



Ornamental Horticulture Program Research Project Sheet

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Project Name: Fungicide Crop Safety – New Products

New	Ongoing	X	Completed	Duration if ongoing or completed:	2010-2015
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Project Description:

While labels allowing the use of fungicides generally on ornamental horticulture crops is fairly common, developing crop safety data is still critical to support these 'open' labels. Many labels list the tested crops along with the plant type as well as any crops that might be injured after application. From 2010 through 2013, IR-4 has tested several new fungicides to verify and expand the screened crops.

Research Project Abstract (if available):

Abstract from 2015 Acibenzolar-methyl Crop Safety Summary

Acibenzolar is an active ingredient that stimulates plant defense systems. In 2002, IR-4 started testing Insimmo (acibenzolar) for safety on several ornamental horticulture crops. In 2008, IR-4 continued crop safety screening after a renewed interest in bringing this active ingredient to ornamental horticulture growers. From 2002 through 2014, the IR-4 Project completed 249 trials on 67 ornamental plant genera or species examining phytotoxicity related to foliar and/or drench applications of Insimmo. In these trials, 36 species or genera exhibited minimal or no injury after foliar applications. Based on this information, it is recommended that all but 2 of these crops be added to a list of tolerant plants when this active ingredient gains registration. While there was sufficient evidence of minimal or no injury for *Dianthus sp.* and *Pelargonium x hortorum*, a single trial for each crop did elicit moderate to severe injury. Further investigation on cultivar or species differences may be warranted.

Abstract from 2014 Cyflufenamid Crop Safety Summary

Cyflufenamid is an active ingredient for managing foliar diseases including powdery mildew and botrytis. It is not yet registered by EPA for the ornamental horticulture industry. During 2012 and 2013, the IR-4 Project completed 29 trials on 15 ornamental plant genera or species. In these trials, 3 species or genera exhibited minimal or no injury after foliar applications. For the remaining 12 crops, not sufficient information has been generated. However, to date the tested crops are not sensitive to foliar applications up to 4X the proposed high label rate.

Abstract from 2014 Metconazole Crop Safety Summary

Metconazole was registered as Tourney 50WDG in the United States in 2007 as a turf fungicide. In 2010, uses for ornamental horticulture plants in greenhouse, nurseries, and landscapes were added. The commercial label contains a list of 49 woody ornamental plants exhibiting no or minimal injury. However, because metconazole is in the triazole class it could cause symptoms similar to plant growth regulators and additional testing is warranted on additional herbaceous and woody ornamental species. Between 2010 and 2013, the IR-4 Project completed 124 trials on 35 ornamental plant species examining phytotoxicity related to foliar applications of Tourney. In these trials, 18 species or genera exhibited minimal or no injury after foliar applications. Of these, 11 are already on the Tourney label; *Antirrhinum majus*, *Buxus sp.*, *Hemerocallis sp.*, *Hydrangea sp.*, *Lantana sp.*, *Liriope sp.* and *Verbena sp.* are the seven crops not yet listed. Based on this information, it is recommended that these be added to the list of tolerant plants on the Tourney 50WDG label. Four crops exhibited stunting: Begonia, Impatiens, Pansy and Zinnia.

Abstract from 2014 Tebuconazole Crop Safety Summary

Tebuconazole was first registered in 1994 for peanut diseases. Since then its food use label has expanded to several other food crops. The first noncrop registration of Torque 3.6SC (tebuconazole) occurred in 2010 for ornamental horticulture growers, professional landscape managers and for golf course turf. Tebuconazole manages foliar ornamental horticulture diseases including powdery mildew and rusts. However, given that



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triazoles have a tendency to also exhibit impacts similar to growth regulators, the crop safety profile for Torque 3.6SC is not well known. During 2012 and 2013, the IR-4 Project completed 25 trials on 13 ornamental plant genera or species. In these trials, 2 species or genera exhibited minimal or no injury after foliar applications. Torque caused stunting in Pansy and Zinnia at the higher application rates. In one trial, Narcissus exhibited moderate injury after the third application; additional trials are warranted to determine whether number of applications or the crop cultivar might be the contributing factor for injury. For the remaining 8 crops, not sufficient information has been generated.

Abstract from 2014 Triticonazole Crop Safety Summary

Triticonazole was registered as Trinity 2SC in the United States in 2007 as a turf fungicide. Since that time it has been under development to expand to ornamental horticulture diseases. Because triticonazole is in the triazole class, it could cause symptoms similar to plant growth regulators and testing is warranted on additional herbaceous and woody ornamental species. Between 2010 and 2013, the IR-4 Project completed 148 trials on 36 ornamental plant species examining phytotoxicity related to foliar applications of Trinity 2SC. In these trials, 22 species or genera exhibited minimal or no injury after foliar applications. Of these, five are not yet listed on the label: *Alyssum sp.*, *Buxus sp.*, *Cornus sp.*, *Lantana sp.*, and *Osteospermum sp.*

Target Species (Phytotoxicity, or common and Latin name of arthropod, pathogen, weed):

Crop Safety

Target Crops (list tested crops if ongoing or completed project)

See "IR-4 Crop Safety to Date" below

Target Product(s) (list tested products or numbered compounds if ongoing or completed project)

Alibi Flora	Orvego (prior to 2014)
BAS 703	S2200
Insimmo	Torque 3.6SC
Mural	Tourney 50WDG
NF-149	Trinity 2SC

Product Registration and Research Status

	Registration Status
Labeled & Commercialized Wide range of ornamental horticulture crops listed	Torque 3.6SC
Labeled & Commercialized Opportunity to add additional ornamental horticulture crops	Orvego Tourney 50WDG Trinity 2SC
Labeled But NOT Commercialized Not yet registered or labeled	BAS 703 06F NF-149
No longer available for development	
* IR-4 Data contributed to registration decision – either adding pest to label or not pursuing further research	

Other:



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Project Pros	Project Cons
<ol style="list-style-type: none">1 NF-149 is not yet registered and so far had had little injury on the tested crops.2 Orvego has had little injury on screened crops and had a limited crop list3 Tourney has exhibited little injury to date and has a limited crop list4 Torque is very widely labeled for outdoor uses, but not for greenhouse use.5 Trinity has exhibited very little injury to tested plants and is not yet registered.	<ol style="list-style-type: none">1 Torque is very widely labeled for outdoor uses, but not for greenhouse use.2

IR-4 Crop Safety Trials to Date

Average rating on a scale of 1 – 5 with 1 = 0 to about no injury and 5 = severe injury and mortality; minimum to maximum rating; number of trials. A rating of 3 or higher is considered commercially unacceptable (*red text*). A rating of 1 or 2 is considered commercially acceptable and those with more than 3 trials are complete (*green text*). 'Labeled' indicates that IR-4 generated data in at least one trial and that this crop is listed on the label. For crop/product combinations that are blank, IR-4 has not screened this combination.

Plant Group	Crop	Alibi Flora (A13703G) SC (Difencnazole + Azoxystrobin)	Insimmo (Acibenzolar-S- methyl)	Mural (A18126B) WDG (Benzovindiflupyr + Azoxystrobin)	NF-149 (Cyflufenamid)	Torque 3.6SC (Tebuconazole)	Tourney 50WDG (Metconazole)	Trinity 2SC (Triticonazole)
Broadleaf Evergreen Tree/ Shrub	Boxwood (<i>Buxus</i> sp.)		1.0 (1 - 1) n2	1.0 (1 - 1) n1		Labeled	1.0 (1 - 1) n6	1.0 (1 - 1) n6
	Camellia (<i>Camellia</i> sp.)		1.0 (1 - 1) n3	1.0 (1 - 1) n3			Labeled	Labeled
	Holly, Japanese (<i>Ilex crenata</i>)		1.0 (1 - 1) n2					
	Holly (<i>Ilex</i> sp.)						Labeled	1.0 (1 - 1) n2
	Heavenly Bamboo (<i>Nandina domestica</i>)						1.0 (1 - 1) n1	Labeled
	Photinia (<i>Photinia</i> sp.)							1.0 (1 - 1) n1
	Indian Hawthorn (<i>Raphiolepis indica</i>)		1.0 (1 - 1) n2	1.0 (1 - 1) n2			1.0 (1 - 1) n1	1.0 (1 - 1) n1
	Azalea (<i>Rhododendron</i> sp.)		1.0 (1 - 1) n4			MFG Hold	Labeled	Labeled
Rhododendron (<i>Rhododendron</i> sp.)					MFG Hold	1.0 (1 - 1) n1	Labeled	Labeled
Broadleaf Evergreen/ Deciduous Tree/ Shrub	Barberry (<i>Berberis</i> sp.)		1.0 (1 - 1) n2	1.0 (1 - 1) n2				
	Cotoneaster (<i>Cotoneaster</i> sp.)		1.0 (1 - 1) n9					
	Firethorn (<i>Pyracantha</i> sp.)		1.0 (1 - 1) n6					
Bulbs & Corms	Dahlia (<i>Dahlia</i> sp.)		1.0 (1 - 1) n5					1.0 (1 - 1) n2
	Corn Flag, Sword Lily (<i>Gladiolus</i> sp.)		1.0 (1 - 1) n4					
	Daylily (<i>Hemerocallis</i> sp.)		1.2 (1 - 2) n6				1.0 (1 - 1) n10	Labeled
	Daffodil (<i>Narcissus</i> sp.)		MFG Hold		MFG Hold	3.0 (3 - 3) n1	3.0 (3 - 3) n1	
	Tulip (<i>Tulipa</i> sp.)				MFG Hold	2.0 (2 - 2) n1	3.0 (3 - 3) n1	1.0 (1 - 1) n1
Deciduous Tree/ Shrub/Vine	Maple (<i>Acer</i> sp.)		1.0 (1 - 1) n3					
	Butterfly Bush (<i>Buddleia davidii</i>)	Labeled	1.0 (1 - 1) n5	1.0 (1 - 1) n2			Labeled	Labeled
	Dogwood, Flowering (<i>Cornus florida</i>)		MFG Hold					
	Dogwood (<i>Cornus</i> sp.)						Labeled	1.0 (1 - 1) n4
	Euonymus (<i>Euonymus</i> sp.)		1.0 (1 - 1) n3					
	Hydrangea (<i>Hydrangea</i> sp.)	Labeled	1.0 (1 - 1) n11	1.0 (1 - 1) n2	MFG Hold	1.3 (1 - 2) n3	1.0 (1 - 1) n5	Labeled
	Lavender (<i>Lavandula</i> sp.)	1.0 (1 - 1) n4	MFG Hold	1.0 (1 - 1) n4				
	Apple & Crabapple (Non-Bearing) (<i>Malus</i> sp.)		MFG Hold				Labeled	Labeled
	Pear, Bradford (Non-Bearing) (<i>Pyrus calleryana</i>)						MFG Hold	1.0 (1 - 1) n1
	Oak (<i>Quercus</i> sp.)		1.0 (0 - 2) n4				Labeled	Labeled
	Rose (<i>Rosa</i> sp.)		1.0 (1 - 1) n3		MFG Hold	1.0 (1 - 1) n3	Labeled	Labeled
	Bridal-Wreath (<i>Spiraea</i> sp.)		MFG Hold				Labeled	
	Elm (<i>Ulmus</i> sp.)						Labeled	
Arrowwood (<i>Viburnum</i> sp.)		1.0 (1 - 1) n3						
Hardy Ground Cover Foliage	English Ivy (<i>Hedera helix</i> L. ssp. <i>Helix</i>)						1.0 (1 - 1) n1	1.0 (1 - 1) n1
	Shrub Verbena (<i>Lantana</i> sp.)		MFG Hold				1.0 (1 - 1) n4	1.0 (1 - 1) n5
	Lilyturf, Creeping (<i>Liriope</i> sp.)		MFG Hold				1.0 (1 - 1) n4	Labeled

Plant Group	Crop	Alibi Flora (A13703G) SC (Difencnazole + Azoxystrobin)	Insimmo (Acibenzolar-S-methyl)	Mural (A18126B) WDG (Benzovindiflupyr + Azoxystrobin)	NF-149 (Cyflufenamid)	Torque 3.65C (Tebuconazole)	Tourney 50WDG (Metconazole)	Trinity 2SC (Triticonazole)
	Periwinkle (<i>Vinca</i> sp.)		1.0 (1 - 1) n4					
Herbaceous Flowering Plant	Bougainvillea (<i>Bougainvillea</i> sp.)		1.0 (1 - 1) n2					
	Blanket Flower (<i>Gaillardia x grandiflora</i>)						1.0 (1 - 1) n1	1.0 (1 - 1) n1
	Mallow, Rose Mallow (<i>Hibiscus</i> sp.)		1.0 (1 - 1) n3	1.0 (1 - 1) n2				
	Sweet Alyssum (<i>Lobularia maritima</i>)							Labeled
	Cinquefoil (<i>Potentilla</i> sp.)		MFG Hold					
	Sage, common (<i>Salvia officinalis</i>)		1.0 (1 - 1) n2	1.0 (1 - 1) n1			1.3 (1 - 2) n3	1.0 (1 - 1) n3
Herbaceous Flowering Plant - Annual	Snapdragon (<i>Antirrhinum majus</i>)		1.1 (1 - 2) n12		MFG Hold	1.2 (1 - 2) n5	Labeled	Labeled
	Begonia (<i>Begonia</i> sp.)		1.0 (1 - 1) n7				Labeled	Labeled
	Calibrachoa (<i>Calibrachoa</i> sp.)	1.0 (1 - 1) n4	1.1 (1 - 2) n9	1.3 (1 - 2) n4	MFG Hold	1.0 (1 - 1) n4	1.5 (1 - 3) n6	Labeled
	Poinsettia (<i>Euphorbia pulcherrima</i>)		MFG Hold					
	Transvaal Daisy (<i>Gerbera</i> sp.)		2.0 (1 - 4) n6					
	Sunflower (<i>Helianthus</i> sp.)		1.0 (1 - 1) n4	1.0 (1 - 1) n4				
	New Guinea Impatiens (<i>Impatiens hawkeri</i>)						3.0 (3 - 3) n1	Labeled
	Balsam (<i>Impatiens</i> sp.)		3.0 (2 - 4) n2					
	Garden Impatiens (<i>Impatiens walleriana</i>)		MFG Hold					
	African Daisy (<i>Osteospermum</i> sp.)	1.0 (1 - 1) n2	1.0 (1 - 1) n6	1.0 (1 - 1) n4	MFG Hold	1.0 (1 - 1) n4	1.0 (1 - 1) n3	1.0 (1 - 1) n4
	Geranium (<i>Pelargonium</i> sp.)		1.0 (1 - 1) n5		MFG Hold	1.5 (1 - 2) n4	Labeled	Labeled
	Geranium, Zonal (<i>Pelargonium x hortorum</i>)		3.0 (3 - 3) n2					
	Petunia (<i>Petunia</i> sp.)		1.0 (1 - 1) n5		MFG Hold	1.0 (1 - 1) n4	Labeled	Labeled
	Marigold (<i>Tagetes</i> sp.)						Labeled	Labeled
	Pansy (<i>Viola</i> sp.)		1.0 (1 - 1) n3		MFG Hold	3.0 (3 - 3) n2	Labeled	Labeled
	Zinnia (<i>Zinnia</i> sp.)	Labeled	1.0 (1 - 1) n6		MFG Hold	1.3 (1 - 2) n3	Labeled	Labeled
Herbaceous Flowering Plant - Perennial	Madwort (<i>Alyssum</i> sp.)							1.0 (1 - 1) n4
	Columbine (<i>Aquilegia</i> sp.)	1.0 (1 - 1) n2		1.0 (1 - 1) n2				
	Aster (<i>Aster</i> sp.)	Labeled	1.7 (1 - 3) n3	1.0 (1 - 1) n1				
	Rose Periwinkle (<i>Catharanthus roseus</i>)						2.0 (2 - 2) n1	
	Chrysanthemum, Garden (<i>Chrysanthemum/Dendranthema</i> sp.)		1.0 (1 - 1) n4		1.0 (1 - 1) n1		Labeled	Labeled
	Tickseed (<i>Coreopsis</i> sp.)		1.0 (1 - 1) n7					
	Pinks (<i>Dianthus</i> sp.)	Labeled	1.6 (1 - 4) n5	1.0 (1 - 1) n3				
	Purple Coneflower (<i>Echinacea</i> sp.)		1.0 (1 - 1) n5					
	Geranium (<i>Geranium magniflorum</i>)		MFG Hold					
	Alumroot (<i>Heuchera</i> sp.)		1.0 (1 - 1) n2	1.0 (1 - 1) n4				

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	Lily, Plantain (<i>Hosta fortunei</i>)		1.0 (1 - 1) n4					
	Bee Balm (<i>Monarda didyma</i>)	1.0 (1 - 1) n3		1.0 (1 - 1) n3				
	Phlox, Perennial (<i>Phlox paniculata</i>)	Labeled		1.0 (1 - 1) n1				
	Carolinia Phlox (<i>Phlox sp.</i>)		1.0 (1 - 1) n5					
	Coneflower (<i>Rudbeckia sp.</i>)		1.0 (1 - 1) n5					
	Vervain (<i>Verbena sp.</i>)		1.0 (1 - 1) n5				Labeled	Labeled
Narrowleaf Evergreen Tree/Shrub	Fir (<i>Abies sp.</i>)		1.0 (1 - 1) n2	1.0 (1 - 1) n2				
	Juniper (<i>Juniperus sp.</i>)		1.0 (1 - 1) n3	1.0 (1 - 1) n1				
	Spruce (<i>Picea sp.</i>)		MFG Hold					
	Pine (<i>Pinus sp.</i>)		1.0 (1 - 1) n3					
	Fir, Douglas (<i>Pseudotsuga menziesii</i>)		1.0 (1 - 1) n4	1.0 (1 - 1) n1	MFG Hold	1.0 (1 - 1) n3	Labeled	1.0 (1 - 1) n3
	Yew (<i>Taxus sp.</i>)		MFG Hold					
Tropical Foliage Plant	Arborvitae (<i>Thuja sp.</i>)		1.0 (1 - 1) n3					
	Aglaonema (<i>Aglaonema sp.</i>)		1.0 (1 - 1) n2	1.0 (1 - 1) n1				
	Coleus, Flamenettle (<i>Coleus sp.</i>)		1.0 (1 - 1) n7					
	Pothos, Epipremnum (<i>Scindapsus aureus</i>)		1.0 (1 - 1) n3	1.0 (1 - 1) n2				
	Nephthytis, African Evergreen (<i>Syngonium podophyllum</i>)		MFG Hold					