IR-4 Ornamental Horticulture Program
Pydiflumetofen Crop Safety

Authors: Cristi L. Palmer and Ely Vea
Date: January 13, 2017

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 ................................................................... 9
Appendix 1: Contributing Researchers ................................... 10
Table of Tables

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

Pydiflumetofen 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 19 crop safety trials on 18 ornamental horticulture plant species or genera during 2015 and 2016. In these trials, all 18 species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop; Syngenta can consider adding these to the label.
Introduction
Pydiflumetofen 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 19 crop safety trials on 18 ornamental horticulture plant species or genera during 2015 and 2016.

Materials and Methods
Pydiflumetofen 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. 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 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, and 4) more data is needed to make informed recommendations.

Phytotoxicity
Across all crops tested, Pydiflumetofen exhibited no or minimal negative impact on all plant species or genera. However none of these crops had the minimum number of 3 tests for definitive conclusion of crop safety. There are 18 species or genera where less than 3 trials were conducted so there is not enough information available at this time (Table 4). All trials for each of these crops showed no or minimal, transitory phytotoxicity.

Please see Table 5 for a summary of the individual trial results.
Table 1. List of Pydiflumetofen treated crops with no or minimal transitory injury.

None

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

None

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

None

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

Alyssum sp.\(^1\)
Antirrhinum majus\(^1\)
Begonia sp.\(^2\)
Calibrachoa sp.\(^1\)
Chrysanthemum/Dendranthema x morifolium\(^1\)
Coreopsis sp.\(^1\)
Dianthus sp.\(^1\)
Gerbera sp.\(^1\)
Impatiens hawkeri\(^1\)
Impatiens walleriana\(^1\)
Lupinus sp.\(^1\)
Osteospermum sp.\(^1\)
Pelargonium x hortorum\(^1\)
Petunia sp.\(^1\)
Salvia sp.\(^1\)
Verbena sp.\(^1\)
Viola sp.\(^1\)
Viola x wittrockiana\(^1\)

\(^1\) No injury in 1 trial
\(^2\) No injury in 2 trials
Table 5  Detailed Summary of Crop Safety Testing with Pydiflumetofen.
Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 1/7/2017 are listed below.

<table>
<thead>
<tr>
<th>PR#</th>
<th>Crop</th>
<th>Production Site</th>
<th>Researcher</th>
<th>State</th>
<th>Year</th>
<th>Application Type</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>32428</td>
<td>Madwort (Alyssum sp.) 'Clear Crystal Lavender'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>No significant injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32437</td>
<td>Snapdragon (Antirrhinum majus) 'Rocket Mix'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32440</td>
<td>Begonia (Begonia sp.) B. semperflorens 'Bada Bing'</td>
<td>Greenhouse</td>
<td>Hausbeck</td>
<td>MI</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32440</td>
<td>Begonia (Begonia sp.) 'Dragon Wing Red'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32436</td>
<td>Calibrachoa (Calibrachoa sp.) 'Kabloom Deep Blue'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32444</td>
<td>Hardy Mum (Chrysanthemum/Dendranthema x morifolium) 'Dark Roonole'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32431</td>
<td>Tickseed (Coreopsis sp.) 'Early Sunrise Yellow'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32427</td>
<td>Pinks (Dianthus sp.) 'Bouquet Rose Magic'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32432</td>
<td>Transvaal Daisy (Gerbera sp.) 'Garvenia Sweet Honey'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32443</td>
<td>New Guinea Impatiens (Impatiens hawkeri) 'Super Sonic Purple'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times; slight leaf yellowing at end of trial.</td>
</tr>
<tr>
<td>32442</td>
<td>Garden Impatiens (Impatiens walleriana) 'Super XP Pink'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32426</td>
<td>Lupine (Lupinus sp.) 'Gallery Blue'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Drench</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal.</td>
</tr>
<tr>
<td>32435</td>
<td>African Daisy (Osteospermum sp.) 'Asti Purple'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32439</td>
<td>Geranium, Zonal (Pelargonium x hortorum) 'Zonal Tango Orange'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32438</td>
<td>Petunia (Petunia sp.) 'Tritunia Blue'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>Slight injury only after 3rd application, with complete recovery, with 13.7, 27.4 and 54.8 fl oz per 100 gal; no growth reduction.</td>
</tr>
<tr>
<td>32429</td>
<td>Sage (Salvia sp.) 'Evolution White'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32433</td>
<td>Vervain (Verbena sp.) 'Lanai Vintage Vodka'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
<tr>
<td>32441</td>
<td>Pansy (Viola sp.) 'Colossus Yellow'</td>
<td>Greenhouse</td>
<td>Freiberger</td>
<td>NJ</td>
<td>2016</td>
<td>Drench</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal.</td>
</tr>
<tr>
<td>PR#</td>
<td>Crop</td>
<td>Production Site</td>
<td>Researcher</td>
<td>State</td>
<td>Year</td>
<td>Application Type</td>
<td>Results</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------------</td>
<td>------------</td>
<td>-------</td>
<td>------</td>
<td>------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>32430</td>
<td>Garden Pansy (Viola x wittrockiana) 'Delta Orange Blotch'</td>
<td>Greenhouse</td>
<td>Bodine</td>
<td>NJ</td>
<td>2015</td>
<td>Foliar</td>
<td>No injury or growth reduction with 13.7, 27.4 and 54.8 fl oz per 100 gal applied 3 times.</td>
</tr>
</tbody>
</table>
Label Suggestions

In this report, all plants exhibited no or minimal injury after foliar treatments of Pydiflumetofen at 13.7, 27.4 and 54.8 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 18 plants in Table 4 (listed below) that showed no injury be placed on the Pydiflumetofen 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 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 to that crop’.

Alyssum sp.
Antirrhinum majus
Begonia sp.
Calibrachoa sp.
Chrysanthemum/Dendranthema x morifolium
Coreopsis sp.
Dianthus sp.
Gerbera sp.
Impatiens hawkeri
Impatiens walleriana
Lupinus sp.
Osteospermum sp.
Pelargonium x hortorum
Petunia sp.
Salvia sp.
Verbena sp.
Viola sp.
Viola x wittrockiana
## Appendix 1: Contributing Researchers

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. Dave Bodine</td>
<td>Rutgers University</td>
<td>Cream Ridge Experiment Station</td>
</tr>
<tr>
<td></td>
<td></td>
<td>283 Rt. 539</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cream Ridge, NJ 08514</td>
</tr>
<tr>
<td>Mr. Tom Freiberger</td>
<td>Rutgers University</td>
<td>Cream Ridge Experiment Station</td>
</tr>
<tr>
<td></td>
<td></td>
<td>283 Rt. 539</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cream Ridge, NJ 08514</td>
</tr>
<tr>
<td>Dr. Mary Hausbeck</td>
<td>Michigan State University</td>
<td></td>
</tr>
<tr>
<td>Mr. Blair Harlan</td>
<td>Dept. of Plant Pathology</td>
<td>140 Plant Pathology Building</td>
</tr>
<tr>
<td></td>
<td></td>
<td>East Lansing, MI 48824</td>
</tr>
<tr>
<td></td>
<td></td>
<td>517-355-4534</td>
</tr>
</tbody>
</table>