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**IR-4 Ornamental Horticulture Program
Pydiflumetofen + Azoxystrobin + Propiconazole Crop Safety**

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Abstract

Pydiflumetofen + Azoxystrobin + Propiconazole was a new fungicide being developed by Syngenta for the control of leaf spots (*Septoria*, *Cercospora*, *Alternaria*, *Venturia*), powdery mildew, *Fusarium*, *Botrytis*, *Sclerotinia*, *Corynespora*, and other foliar diseases. The IR-4 Project completed 39 crop safety trials on 18 ornamental horticulture plant species or genera from 2015 through 2017. In these trials, sufficient injury was observed such that future development of both formulations tested was discontinued.

Introduction

Pydiflumetofen + Azoxystrobin + Propiconazole is a new fungicide being developed by Syngenta for the control of leaf spots (*Septoria*, *Cercospora*, *Alternaria*, *Venturia*), powdery mildew, *Fusarium*, *Botrytis*, *Sclerotinia*, *Corynespora*, and other foliar diseases. The IR-4 Project completed 39 crop safety trials on 18 ornamental horticulture plant species or genera between 2015 and 2017.

Materials and Methods

Pydiflumetofen + Azoxystrobin + Propiconazole was applied as foliar treatment typically 3 times at approximately 14 days intervals. The application rates were 13.7, 27.4 and 54.8 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 and 16-004 with two different formulations. 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 + Azoxystrobin + Propiconazole 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 three 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 + Azoxystrobin + Propiconazole, and 4) more data is needed to make informed recommendations.

Phytotoxicity

One crop *Pelargonium x hortorum* exhibited little injury with application of either Pydiflumetofen + Azoxystrobin + Propiconazole formulation. However, eleven of the tested crops exhibited significant injury. There are 7 species or genera where less than 3 trials were conducted so there is not enough information available at this time (Table 4).

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

Table 1. List of Pydiflumetofen + Azoxystrobin + Propiconazole treated crops with no or minimal transitory injury.

Pelargonium x hortorum

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

Alyssum sp.

Antirrhinum majus

Calibrachoa sp.

Dianthus sp.

Gerbera sp.

*Verbena sp.*¹

*Viola sp.*¹

*Viola x wittrockiana*¹

Table 3. List of Pydiflumetofen + Azoxystrobin + Propiconazole treated crops with significant injury at 1X.

Begonia sp

Impatiens hawkeri

Impatiens walleriana

Table 4. List of Pydiflumetofen + Azoxystrobin + Propiconazole treated crops where more information is needed.

Chamaerops humilis

Chrysanthemum/Dendranthema x morifolium

Coreopsis sp.

Lupinus sp.

Osteospermum sp.

Petunia sp.

Salvia sp.

Table 5 Detailed Summary of Crop Safety Testing with Pydiflumetofen + Azoxystrobin + Propiconazole.

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 3/15/2018 are listed below.

PR#	Crop	Formulation	Production Site	Researcher	State	Year	Application Type	Results
32466	Madwort (Alyssum sp.)	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	Slight injury (leaf yellowing) with 13.7, 27.4 and 54.8 fl oz per 100 gal; slight stunting and decreased flowering at 4X. 1X applied 3 times, 2X and 4X applied twice.
32975	Madwort (Alyssum sp.) 'Clear Crystal White'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor to severe injury and stunting increasing with rates (13.7, 27.4 and 54.8 fl oz per 100 gal) applied 3 times.
32475	Garden Snapdragon (Antirrhinum majus) 'Sonnet Mix'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	Slight injury (leaf curling and spotting) with 13.7, 27.4 and 54.8 fl oz per 100 gal; moderate and severe stunting at 2X and 4X. 1X applied 3 times, 2X and 4X applied twice.
32976	Snapdragon (Antirrhinum sp.) 'Sonnet White'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor injury and stunting with 13.7 and 27.4, severe with 54.8 fl oz per 100 gal applied 3 times.
32478	Begonia (Begonia sp.) B. semperflorens 'Bada Bing'	A21416A	Greenhouse	Hausbeck	MI	2016	Foliar	Severe injury and growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32478	Begonia (Begonia sp.) 'Dragon Wing Red'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	Slight injury (leaf wrinkle, darker leaf) with 13.7, 27.4 and 54.8 fl oz per 100 gal; moderate to severe stunting at all rates. 1X applied 3 times, 2X and 4X applied twice.
32977	Begonia (Begonia sp.) 'Megawatt Red'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor injury and stunting with 13.7, moderate to severe injury and stunting with 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32474	Calibrachoa (Calibrachoa sp.) 'Kaboom Deep Blue'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury with 13.7, 27.4 and 54.8 fl oz per 100 gal; moderate stunting at 2X and 4X. 1X applied 3 times, 2X and 4X applied twice.
32978	Calibrachoa (Calibrachoa sp.) 'Cabaret Purple'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times biweekly.
33066	Palm, Mediterranean Fan (Chamaerops humilis)	A21416A	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.
32472	Hardy Mum (Chrysanthemum/Dendranthema x morifolium) 'Orange Blush'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32979	Hardy Mum (Chrysanthemum/Dendranthema x morifolium) 'Snow Lady'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.

PR#	Crop	Formulation	Production Site	Researcher	State	Year	Application Type	Results
32469	Tickseed (<i>Coreopsis</i> sp.) 'Nana'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	Slight injury (leaf curling), no growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal; 1X and 2X applied 3 times, 4X applied twice.
32980	Tickseed (<i>Coreopsis</i> sp.) 'Bengal Tiger'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32465	Pink (<i>Dianthus</i> sp.) 'Diabunda Purple Picot'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury with 13.7, 27.4 and 54.8 fl oz per 100 gal; slight stunting at 1X and 2X, moderate at 4X. 1X applied 3 times, 2X and 4X applied twice.
32981	Pink (<i>Dianthus</i> sp.) 'Select Mix'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor injury and stunting with 13.7, moderate injury and stunting with 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32982	Poinsettia (<i>Euphorbia pulcherrima</i>) 'Whitestar'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32470	Transvaal Daisy (<i>Gerbera</i> sp.) 'Garvenia Sweet Honey'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times; slight stunting at all rates.
32983	Transvaal Daisy (<i>Gerbera</i> sp.) 'Jaguar Scarlet'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor injury with 13.7, moderate with 27.4 and 54.8 fl oz per 100 gal applied 3 times; slight stunting with 1X and 2X, severe with 4X.
32481	Impatiens, New Guinea (<i>Impatiens hawkeri</i>) 'Super Sonic Purple'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	Slight injury (leaf curling, necrosis) with 13.7, moderate with 27.4 and 54.8 fl oz per 100 gal applied twice; slight stunting and decreased flowering at 1X, severe at 2X and 4X; 2X and 4X not marketable.
32984	Impatiens, New Guinea (<i>Impatiens hawkeri</i>) 'Pure Beauty White'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or growth reduction with 13.7 fl oz per 100 gal applied 3 times biweekly; moderate and severe injury (black spots on leaves) and growth reduction with 27.4 and 54.8 fl oz.
32480	Impatiens, Common Garden/Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Super XP Pink'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	Slight injury (leaf necrosis) with 13.7, 27.4 and 54.8 fl oz per 100 gal applied twice; slight stunting and decreased flowering at 1X, moderate at 2X and 4X; 2X and 4X not marketable.
32985	Impatiens, Common Garden/Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Blue Pearl'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor injury (reduced flowering) with 13.7, moderate with 27.4 and 54.8 fl oz per 100 gal; severe growth reduction.
32986	Lupine (<i>Lupinus</i> sp.) 'Gallery Mix'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor injury with 13.7 and 27.4, moderate with 54.8 fl oz per 100 gal applied 3 times moderate stunting with 4X.

PR#	Crop	Formulation	Production Site	Researcher	State	Year	Application Type	Results
32473	Daisybush (Osteospermum sp.) 'Sideshow Purple Bi-color'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury with 13.7, 27.4 and 54.8 fl oz per 100 gal; slight stunting at 2X and 4X. 1X applied 3 times, 2X and 4X applied twice.
32987	Daisybush (Osteospermum sp.) Asti 'White'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or stunting with 13.7, slight 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32477	Geranium, Zonal (Pelargonium x hortorum) 'Zonal Tango Orange'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32988	Geranium, Zonal (Pelargonium x hortorum) 'Bullseye Scarlet'	A21416B	Greenhouse	Gu	TX	2017	Foliar	Minor injury, with quick recovery, with 13.7, 27.4 and 54.8 fl oz per 100 gal; no growth reduction.
32988	Geranium, Zonal (Pelargonium x hortorum) 'Cherry Rose'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32476	Petunia (Petunia sp.) 'Easy Wave Blue'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury with 13.7, 27.4 and 54.8 fl oz per 100 gal; slight stunting at all rates. 1X and 2X applied 3 times, 4X applied twice.
32989	Petunia (Petunia sp.) 'Sky Blue'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	Minor injury with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32467	Sage (Salvia sp.) 'Evolution White'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32990	Sage (Salvia sp.) 'May Night'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury with 13.7, minor (leaf curling) with 27.4 and 54.8 fl oz per 100 gal, applied 3 times biweekly; no growth reduction.
32471	Vervain (Verbena sp.) 'Lanai Vintage Vodka'	A21416A	Greenhouse	Freiberger	NJ	2016	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32991	Vervain (Verbena sp.) 'Imagination Violet'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or stunting with 13.7, slight with 27.4, and severe with 54.8 fl oz per 100 gal applied 3 times.
32991	Vervain (Verbena sp.) 'Tuscany Peach'	A21416B	Greenhouse	Gu	TX	2017	Foliar	Minor injury, with quick recovery, with 13.7, 27.4 and 54.8 fl oz per 100 gal; moderate growth reduction at 4X.
32992	Pansy (Viola sp.) 'Delta Rose Blotch'	A21416B	Greenhouse	Freiberger	NJ	2017	Foliar	No injury or stunting with 13.7, minor with 27.4, and moderate to severe with 54.8 fl oz per 100 gal applied 3 times.
32479	Wittrock's Violet; Pansy (Viola X wittrockiana) 'Delta Orange Blotch'	A21416A	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.
32468	Wittrock's Violet; Pansy (Viola X wittrockiana) 'Delta Orange Blotch'	A21416B	Greenhouse	Bodine	NJ	2015	Foliar	Slight injury (stunting) with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.

Label Suggestions

Based on the injury observed in this research, both formulations of Pydiflumetofen + Azoxystrobin + Propiconazole were discontinued for future development.

Appendix 1: Contributing Researchers

Mr. Dave Bodine	Rutgers University Cream Ridge Experiment Station 283 Rt. 539 Cream Ridge, NJ 08514
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