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**IR-4 Ornamental Horticulture Program
Benzovindiflupyr + Azoxystrobin Crop Safety**

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Abstract

In 2013 as part of the crop safety screening for new active ingredients and recently registered fungicides, IR-4 started testing Mural WDG (benzovindiflupyr + azoxystrobin) for safety on several ornamental horticulture crops. During 2013 and 2014, the IR-4 Project completed 52 trials on 23 ornamental plant genera or species examining phytotoxicity related to foliar and/or drench applications. In these trials, no injury was observed on any species or genera. If a list of tested plants is placed on the Mural WDG label, 8 of the IR-4 screened plants can be added to the EPA label based on having 3 or more completed trials: *Calibrachoa sp.*, *Camellia sp.*, *Dianthus sp.*, *Helianthus sp.*, *Heuchera sp.*, *Lavandula sp.*, *Monarda sp.*, and *Osteospermum sp.*

Introduction

In 2013 as part of the crop safety screening for new active ingredients and recently registered fungicides, IR-4 started testing Mural WDG (benzovindiflupyr + azoxystrobin) for safety on several ornamental horticulture crops. During 2013 and 2014, the IR-4 Project completed 52 trials on 23 ornamental plant genera or species examining phytotoxicity related to foliar and/or drench applications of Mural WDG.

Materials and Methods

Mural WDG was tested as foliar and drench applications. Foliar applications were applied three times at 14 day intervals. The drench applications were applied once. For foliar applications, the application rates were 4.0, 7.0 and 14.0 oz per 100 gal; for drench applications, the rates were 2.0, 3.0 and 6.0 oz per 100 gal. All experiments had an untreated control. A minimum of 10 plants (replicate treatments) were required. Phytotoxicity was planned to be recorded on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill), although one research used a 1 to 10 scale instead. Phytotoxicity was rate 7 days after each application. For testing, the following protocols were used: 13-010, 13-011, and 14-003. Please visit <http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm> to view and download these protocols.

Mural WDG was provided by Syngenta. See list of researchers in Appendix 1.

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 sufficient to recommend growers not utilize benzovindiflupyr + azoxystrobin.

Phytotoxicity

Across all plant species tested, benzovindiflupyr + azoxystrobin exhibited no or minimal negative impact (Table 1) on 8 plant genera or species fell into this category. No crops exhibited significant injury (Table 3). There are 15 species or genera where less than 3 trials were conducted for either foliar or drench applications 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 benzovindiflupyr + azoxystrobin treated crops with no or minimal transitory injury.

Calibrachoa sp.
Camellia sp.
Dianthus sp.
Helianthus sp.

Heuchera sp.
Lavandula sp.
Monarda sp.
Osteospermum sp.

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

None

Table 3. List of benzovindiflupyr + azoxystrobin treated crops with significant injury at 1X.

None

Table 4. List of benzovindiflupyr + azoxystrobin treated crops where more information is needed.

Abies sp.
Aglaonema sp.
Aquilegia sp.
Aster sp.
Berberis sp.
Buddleia davidii
Buxus sp.
Hibiscus sp.

Hydrangea sp.
Juniperus sp.
Phlox sp.
Pseudotsuga menziesii
Raphiolepis indica
Salvia officinalis
Scindapsus aureaus

Table 5 Detailed Summary of Crop Safety Testing with Benzovindiflupyr + azoxystrobin

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 5/8/2015 are listed below.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
31502	Fir (Abies sp.) A. balseama	Field Container	Brazee	MA	2013	Foliar	No injury with 4, 7 and 14 fl oz per 100 gal applied 3 times; minor height reduction with 4X.
31502	Fir (Abies sp.) Abies procera	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31503	Aglaonema (Aglaonema sp.) 'Silver Queen'	Field Container	Gu (TX A&M)	TX	2013	Foliar	No injury or growth reduction with X4602B at 4, 7 and 14 fl oz per 100 gal applied 3 times.
31751	Columbine (Aquilegia sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal; all plants saleable.
31751	Columbine (Aquilegia sp.) A. canadensis 'Little Lanterns'	Field Container	Catlin	NY	2014	Foliar	No injury or significant growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times; slight spray residue after 3rd application.
31593	Aster (Aster sp.) 'Believe Purple'	Field Container	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31511	Barberry (Berberis sp.)	Field Container	Harvey	WA	2013	Drench	No injury with 2, 3 and 6 oz per 100 gal.
31511	Barberry (Berberis sp.) B. thunbergii 'Aurea'	Field Container	Wade	SC	2013	Drench	No injury or growth reduction with 2, 3 and 6 oz per 100 gal applied 3 times; all plants marketable.
31752	Butterfly Bush (Buddleia davidii)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal; all plants saleable.
31752	Butterfly Bush (Buddleia davidii)	Field Container	Harvey	WA	2014	Foliar	No injury with 4, 7 and 14 oz per 100 gal applied 3 times.
31512	Boxwood (Buxus sp.) B. microphylla japnica 'Winter Gem'	Field Container	Fraelich	GA	2013	Drench	No injury or growth reduction at 4, 7, and 14 oz per 100 gal.
31706	Calibrachoa (Calibrachoa sp.)	Greenhouse	Williams	IL	2013	Drench	No injury with 4, 7 and 14 fl oz per 100 gal applied 3 times at monthly intervals slight width reduction at 4X.
31706	Calibrachoa (Calibrachoa sp.)	Greenhouse	Williams	IL	2013	Foliar	No injury or growth reduction with 4, 7 and 14 fl oz per 100 gal applied 3 times at monthly intervals.
31706	Calibrachoa (Calibrachoa sp.) 'Cabaret Purple'	Greenhouse	Williams-Woodward	GA	2013	Foliar	No significant injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31706	Calibrachoa (Calibrachoa sp.) Kabloom White	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times
31504	Camellia (Camellia sp.) C. japonica 'Elena'	Field Container	Henn	MS	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31504	Camellia (Camellia sp.) 'ShiShi Gashira'	Field Container	Wade	SC	2013	Drench	No injury or growth reduction with 2, 3 and 6 oz per 100 gal applied 3 times; all plants marketable.
31504	Camellia (Camellia sp.) 'ShiShi Gashira'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times; all plants marketable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
31754	Pinks (Dianthus sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal; all plants saleable.
31754	Pinks (Dianthus sp.) D. chinensis 'First Love'	Field Container	DeFrancesco	OR	2014	Foliar	No injury with 4, 7 and 14 oz per 100 gal applied 3 times; slight to moderate growth reduction.
31754	Pinks (Dianthus sp.) D. gratianopolitanus 'Firewitch'	Field Container	Hausbeck	MI	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times; visible spray residue on treated plants.
31505	Sunflower (Helianthus sp.)	Field Container	Grunwald	OR	2014		No injury or growth reduction with 4, 7 and 14 oz per 100 gal; all plants saleable.
31505	Sunflower (Helianthus sp.)	Field Container	Harvey	WA	2013	Drench	No injury with 2, 3 and 6 oz per 100 gal.
31505	Sunflower (Helianthus sp.)	Field Container	Harvey	WA	2013	Foliar	No injury with 4, 7 and 14 oz per 100 gal applied 3 times.
31505	Sunflower (Helianthus sp.) 'Table Mountain'	Field Container	Gu (TX A&M)	TX	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31506	Alumroot (Heuchera sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal; all plants saleable.
31506	Alumroot (Heuchera sp.)	Field Container	Harvey	WA	2013	Drench	No injury with 2, 3 and 6 oz per 100 gal.
31506	Alumroot (Heuchera sp.)	Field Container	Harvey	WA	2013	Foliar	No injury with 4, 7 and 14 oz per 100 gal applied 3 times.
31506	Alumroot (Heuchera sp.) H. americana 'Electra'	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31507	Mallow, Rose Mallow (Hibiscus sp.) 'Disco Belle Rosy Red'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times; all plants marketable.
31507	Mallow, Rose Mallow (Hibiscus sp.) H. trionum 'Simply Love'	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31755	Hydrangea (Hydrangea sp.)	Field Container	Harvey	WA	2014	Foliar	No injury with 4, 7 and 14 oz per 100 gal applied 3 times.
31755	Hydrangea (Hydrangea sp.) H. macrophylla 'Nikko Blue'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31513	Juniper (Juniperus sp.)	Field Container	Harvey	WA	2013	Drench	No injury with 2, 3 and 6 oz per 100 gal.
31760	Lavender (Lavandula sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal; all plants saleable.
31760	Lavender (Lavandula sp.)	Field Container	Harvey	WA	2014	Foliar	No injury with 4, 7 and 14 oz per 100 gal applied 3 times.
31760	Lavender (Lavandula sp.) L. angustifolia 'Munstead'	Field Container	Hausbeck	MI	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31760	Lavender (Lavandula sp.) L. x intermedia 'Grosso'	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31757	Bee Balm (Monarda didyma)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal; all plants saleable.

PR#	Crop	Production Site	Researcher	State	Year	Application Type	Results
31757	Bee Balm (<i>Monarda didyma</i>) 'Marshal's Delight'	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31757	Bee Balm (<i>Monarda didyma</i>) 'Pink Supreme'	Field Container	Gu (TX A&M)	TX	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31508	African Daisy (<i>Osteospermum</i> sp.)	Greenhouse	Williams	IL	2013	Foliar	No injury or growth reduction with 4, 7 and 14 fl oz per 100 gal applied 3 times at monthly intervals.
31508	African Daisy (<i>Osteospermum</i> sp.) 'Akila'	Greenhouse	Freiberger	NJ	2014	Drench	No injury or growth reduction with 2, 3 and 6 oz per 100 gal.
31508	African Daisy (<i>Osteospermum</i> sp.) 'Akila'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31508	African Daisy (<i>Osteospermum</i> sp.) <i>O. ecklonis</i> 'Summertime Blueberry'	Greenhouse	DeFrancesco	OR	2013	Drench	No injury or growth reduction with 2, 3 and 6 oz per 100 gal.
31758	Phlox, Perennial (<i>Phlox paniculata</i>)	Field Container	Harvey	WA	2014	Foliar	No injury with 4, 7 and 14 oz per 100 gal applied 3 times.
31509	Fir, Douglas (<i>Pseudotsuga menziesii</i>)	Greenhouse	Grunwald	OR	2013	Drench	No injury or growth reduction with 2, 3 and 6 fl oz per 100 gal; all plants marketable.
31510	Indian Hawthorn (<i>Raphiolepis indica</i>) 'Alba'	Field Container	Wade	SC	2013	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times; all plants marketable.
31510	Indian Hawthorn (<i>Raphiolepis indica</i>) <i>R. umbellata</i> 'Southern Moon Yedda'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.
31514	Sage, common (<i>Salvia officinalis</i>)	Field Container	Wade	SC	2013	Drench	No injury or growth reduction with 2, 3 and 6 oz per 100 gal applied 3 times; all plants marketable.
31594	Pothos, Epipremnum (<i>Scindapsus aureus</i>)	Greenhouse	Catlin	NY	2013	Drench	No injury or growth reduction with 2, 3 and 6 oz per 100 gal.
31594	Pothos, Epipremnum (<i>Scindapsus aureus</i>)	Greenhouse	Gu (TX A&M)	TX	2014	Foliar	No injury or growth reduction with 4, 7 and 14 oz per 100 gal applied 3 times.

Label Suggestions

In this report, all 23 species or genera exhibited minimal or no injury after foliar and/or drench treatments of benzovindiflupyr + azoxystrobin. If a list of tested plants is placed on the Mural WDG label, 8 of the IR-4 screened plants can be added to the EPA label based on having 3 or more completed trials:

Calibrachoa sp.

Camellia sp.

Dianthus sp.

Helianthus sp.

Heuchera sp.

Lavandula sp.

Monarda sp.

Osteospermum sp.

Appendix 1: Contributing Researchers

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