin 33.5% + pyroxasulfone 42.5%) were applied to plants in #2 pots (Table 3) for 48 plants per protocol (PR#: 31554). Rates are listed in ounces of active ingredient (a.i)/acre with 1X being 7.5 oz ai/ac (Table 1). Evaluations were conducted at 1, 2 and 4 weeks after treatment (WAT). A reapplication was conducted at 4WAT, and evaluations occurred 1, 2, and 4 weeks after second treatment (WA2T). *Crataegus phaenopyrum* was located at Mathers Environmental Science Services, LLC, Gahanna, OH. 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. The trial was initiated on 06/23/2019 as the protocol specified the plants were to have a sufficient canopy of fully expanded leaves at application. The plants placed in 2-gallon containers on May 12, 2019. The plants came from Klyn Nurseries, Inc., Perry, OH and were received bareroot. Roots were soaked in a water-mud slurry bath for one hour before planting. Herbicides were applied around the base of the plants, without contacting the foliage, as directed applications. To avoid contact with the foliage, at time of application, plants were sealed in zip-lock bags (Fig. 3.1).

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Project Title:	V-102337	76WG Crop Safety with Directed Sprays			
Protocol #:	19-021	PRnumbers: 315	554		

<u>Name(s) of Personnel Conducting Research</u>: Dr. Hannah Mathers <u>Location of Trial (city/state)</u>: Mathers Environmental Science Services, LLC., Gahanna, OH <u>Use Site (greenhouse/shadehouse/field container/etc.</u>): Field container

Crop History

Crop Cultivar/Variety:	Crataegus phaenopyrum
Purchased from:	Klyn Nurseries, Perry, OH
Date of Transplanting:	May 12, 2019
Potting Mix:	See above
Pot size & spacing:	2-gallon pots on 2-foot centers

Product(s) applied prior to start of experiment:

Product	Rate	Application Type		Crop Growth Stage
V-10233 76 WG	0			Fully expanded
	7.5 oz a.i/ac	Liquid - applied via CO ₂ backpack	06/23/2019	Fully expanded
	15 oz a.i/ac	Liquid - applied via CO ₂ backpack	06/23/2019	Fully expanded
	30 oz a.i/ac	Liquid - applied via CO ₂ backpack	06/23/2019	Fully expanded

Experiment Information

Experimental Design: Number of Reps: Completely randomized design with 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.



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Protocol #:	19-021		PRnu	mbers: 31	1554		



Fig. 3.1. (Above) *Crataegus phaenopyrum* at Mathers environmental Science Services, LLC, Gahanna, OH. This photo was taken on June 23, 2019 at initiation of trial with V-10233 76 WG, showing plants covered briefly by plastic zip-lock bags while spraying occurred to prevent any foliar contact of the V-10233. Photo taken by: H. Mathers.



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Fig. 3.2. (Above) *Crataegus phaenopyrum* at Mathers environmental Science Services, LLC, Gahanna, OH. This photo was taken on July 7, 2019 or 2WAT with V-10233 76 WG, showing the 1X plants are shorter, early in the trial; however, the 4X and especially the 2X plants have sparse growth. There is no indication of foliar burn indicating the brief covering with plastic zip-lock bags while spraying did prevent any foliar contact of the V-10233. Photo taken by: H. Mathers.



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Protocol #:	19-021	PRnumbers:	31554			



Fig. 3.3. (Above) *Crataegus phaenopyrum* at Mathers environmental Science Services, LLC, Gahanna, OH. This photo was taken on August 4, 2019 or 2WA2T with V-10233 76 WG, showing surviving 1X plants have grown significantly in height; however, six have died in this treatment. The surviving (11 or 12) 2X plants, and (12 of 12) 4X plants have changed marginally in height and reduced in width. 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 this 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.). Starting and final heights, and two perpendicular measurements of diameter were taken per plant. These measures were used to calculate Growth index (GI) (in³) 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

Mathers Table 1 2017

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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/2019-5 { or 2019-6, or 2019-7 or 2019-8}

Time	Temp	erature	(° F)	Dew	Point (°F)	Hur	nidity (%	%)	Wind (m	Speed ph)	Press	ure (Hg)	Precipit ation (in)
Jun	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Max	Avg	Total
1	81	67.5	59	63	59.8	57	100	79.9	44	16	5.8	29.0	29.0	0.22
2	74	67.3	60	62	57.4	42	97	72.1	48	17	8.6	29.1	28.9	0.00
3	70	61.0	49	45	40.8	37	80	48.9	33	14	7.4	29.3	29.2	0.00
4	78	66.8	54	55	48.8	41	69	53.3	39	14	6.9	29.3	29.2	0.00
5	80	71.7	65	67	62.7	55	93	73.5	61	16	9.4	29.1	28.9	0.03
6	82	71.6	64	65	62.5	60	93	74.4	47	10	5.3	29.0	29.0	0.09
7	77	69.8	63	62	58.5	52	90	68.8	51	16	9.9	29.1	29.0	0.00
8	77	71.4	67	61	57.4	53	73	61.5	52	16	12.3	29.1	29.1	0.00
9	81	74.5	69	66	60.8	57	76	62.4	54	18	11.8	29.1	29.1	0.00
10	76	69.7	59	70	61.3	48	90	74.8	58	23	12.8	29.3	29.1	0.00
11	78	65.0	49	50	45.8	42	93	55.0	29	14	5.4	29.4	29.3	0.06
12	77	64.9	57	61	52.2	44	96	67.0	37	20	10.5	29.3	29.1	0.00
13	64	59.2	53	59	52.6	45	93	79.5	60	24	14.4	29.1	28.9	0.53
14	74	63.3	49	46	42.6	39	83	50.9	28	17	10.5	29.3	29.2	0.00
15	76	67.7	61	66	57.0	46	93	69.8	48	20	8.5	29.1	29.1	0.00
16	79	71.0	66	70	66.5	64	100	86.2	64	21	9.6	29.0	29.0	0.93
17	77	70.8	66	70	66.4	64	94	86.4	66	13	5.9	29.1	29.1	0.18
18	78	70.6	67	70	66.4	65	97	86.9	66	12	5.1	29.1	29.1	0.75
19	82	72.0	67	70	67.5	65	97	86.3	60	17	4.9	29.0	28.9	0.26
20	76	68.5	64	67	64.8	60	97	88.1	69	23	10.9	28.9	28.8	2.66
21	77	68.0	61	61	54.9	51	90	65.3	42	14	8.0	29.1	29.1	0.01
22	80	71.2	64	57	52.3	49	75	52.5	38	12	6.5	29.2	29.2	0.00

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Researcher:Hannah Mathers, PhDDate:2/23/2021									1					
Project Title: V-102				76WG Crop Safety with Directed Sprays										
Protocol #: 19-021 PRnumbers: 31554														
Time Temperature (° F)			Dew Point (° F)			Humidity (%)			Wind Speed (mph)		Pressure (Hg)		Precipit ation (in)	
23	82	71.4	55	66	54.3	47	89	57.7	32	10	5.2	29.2	29.1	0.00
24	83	72.4	68	70	66.8	64	96	83.2	54	16	8.9	29.0	28.9	0.34
25	84	75.1	66	65	60.1	55	93	62.8	38	16	10.2	29.1	29.1	0.86
26	89	78.6	68	66	62.3	60	78	59.0	38	13	6.8	29.3	29.2	0.00
27	87	77.5	71	68	64.9	61	84	66.3	48	18	5.1	29.3	29.3	0.00
28	90	79.3	70	69	65.3	62	90	65.0	39	12	5.6	29.4	29.3	0.00
29	91	81.0	69	67	64.6	63	84	59.2	39	17	8.4	29.3	29.2	0.00
30	89	80.3	72	70	63.8	59	84	59.0	37	14	6.3	29.1	29.1	0.00
Time Temperature (° F)			Dew Point (° F)			Humidity (%)			Wind Speed (mph)		Pressure (Hg)		Precipitatio n (in)	
Jul	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Max	Avg	Total
1	89	78.2	65	68	61.0	57	81	57.4	39	9	5.0	29.2	29.1	0.00
2	93	80.0	70	73	67.3	64	90	67.5	39	25	7.1	29.1	29.1	0.00
3	84	73.2	69	72	68.9	67	97	87.0	58	14	6.8	29.1	29.1	0.35
4	86	73.3	67	71	68.4	66	100	86.1	51	9	3.1	29.2	29.1	0.51
5	90	81.1	71	74	70.6	68	96	71.8	50	14	5.5	29.2	29.2	0.00
6	90	79.7	74	73	71.1	69	94	76.6	52	29	6.1	29.1	29.1	0.03
7	86	77.0	72	72	69.8	63	93	79.3	59	16	5.3	29.1	29.1	0.28
8	85	75.8	67	66	61.8	55	79	62.9	47	13	8.4	29.1	29.1	0.07
9	88	77.3	64	70	62.2	52	76	60.0	49	8	3.3	29.2	29.1	0.00
10	90	81.9	71	71	67.6	65	91	64.3	43	10	4.3	29.1	29.1	0.00
11	90	80.8	75	73	67.8	60	84	66.0	43	17	6.7	29.0	29.0	0.00
12	85	75.8	68	66	62.5	58	87	65.2	40	9	5.5	29.1	29.0	0.32
13	89	77.7	64	63	58.4	52	93	56.5	28	10	4.0	29.2	29.1	0.00
14	90	80.4	71	68	65.1	62	78	60.5	43	12	5.3	29.3	29.2	0.00
15	92	80.8	71	69	65.9	62	79	61.9	39	13	5.1	29.3	29.2	0.00
16	90	78.9	72	73	69.2	67	94	73.7	46	17	8.2	29.2	29.1	0.00
17	86	77.3	73	75	72.4	70	94	85.3	65	18	8.4	29.1	29.1	0.31
18	90	79.5	71	72	70.3	68	97	75.2	52	10	4.2	29.1	29.1	0.44
19	92	81.6	73	77	73.1	70	93	76.5	54	15	7.6	29.1	29.1	0.00
20	94	85.2	76	75	72.0	68	91	66.4	43	21	8.6	29.1	29.1	0.00
21	92	82.4	73	73	70.8	66	96	69.2	47	20	8.3	29.1	29.1	0.00
22	76	72.7	68	72	68.5	63	96	86.8	68	16	7.7	29.1	29.0	0.79
23	78	69.3	60	62	52.8	41	90	59.3	29	15	7.9	29.2	29.1	0.07
24	78	68.4	58	58	56.1	54	90	66.5	45	12	5.7	29.3	29.2	0.00
25	81	70.8	57	59	55.0	51	93	60.8	35	8	3.6	29.4	29.3	0.00

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Proje	ect Title	<u>e: V-</u>	V-10233 76WG Crop Safety with Directed Sprays													
Proto	<u>);#2000</u>	19	-021					PRnu	mber	s: 315	54					
Time	Temp	perature	e (° F)	Dew	Point (°F)	Hu	midity (%)	Wind (m	Speed ph)	Press	ure (Hg)	Precipitatio n (in)		
26	84	73.6	61	60	57.3	55	90	59.8	39	10	3.3	29.4	29.4	0.00		
27	87	76.7	64	63	60.3	57	87	59.9	37	17	6.8	29.4	29.3	0.00		
28	89	79.2	69	65	62.9	60	84	59.5	40	17	8.5	29.3	29.3	0.00		
29	89	79.7	69	67	63.8	59	87	60.6	37	17	8.8	29.2	29.1	0.00		
30	85	75.8	70	69	67.0	64	93	74.9	49	13	7.6	29.2	29.1	0.05		
31	87	76.8	68	66	64.2	61	93	67.6	41	13	4.9	29.2	29.2	0.00		
Time	e Ten	nperatu	re (° F)) Dew Point (°		t (° F)) Humidity (%)		r (%)	Wind Spee		^d Pressure (Hg) Precipitati		
Ang	Max	Avø	Min	Max	Avø	Min	Max	Avø	Mir	ı Max	Avø	Max	Avg	Total		
1	84	75.6	69	65	62.9	60	87	66.6	44	14	7.1	29.3	29.2	0.00		
2	87	76.8	67	61	58.0	56	73	54.1	36	10	6.6	29.2	29.2	0.00		
3	87	75.1	63	61	56.6	50	87	56.1	28	9	5.8	29.2	29.2	0.00		
4	89	75.1	61	67	58.1	50	90	59.8	30	26	5.5	29.2	29.1	0.00		
5	89	78.2	67	68	63.9	59	93	64.1	39	15	4.6	29.1	29.1	0.71		
6	86	75.2	68	69	65.2	60	93	72.8	43	18	7.5	29.1	29.0	0.01		
7	84	75.9	68	68	64.3	55	96	69.5	37	15	7.3	29.0	29.0	0.11		
8	89	77.5	65	67	62.1	60	87	61.3	39	26	11.3	29.0	29.0	0.00		
9	83	73.6	65	65	54.5	46	90	55.7	29	10	6.1	29.1	29.1	0.01		
10	83	71.1	60	58	54.5	51	87	59.0	34	12	5.6	29.2	29.1	0.00		
11	84	72.6	58	59	55.0	53	90	56.7	35	8	4.3	29.2	29.2	0.00		
12	85	76.5	65	65	60.0	56	84	58.0	38	12	5.7	29.1	29.1	0.00		
13	83	75.6	71	72	69.6	65	96	81.9	63	14	8.1	29.0	28.9	0.29		
14	85	74.6	68	69	65.5	60	96	75.9	43	12	4.8	29.1	29.0	0.00		
15	85	76.0	67	66	62.5	58	93	65.8	40	15	7.6	29.1	29.1	0.00		
16	84	75.8	64	65	61.4	53	93	63.4	34	12	4.7	29.1	29.1	0.00		
17	90	77.8	67	69	64.5	61	87	65.4	39	16	5.8	29.1	29.1	0.00		
18	93	82.0	72	69	67.8	65	87	64.3	41	36	7.7	29.1	29.1	0.00		
19	89	76.2	66	70	65.9	63	93	72.2	46	20	6.4	29.2	29.1	0.50		
20	91	79.7	71	71	68.4	66	90	69.3	48	18	6.2	29.2	29.1	0.00		
21	85	75.5	69	67	65.6	64	90	72.7	49	15	7.8	29.1	29.1	0.01		
22	78	72.2	69	69	66.5	62	93	82.7	66	13	6.4	29.1	29.1	0.00		
23	76	68.1	59	61	54.4	50	79	63.2	40	16	8.3	29.3	29.2	0.27		
24	77	66.2	55	55	50.7	47	89	60.5	36	14	7.9	29.4	29.3	0.00		
25	80	68.1	57	55	52.1	50	78	58.6	38	13	8.8	29.3	29.3	0.00		
26	68	65.6	63	65	60.2	52	97	83.3	65	15	9.9	29.2	29.1	0.00		
27	76	70.6	67	70	68.0	65	97	91.8	79	16	7.5	29.1	29.0	0.61		
28	79	69.9	63	70	58.8	47	100	73.0	33	17	6.0	29.1	29.1	0.76		
Mathe	ers Tahl	e 1 201'	7													

Ornamental Horticulture Program Research Report Form



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Researcher:		r: H	annah N	s, PhD			Date: 2/23/2021								
Project Title:			-10233	Crop Sa	fety w	ith Dir									
Proto	<u>col #:</u>	19	19-021 PRnumbers:							31554					
Time	Ten	nperatu	ıre (° F)	De	ew Point	(° F)	F	lumidity (%)	Wine (I	d Speed mph)	Press	ure (Hg)	Precipitati on (in)	
29	81	69.4	57	58	54.6	52	93	62.3	36	17	6.8	29.2	29.1	0.00	
30	87	74.9	66	65	60.4	55	79	62.0	33	13	6.9	29.3	29.2	0.00	
31	77	69.8	66	60	56.9	54	79	64.0	46	12	6.6	29.4	29.3	0.00	