Environment Horticulture Program Research Summaries

IR-4 Environmental Horticulture Program
Pydiflumetofen + Fludioxonil Crop Safety

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Abstract

Pydiflumetofen + Fludioxonil is a new fungicide being developed for the control of foliar and soil-borne diseases of environmental (aka ornamental) horticulture crops. The IR-4 Project completed 54 crop safety trials on 26 environmental horticulture plant species or genera from 2015 to 2018. In these trials, 23 species or genera exhibited minimal or no injury. Five species or genera (*Antirrhinum majus, Begonia* sp., *Calibrachoa* sp., *Lupinus* sp. and P*etunia x hybrida*) exhibited minimal or no injury in 3 trials (Table 1) and 18 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop (Table 4). It is recommended these plant species be added to the label.

Introduction

Pydiflumetofen + Fludioxonil is a new fungicide being developed for the control of foliar and soil-borne diseases of environmental (aka ornamental) horticulture crops. The IR-4 Project completed 54 crop safety trials on 26 environmental horticulture plant species or genera between 2015 and 2018.

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, 17-005, 18-006 and 18-007. For more detailed materials and methods, including application rates for various products, please visit https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-researcher-resources/#Protocols 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 24 plant species or genera. Five species or genera (*Antirrhinum majus*, *Begonia* sp., *Calibrachoa* sp., *Lupinus* sp. and P*etunia x hybrida*) exhibited minimal or no injury in 3 trials (Table 1) and 18 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.

Antirrhinum majus
Begonia sp.
Calibrachoa sp.
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.

Alyssum sp. [1]
Chamaerops humilis [1]
Chrysanthemum/Dendranthema x morifolium [1]
Coreopsis sp. [1]
Dianthus sp. [3]
Dianthus carpophyllus [1]
Dianthus plumarius [1]
Euphorbia pulcherrima [3]
Gerbera sp. [1]
Impatiens hawkeri [1]
Impatiens walleriana [1]
Osteospermum ecklonis [2]
Osteospermum sp. [2]
Pelargonium x hortorum
Salvia greggi [2]
Salvia sp. [2]
Verbena x hybrida [1]
Verbena sp. [2]
Viola sp. [1]
Viola cornuta [1]
Viola x wittrockiana [2]

[1] No injury in 1 trial
[2] No injury in 2 trials
[3] There may be differential responses due to cultivar.

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 6/16/2020 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
32447	Madwort (Alyssum 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 (Antirrhinum majus) '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.
32456	Garden Snapdragon (Antirrhinum majus)	Greenhouse	Grunwald	OR	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32456	Garden Snapdragon (Antirrhinum majus) '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.
32459	Begonia (Begonia 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.
32459	Begonia (Begonia sp.)	Greenhouse	Grunwald	OR	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32459	Begonia (Begonia sp.) B. semperflorens '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.
33056	Begonia (Begonia sp.) 'Summerwings Rose'	Shadehouse/Lath House	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 (Calibrachoa sp.) 'Kabloom Deep Blue'	Greenhouse	Bodine (NER)	NJ	2015	Foliar	No injury or growth reduction with 27.8, 54.6, and 109.2 fl oz per 100 gal applied 3 times.
32455	Calibrachoa (Calibrachoa sp.)	Greenhouse	Grunwald	OR	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
33054	Calibrachoa (Calibrachoa sp.) Minifamous Double Amethest	Shadehouse/Lath House	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; Dwarf Fan Palm (Chamaerops humilis)	Field Container	Palmateer (UF)	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 (Chrysanthemum/Dendranthema x morifolium) '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 (Coreopsis 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 (Dianthus 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.
32446	Pink (Dianthus sp.) ''Parfait Super Raspberry'	Greenhouse	Hausbeck	MI	2018	Drench	Moderate to severe injury increasing with rates (27.8, 55.6 and 111.2 fl oz per 100 gal); all treated plants not marketable.
32446	Pink (Dianthus sp.) D. plumarius 'Parfait Super Raspberry'	Greenhouse	Hausbeck	MI	2018	Foliar	No significant injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times biweekly; all plants marketable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
33055	Pink (Dianthus sp.) Dianthus SCENT FIRST POT Coral Reef	Shadehouse/Lath House	Klett	CO	2017	Foliar	No injury with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32446	Pink (Dianthus sp.) D. caryophyllus '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.
32463	Poinsettia (Euphorbia pulcherrima) 'Prestige Red'	Greenhouse	Catlin	NY	2017	Foliar	Severe injury increasing with rates (27.8, 55.6 and 111.2 fl oz per 100 gal); spray residue levels unacceptable at sale with all rates.
32463	Poinsettia (Euphorbia pulcherrima) '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 (Euphorbia pulcherrima) '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 (Gerbera 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.
32451	Transvaal Daisy (Gerbera sp.)	Greenhouse	Grunwald	OR	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32451	Transvaal Daisy (Gerbera sp.) G. jamesonii ‘Majorette Pink Halo’	Greenhouse	Meadows	NC	2018	Drench	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal.
32451	Transvaal Daisy (Gerbera sp.) G. jamesonii ‘Majorette Pink Halo’	Greenhouse	Meadows	NC	2018	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
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.) '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.
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.)	Greenhouse	Grunwald	OR	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32454	Daisybush (Osteospermum sp.) 'Asti Purple'	Greenhouse	Bodine (NER)	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.
32454	Daisybush (Osteospermum sp.) 'Asti Purple'	Greenhouse	Meadows	NC	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
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.
32458	Geranium, Zonal (Pelargonium x hortorum) 'Super Moon Red'	Greenhouse	Klett	CO	2018	Drench	Moderate injury to mortality increasing with rates (27.8, 55.6 and 111.2 fl oz per 100 gal).
32458	Geranium, Zonal (Pelargonium x hortorum) 'Super Moon Red'	Greenhouse	Klett	CO	2018	Foliar	No injury with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times, but severe growth reduction with 2X and 4X rates.
32457	Petunia (Petunia sp.) 'Tritunia Blue'	Greenhouse	Bodine (NER)	NJ	2015	Foliar	No injury or growth reduction with 27.8, 54.6, and 109.2 fl oz per 100 gal applied 3 times.
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.
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.
32448	Sage (Salvia sp.)	Greenhouse	Grunwald	OR	2017	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
33057	Sage (Salvia sp.) S. greggi 'Raspberry'	Shadehouse/Lath House	Klett	CO	2017	Drench	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal.
32448	Sage (Salvia sp.) S. greggi “Furman Red	Greenhouse	Ong	TX	2017	Drench	No significant injury or stunting 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.
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.
33058	Vervain (Verbena sp.) V. x hybrida 'Lanai Magenta'	Shadehouse/Lath House	Klett	CO	2017	Drench	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal.
32460	Violet (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.
32460	Violet (Viola sp.) V. x wittrockiana 'Cool Wave Blue Skies'	Greenhouse	Hand	OH	2018	Drench	Minor injury, with complete recovery, with 27.8, 55.6 and 111.2 fl oz per 100 gal applied once; no significant growth reduction
32460	Violet (Viola sp.) V. cornuta 'Penny™ Denim Jump '	Greenhouse	Klett	CO	2018	Foliar	No injury or growth reduction with 27.8, 55.6 and 111.2 fl oz per 100 gal applied 3 times.
32449	Pansy, Large Flowering; Wittrock's Violet (Viola X wittrockiana) 'Delta Orange Blotch'	Greenhouse	Bodine (NER)	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 environmental horticulture crops. Given the lack of phytotoxicity across so many different plant species and genera, it is suggested that all the 23 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 environmental plant species according to labeled use instructions. Pydiflumetofen + Fludioxonil may be used on a wide number of crops, but it 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
Chrysanthemum/Dendranthema x morifolium
Coreopsis sp.
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 cornuta
Viola sp.
Viola x wittrockiana

Appendix 1: Contributing Researchers

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