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**IR-4 Ornamental Horticulture Program
Orkestra (Fluxapyroxad + Pyraclostrobin) Crop Safety**

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Acknowledgements

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Abstract

The IR-4 Project screens new active ingredients for potential deleterious impacts to aid growers in selection of appropriate disease management tools for their crops. During 2014 and 2015, IR-4 completed 42 trials on 22 ornamental plant species examining phytotoxicity related to foliar applications of Orkestra (fluxapyroxad + pyraclostrobin). In these trials, 4 species or genera exhibited minimal or no injury after foliar applications in a minimum of 3 trials for each crop; these can be added to a list of tolerant plants in the new label for this active ingredient. All trials for sixteen other species or genera exhibited minimal or no injury in the limited number of trials (one or two) for each crop; BASF can consider adding these to the label.

Introduction

The IR-4 Project screens new active ingredients for potential deleterious impacts to aid growers in selection of appropriate disease management tools for their crops. During 2014 and 2015, IR-4 completed 42 trials on 22 ornamental plant species examining phytotoxicity related to foliar applications of Orkestra (fluxapyroxad + pyraclostrobin).

Materials and Methods

Orkestra was tested applied as foliar treatment typically 3 times at approximately 14 days intervals. The application rates were 8, 16 and 32 fl oz per 100 gal, plus a water treated control. A minimum of six plants (replicate treatments) were required. Phytotoxicity was rated 7 days after each application using a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill). The following protocols were used: 14-003 and 15-003. 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.

Orkestra was supplied to researchers (See list of researchers in Appendix 1) by BASF.

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 sufficient to recommend growers not utilize fluxapyroxad + pyraclostrobin, and 4) more data is needed to make informed recommendations.

Phytotoxicity

Across all plant species tested, Orkestra caused no or minimal negative impact on 4 plant species or genera (Table 1). Only one plant species (*Cornus florida*) exhibited significant injury in one study (Table 2). No crops exhibited significant injury at 1x (Table 3). 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 16 of these crops showed no or minimal, transitory phytotoxicity.

Please see Table 5 for a list of research and a summary of the individual trial results with Orkestra.

Table 1. List of Orkestra treated crops with no or minimal transitory injury.

Dianthus sp.
Pinus sp.
Verbena sp.
Zinnia sp.

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

*Cornus florida*¹

¹ Injury observed was in the form of discolored and distorted leaves.

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

None

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

<i>Aquilegia sp.</i> ¹	<i>Osteospermum sp.</i> ¹
<i>Catharanthus roseus</i> ¹	<i>Pelargonium x hortorum</i> ¹
<i>Coreopsis sp.</i> ¹	<i>Picea sp.</i> ¹
<i>Cornus amomum</i> ¹	<i>Pseudotsuga menziesii</i> ¹
<i>Hemerocallis sp.</i>	<i>Rosa sp.</i> ¹
<i>Hydrangea macrophylla</i> ¹	<i>Salvia sp.</i> ¹
<i>Impatiens hawkeri</i> ¹	<i>Ulmus sp.</i>
<i>Lantana sp.</i> ¹	<i>Vinca sp.</i> ¹
<i>Lupinus sp.</i> ¹	<i>Viola x wittrockiana</i> ¹

¹ For these plants, the one or two trials presented here indicate no phytotoxicity or slight, transient injury, but these findings need to be confirmed.

Table 5 Detailed Summary of Crop Safety Testing with Orkestra (fluxapyroxad + pyraclostrobin)

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 3/16/2016 are listed below.

PR#	Product (Active Ingredients)	Crop	Production Site	Researcher	State	Year	Application Type	Results
31765	Orkestra (Fluxapyroxad + pyraclostrobin)	Columbine (<i>Aquilegia</i> sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
31765	Orkestra (Fluxapyroxad + pyraclostrobin)	Columbine (<i>Aquilegia</i> sp.) <i>A. canadensis</i> 'Little Lanterns'	Field Container	Catlin	NY	2014	Foliar	No injury or significant growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times; unacceptable spray residue at 2X and 4X after 3rd application.
32214	Orkestra (Fluxapyroxad + pyraclostrobin)	Rose Periwinkle (<i>Catharanthus roseus</i>) 'Cora Burgundy'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times; no delay in blooming.
32416	Orkestra (Fluxapyroxad + pyraclostrobin)	Tickseed (<i>Coreopsis</i> sp.) 'Early Sunrise Yellow'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31772	Orkestra (Fluxapyroxad + pyraclostrobin)	Dogwood (<i>Cornus</i> sp.) <i>C. amomum</i>	Field Container	Brazeo	MA	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31772	Orkestra (Fluxapyroxad + pyraclostrobin)	Dogwood (<i>Cornus</i> sp.) <i>C. florida</i>	Field Container	Reding	OH	2015	Foliar	Moderate to high injury increasing with rates (8, 16 and 32 fl oz per 100 gal) applied 3 times; no growth reduction but 4X treated plants not marketable.
31761	Orkestra (Fluxapyroxad + pyraclostrobin)	Pinks (<i>Dianthus</i> sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
31761	Orkestra (Fluxapyroxad + pyraclostrobin)	Pinks (<i>Dianthus</i> sp.) <i>D. chinensis</i> 'First Love'	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31761	Orkestra (Fluxapyroxad + pyraclostrobin)	Pinks (<i>Dianthus</i> sp.) <i>D. gratianopolitanus</i> 'Firewitch'	Field Container	Hausbeck	MI	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times; visible spray residue on treated plants.
31761	Orkestra (Fluxapyroxad + pyraclostrobin)	Pinks (<i>Dianthus</i> sp.) 'Neon Star'	Field Container	Hand	OH	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31766	Orkestra (Fluxapyroxad + pyraclostrobin)	Daylily (<i>Hemerocallis</i> sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.

PR#	Product (Active Ingredients)	Crop	Production Site	Researcher	State	Year	Application Type	Results
31766	Orkestra (Fluxapyroxad + pyraclostrobin)	Daylily (Hemerocallis sp.)	Field Container	Reding	OH	2015	Foliar	No injury with 8, slight and moderate with 16 and 32 fl oz per 100 gal applied 3 times; good recovery, with all plants marketable at end of trial.
31767	Orkestra (Fluxapyroxad + pyraclostrobin)	Hydrangea (Hydrangea sp.) H. macrophylla 'Nikko Blue'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31767	Orkestra (Fluxapyroxad + pyraclostrobin)	Hydrangea (Hydrangea sp.) H. macrophylla 'Robert'	Field Container	DeFrancesco	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
32413	Orkestra (Fluxapyroxad + pyraclostrobin)	New Guinea Impatiens (Impatiens hawkeri) 'Harmony Deep Red'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31769	Orkestra (Fluxapyroxad + pyraclostrobin)	Shrub Verbena (Lantana sp.) 'Chapel Hill Yellow'	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
32418	Orkestra (Fluxapyroxad + pyraclostrobin)	Lupine (Lupinus sp.) 'Gallery Mix'	Greenhouse	Bodine	NJ	2015	Foliar	No significant injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
32215	Orkestra (Fluxapyroxad + pyraclostrobin)	African Daisy (Osteospermum sp.) 'Summertime Blueberry'	Greenhouse	Freiberger	NJ	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
32417	Orkestra (Fluxapyroxad + pyraclostrobin)	Geranium, Zonal (Pelargonium x hortorum) 'Maverick Violet'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31778	Orkestra (Fluxapyroxad + pyraclostrobin)	Spruce (Picea sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
31778	Orkestra (Fluxapyroxad + pyraclostrobin)	Spruce (Picea sp.) P. glauca	Field Container	Brazee	MA	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31777	Orkestra (Fluxapyroxad + pyraclostrobin)	Pine (Pinus sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
31777	Orkestra (Fluxapyroxad + pyraclostrobin)	Pine (Pinus sp.) P. taeda	Field Container	Fraelich	GA	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31777	Orkestra (Fluxapyroxad + pyraclostrobin)	Pine (Pinus sp.) P. taeda	Field Container	Henn	MS	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.

PR#	Product (Active Ingredients)	Crop	Production Site	Researcher	State	Year	Application Type	Results
31774	Orkestra (Fluxapyroxad + pyraclostrobin)	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Brazeo	MA	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31774	Orkestra (Fluxapyroxad + pyraclostrobin)	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
31768	Orkestra (Fluxapyroxad + pyraclostrobin)	Rose (Rosa sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
32415	Orkestra (Fluxapyroxad + pyraclostrobin)	Sage (Salvia sp.) 'New Dimension Blue'	Greenhouse	Bodine	NJ	2015	Foliar	No significant injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31773	Orkestra (Fluxapyroxad + pyraclostrobin)	Elm (Ulmus sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
31773	Orkestra (Fluxapyroxad + pyraclostrobin)	Elm (Ulmus sp.) U. parvifolia	Field Container	Henn	MS	2014	Foliar	Slight injury (bleaching/interveinal chlorosis) with 8, 16 and 32 fl oz per 100 gal applied 3 times; no significant growth reduction.
31773	Orkestra (Fluxapyroxad + pyraclostrobin)	Elm (Ulmus sp.) U. parvifolia	Field Container	Uber	CA	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31763	Orkestra (Fluxapyroxad + pyraclostrobin)	Vervain (Verbena sp.)	Field Container	Harvey	WA	2015	Foliar	No injury or growth reduction with 8, moderate and severe with 16 and 32 fl oz per 100 gal, applied 3 times.
31763	Orkestra (Fluxapyroxad + pyraclostrobin)	Vervain (Verbena sp.) V. hastata	Field Container	Catlin	NY	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31763	Orkestra (Fluxapyroxad + pyraclostrobin)	Vervain (Verbena sp.) 'Lanai Premium Twister Amethyst'	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.; all plants marketable.
31770	Orkestra (Fluxapyroxad + pyraclostrobin)	Periwinkle (Vinca sp.)	Field Container	Harvey	WA	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31770	Orkestra (Fluxapyroxad + pyraclostrobin)	Periwinkle (Vinca sp.) V. maculata	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.; all plants marketable.
32411	Orkestra (Fluxapyroxad + pyraclostrobin)	(Viola x wittrockiana) 'Delta Orange Blotch'	Greenhouse	Bodine	NJ	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.

PR#	Product (Active Ingredients)	Crop	Production Site	Researcher	State	Year	Application Type	Results
31764	Orkestra (Fluxapyroxad + pyraclostrobin)	Zinnia (Zinnia sp.)	Field Container	Grunwald	OR	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal; all plants saleable.
31764	Orkestra (Fluxapyroxad + pyraclostrobin)	Zinnia (Zinnia sp.) 'Dreamland Red'	Field Container	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.
31764	Orkestra (Fluxapyroxad + pyraclostrobin)	Zinnia (Zinnia sp.) 'Envy'	Field Container	Catlin	NY	2014	Foliar	No injury or significant growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times; unacceptable spray residue at 4X after 3rd application.
31764	Orkestra (Fluxapyroxad + pyraclostrobin)	Zinnia (Zinnia sp.) 'Profusion Cherry'	Field Container	Reding	OH	2015	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times.; all plants marketable.
32217	Orkestra (Fluxapyroxad + pyraclostrobin)	Zinnia (Zinnia sp.) 'Profusion Cherry'	Greenhouse	Freiberger	NJ	2014	Foliar	No injury or growth reduction with 8, 16 and 32 fl oz per 100 gal applied 3 times; no delay in blooming.

Label Suggestions

In this report, 4 species or genera exhibited no or minimal injury after foliar treatments of Orkestra (fluxapyroxad + pyraclostrobin) at 8, 16 and 32 fl oz per 100 gal. These can be included in a future label: *Dianthus sp.*, *Pinus sp.*, *Verbena sp.*, and *Zinnia sp.*

Given the lack of phytotoxicity across so many different plant species and genera, it is suggested that all the 16 plants in Table 4 (listed below) that showed no injury be placed on the Orkestra label if BASF have similar results on these crops. Or a general statement can be placed on the label such as ‘Orkestra has not been demonstrated to cause damage on various ornamental plant species according to labeled use instructions. Orkestra 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 Orkestra to that crop’.

Aquilegia sp.

Catharanthus roseus

Coreopsis sp.

Cornus amomum

Hydrangea macrophylla

Impatiens hawkeri

Lantana sp.

Lupinus sp.

Osteospermum sp.

Pelargonium x hortorum

Picea sp.

Pseudotsuga menziesii

Rosa sp.

Salvia sp.

Vinca sp.

Viola x wittrockiana

Appendix 1: Contributing Researchers

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