



## Environmental Horticulture Program Research Project Sheet

<https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-extension-resources/>

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**Project Name:** Pre Emergent Herbicide Crop Safety–Granulars

<b>New</b>	<b>Ongoing</b>	X	<b>Completed</b>	<b>Duration if ongoing or completed:</b>	2004-2021
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### Project Description:

The Pre-Emergent Herbicide Crop Safety Project began in 2004 and has continued through 2019. While specific crops and herbicides have changed, the intent of this research has been to screen over-the-top applications of pre-emergent herbicides as plants are breaking dormancy, or beginning new growth, and then 4 to 6 weeks later once foliage is more mature.

This research project sheet covers granular formulations applied as broadcast, over the top of plants while breaking dormancy and then approximately 6 weeks later.

### Research Project Abstract (if available):

#### **Abstract from 2021 Isoxaben + Dithiopyr Crop Safety Summary**

Fortress (isoxaben + dithiopyr) was registered in 2018 for environmental horticulture crop uses. Between 2018 and 2020, IR-4 examined 17 crop species / genera to expand this label to other crops. Of these, 2 crop species (*Hydrangea macrophylla* and *H. paniculata*) exhibited no or transient injury. Eight crops exhibited significant injury in this research: *Digitalis grandiflora* and *D. purpurea*.

#### **Abstract from 2019 Pendimethalin Crop Safety Summary**

Pendimethalin has been registered in the United States since 1994 for uses in and around environmental horticulture plants in production nurseries and in landscapes. Between 1981 and 2008, the IR-4 Project has conducted over 469 trials using two granular formulations (Corral 2.68G and Pendulum 2G), two liquid formulations (Pendulum AquaCap and Prowl 4E) and a wettable dry granular formulation (Pendulum WDG). Between 2014 and 2018, 70 trials were conducted on ornamental grasses to determine crop safety of the Pendulum 2G formulation. This summary is an update of the second summary, issued in 2017, across all the available data generated through IR-4 since screenings began in 1981.

Eighty-seven plant species or genera exhibited no or minimal, transitory phytotoxicity to over the top applications of Corral 2.68G and Pendulum 2G formulations. Of these, 22 species or genera are not on the current Pendulum 2G label. Two species (*Phlox paniculata* and *Rhodiola pachyclados*) exhibited significant injury to Pendulum 2G. Thirty-seven plant species or genera exhibited no or minimal transitory phytotoxicity to applications of Pendulum AquaCap and Pendulum WDG formulations. All these ornamentals are currently listed on the Pendulum AquaCap label. One species (*Stachys byzantina*) exhibited phytotoxicity at 2 lb ai per acre and higher rates. Twenty plant species or genera exhibited no or minimal transitory phytotoxicity to applications of Prowl 4E. Of these, one (*Paeonia* sp.) is not currently listed on the label.

#### **Abstract from 2019 Pendimethalin + Dimethenamid-p Crop Safety Summary**

From 2007 to 2018, IR-4 completed 657 trials on Freehand 1.75G (BAS 659 G; dimethenamid-p + pendimethalin). The data contained in this report was generated to register uses of dimethenamid-p + pendimethalin on and around environmental horticulture plants with broadcast applications, including over the top of established plants. The Freehand rates in this testing program were 2.65, 5.3 and 10.6 pounds active ingredient per acre (lb ai per A) as the 1X, 2X and 4X rates. Freehand 1.75G had been applied to 194 plant genera or species. Of these genera and species, 74 exhibited no or minimal transient injury after application at all three rates. Thirty five (35) crops exhibited little or no phytotoxicity at 2.65 lb ai per acre, but did have some injury at 5.3 and/or 10.6 lb ai per acre, or showed injury after the second application. Twenty two (22) genera or species exhibited damage at the lowest rate sufficient to recommend growers not utilize Freehand 1.75G as an over-the-top treatment for pre-emergent weed control. Of the sixty two (62) crops that still need additional information, there are twelve (12) genera or species in which three or more trials do not show significant injury,

but one or more additional trials shows some sort of notable injury, necessitating additional research. Additional trials are also indicated to establish species or cultivar sensitivities.

**Abstract from 2019 Prodiamine + Isoxaben Crop Safety Summary**

Prodiamine + Isoxaben (Gemini G) is a new herbicide combination being developed by Everris dba ICL Specialty Fertilizers for pre-emergent control of grasses and broadleaf weeds on environmental horticulture crops. The IR-4 Project completed 32 crop safety trials on 22 ornamental horticulture plant species or genera during 2017 and 2018. In these trials, one species (*Quercus virginiana*) exhibited no injury after over-the-top applications in a minimum of 3 trials; this species can be added to a list of tolerant plants in the new label for this product. One species (*Phlox paniculata*) exhibited damage at the 1X rate sufficient to recommend growers not utilize Gemini G as an over-the-top treatment for pre-emergent weed control.

**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)**

Biathlon (oxyfluorfen + prodiamine)  
 Ronstar G (oxadiazon)  
 Fortress (isoxaben + dithiopyr)  
 Freehand G ( dimethenamid-p + pendimethalin)  
 Gemini Granular (prodiamine + isoxaben)

Marengo G (indaziflam)  
 Pendulum 2G (pendimethalin)  
 Rout (oxyfluorfen + oryzalin)  
 Snapshot 2.5TG (trifluralin + isoxaben)  
 Terracyte (sodium carbonate peroxyhydrate)

**Product Registration and Research Status**

	<b>Registration Status</b>
Labeled & Commercialized Wide range of ornamental horticulture crops listed	Biathlon (oxyfluorfen + prodiamine) Ronstar G (oxadiazon) Fortress (isoxaben + dithiopyr) Freehand G ( dimethenamid-p + pendimethalin) Gemini Granular (prodiamine + isoxaben) Marengo G (indaziflam) Pendulum 2G (pendimethalin) Rout (oxyfluorfen + oryzalin) Snapshot 2.5TG (trifluralin + isoxaben) Terracyte (sodium carbonate peroxyhydrate)
Labeled & Commercialized Opportunity to add additional ornamental horticulture crops	
Labeled But NOT Commercialized	
Not yet registered or labeled	
No longer available for development	
* IR-4 Data contributed to registration decision – either adding pest to label or not pursuing further research	
1 At least one crop species screened fully	
2 Product not available for production ornamentals	

Area	Characteristic	Pro	Con
Availability & effectiveness of alternative management tools	Additional research could yield data favorable for further label expansion	x	
Damage potential of target			
Performance and crop safety of proposed products (from other systems)			
Compatibility with IPM, resistance management programs			



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Economics			
Geographic distribution			
Manufacturer interest in labeling products			
Other			
Comments:			

### 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	Chipco Ronstar 2G (Oxadiazon)	Fortress (OHP1701B) (isoxaben + dithiopyr)	Freehand G (Dimethenamid-p + pendimethalin)	Fuerte (OHP1702V) (OHP1702V)	Gemini Granular (Prodiamine + isoxaben)	Pendulum 2G (Pendimethalin)
Broadleaf Evergreen Tree/Shrub	Manzanita ( <i>Arctostaphylos</i> sp.)			1.0 (1 - 1) n4			
	Aucuba ( <i>Aucuba</i> sp.)	MFG Hold		1.0 (1 - 1) n1			
	Boxwood ( <i>Buxus</i> sp.)	2.0 (2 - 2) n1 Labeled		1.0 (1 - 1) n3 Labeled	1.0 (1 - 1) n3		
	Bottlebrush ( <i>Callistemon</i> sp.)	1.0 (1 - 1) n1		1.5 (1 - 2) n4			
	Camellia ( <i>Camellia</i> sp.)			1.0 (1 - 1) n4 Labeled			
	Natal Plum, Amatungulu ( <i>Carissa macrocarpa</i> )	1.0 (1 - 1) n1					
	Ceanothus, Maritime ( <i>Ceanothus maritimus</i> )			1.7 (1 - 3) n3 Labeled			
	Sakaki, Cleyera ( <i>Cleyera japonica</i> )	1.2 (1 - 2) n5 Labeled					
	False Heather, Elfin Herb, Mexican Heather ( <i>Cuphea hyssopifolia</i> )						1.0 (1 - 1) n1 Labeled
	Distylium ( <i>Distylium</i> sp.)			1.7 (1 - 3) n3			
	Wintercreeper ( <i>Euonymus fortunei</i> )	1.0 (1 - 1) n2 Labeled					
	Gardenia ( <i>Gardenia</i> sp.)	2.0 (2 - 2) n1 Labeled		2.5 (1 - 3) n4			
	Holly ( <i>Ilex</i> sp.)	1.3 (1 - 2) n8 Labeled		1.0 (1 - 1) n6 Labeled			
	Laurel ( <i>Kalmia</i> sp.)			1.5 (1 - 2) n2			
	Doghobble ( <i>Leucothoe</i> sp.)	1.0 (1 - 1) n1		1.0 (1 - 1) n3			
	Loropetalum ( <i>Loropetalum</i> sp.)			1.2 (1 - 2) n5 Labeled			
	Barberry, Hollyleaved ( <i>Mahonia aquifolium</i> )			1.0 (1 - 1) n4 Labeled			
	Wax Myrtle ( <i>Myrica cerifera</i> )				1.0 (1 - 1) n1		
	Myrtle ( <i>Myrtus communis</i> )	1.0 (1 - 1) n1					
	Sacred Bamboo ( <i>Nandina domestica</i> )	1.0 (1 - 1) n1 Labeled					
Oleander, Rosebay ( <i>Nerium oleander</i> )	1.0 (1 - 1) n1 Labeled						

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Broadleaf Evergreen Tree/Shrub	Olive, Holly (Osmanthus heterophyllus)			1.0 (1 - 1) n2			
	Chokeberry (Photinia sp.)	MFG Hold		2.8 (1 - 4) n4 Labeled			
	Andromeda, Fetterbush (Pieris sp.)			1.0 (1 - 1) n3			
	Indian Hawthorn (Raphiolepis indica)			1.0 (1 - 1) n3 Labeled			
	Azalea (Rhododendron sp.)	1.3 (1 - 2) n7 Labeled		1.2 (1 - 2) n5 Labeled			
	Rhododendron (Rhododendron sp.)	1.0 (1 - 1) n2 Labeled					
	Ternstroemia (Ternstroemia sp.)			1.0 (1 - 1) n3			
Broadleaf Evergreen/Deciduous Tree/Shrub	Abelia (Abelia sp.)				1.0 (1 - 1) n2		
	Barberry (Berberis sp.)			1.8 (1 - 3) n6 Labeled			
	Sweetshrub (Calycanthus sp.)			1.0 (1 - 1) n3			
	Ceanothus (Ceanothus sp.)			1.7 (1 - 3) n3 Labeled			
	Cotoneaster (Cotoneaster sp.)	1.1 (1 - 2) n12 Labeled		2.3 (1 - 3) n3 Labeled	1.0 (1 - 1) n1		
	Spindletree (Euonymus sp.)	1.0 (1 - 1) n2 Labeled					
	Privet (Ligustrum sp.)	1.3 (1 - 2) n4 Labeled		2.5 (1 - 4) n4 Labeled			
	Magnolia (Magnolia sp.)	1.0 (1 - 1) n1 Labeled		1.0 (1 - 1) n3 Labeled			
	Firethorn (Pyracantha sp.)	1.0 (1 - 1) n2 Labeled					
	Wall Germander (Teucrium chamaedrys)			3.3 (2 - 4) n3 Labeled			
Bulbs & Corms	Amaryllis (Amaryllis sp.)	3.0 (3 - 3) n1					
	Canadian Wildginger (Asarum canadense)						1.0 (1 - 1) n3 Labeled
	Elephant's-Ear, Angel-Wings (Caladium sp.)			1.0 (1 - 1) n2 Labeled			

Plant Group	Crop	Chipco Ronstar 2G (Oxadiazon)	Fortress (OHP1701B) (isoxaben + dithiopyr)	Freehand G (Dimethenamid-p + pendimethalin)	Fuerte (OHP1702V) (OHP1702V)	Gemini Granular (Prodiamine + isoxaben)	Pendulum 2G (Pendimethalin)
Bulbs & Corms	Canna (Canna sp.)	MFG Hold		2.0 (1 - 4) n4 Labeled			
	Dahlia (Dahlia sp.)						3.0 (3 - 3) n1
	Gladiolus (Gladiolus sp.)			1.3 (1 - 2) n3 Labeled			
	Daylily (Hemerocallis sp.)	MFG Hold		1.4 (1 - 3) n5 Labeled		1.8 (1 - 3) n4	
	Iris (Iris sp.)			1.3 (1 - 2) n3 Labeled			
	Daffodil (Narcissus sp.)	4.0 (4 - 4) n2					
Cactus & Succulents	Agave (Agave sp.)			1.7 (1 - 2) n3			
	Aloe (Aloe sp.)			1.3 (1 - 2) n3			
	Cactus, Cacti (Cactaceae)			1.0 (1 - 1) n1			
	Pygmyweed (Crassula sp.)			3.0 (3 - 3) n2			
	Echeveria (Echeveria sp.)			3.5 (3 - 4) n2			
	Spider-cactus, dwarf chin cactus (Gymnocalycium baldianum)			4.0 (4 - 4) n1			
	Devil's-tongue; Eastern Prickly Pear (Opuntia humifusa)						1.0 (1 - 1) n1
	Stonecrop, Gray (Rhodiola pachyclados)	4.0 (4 - 4) n2					3.7 (3 - 4) n3
	Stonecrop, Moss (Sedum acre)	2.0 (1 - 3) n3		4.0 (4 - 4) n1 Labeled		2.5 (1 - 4) n2	2.3 (1 - 3) n4
	Sedum Hybrids (Sedum hybridum)	2.5 (1 - 4) n4				2.0 (1 - 3) n2	3.0 (2 - 4) n4
	Stonecrop, Kamchatka (Sedum kamtschaticus)	1.8 (1 - 3) n4					3.0 (2 - 4) n3
	Stonecrop, Jenny's (Sedum rupestre)	1.3 (1 - 2) n3		4.0 (4 - 4) n1 Labeled		3.3 (1 - 4) n4	2.3 (1 - 4) n3
	Stonecrop, Tasteless (Sedum sexangulare)						3.3 (2 - 5) n3
	Stonecrop (Sedum sp.)	2.0 (1 - 3) n2			2.0 (1 - 4) n5 Labeled		1.3 (1 - 2) n4 Labeled
	Stonecrop, Two-Row/Caucasian (Sedum spurium)						2.5 (2 - 3) n2
Houseleek, Cobweb (Sempervivum arachnoideum)						1.0 (1 - 1) n2 Labeled	

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Cactus & Succulents	Houseleek, Common ( <i>Sempervivum tectorum</i> )						1.0 (1 - 1) n3 Labeled
Deciduous Tree/Shrub/Vine	Maple, Paperbark ( <i>Acer griseum</i> )						2.0 (2 - 2) n2 Labeled
	Maple, Boxelder ( <i>Acer negundo</i> var. <i>negundo</i> )			1.0 (1 - 1) n3			
	Maple, Japanese ( <i>Acer palmatum</i> )			1.0 (1 - 1) n5 Labeled			
	Maple, Red ( <i>Acer rubrum</i> )			1.6 (1 - 2) n5 Labeled		2.0 (1 - 5) n4	
	Maple ( <i>Acer</i> sp.)	1.0 (1 - 1) n4 Labeled		1.0 (1 - 1) n4 Labeled			
	Horse Chestnut ( <i>Aesculus</i> sp.)			1.0 (1 - 1) n3			
	Alder ( <i>Alnus</i> sp.)			2.0 (2 - 2) n1			
	Serviceberry ( <i>Amelanchier</i> sp.)			2.0 (1 - 4) n4 Labeled			
	Butterfly Bush, Silver ( <i>Buddleia alternifolia</i> )						1.0 (1 - 1) n2
	Butterfly Bush ( <i>Buddleia davidii</i> )			1.0 (1 - 1) n4 Labeled			1.0 (1 - 1) n3 Labeled
	Wild Lilac ( <i>Ceanothus x pallida</i> )			1.0 (1 - 1) n3 Labeled			
	American Redbud, Eastern Redbud ( <i>Cercis canadensis</i> )			1.0 (1 - 1) n4	1.0 (1 - 1) n1		
	Flowering Quince ( <i>Chaenomeles</i> sp.)	1.0 (1 - 1) n1 Labeled					
	Yellowwood ( <i>Cladrastis</i> sp.)			1.6 (1 - 4) n5 Labeled			
	Leather Flower ( <i>Clematis</i> sp.)			1.3 (1 - 3) n8 Labeled			1.0 (1 - 1) n1 Labeled
	Sweet Pepperbush, Summersweet ( <i>Clethra alnifolia</i> )			2.8 (1 - 4) n4 Labeled			
	Dogwood, Pagoda ( <i>Cornus alternifolia</i> )				1.0 (1 - 1) n1		
Dogwood, Flowering ( <i>Cornus florida</i> )			1.3 (1 - 2) n4 Labeled				

Plant Group	Crop	Chipco Ronstar 2G (Oxadiazon)	Fortress (OHP1701B) (isoxaben + dithiopyr)	Freehand G (Dimethenamid-p + pendimethalin)	Fuerte (OHP1702V) (OHP1702V)	Gemini Granular (Prodiamine + isoxaben)	Pendulum 2G (Pendimethalin)	
Deciduous Tree/Shrub/Vine	Dogwood, Kousa (Cornus kousa)			1.3 (1 - 2) n6	1.0 (1 - 1) n1			
	Dogwood, Red Osier (Cornus sericea)				1.0 (1 - 1) n1			
	Dogwood (Cornus sp.)	1.7 (1 - 2) n3 Labeled						
	Hawthorn (Crataegus sp.)			1.0 (1 - 1) n3 Labeled				
	Spanish Gold Broom (Cytisus purgans)						1.0 (1 - 1) n1	
	Russian Olive (Elaeagnus angustifolia)	1.0 (1 - 1) n2 Labeled						
	Burning Bush (Euonymus alatus)			1.0 (1 - 1) n1 Labeled		1.5 (1 - 2) n2		
	Beech (Fagus sp.)			1.7 (1 - 3) n3				
	Forsythia (Forsythia sp.)	1.0 (1 - 1) n5		1.3 (1 - 2) n4 Labeled				
	Dwarf Fothergilla (Fothergilla gardenii)			1.0 (1 - 1) n4 Labeled				
	Ash (Fraxinus sp.)			1.0 (1 - 1) n2				
	Locust (Gleditsia sp.)			1.0 (1 - 1) n4 Labeled				
	Baby's Breath (Gypsophila paniculata)	1.0 (1 - 1) n2						
	Toyon (Heteromeles arbutifolia)			2.0 (2 - 2) n1				
	Bigleaf Hydrangea (Hydrangea macrophylla)			1.8 (1 - 3) n4		3.0 (1 - 4) n5		
	Panicle Hydrangea (Hydrangea paniculata)			2.0 (1 - 3) n3				
	Hydrangea, Oakleaf (Hydrangea quercifolia)			1.7 (1 - 3) n3				
	Hydrangea (Hydrangea sp.)	2.0 (2 - 2) n1 Labeled			1.4 (1 - 2) n8 Labeled		1.4 (1 - 3) n5	
	Candytuft (Iberis sp.)				3.3 (2 - 4) n3 Labeled			MFG Hold
	Common Winterberry (Ilex verticillata)					1.0 (1 - 1) n1		



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Deciduous Tree/Shrub/Vine	Virginia Sweetspire ( <i>Itea virginica</i> )			1.7 (1 - 3) n3 Labeled			
	Japanese Rose ( <i>Kerria japonica</i> )			1.3 (1 - 2) n3 Labeled			
	Crape Myrtle ( <i>Lagerstroemia indica</i> )	1.0 (1 - 1) n2 Labeled		1.3 (1 - 2) n4			
	Larch ( <i>Larix</i> sp.)			1.0 (1 - 1) n3			
	Apple ( <i>Malus</i> sp.)	1.0 (1 - 1) n4 Labeled		1.0 (1 - 1) n3 Labeled			
	Sourwood, Sorrel Tree ( <i>Oxydendrum arboreum</i> )			1.0 (1 - 1) n1 Labeled			
	Mock Orange ( <i>Philadelphus</i> sp.)			2.5 (1 - 4) n2 Labeled			
	Beach Plum ( <i>Prunus maritima</i> )	1.0 (1 - 1) n1					
	Plum ( <i>Prunus</i> sp.)	1.0 (1 - 1) n1					
	Common Pear ( <i>Pyrus communis</i> )	1.0 (1 - 1) n1					
	Oak, Shumard Red ( <i>Quercus shumardii</i> )			1.7 (1 - 2) n3			
	Oak ( <i>Quercus</i> sp.)			1.0 (1 - 1) n4 Labeled			
	Oak, Southern Live ( <i>Quercus virginiana</i> )			1.5 (1 - 2) n2		1.0 (1 - 1) n3	
	Buckthorn ( <i>Rhamnus</i> sp.)						MFG Hold
	Island Gooseberry ( <i>Ribes viburnifolium</i> )			1.5 (1 - 2) n2			
	Rose ( <i>Rosa</i> sp.)	1.0 (1 - 1) n24 Labeled		1.0 (1 - 1) n6 Labeled	3.0 (3 - 3) n1	1.7 (1 - 2) n3	
	Elderberry ( <i>Sambucus</i> sp.)			2.8 (1 - 5) n5 Labeled			
	Japanese Meadowsweet ( <i>Spiraea japonica</i> )				2.0 (1 - 3) n2		
	Bridal-Wreath ( <i>Spiraea</i> sp.)			1.3 (1 - 2) n4 Labeled			
Camellia, Mountain ( <i>Stewartia</i> sp.)			1.0 (1 - 1) n3				
Lilac ( <i>Syringa</i> sp.)			1.3 (1 - 2) n4 Labeled				

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Deciduous Tree/Shrub/Vine	Elm (Ulmus sp.)			1.3 (1 - 2) n3			
	Arrowwood (Viburnum sp.)	2.0 (2 - 2) n1 Labeled		1.3 (1 - 3) n9 Labeled	1.0 (1 - 1) n1		
	Weigela (Weigela sp.)	MFG Hold					
	Japanese Zelkova (Zelkova serrata)			1.0 (1 - 1) n3			
Fern	Fern, Variegated Leatherleaf (Arachniodes simplicior)	2.0 (2 - 2) n1					1.0 (1 - 1) n1
	Fern, Lady (Athyrium nipponicum)			2.5 (1 - 4) n2			3.0 (2 - 4) n3
	Japanese Netvein Hollyfern (Cyrtomium falcatum)						3.0 (3 - 3) n1
	Fern, Shaggy Shield (Dryopteris cycadina)			4.0 (4 - 4) n1			
	Fern, Autumn (Dryopteris erythrosora)			2.3 (1 - 4) n4			1.0 (1 - 1) n1
	Fern, Southern Wood (Dryopteris ludoviciana)	2.0 (2 - 2) n1					1.0 (1 - 1) n1
	Fern, Royal (Osmunda regalis)			4.0 (4 - 4) n2 Labeled			
	Korean Tasselfen (Polystichum polyblepharum)						2.0 (2 - 2) n1
Hardy Ground Cover Foliage	Carpet Bugleweed (Ajuga reptans)	1.0 (1 - 1) n1 Labeled					
	Lilacbush (Aubrieta sp.)						MFG Hold
	Ivy (Hedera sp.)	1.3 (1 - 2) n4 Labeled					
	Lilyturf, Big Blue (Liriope muscari)		1.7 (1 - 3) n3 Labeled				1.0 (1 - 1) n1 Labeled
	Lilyturf (Liriope sp.)	1.9 (1 - 3) n9 Labeled		1.0 (1 - 1) n4 Labeled			
	Liriope, Creeping (Liriope spicata)				2.0 (1 - 3) n2		
	Catnip (Nepeta cataria)			2.0 (1 - 3) n4 Labeled			
	Mondo Grass; Lilyturf; Ker-Gawl (Ophiopogon sp.)	1.0 (1 - 1) n1		1.3 (1 - 2) n3			
	Japanese Pachysandra (Pachysandra terminalis)	1.0 (1 - 1) n1 Labeled		1.0 (1 - 1) n3 Labeled			

Plant Group	Crop	Chipco Ronstar 2G (Oxadiazon)	Fortress (OHP1701B) (isoxaben + dithiopyr)	Freehand G (Dimethenamid-p + pendimethalin)	Fuerte (OHP1702V) (OHP1702V)	Gemini Granular (Prodiamine + isoxaben)	Pendulum 2G (Pendimethalin)
Hardy Ground Cover Foliage	Periwinkle, Big (Vinca major)			1.7 (1 - 3) n3	1.0 (1 - 1) n1		
	Periwinkle, Common (Vinca minor)			3.0 (1 - 4) n4 <i>Labeled</i>	1.0 (1 - 1) n2		
	Periwinkle (Vinca sp.)	1.0 (1 - 1) n2					
Herbaceous Flowering Plant	Lily-Of-The-Nile (Agapanthus sp.)			1.8 (1 - 4) n4 <i>Labeled</i>			
	Giant Hyssop, Sunset (Agastache rupestris)						1.0 (1 - 1) n2
	Giant Hyssop (Agastache sp.)			1.0 (1 - 1) n4			2.0 (1 - 4) n3 <i>Labeled</i>
	Lady's-Mantle (Alchemilla sp.)						1.2 (1 - 2) n6 <i>Labeled</i>
	Golden Trumpet (Allamanda cathartica)			1.0 (1 - 1) n1			
	Allamanda (Allamanda sp.)					1.0 (1 - 1) n1	
	Pussy-Toes, Stoloniferous (Antennaria dioica)						1.0 (1 - 1) n1 <i>Labeled</i>
	Pussy-Toes, Small-leaf (Antennaria parvifolia)						1.0 (1 - 1) n2 <i>Labeled</i>
	Thrift Sea Pink (Armeria maritima)			2.5 (1 - 4) n4 <i>Labeled</i>			1.3 (1 - 2) n3 <i>Labeled</i>
	Twinspur (Diascia integerrima)						1.0 (1 - 1) n2
	Hummingbird Trumpet (Epilobium canum)			2.0 (0 - 4) n2 <i>Labeled</i>			
	Alpine Willowherb (Epilobium fleischeri)						1.0 (1 - 1) n2
	Epimedium (Epimedium sp.)						2.0 (2 - 2) n2
	Gazania (Gazania sp.)			3.4 (2 - 4) n5 <i>Labeled</i>			MFG Hold
	Dead Nettle (Lamium sp.)			3.5 (0 - 5) n4 <i>Labeled</i>			
	Golden Rockets (Ligularia stenocephala)						1.0 (1 - 1) n4 <i>Labeled</i>
	Sweet Alyssum (Lobularia maritima)			1.3 (1 - 2) n3 <i>Labeled</i>			

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Herbaceous Flowering Plant	Loosestrife, Yellow; Golden Globe (Lysimachia sp.)						2.0 (2 - 2) n1 Labeled
	Tenweeks Stock (Matthiola incana)			3.3 (3 - 4) n3 Labeled			
	Hopflower Oregano; Majoram (Origanum libanoticum)						1.0 (1 - 1) n2 Labeled
	Little Pickles Ice Plant (Othonna capensis)						1.0 (1 - 1) n2
	Carolina Wild Petunia (Ruellia caroliniensis)						1.0 (1 - 1) n1 Labeled
	Thick-Leaved Butcher's Broom (Ruscus hypophyllum)				1.0 (1 - 1) n1		
	Sage (Salvia daghestanica)						1.0 (1 - 1) n2
	Woodland Sage (Salvia x sylvestris)				1.9 (1 - 2) n7 Labeled		1.0 (1 - 1) n1 Labeled
	Lavender Cotton (Santolina chamaecyparissus)				1.0 (1 - 1) n1		1.0 (1 - 1) n2 Labeled
	Naupaka; Fan-flower (Scaevola sp.)				2.8 (1 - 4) n4 Labeled		
	South American Skullcap (Scutellaria racemosa)						1.0 (1 - 1) n2
	Virginia Spiderwort; Spider Lily (Tradescantia virginiana)						1.0 (1 - 1) n2 Labeled
Herbaceous Flowering Plant - Annual	Ageratum (Ageratum sp.)	1.0 (1 - 1) n3					
	Garden Snapdragon (Antirrhinum majus)	3.0 (3 - 3) n2					
	Periwinkle, Madagascar (Catharanthus roseus)			3.3 (2 - 4) n4 Labeled			
	Cosmos (Cosmos sp.)						1.0 (1 - 1) n1
	Transvaal Daisy (Gerbera sp.)						1.5 (1 - 3) n6 Labeled
	Common sunflower (Helianthus annuus)						3.0 (3 - 3) n1
	Sunflower (Helianthus sp.)				2.3 (1 - 4) n3		1.5 (1 - 2) n2 Labeled

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Herbaceous Flowering Plant - Annual	Impatiens, New Guinea (Impatiens hawkeri)			2.8 (2 - 4) n4 Labeled			
	Morning Glory (Ipomoea sp.)			1.8 (1 - 3) n4			
	Lantana (Lantana sp.)			1.8 (1 - 3) n4 Labeled			1.0 (1 - 1) n1 Labeled
	Geranium (Pelargonium sp.)						2.0 (2 - 2) n1 Labeled
	Regal Geranium (Pelargonium x domesticum)					1.0 (1 - 1) n2	
	Pentas (Pentas sp.)						MFG Hold
	Petunia (Petunia sp.)	2.0 (2 - 2) n1		1.0 (1 - 1) n4 Labeled			
	Purslane (Portulaca sp.)	1.0 (1 - 1) n1		2.5 (2 - 3) n2 Labeled			
	Scarlet Sage (Salvia splendens)			1.0 (1 - 1) n1 Labeled			
	Marigold, African (Tagetes erecta)					2.3 (1 - 4) n3	
	Marigold (Tagetes sp.)			3.2 (1 - 4) n5 Labeled			
	Violet (Viola sp.)						1.0 (1 - 1) n1 Labeled
	Pansy, Large Flowering; Wittrock's Violet (Viola X wittrockiana)	1.0 (1 - 1) n1					
	Zinnia (Zinnia sp.)						3.0 (3 - 3) n1
Herbaceous Flowering Plant - Annual/Biennial/Peren	Delosperma (Delosperma sp.)			2.0 (1 - 3) n3			
	Sage (Salvia sp.)		2.0 (1 - 3) n2				
Herbaceous Flowering Plant - Perennial	Yarrow, Common (Achillea millefolium)			2.3 (1 - 3) n3			1.0 (1 - 1) n3 Labeled
	Yarrow (Achillea sp.)		2.0 (1 - 3) n2				
	Black Bugbane (Actaea racemosa var. racemosa)						3.0 (3 - 3) n1 Labeled
	Madwort (Alyssum sp.)	MFG Hold					
	Bluestar (Amsonia sp.)			3.0 (2 - 4) n2 Labeled			2.0 (1 - 4) n3 Labeled



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Herbaceous Flowering Plant - Perennial	Cheddar Pink ( <i>Dianthus gratianopolitanus</i> )		1.0 (1 - 1) n1				
	Pink ( <i>Dianthus</i> sp.)	MFG Hold		1.5 (1 - 2) n4 Labeled			
	Foxglove, Yellow ( <i>Digitalis grandiflora</i> )		4.5 (4 - 5) n2				
	Foxglove ( <i>Digitalis</i> sp.)					2.7 (1 - 4) n3	MFG Hold
	Purple Coneflower ( <i>Echinacea</i> sp.)				1.7 (1 - 4) n6 Labeled	2.0 (1 - 3) n3	1.0 (1 - 1) n5 Labeled
	Joe Pye Weed ( <i>Eupatorium maculatum</i> )						1.0 (1 - 1) n1 Labeled
	Common Boneset ( <i>Eupatorium perfoliatum</i> )						1.0 (1 - 1) n1
	Joe Pye Weed ( <i>Eupatorium purpureum</i> )						1.0 (1 - 1) n4 Labeled
	Thoroughwort ( <i>Eupatorium</i> sp.)				1.5 (1 - 3) n4		1.0 (1 - 1) n3 Labeled
	Apache Plume ( <i>Fallugia paradoxa</i> )						1.0 (1 - 1) n2
	Blanket Flower ( <i>Gaillardia</i> sp.)	2.0 (1 - 3) n2 Labeled			2.0 (1 - 5) n4		
	Beeblossom, Lindheimer's ( <i>Gaura lindheimeri</i> )				2.0 (1 - 3) n7 Labeled		1.0 (1 - 1) n4 Labeled
	Treasureflower ( <i>Gazania linearis</i> )						1.3 (1 - 2) n3 Labeled
	Globe Amaranth ( <i>Gomphrena</i> sp.)						1.3 (1 - 2) n4 Labeled
	Common Sneezeweed ( <i>Helenium autumnale</i> )						1.0 (1 - 1) n4 Labeled
	Sneezeweed ( <i>Helenium</i> sp.)						1.0 (1 - 1) n1
	Frostweed ( <i>Helianthemum</i> sp.)						1.0 (1 - 1) n1 Labeled
	Sunflower, Willowleaf ( <i>Helianthus salicifolius</i> )						1.0 (1 - 1) n1 Labeled
Smooth Oxeye ( <i>Heliopsis helianthoides</i> )						MFG Hold	

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Herbaceous Flowering Plant - Perennial	Hellebore, Black ( <i>Helleborus niger</i> )	2.0 (2 - 2) n1					3.0 (2 - 4) n2 Labeled
	Coral Bells ( <i>Heuchera sanguinea</i> )						1.3 (1 - 2) n3 Labeled
	Alumroot ( <i>Heuchera</i> sp.)			2.0 (1 - 4) n3 Labeled			
	Rosemallow ( <i>Hibiscus</i> sp.)	1.0 (1 - 1) n1		1.2 (1 - 2) n6 Labeled			
	Lily, Plantain ( <i>Hosta fortunei</i> )						1.0 (1 - 1) n1 Labeled
	Plantain Lily ( <i>Hosta</i> sp.)	1.0 (1 - 1) n1 Labeled		1.4 (1 - 2) n5 Labeled			
	Stonecrop, October Daphne ( <i>Hylotelephium sieboldii</i> )						5.0 (5 - 5) n1
	Poker Plant ( <i>Kniphofia</i> sp.)						1.1 (1 - 2) n7 Labeled
	Max Chrysanthemum ( <i>Leucanthemum maximum</i> )			1.5 (1 - 3) n4			1.0 (1 - 1) n2
	Blazing-Star ( <i>Liatris</i> sp.)	1.0 (1 - 1) n1 Labeled		3.0 (2 - 4) n4 Labeled			
	Sealavender ( <i>Limonium</i> sp.)	2.0 (2 - 2) n1					
	Perennial Flax ( <i>Linum perenne</i> )						1.0 (1 - 1) n5 Labeled
	Lobelia ( <i>Lobelia</i> sp.)				2.8 (1 - 4) n5 Labeled		
	Bee Balm, Scarlet ( <i>Monarda didyma</i> )						1.3 (1 - 2) n3 Labeled
	Evening Primrose; Sundrops ( <i>Oenothera</i> sp.)				2.4 (1 - 4) n5 Labeled		1.3 (1 - 2) n3
	Peony, Common Garden ( <i>Paeonia lactiflora</i> )					1.0 (1 - 1) n1	
	Peony ( <i>Paeonia</i> sp.)				1.0 (1 - 1) n3		1.0 (1 - 1) n1
	Beard-Tongue ( <i>Penstemon</i> sp.)				1.0 (1 - 1) n4		1.0 (1 - 1) n6 Labeled
Sage, Russian ( <i>Perovskia atriplicifolia</i> )			2.0 (1 - 3) n2 Labeled				



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Herbaceous Flowering Plant - Perennial	Sage, Russian (Perovskia sp.)						2.0 (2 - 2) n1 Labeled
	Phlox, Carolina (Phlox carolinia)			2.5 (1 - 4) n4			
	Phlox, Fall (Phlox paniculata)			2.5 (1 - 4) n2 Labeled		3.5 (3 - 4) n4	4.0 (4 - 4) n1
	Phlox, Moss (Phlox subulata)			2.0 (1 - 3) n4 Labeled			1.7 (1 - 2) n3 Labeled
	False Dragon Head; Lion's Heart (Physostegia sp.)						1.0 (1 - 1) n1 Labeled
	Jacob's Ladder (Polemonium sp.)						1.3 (0 - 3) n6 Labeled
	Cinquefoil (Potentilla sp.)	1.0 (1 - 1) n1 Labeled		1.0 (1 - 1) n4 Labeled			
	Coneflower, Orange, var. speciosa (Rudbeckia fulgida var. speciosa)			3.7 (3 - 4) n3 Labeled			
	Black-Eyed Susan (Rudbeckia hirta)						3.0 (3 - 3) n1
	Pincushions (Scabiosa sp.)			3.3 (2 - 4) n4 Labeled			MFG Hold
	Goldenrod, Wrinkleleaf (Solidago rugosa)						1.0 (1 - 1) n4 Labeled
	Goldenrod, Seaside (Solidago sempervirens)						1.0 (1 - 1) n3 Labeled
	Goldenrod (Solidago sp.)			1.0 (1 - 1) n3 Labeled			1.5 (1 - 2) n2
	Goldenrod, Showy (Solidago speciosa)						1.0 (1 - 1) n1 Labeled
	Goldenrod, Autumn (Solidago sphacelata)			1.0 (1 - 1) n3 Labeled			
	Lamb's Ears (Stachys byzantina)			3.0 (2 - 4) n2			1.0 (1 - 1) n1
	Aster, White Heath (Symphyotrichum ericoides)						1.0 (1 - 1) n2
	Aster, New York (Symphyotrichum novi-belgii)						1.0 (1 - 1) n4 Labeled
Foamflower, Heartleaf (Tiarella cordifolia)						2.3 (1 - 4) n4 Labeled	

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Herbaceous Flowering Plant - Perennial	Foamflower; False Miterwort (Tiarella sp.)						4.0 (4 - 4) n1 Labeled
	Vervain (Verbena sp.)			1.3 (1 - 2) n4 Labeled			1.0 (1 - 1) n1 Labeled
	Ironweed, New York (Vernonia noveboracensis)			1.5 (1 - 2) n2			1.0 (1 - 1) n2 Labeled
	Turkish Veronica (Veronica liwanensis)						2.7 (1 - 4) n3
	Speedwell (Veronica sp.)			2.0 (1 - 4) n5 Labeled			
	Speedwell, Spiked (Veronica spicata)			3.7 (3 - 4) n3 Labeled			
Herbaceous Perennials	Mugwort, White (Artemisia lactiflora)						1.0 (1 - 1) n2 Labeled
	Lavender, English (Lavandula angustifolia)						1.0 (1 - 1) n6 Labeled
	Lavender (Lavandula sp.)			1.3 (1 - 3) n7 Labeled			1.0 (1 - 1) n1 Labeled
	Nepeta (Nepeta x faassenii)			1.8 (1 - 4) n5 Labeled		2.0 (1 - 3) n3	1.6 (1 - 4) n7
Narrowleaf Evergreen Tree/Shrub	Fir, Fraser (Abies fraseri)			1.3 (1 - 2) n4 Labeled			
	Cedar, Atlas (Cedrus atlantica)			1.0 (1 - 1) n2			
	Cedar (Chamaecyparis sp.)			1.2 (1 - 2) n6 Labeled			
	Japanese Cedar (Cryptomeria japonica)			1.3 (1 - 2) n4			
	Leyland Cypress (Cuprocyparis leylandii)			1.0 (1 - 1) n3			
	Juniper (Juniperus sp.)	1.4 (1 - 2) n5 Labeled		1.0 (1 - 1) n6 Labeled			
	Spruce, Dwarf Alberta (Picea glauca 'Conica')				1.0 (1 - 1) n1		
	Spruce (Picea sp.)			1.0 (1 - 1) n3 Labeled			
	Pine, Austrian (Pinus nigra)				1.0 (1 - 1) n1		



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Ornamental Grass	Weeping Lovegrass ( <i>Eragrostis curvula</i> )						1.0 (1 - 1) n3	
	Purple Lovegrass ( <i>Eragrostis spectabilis</i> )						1.5 (1 - 2) n2	
	Blue Fescue ( <i>Festuca cinerea</i> )		1.0 (1 - 1) n1					
	Field Fescue ( <i>Festuca glauca</i> )			3.0 (2 - 4) n4				
	Hakone Grass ( <i>Hakonechloa</i> sp.)						1.0 (1 - 1) n1	
	Sweet Grass ( <i>Hierochloa odorata</i> )						1.0 (1 - 1) n1	
	Common Rush ( <i>Juncus effusus</i> )						1.0 (1 - 1) n3	
	Ryegrass, Sand ( <i>Leymus arenarius</i> )						1.0 (1 - 1) n3	
	Silver Grass ( <i>Miscanthus</i> sp.)				1.7 (1 - 2) n3 Labeled			
	Muhly, Hairawn ( <i>Muhlenbergia capillaris</i> )		1.0 (1 - 1) n2		2.0 (1 - 4) n3 Labeled			1.0 (1 - 1) n3
	Pine Muhly ( <i>Muhlenbergia dubia</i> )				3.5 (3 - 4) n2 Labeled			1.0 (1 - 1) n2
	Bamboo Muhly ( <i>Muhlenbergia dumosa</i> )							1.7 (1 - 2) n3
	Finestem Needlegrass ( <i>Nassella tenuissima</i> )			1.0 (1 - 1) n2				2.7 (1 - 4) n3
	Switch Grass ( <i>Panicum virgatum</i> )							MFG Hold
	Fountaingrass ( <i>Pennisetum alopecuroides</i> )							1.0 (1 - 1) n3
	Oriental Fountain Grass ( <i>Pennisetum orientale</i> )							1.8 (1 - 2) n4
	Crimson Fountain Grass ( <i>Pennisetum setaceum</i> )			1.5 (1 - 2) n2 Labeled	3.4 (1 - 4) n5			
	Flax, New Zealand ( <i>Phormium tenax</i> )							1.0 (1 - 1) n1 Labeled
	Plumegrass; Sugarcane ( <i>Saccharum</i> sp.)					2.3 (1 - 3) n3		1.0 (1 - 1) n3
	Little Bluestem ( <i>Schizachyrium scoparium</i> )							1.8 (1 - 3) n4
Indian Grass ( <i>Sorghastrum nutans</i> )							1.3 (1 - 2) n3	

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Ornamental Grass	Prairie Dropseed (Sporobolus heterolepis)						1.0 (1 - 1) n3
Palm	Dwarf Palmetto (Sabal minor)			1.0 (1 - 1) n4			
	Palm, Chinese Windmill (Trachycarpus fortunei)			1.0 (1 - 1) n1 Labeled			
Tropical Foliage Plant	Fatsia (Fatsia sp.)	1.0 (1 - 1) n2					
	Japanese Mock Orange (Pittosporum tobira)	2.0 (1 - 3) n2 Labeled					
	Jasmine, Asian Star (Trachelospermum asiaticum)			1.0 (1 - 1) n2			