



<http://www.ir4project.org/about-environmental-horticulture/environmental-horticulture-research-summaries>

## **IR-4 Ornamental Horticulture Program Pydiflumetofen + Fludioxonil Crop Safety**

**Authors: Cristi L. Palmer and Ely Vea  
Date: June 14, 2018**

**Acknowledgements  
Susan Bierbrunner**

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-34383-23710 with substantial cooperation and support from the State Agricultural Experiment Stations and USDA-ARS.

## Table of Contents

Table of Contents .....	2
Table of Tables .....	3
Abstract .....	4
Introduction.....	5
Materials and Methods.....	5
Results and Summary .....	5
Phytotoxicity .....	5
Label Suggestions .....	10
Appendix 1: Contributing Researchers .....	11

## Table of Tables

Table 1.	List of Pydiflumetofen + Fludioxonil treated crops with no or minimal transitory injury. ....	6
Table 2.	List of Pydiflumetofen + Fludioxonil treated crops with no injury at 1X but significant injury at 2X or 4X.....	6
Table 3.	List of Pydiflumetofen + Fludioxonil treated crops with significant injury at 1X. ....	6
Table 4.	List of Pydiflumetofen + Fludioxonil treated crops where more information is needed.....	6
Table 5	Detailed Summary of Crop Safety Testing with Pydiflumetofen + Fludioxonil.....	7

## Abstract

Pydiflumetofen + Fludioxonil is a new fungicide being developed by Syngenta for the control of foliar and soil-borne diseases of ornamental horticulture crops. The IR-4 Project completed 37 crop safety trials on 24 ornamental horticulture plant species or genera during 2015 to 2017. In these trials, all 24 species or genera exhibited minimal or no injury. Two species or genera (*Lupinus* sp. and *Petunia x hybrida*) exhibited minimal or no injury in 3 trials and 22 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop. Syngenta may consider adding these to the label.

## Introduction

Pydiflumetofen + Fludioxonil is a new fungicide being developed by Syngenta for the control of foliar and soil-borne diseases of ornamental horticulture crops. The IR-4 Project completed 37 crop safety trials on 24 ornamental horticulture plant species or genera during 2015 to 2017.

## Materials and Methods

Pydiflumetofen + Fludioxonil was applied as foliar treatment typically 3 times at approximately 14 days intervals; in a few trials, it was applied as a single drench treatment. The application rates were 27.8, 54.6 and 109.2 fl oz per 100 gal, plus a water treated control. A minimum of ten plants (replicate treatments) were required. Phytotoxicity was planned to be recorded on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill). Phytotoxicity was rated weekly up to 6 weeks after initial application. For IR-4 testing, the following protocols were used: 15-003, 16-004, 16-005, 17-004 and 17-005. For more detailed materials and methods, including application rates for various products, please visit <http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm> to view and download these protocols.

Pydiflumetofen + Fludioxonil was supplied to researchers (See list of researchers in Appendix 1) by Syngenta.

## Results and Summary

Based on the type and nature of injury seen with pesticide applications, tested plant species were placed into four categories: 1) no significant phytotoxicity or growth differences from the untreated check or any injury was transitory, 2) no or minimal transitory injury seen at the 1X rate, but the 2X and/or 4X rates did cause significant phytotoxicity, 3) significant injury at the 1X rate sufficient to recommend growers not utilize Pydiflumetofen + Fludioxonil, and 4) more data is needed to make informed recommendations.

### Phytotoxicity

Across all crops tested, Pydiflumetofen + Fludioxonil exhibited no or minimal negative impact on all plant species or genera. Two species or genera (*Lupinus* sp. and *Petunia x hybrida*) exhibited minimal or no injury in 3 trials (Table 1) and 22 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop (Table 4).

Please see Table 5 for a summary of the individual trial results.

**Table 1. List of Pydiflumetofen + Fludioxonil treated crops with no or minimal transitory injury.**

*Lupinus* sp.  
*Petunia x hybrida*

**Table 2. List of Pydiflumetofen + Fludioxonil treated crops with no injury at 1X but significant injury at 2X or 4X.**

None

**Table 3. List of Pydiflumetofen + Fludioxonil treated crops with significant injury at 1X.**

None

**Table 4. List of Pydiflumetofen + Fludioxonil treated crops where more information is needed.**

<i>Alyssum</i> sp. <sup>1</sup>	<i>Impatiens walleriana</i> <sup>1</sup>
<i>Antirrhinum majus</i> <sup>2</sup>	<i>Osteospermum ecklonis</i> <sup>2</sup>
<i>Begonia</i> sp. <sup>2</sup>	<i>Osteospermum</i> sp. <sup>1</sup>
<i>Calibrachoa</i> sp. <sup>2</sup>	<i>Pelargonium x hortorum</i> <sup>1</sup>
<i>Chamaerops humilis</i> <sup>1</sup>	<i>Salvia greggi</i> <sup>1</sup>
<i>Chrysanthemum/Dendranthema x morifolium</i> <sup>1</sup>	<i>Salvia</i> sp. <sup>1</sup>
<i>Coreopsis</i> sp. <sup>1</sup>	<i>Verbena x hybrida</i> <sup>1</sup>
<i>Dianthus</i> sp. <sup>2</sup>	<i>Verbena</i> sp. <sup>2</sup>
<i>Dianthus carophyllus</i> <sup>1</sup>	<i>Viola</i> sp. <sup>1</sup>
<i>Euphorbia pulcherrima</i> <sup>2</sup>	<i>Viola x wittrockiana</i> <sup>1</sup>
<i>Gerbera</i> sp. <sup>1</sup>	
<i>Impatiens hawkeri</i> <sup>1</sup>	

<sup>1</sup> No injury in 1 trial

<sup>2</sup> No injury in 2 trials

**Table 5 Detailed Summary of Crop Safety Testing with Pydiflumetofen + Fludioxonil.**

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 5/31/2018 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32447	Madwort ( <i>Alyssum</i> sp.) 'Snow Crystals'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
32456	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Orange'	Greenhouse	Hausbeck	MI	2017	Foliar	No injury with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times biweekly; slight stunting with 4X.
32456	Garden Snapdragon ( <i>Antirrhinum majus</i> ) 'Sonnet Mix'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
32459	Begonia ( <i>Begonia</i> sp.) B. <i>semperflorens</i> 'Bada Bing'	Greenhouse	Hausbeck	MI	2016	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32459	Begonia ( <i>Begonia</i> sp.) 'Dragon Wing Red'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
33056	Begonia ( <i>Begonia</i> sp.) 'Summerwings Rose'	Shadehouse/Lathehouse	Klett	CO	2017	Drench	No injury with 27.8, 55.6 and 111.2 fl oz per 100 gal; moderate growth reduction at 4X.
32455	Calibrachoa ( <i>Calibrachoa</i> sp.) 'Kabloom Deep Blue'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 27.8, 54.6, and 109.2 fl oz per 100 gal applied 3 times.
33054	Calibrachoa ( <i>Calibrachoa</i> sp.) Minifamous Double Amethyst	Shadehouse/Lathehouse	Klett	CO	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
33065	Palm, Mediterranean Fan ( <i>Chamaerops humilis</i> )	Field Container	Palmateer	FL	2016	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32453	Hardy Mum ( <i>Chrysanthemum/Dendranthema x morifolium</i> ) 'Orange Blush'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
32450	Tickseed ( <i>Coreopsis</i> sp.) 'Nana'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
32446	Pink ( <i>Dianthus</i> sp.) D. <i>caryophyllus</i> 'Crimson Red'	Greenhouse	Uber	CA	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32446	Pink ( <i>Dianthus</i> sp.) 'Diabunda Purple Picot'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
33055	Pink ( <i>Dianthus</i> sp.) <i>Dianthus</i> SCENT FIRST POT Coral Reef	Shadehouse/Lathehouse	Klett	CO	2017	Foliar	No injury with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32463	Poinsettia ( <i>Euphorbia pulcherrima</i> ) 'Whitestar'	Greenhouse	Freiberger	NJ	2016	Drench	No injury, growth reduction or delayed blooming with 27.8, 54.6 and 109.2 fl oz per 100 gal.
32463	Poinsettia ( <i>Euphorbia pulcherrima</i> ) 'Whitestar'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury, growth reduction or delayed blooming with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32451	Transvaal Daisy ( <i>Gerbera</i> sp.) 'Garvenia Sweet Honey'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury with 27.8 and 54.6, some leaf necrosis with 109.2 fl oz per 100 gal applied 3 times; decreased flowering and smaller leaf size at all rates.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32462	Impatiens, New Guinea (Impatiens hawkeri) 'Super Sonic Purple'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury with 27.8, 54.6 and 109.2 fl oz per 100 gal for first 2 applications, some leaf yellowing after third application increasing with each rate.
32461	Impatiens, Common Garden/Buzzy Lizzy (Impatiens walleriana) 'Super XP Pink'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times; slight decrease in flowering.
32445	Lupine (Lupinus sp.) 'Gallery Blue'	Greenhouse	Freiberger	NJ	2016	Drench	No injury with 27.8, 54.6 and 109.2 fl oz per 100 gal at first 2 evaluations, last evaluation not done; no growth reduction.
32445	Lupine (Lupinus sp.) 'Russell Mix'	Greenhouse	Baysal-Gurel	TN	2017	Drench	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal.
32445	Lupine (Lupinus sp.) 'Russell Mix'	Greenhouse	Baysal-Gurel	TN	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times biweekly.
32454	Daisybush (Osteospermum sp.) 'Asti Purple'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 27.8, 54.6, and 109.2 fl oz per 100 gal applied 3 times.
32454	Daisybush (Osteospermum sp.) O. ecklonis 'Rose Magic'	Greenhouse	Hausbeck	MI	2017	Drench	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal.
32454	Daisybush (Osteospermum sp.) O. ecklonis 'Rose Magic'	Greenhouse	Hausbeck	MI	2017	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
32458	Geranium, Zonal (Pelargonium x hortorum) 'Zonal Tango Orange'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury with 27.8 and 54.6, some leaf necrosis with 109.2 fl oz per 100 gal applied 3 times; slight to moderate reduction of leaf size and flowering increasing with rates.
32457	Petunia (Petunia sp.) Petunia x hybrida 'Carpet velvet'	Greenhouse	Hand	OH	2017	Drench	Minor injury (chlorosis) with 27.8, 54.6 and 109.2 fl oz per 100 gal; no growth reduction.
32457	Petunia (Petunia sp.) Petunia x hybrida 'Carpet velvet'	Greenhouse	Hand	OH	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32457	Petunia (Petunia sp.) Petunia x hybrida 'Dreams Midnight'	Greenhouse	Uber	CA	2017	Drench	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal.
32457	Petunia (Petunia sp.) 'Tritunia Blue'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 27.8, 54.6, and 109.2 fl oz per 100 gal applied 3 times.
32448	Sage (Salvia sp.) 'Evolution White'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
33057	Sage (Salvia sp.) S. greggi 'Raspberry'	Shadehouse/Lathehouse	Klett	CO	2017	Drench	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal.
32452	Vervain (Verbena sp.) 'Burgundy Wink'	Greenhouse	Hausbeck	MI	2017	Drench	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal.
32452	Vervain (Verbena sp.) 'Lanai Vintage Vodka'	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 27.8, 54.6 and 109.2 fl oz per 100 gal applied 3 times.
33058	Vervain (Verbena sp.) V. x hybrida 'Lanai Magenta'	Shadehouse/Lathehouse	Klett	CO	2017	Drench	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal.



PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32460	Pansy (Viola sp.) 'Colossus Yellow'	Greenhouse	Freiberger	NJ	2016	Drench	No injury with 27.8, 54.6 and 109.2 fl oz per 100 gal at first 2 evaluations, last evaluation not done; no growth reduction.
32449	Wittrock's Violet; Pansy (Viola x wittrockiana) 'Delta Orange Blotch'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 27.8, 54.6, and 109.2 fl oz per 100 gal applied 3 times.

## Label Suggestions

In this report, all plants exhibited no or minimal injury after foliar treatments of Pydiflumetofen + Fludioxonil at 27.8, 54.6 and 109.2 fl oz per 100 gal, suggesting that this active ingredient is safe to ornamental horticulture crops. Given the lack of phytotoxicity across so many different plant species and genera, it is suggested that all the 24 plants in Table 1 and Table 4 (listed below) that showed no injury be placed on the Pydiflumetofen + Fludioxonil label if Syngenta has similar results on these crops. Or a general statement can be placed on the label such as 'has not been demonstrated to cause damage on various ornamental plant species according to labeled use instructions. Pydiflumetofen + Fludioxonil may be used on a wide number of crops, but must be tested on a limited portion of the crop prior to applying to the whole crop if the grower has no previous experience applying Pydiflumetofen + Fludioxonil to that crop'.

*Alyssum* sp.

*Antirrhinum majus*

*Begonia* sp.

*Calibrachoa* sp.

*Chamaerops humilis*<sup>1</sup>

*Chrysanthemum/Dendranthema x morifolium*

*Coreopsis* sp.

*Dianthus* sp.

*Dianthus carophyllus*

*Euphorbia pulcherrima*

*Gerbera* sp.

*Impatiens hawkeri*

*Impatiens walleriana*

*Lupinus* sp.

*Osteospermum ecklonis*

*Osteospermum* sp.

*Pelargonium x hortorum*

*Petunia x hybrida*

*Salvia greggi*

*Salvia* sp.

*Verbena x hybrida*

*Verbena* sp.

*Viola* sp.

*Viola x wittrockiana*

## Appendix 1: Contributing Researchers

Dr. Fulya Baysal-Gurel	Tennessee State University Otis L. Floyd Research Center 472 Cadillac Lane McMinnville, TN 37110
Mr. Dave Bodine	Rutgers University Cream Ridge Experiment Station 283 Rt. 539 Cream Ridge, NJ 08514
Mr. Tom Freiberger	Rutgers University Cream Ridge Experiment Station 283 Rt. 539 Cream Ridge, NJ 08514
Dr. Francesca Hand	Ohio State University Department of Plant Pathology 475C Kottman Hall Columbus, OH 43210
Dr. Mary Hausbeck Mr. Blair Harlan	Michigan State University Dept. of Plant Pathology 140 Plant Pathology Building East Lansing, MI 48824 517-355-4534
Dr. Jim Klett	Colorado State University Department of Horticulture and Landscape Architecture Fort Collins, CO 80423
Dr. Aaron Palmateer	University of Florida Tropical Research & Education Center 18905 SW 280 Street Homestead, FL 33031
Mr. Buzz Uber	Crop Inspection Service 31130 Hilltop Drive Valley Center, CA 92082