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**IR-4 Ornamental Horticulture Program
Flumioxazin + Pyroxasulfone Crop Safety**

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Abstract

Between 2013 and 2015, IR-4 conducted twenty-seven (27) trials evaluating V-10336 61.5 WG and V-10233 76 WG (flumioxazin + pyroxasulfone) for crop safety. The data contained in this report was generated to register the use of this active ingredient combination with directed spray applications around ornamental horticulture plants. The rates tested were either 0.35, 0.71 and 1.42 pounds active ingredient per acre (lb ai per A) or 0.29, 0.58 and 1.15 lb ai per A as the 1X, 2X and 4X rates.

V-10336 and V-10233 were applied to twenty-three (23) plant species or genera. One genus (*Cornus* spp.) exhibited no or minimal transient injury in 3 trials across both formulations. None of the tested species exhibited injury or growth reduction at either the 2X or 4X rate with the exception of *Cercis canadensis* which exhibited moderate injury at all rates and stunting at 2X. Further testing is required before a conclusion can be made confirming crop safety on these crops.

Introduction

Non-phytotoxic and effective residual control of broadleaved weeds and grasses in the production of woody perennials can be problematic because nurseries grow many different types of plants, and not all genera or species are listed on labels. Some weeds may also be difficult to control in landscape settings for the same reason. Between 2013 and 2015, the IR-4 Project has conducted -- trials evaluating V-10233 76 WG and V-10336 61.5 WG as directed spray applications on and around ornamental horticulture plants. The data contained in this summary report were generated to help register the use of a premix combination of flumioxazin + pyroxasulfone.

Materials and Methods

For V-10233, one directed spray was made at rates of 0.35, 0.71 and 1.42 lb ai/A in 2013 and 2015. One directed spray of V-10336 was made at 0.29, 0.58 or 1.15 lb ai/A in 2013 and at 0.35, 0.71 or 1.42 lb ai/A in 2015. Both formulations contained the same amount of flumioxazin but different concentrations of pyroxasulfone. A minimum of four plants (replicate treatments) were required with many researchers exceeding this minimum. Phytotoxicity was recorded using a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill) at approximately 1, 2, and 4, weeks after application. Plant size was also evaluated for several species at the time of the first application and again at the time of the last evaluation. The protocol used was 13-022. For more detailed materials and methods, please see Protocols at <http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm>.

V-10233 76 WG and V-10336 61.5 WG were supplied to researchers (See list of researchers in Appendix 1) by Valent.

Results and Summary

Phytotoxicity

Based on the type and nature of injury seen with flumioxazin + pyroxasulfone applications in the research conducted between 2013 and 2015, 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 this product, and 4) more data is needed to make informed recommendations.

In testing from 2013 to 2015, V-10233 76 WG and V-10336 61.5 WG exhibited no or minimal negative impact on one plant genus across plants species with the exception of one crop (Tables 1 - 3). All crops evaluated , except *Cercis canadensis*, showed no injury or growth reduction, but most were only screened in 1 trial; hence further testing is required before a conclusion can be made confirming crop safety on these crops.

Please see Table 4 for a list of research and the summary of the results received for research conducted with V-10233 76 WG and V-10336 61.5 WG.

Table 1. List of V-10233 76WG treated crops with no or minimal transitory injury where more information is needed.

Acer rubrum
Betula nigra
Cornus florida
Crataegus viridis
Fraxinus americana
Picea abies
Pinus strobus
Populus deltoides
Prunus laurocerasus
Rhododendron sp.
Taxus cuspidata

Table 2. List of V-10336 61.5WG treated crops with no or minimal transitory injury where more research is needed to clarify response.

Acer palmatum
Aesculus sp.
Berberis thunbergii
Betula alba
Buxus microphylla
Cornus sp.
Eucalyptus henkelii
Ginkgo biloba
Juglans nigra
Platanus racemosa
Prunus pendula
Quercus rubra
Quercus sp.
Salix sp.

Table 3. List of V-10233 76WG and V-10336 61.5WG treated crops exhibiting significant injury at 1X

*Cercis occidentalis*¹

1. Single trial. More information is needed to clarify response.

Table 4. Detailed Summary Crop Safety Testing with V-10233 76WG and V-10336 61.5WG.

Notes: Table entries are sorted by crop Latin name. Only those reports received by 3/14/2016 are included.

PR#	Product (Active ingredients)	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31555	V-10233 76WG (Flumioxazin + pyroxasulfone)	Maple (Acer sp.) A. rubrum	Field Container	Beste/Frank (NER)	MD	2013	Directed	No significant injury or growth reduction with 0.35 and 0.71, slight with 1.42 lb ai per acre applied once; no marketability reduction.
31548	V-10233 76WG (Flumioxazin + pyroxasulfone)	Birch (Betula sp.) B. nigra	Field Container	Beste/Frank (NER)	MD	2013	Directed	No significant injury or growth reduction with 0.35, 0.71 and 1.42 lb ai per acre applied once; no marketability reduction.
31551	V-10233 76WG (Flumioxazin + pyroxasulfone)	Dogwood (Cornus sp.) C. florida	Field Container	Beste/Frank (NER)	MD	2013	Directed	Commercially acceptable injury with 0.36, 0.71 and 1.42 lb ai per acre; no reduction in growth or marketability.
31551	V-10233 76WG (Flumioxazin + pyroxasulfone)	Dogwood (Cornus sp.) C. florida	Field Container	Beste/Frank (NER)	MD	2015	Directed	No significant injury or growth reduction with 0.35, 0.71 and 1.42 lb ai per acre; no reduction in marketability.
31554	V-10233 76WG (Flumioxazin + pyroxasulfone)	Hawthorn (Crataegus sp.) C. viridis	Field Container	Beste/Frank (NER)	MD	2013	Directed	No significant injury or growth reduction with 0.36, 0.71 and 1.42 lb ai per acre; no reduction in marketability.
31547	V-10233 76WG (Flumioxazin + pyroxasulfone)	Ash (Fraxinus sp.) F. americana	Field Container	Beste/Frank (NER)	MD	2013	Directed	No significant injury or growth reduction with 0.36, 0.71 and 1.42 lb ai per acre; no reduction in marketability.
30941	V-10233 76WG (Flumioxazin + pyroxasulfone)	Spruce (Picea sp.) P. abies	Field Container	Beste/Frank (NER)	MD	2015	Directed	No injury or significant growth reduction with 0.35, 0.71 and 1.42 lb ai per acre applied once; no marketability reduction.
30942	V-10233 76WG (Flumioxazin + pyroxasulfone)	Pine (Pinus sp.) P. strobus	Field Container	Beste/Frank (NER)	MD	2015	Directed	No injury or significant growth reduction with 0.35, 0.71 and 1.42 lb ai per acre applied once; no marketability reduction.
31557	V-10233 76WG (Flumioxazin + pyroxasulfone)	Aspen, Poplar (Populus sp.) P/ deltoides	Field Container	Beste/Frank (NER)	MD	2013	Directed	Slight, commercially acceptable injury with 0.36, 0.71 and 1.42 lb ai per acre; no reduction in growth or marketability.
31550	V-10233 76WG (Flumioxazin + pyroxasulfone)	Cherry (Non-Bearing) (Prunus sp.) P. laurocerasus 'Otto Luyken'	Field Container	Beste/Frank (NER)	MD	2013	Directed	No significant injury or growth reduction with 0.36, 0.71 and 1.42 lb ai per acre; no reduction in marketability.
30875	V-10233 76WG (Flumioxazin + pyroxasulfone)	Azalea (Rhododendron sp.) 'Hino-crimson'	Field Container	Beste/Frank (NER)	MD	2015	Directed	Slight initial injury with complete recovery with 0.35, 0.71 and 1.42 lb ai per acre; no reduction in growth or marketability.
31592	V-10233 76WG (Flumioxazin + pyroxasulfone)	Yew, Japanese (Taxus cuspidata) 'Capitata'	Field Container	Beste/Frank (NER)	MD	2013	Directed	No injury or growth reduction with 0.36, 0.71 and 1.42 lb ai per acre; no reduction in marketability.
32707	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Maple (Acer sp.) A. palmatum	Field Container	Uber	CA	2013	Directed	No injury or growth reduction with 7.5, 15 and 30 oz per acre.

PR#	Product (Active ingredients)	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31549	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Horse Chestnut (Aesculus sp.)	Field Container	Mathers (OSU)	OH	2013	Directed	No injury with 7.5, 15 and 30 oz per acre.
30859	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Barberry (Berberis sp.) B. thunbergii 'Rose Glow'	Field Container	Beste/Frank (NER)	MD	2015	Directed	No significant injury or growth reduction with 0.35, 0.71 and 1.42 lb ai per acre by the end of trial; no reduction in marketability.
32708	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Birch (Betula sp.) B. alba	Field Container	Uber	CA	2013	Directed	Minor injury with complete recovery at 7.5, 15 and 30 oz per acre; no growth reduction.
30860	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Boxwood (Buxus sp.) B. microphylla 'Winter Gem'	Field Container	Beste/Frank (NER)	MD	2015	Directed	No significant injury or growth reduction with 0.36, 0.71 and 1.42 lb ai per acre by the end of trial; no reduction in marketability
31558	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Red Bud, Western (Cercis reniformis) C. occidentalis	Field Container	Uber	CA	2013	Directed	Moderate injury with 7.5, 15 and 30 oz per acre; significant stunting at 2X.
32709	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Dogwood (Cornus sp.) 'Galilean'	Field Container	Mathers (OSU)	OH	2013	Directed	No injury with 7.5, 15 and 30 oz per acre.
31552	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Eucalypt, Australian Gum (Eucalyptus sp.) E. henkelii	Field Container	Uber	CA	2013	Directed	No injury or growth reduction with 7.5, 15 and 30 oz per acre.
31553	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Maidenhair Tree (Ginkgo biloba)	Field Container	Uber	CA	2013	Directed	Slight injury, no growth reduction with 7.5, 15 and 30 oz per acre.
31560	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Walnut, Black (Non-Bearing) (Juglan snigra)	Field Container	Mathers (OSU)	OH	2013	Directed	No injury with 7.5, 15 and 30 oz per acre.
31559	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Plane Tree, Sycamore (Platanus sp.) P. racemosa	Field Container	Uber	CA	2013	Directed	Slight injury, no growth reduction with 7.5, 15 and 30 oz per acre.
32710	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Cherry (Non-Bearing) (Prunus sp.) P. pendula 'Rosea'	Field Container	Mathers (OSU)	OH	2013	Directed	No injury with 7.5, 15 and 30 oz per acre.
31556	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Oak (Quercus sp.)	Field Container	Beste/Frank (NER)	MD	2015	Directed	No significant injury or growth reduction with 0.35, 0.71 and 1.42 lb ai per acre applied once; no marketability reduction.
31556	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Oak (Quercus sp.) Q. rubra'	Field Container	Mathers (OSU)	OH	2013	Directed	No injury with 7.5, 15 and 30 oz per acre.
31561	V-10336 61.5WG (Flumioxazin + pyroxasulfone)	Willow (Salix sp.) 'Prairie Cascade'	Field Container	Mathers (OSU)	OH	2013	Directed	No injury with 7.5, 15 and 30 oz per acre.

Label Suggestions

No conclusions can be made at this time for either formulation.

Appendix 1: Contributing Researchers

Dr. Ed Beste	University of Maryland LESREC – Salisbury Facility 27664 Nanticoke Road Salisbury, MD 21801
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