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**IR-4 Ornamental Horticulture Program
Adorn (Fluopicolide) Crop Safety**

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**Acknowledgements
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Abstract

Fluopicolide was registered as Adorn 4SC in the United States in 2008 for control of Pythium, Phytophthora and downy mildew in ornamental plants. State registrations in California and New York occurred in 2010 and 2011, respectively. Adorn 4SC may be applied on container, bench, or bed grown ornamentals in greenhouses, lathouses, shadehouses or outdoor landscapes, and on conifers including Christmas trees in outdoor landscapes. The commercial label contains a list of 22 ornamental plants exhibiting no or minimal injury. During 2008 to 2010, the IR-4 Project completed 76 trials on 38 ornamental plant species examining phytotoxicity related to drench and foliar applications of Adorn 4SC. In all trials except one, treated plants exhibited minimal or no injury to drench and foliar applications. Sufficient trials showed 9 species or genera exhibiting minimal or no injury. Of these, 3 are already on the Adorn label; *Acer palmatum*, *Begonia sp.*, *Calibrachoa sp.*, *Juniperus sp.*, *Petunia sp.*, and *Vinca sp.* are the six crops not yet listed. Based on this information, it is recommended that these be added to the list of tolerant plants on the Adorn 4SC label.

Introduction

Fluopicolide was registered as Adorn 4SC in the United States in 2008 for control of Pythium, Phytophthora and downy mildew in ornamental plants. State registrations in California and New York occurred in 2010 and 2011, respectively. It may be used on container, bench, or bed grown ornamentals in greenhouses, lathouses, shadehouses or outdoor landscapes, and on conifers including Christmas trees in outdoor landscapes. The commercial label contains a list of 22 ornamental plants exhibiting no or minimal injury. During 2008 to 2010, the IR-4 Project completed 76 trials on 38 ornamental plant species examining phytotoxicity related to drench and foliar applications of Adorn 4SC, also known as the code number V-10161.

Materials and Methods

Adorn 4SC was tested applied as drench twice at approximately 4 weeks intervals or as foliar treatment 5 times) at approximately 7 days intervals. The application rates were 1, 2 and 4 fl oz per 100 gal, plus a water treated control. A minimum of 3 replicates, three plants per replicate, were required. Phytotoxicity was planned to be recorded on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill). Phytotoxicity was rated 1, 2 and 4 weeks after each application. For more detailed materials and methods, please see protocols at <http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm>

Adorn was supplied to researchers (See list of researchers in Appendix 1) by Valent.

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 Adorn, and 4) More trials are needed to clarify response.

Phytotoxicity

Across all plant species tested, Adorn 4SC exhibited no or minimal negative impact on nine plant genera or species (Table 1). No plants exhibited significant injury (Tables 2 and 3). There are 29 species or genera where less than 3 trials were conducted so there is not enough information available at this time (Table 4). Of these, only one trial with *Abies sp.* showed significant injury.

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

Table 1. List of Adorn 4SC treated crops with no or minimal transitory injury.

<i>Acer palmatum</i>	<i>Juniperus sp.</i>
<i>Begonia sp.</i>	<i>Petunia sp.</i>
<i>Calibrachoa sp.</i>	<i>Rhododendron sp.</i> ¹
<i>Camellia sp.</i> ¹	<i>Vinca sp.</i> ¹
<i>Geranium sp.</i> ¹	

¹ Already registered

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

None

Table 3. List of Adorn 4SC treated crops with significant injury at 1X.

None

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

<i>Abies balsamea</i>	<i>Syringa reticulata</i>
<i>Abies fraseri</i>	<i>Syringa vulgaris</i>
<i>Abies grandis</i>	<i>Syringa sp.</i>
<i>Abies sp.</i>	<i>Taxus baccata</i>
<i>Acer rubrum</i>	<i>Taxus brevifolia</i>
<i>Cotoneaster dammeri</i>	<i>Taxus x media</i>
<i>Ficus benjamina</i>	<i>Taxus sp.</i>
<i>Malus sp.</i> ¹	<i>Thuja occidentalis</i>
<i>Picea sp.</i>	<i>Thuja plicata</i>
<i>Pinus ponderosa</i>	<i>Thuja sp.</i>
<i>Quercus alba</i>	<i>Viburnum dentatum</i>
<i>Quercus garryana</i>	<i>Viburnum opulus</i>
<i>Rosa sp.</i>	<i>Viburnum plicatum</i>
<i>Salvia sp.</i>	<i>Viburnum sp.</i>
<i>Syringa chinensis</i>	

¹ Crabapple already registered

Table 5 Detailed Summary of Crop Safety Testing with Adorn 4SC (fluopicolide)

Notes: Table entries are sorted by crop Latin name. Only those trials with research reports received by 7/1/2011 are listed below.

PR #	Crop	Production Site	Researcher	Year	Application Type	Results	File Name
27430	Fir (Abies sp.) A. balsamea	Field Container	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27430	Fir (Abies sp.) A. fraseri	Field Container	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27430	Fir (Abies sp.) A. grandis	Field Container	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27430	Fir (Abies sp.) A. grandis	Field Container	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27430	Fir (Abies sp.) Fir Idaho Grand	Field Container	Harvey	2009		Severe injury (some plants dead) at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27799	Maple, Japanese (Acer palmatum) 'Atropurpureum'	Field Container	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27799	Maple, Japanese (Acer palmatum) 'Bloodgood'	Field Container	Pscheidt	2010	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal.	20101206b.pdf
27799	Maple, Japanese (Acer palmatum) Maple Japanese	Field Container	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27800	Maple, Red (Acer rubrum)	Field Container	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27800	Maple, Red (Acer rubrum) 'Franks Red'	Field Container	Pscheidt	2010	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal.	20101206b.pdf
27433	Begonia (Begonia sp.)	Greenhouse	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27433	Begonia (Begonia sp.) B. semperflorens	Greenhouse	Fraelich	2009	Drench	No injury at 1, 2 and 4 fl oz per 100 gal; very slight stunting at 4X; all plants marketable.	20091231f.pdf
27433	Begonia (Begonia sp.) B. semperflorens	Greenhouse	Hausbeck	2009	Drench	No injury at 1, 2 and 4 fl oz per 100 gal.	20091116a.pdf
27433	Begonia (Begonia sp.) Begonia	Greenhouse	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27433	Begonia (Begonia sp.) 'Olympia Red'	Greenhouse	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27433	Begonia (Begonia sp.) 'Vodka Bright Red'	Greenhouse	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27434	Calibrachoa (Calibrachoa sp.)	Greenhouse	Fraelich	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants marketable.	20091231f.pdf
27434	Calibrachoa (Calibrachoa sp.)	Greenhouse	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27434	Calibrachoa (Calibrachoa sp.) Calibrachoa	Greenhouse	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27434	Calibrachoa (Calibrachoa sp.) 'Cherry Pink'	Greenhouse	Hausbeck	2009	Drench	No injury at 1, 2 and 4 fl oz per 100 gal	20091116a.pdf
27435	Camellia (Camellia sp.) 'April Dawn'	Field Container	Pscheidt	2010	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal.	20101206b.pdf

PR #	Crop	Production Site	Researcher	Year	Application Type	Results	File Name
27435	Camellia (Camellia sp.) C. japonica 'Eg Waterhouse'	Field Container	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27435	Camellia (Camellia sp.) 'Magnoliaeflora'	Field Container	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27802	Cotoneaster (Cotoneaster sp.) C. dammeri 'Coral Beauty'	Field Container	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27440	Leatherleaf Fig (Ficus sp.) F. benjamina	Greenhouse	Fraelich	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants marketable.	20091231f.pdf
27441	Geranium (Geranium sp.)	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27441	Geranium (Geranium sp.) 'Brookside'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27441	Geranium (Geranium sp.) 'Maverick Red'	TBD	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27441	Geranium (Geranium sp.) 'Orbit Red'	TBD	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27443	Juniper (Juniperus sp.) J. procumbens 'Nana'	TBD	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27443	Juniper (Juniperus sp.) J. sabina 'Broadmoor'	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27443	Juniper (Juniperus sp.) J. scopolorum 'Moonglow'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27443	Juniper (Juniperus sp.) Juniper	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27804	Apple & Crabapple (Non-Bearing) (Malus sp.) 'Spring Snow'	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27445	Geranium (Pelargonium sp.)	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27445	Geranium (Pelargonium sp.) Geranium	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27445	Geranium (Pelargonium sp.) P. x hortorum	TBD	Fraelich	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants marketable.	20091231f.pdf
27445	Geranium (Pelargonium sp.) P. x hortorum 'Rocky Mountain Red'	TBD	Hausbeck	2009	Drench	No injury at 1, 2 and 4 fl oz per 100 gal	20091116a.pdf
27446	Petunia (Petunia sp.)	TBD	Fraelich	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants marketable.	20091231f.pdf
27446	Petunia (Petunia sp.)	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27446	Petunia (Petunia sp.) 'Dream Red'	TBD	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27446	Petunia (Petunia sp.) 'Madness Red'	TBD	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27446	Petunia (Petunia sp.) P. x hybrida	TBD	Hausbeck	2009	Drench	No injury at 1, 2 and 4 fl oz per 100 gal	20091116a.pdf
27446	Petunia (Petunia sp.) Petunia	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27805	Spruce (Picea sp.) P. sitkensis	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27803	Pine (Pinus sp.) P. ponderosa	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27449	Oak (Quercus sp.) Q. alba	TBD	Freiberger	2008	Drench	All plants were infected with powdery mildew which complicated assessments.	20090319e.pdf

PR #	Crop	Production Site	Researcher	Year	Application Type	Results	File Name
27449	Oak (Quercus sp.) Q. alba	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27449	Oak (Quercus sp.) Q. garryana	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27450	Azalea, & Rhododendron (Rhododendron sp.) 'Lees Dark Purple'	TBD	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27450	Azalea, & Rhododendron (Rhododendron sp.) 'Nova Zembla'	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27450	Azalea, & Rhododendron (Rhododendron sp.) R. catawbiense 'Boursault'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27450	Azalea, & Rhododendron (Rhododendron sp.) 'White'	TBD	Freiberger	2008	Drench	No injury with drench at 1, 2, and 4 oz per 100 gal.	20090319e.pdf
27806	Rose (Rosa sp.) 'Nutmans'	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27807	Sage, Ramona (Salvia sylvestris) S. officinalis	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27453	Lilac (Syringa sp.) Lilac	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27453	Lilac (Syringa sp.) S. chinesis 'Lilac Sunday'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27453	Lilac (Syringa sp.) S. reticulata	TBD	Freiberger	2008	Drench	All plants were infected with powdery mildew which complicated assessments.	20090319e.pdf
27453	Lilac (Syringa sp.) S. vulgaris 'President Grevy'	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27453	Lilac (Syringa sp.) 'Tinkerbelle'	TBD	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27455	Yew (Taxus sp.) T. baccata 'Repandens'	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27455	Yew (Taxus sp.) T. brevifolia	TBD	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27455	Yew (Taxus sp.) T. x media 'Bonnie Green Mound'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27455	Yew (Taxus sp.) Yew	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27456	Arborvitae (Thuja sp.) Arborvitae	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27456	Arborvitae (Thuja sp.) T. occidentalis 'Emerald Green'	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27456	Arborvitae (Thuja sp.) T. occidentalis 'Woodwardii'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27456	Arborvitae (Thuja sp.) T. plicata	TBD	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27457	Arrowwood (Viburnum sp.) Arrowwood	TBD	Harvey	2009	Drench	No significant injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27457	Arrowwood (Viburnum sp.) V. dentatum	TBD	Grunwald	2008	Foliar	No injury at 1, 2 and 4 fl oz per 100 gal	20090825a.pdf
27457	Arrowwood (Viburnum sp.) V. opulus 'Compactum'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf

PR #	Crop	Production Site	Researcher	Year	Application Type	Results	File Name
27457	Arrowwood (Viburnum sp.) V. plicatum tomentosum 'Mariesii'	TBD	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf
27458	Periwinkle (Vinca sp.) 'Cooler Pink'	TBD	Hausbeck	2009	Drench	No injury at 1, 2 and 4 fl oz per 100 gal	20091116a.pdf
27458	Periwinkle (Vinca sp.) 'Illumination'	TBD	Reding	2009	Drench	No injury and no significant difference in growth or marketability with 1, 2 and 4 fl oz per 100 gal.	20091130l.pdf
27458	Periwinkle (Vinca sp.) Periwinkle	TBD	Harvey	2009	Drench	No injury at 1, 2 and 3 fl oz per 100 gal.	20100208a.pdf
27458	Periwinkle (Vinca sp.) V. minor 'Bowles'	TBD	Grunwald	2009	Drench	No injury or growth reduction at 1, 2 and 4 fl oz per 100 gal; all plants saleable.	20100412c.pdf

Label Suggestions

In this report, 9 species or genera exhibited minimal or no injury after drench or foliar treatments of Adorn 4SC (fluopicolide) at 1, 2 and 4 fl oz per 100 gal. Of these, *Acer palmatum*, *Begonia sp.*, *Calibrachoa sp.*, *Juniperus sp.*, *Petunia sp.*, and *Vinca sp.* can be added to the EPA label.

Appendix 1: Contributing Researchers

Mr. Ben Fraelich	USDA-ARS CPES P.O. Box 748 Tifton, GA 31793
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Dr. Mary Hausbeck	Michigan State University Dept. of Plant Pathology 140 Plant Pathology Building East Lansing, MI 48824
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Dr. Michael Reding	Horticultural Insects Lab USDA-ARS 1680 Madison Ave. Wooster, OH, 44691

Appendix 2: Submitted Data

Researcher reports included in the printed copy of this report are only those received prior to 7/1/2011. Reports on following pages are in order by the last name of the researchers for grouped reports and then by PR Number for those reported on individually.