

Project Name: Botrytis Efficacy

New		Ongoing	X	Completed		Duration if ongoing or completed:	2004, 2005 2011-2015
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Project Description:

This project originated as a regional project and then at the 2011 IR-4 Ornamental Horticulture Workshop became a high priority project due to reports of tolerance developing among *Botrytis cinerea* populations to several key fungicides and because there are other Botrytis species not typically screened for efficacy.

Research Project Abstract (if available):

Abstract from 2014 Botrytis Efficacy Summary

At the IR-4 Ornamental Horticulture Program Workshop in 2011, Botrytis Efficacy was selected as a high priority project to expand the knowledge and list of fungicides available to growers for these diseases. In addition to research collected through the IR-4 program, this summary includes a review of experiments conducted from 1998 to 2014 on ornamental horticulture crops. During this time period, numerous products representing 38 active ingredients were tested as foliar applications against several *Botrytis* species causing blight and gray mold on ornamentals. Most products are registered and commercially used. Almost all trials were conducted on *Botrytis cinerea*; other species tested were *B. elliptica* and *B. paeoniae* and *B. tulipae*. Although there were insufficient data for definitive conclusions, three new products that are included in the Botrytis efficacy project, BAS 703 and V-10135, looked promising, while Proud 3 and SP2770 looked ineffective. Limited data on other relatively new products (F9110, S2200, SP2773, Regalia, Torque, Tournay, Trinity) were inconclusive. Of the registered products, Daconil, Decree, Heritage, Insignia, Pageant and Palladium generally provided excellent efficacy; Chipco 26019 and Veranda O provided good efficacy and Disarm provided mediocre efficacy. ZeroTol, and the copper products (Camelot, Phytan 27, STBX-304) generally performed poorly.

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

Botrytis cinerea
Botrytis elliptica

Botrytis tulipae

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

Fir, Douglas (*Pseudotsuga menziesii*)
Geranium (*Pelargonium x hortorum*)

Hemlock, Western (*Tsuga heterophylla*)
Lily (*Lilium sp.*)

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

Alibi Flora (Difencconazole + azoxystrobin)
Badge X2 (Copper oxychloride + copper hydroxide)
BAS703 01F (Fluxapyroxad + pyraclostrobin)
Chipco 26019 N/G (Iprodione)
Daconil (Chlorothalonil)
Decree (Fenhexamid)
Disarm 480SC (Fluoxastrobin)
Endorse (Polyoxin D)
F9110 (F9110)
Insignia Intrinsic (Pyraclostrobin)
Medallion (Fludioxonil)
MilStop (Potassium bicarbonate)
Mural (A18126B) WDG (Benzovindiflupyr + azoxystrobin)

Pageant Intrinsic (Boscalid + Pyraclostrobin)
Palladium (Cyprodinil + fludioxonil)
Phyton-27 (Copper sulfate pentahydrate)
Proud 3 (Thyme oil (5.6%))
Regalia 50 (Extract of Reynoutria sachalinensis)
S2200 4SC
SP2770 10WP
SP2773
Switch 62.5WG (Cyprodinil + Fludioxonil)
Torque 3.6SC (Tebuconazole)
Tournay 50WDG (Metconazole)
Trinity 2SC (Triticonazole)
V-10135 (Fenpyrazamine)
ZeroTol (Hydrogen dioxide)



Ornamental Horticulture Program Research Project Sheet

<http://ir4.rutgers.edu/Ornamental/ornamentalProjectInformationSheets.cfm>

Product Registration and Research Status					
	Fully Screened (also includes standards)			Partially Screened through IR-4 ¹	Need Data Across Species?
Labeled Generally & Commercialized	Alibi Flora Chipco 26019 Decree Disarm Endorse	Insignia Medallion Milstop Pageant Palladium	Phyton-27 Regalia 50 Switch Tourney ZeroTol		Proud 3
Labeled Generally But NOT Commercialized					
Labeled for Specific Diseases & Commercialized					
Labeled for Specific Diseases but NOT Commercialized					
Not yet registered or Labeled					BAS 703 06F F9110 Mural S2200 Torque Trinity V-10135
No longer available for development		SP2770 * SP2773 *			

* IR-4 Data contributed to registration decision – either adding pest to label or not pursuing further research
¹ At least one species screened fully

Project Pros	Project Cons
<ol style="list-style-type: none"> 1 Botrytis is prone to resistance development and new classes of chemistry are a critical component 2 New potential products 3 High economic impact on certain crops 4 Post-harvest 5 Biologicals 6 Resistance management 	<ol style="list-style-type: none"> 1 Very few new products to screen 2 Biologicals? 3 Cost of Applications

IR-4 Efficacy Trials to Date

Average rating on a scale of 1 – 5 with 1 = 0 to about 50% efficacy (not effective) and 5 = 95 to 100 efficacy (very effective); minimum to maximum rating; number of trials (See table on next page). For product/disease combinations that are blank, IR-4 has not screened this combination.

‘Labeled’ indicates that this disease species or genera is listed on the label. A rating of 2 or lower is considered unacceptable efficacy (*red text*). A rating of 3 or higher is considered commercially acceptable (black text). Non-labeled, completed product/disease combinations (3 or more trials) with an average rating of 3 or higher are highlighted with **green text**. For disease/product combinations that are blank, IR-4 has not screened this combination.

Product (Active Ingredients)	<i>Botrytis elliptica</i>	Botrytis Gray Mold (<i>Botrytis cinerea</i>)	<i>Botrytis tulipae</i>
Alibi Flora (A13703G) SC (Difenconazole + Azoxystrobin)		1.0 (1 - 1) n1 Labeled	
Badge X2 (Copper Oxychloride + Copper Hydroxide)		1.0 (1 - 1) n1 Labeled	
BAS 516 UFF (Boscalid + Pyraclostrobin)		2.0 (1 - 3) n2	
BAS703 06F/BAS703 01F (Fluxapyrosad + pyraclostrobin)	5.0 (5 - 5) n1	1.5 (1 - 2) n2	3.0 (3 - 3) n1
Chipco 26019 N/G (Iprodione)	1.0 (1 - 1) n2 Labeled		2.0 (2 - 2) n1
Daconil 54EC (Chlorothalonil)		2.0 (2 - 2) n1	
Decree (Fenhexamid)	2.0 (2 - 2) n1	1.5 (1 - 2) n2 Labeled	
Disarm 480SC (Fluoxastrobin)	2.0 (1 - 3) n2 Labeled	1.0 (1 - 1) n1 Labeled	
Endorse (Polyoxin D)		2.0 (1 - 3) n3 Labeled	
F9110 (F9110)	1.0 (1 - 1) n1	1.0 (1 - 1) n2	2.0 (2 - 2) n1
Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)		2.5 (1 - 4) n2 Labeled	
Medallion (Fludioxonil)	3.0 (3 - 3) n1 Labeled	2.0 (1 - 5) n4 Labeled	
MilStop (Potassium bicarbonate)		1.0 (1 - 1) n2 Labeled	
Mural (A18126B) WDG (Benzovindiflupyr + Azoxystrobin)	5.0 (5 - 5) n1	1.0 (1 - 1) n1	
Pageant 38WG (Boscalid + Pyraclostrobin)	2.0 (1 - 3) n2 Labeled	2.0 (1 - 4) n3 Labeled	3.0 (3 - 3) n1
Palladium (Cyprodinil + fludioxonil)	1.5 (1 - 2) n2 Labeled	1.0 (1 - 1) n1 Labeled	
Phyton-27 (Copper sulfate pentahydrate)		1.0 (1 - 1) n2 Labeled	
Prestop (Gliocladium catenulatum Strain J1446)		1.0 (1 - 1) n1	
Proud 3 (Thyme oil (5.6%))	1.0 (1 - 1) n2	1.0 (1 - 1) n2	1.0 (1 - 1) n1
Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis)	1.0 (1 - 1) n1 Labeled	1.0 (1 - 1) n1 Labeled	
S2200 4SC (Mandestrobin)	4.0 (4 - 4) n1	1.0 (1 - 1) n1	2.0 (2 - 2) n1
SP2770 10WP (SP2770)	2.0 (2 - 2) n1	1.0 (1 - 1) n2	1.0 (1 - 1) n1
SP2773 (SP2773)	2.0 (2 - 2) n1	1.0 (1 - 1) n2	1.0 (1 - 1) n1
Switch 62.5WG (Cyprodinil + Fludioxonil)		3.0 (2 - 4) n2 Labeled	
Torque 3.6SC (Tebuconazole)	1.0 (1 - 1) n2	1.0 (1 - 1) n1	2.0 (2 - 2) n1
Tourney 50WDG (Metconazole)	1.0 (1 - 1) n1 Labeled		
Trinity 2SC (Triticonazole)	1.0 (1 - 1) n2		
V-10135 (Fenpyrazamine)	1.0 (1 - 1) n1	1.0 (1 - 1) n1	
ZeroTol (Hydrogen dioxide)	1.0 (1 - 1) n1 Labeled	1.0 (1 - 1) n1	

Fungicides (active ingredients)	FRAC Class	Registered Use Site(s)	REI	<i>Botrytis cinerea</i>
26/36 (iprodione+thiophanate methyl)	2 + 1	G, N	12 h	?
3336, OHP 6672, etc. (thiophanate methyl)	1	G, I, L, N, S	12 h	P
Actinovate (<i>Streptomyces lydicus</i>)	NC	G, I, L, N, S	1 h	E,G
Affirm, Veranda (polyoxin D zinc salt)	19	G, L, N, S	1 h	G
Alibi Flora (azoxystrobin + difenoconazole)	11 + 3	G, L, N, S	12 h	?
Armicarb, Milstop, etc. (potassium bicarbonate)	NC	G, I, L, N, S	4, 1 h	E
Badge (copper hydroxide+copper oxychloride)	M1	G, N, S	48 h	?
Banner Maxx, ProPensity (propiconazole)	3	N	12 h	?
Basicop, Cuprofix (copper sulfate)	M1	G, N, S	48 h	?
Bayleton, Strike (triadimefon) ^a	3	G, N	12 h	?
Botran (dicloran)	14	G, N	12 h	?
Camelot, etc. (copper octanoate)	M1	G, I, N, S	4 h	P
Captan (captan)	M4	G	48 h	G
Cease, Serenade Optimum, etc. (<i>Bacillus subtilis</i>)	44	G, I, N, S	4 h	E
Champ, Champion, Kentan, Kocide, etc.(copper hydroxide)	M1	G, I N, S	48 h	?
Chipco 26019, etc. (iprodione)	2	G, N	12 h	G
Clevis (mancozeb+myclobutanil)	M3+3	G, N	24 h	?
Compass O (trifloxystrobin) ^b	11	G, I, L, N, S	12 h	G
Concorde, Daconil, etc. (chlorothalonil)	M5	G, N	12 h	E
Concert II (chlorothalonil+propiconazole)	M5+3	N	12 h	G-E
Consyst, Spectro (chlorothalonil+thiophanate methyl)	M5+1	G, I, N	12 h	E
Copper Count-N, etc. (copper ammonium complex)	M1	G, I N, S	12 h	?
Cygnus (kresoxym-methyl) *	11	G, L, N, S	12 h	?
Decree (fenhexamid)	17	G, N	12 h	E
Disarm, Fame (fluoxastrobin) ^e	11	G, I, N, S	12 h	F
Dithane, Fore, etc. (mancozeb)	M3	G, N	24 h	E
Eagle, etc. (myclobutanil)	3	G, N	24 h	?
Heritage (azoxystrobin)	11	G, N, S	4 h	F-E
Insignia, Empress Intrinsic (pyraclostrobin) ^c	11	^c	12 h	E
JMS Stylet Oil, SuffOil-X, etc. (mineral oil)	NC	G, N	4 h	?
Junction (copper hydroxide+mancozeb)	M1 + M3	G, N	24 h	?
Kleengrow (Didecyl dimethyl ammonium chloride)	-	G	48 h	?
Medallion (fludioxonil)	12	G, I, L, N, S	12 h	G-E
Microthiol Disperss etc. (sulfur)	M2	G, N	24 h	?
Mural, A18126B (benzovindiflupyr + azoxystrobin)	- +11	TBD	-	?
Mycostop (<i>Streptomyces griseoviridis</i>)	NC	G, N	4 h	F
Nordox (cuprous oxide)	M1	M1	24 h	?
Pageant Intrinsic (pyraclostrobin+boscalid)	11+7	G, L, I, N, S	12 h	E
Palladium (cyprodinil+fludioxonil)	9+12	G, L, N, S	12 h	E

Fungicides (active ingredients)	FRAC Class	Registered Use Site(s)	REI	<i>Botrytis cinerea</i>
Phyton (copper sulfate pentahydrate)	M1	G, I, N	24 h	P
Prestop (<i>Gliocladium catenulatum</i> strain J446)	NC	G, I, N, S	0 h	P
Regalia (extract of <i>Reynoutria sachalinensis</i>)	P5	G, I, L, N, S	4 h	?
Strike Plus (trifloxystrobin + triadimefon)	11 + 3	G, N	12 h	?
Terraguard (triflumizole)	3	G, I, N, S	12 h	P
Torque, Tebuconazole SC T&O Fungicide (tebuconazole)	3	N	12 h	?
Tourney (metconazole)	3	N	0 h	?
Triact, Trilogy, etc. (neem oil extract)	18B	G, I, L, N, S	4 h	-
Tourney (metconazole)	3	N	12 h	?
Trinity (triticonazole)	3	G, L, I, N, S	12h	G
ZeroTol (hydrogen dioxide)	NC	G, I, N	0 h	P-F
Ziram (ziram)	M3	G,N	48 h	?
Zyban (Mancozeb + thiophanate methyl)	M3 + 1	G, N	24 h	?
Experimentals				
BAS703 (fluxapyroxad + pyraclostrobin)	7 + 11	TBD	-	?
F9110 (F9110)	-	TBD	-	?
Fluopyram 500 SC ^d	7	TBD	-	?
Fluopyram + Trifloxystrobin ^d	7 + 11	TBD	-	?
MBI-110 (<i>Bacillus amyloliquifaciens</i> strain F727)	44	TBD	-	?
NUP 09092 (fludioxonil)	12	TBD	12 h	?
Proud 3 (thyme oil)	NC	TBD	0 h	?
S2200 (mandestrobin)	11	TBD	-	?
SP2770 (SP2770) *	-	TBD	-	?
SP2773 (SP2773) *	-	TBD	-	?

Registered Use Sites: G = Greenhouse; L = Lath House; I = Indoors; N = Nursery; S = Shade House; TBD = To Be Determined

Application Method: D = Drench; S = Spray

Efficacy: E = clearly statistically equivalent or better than untreated non-inoculated and/or clearly statistically different than untreated inoculated; G = statistically different from untreated inoculated and untreated non-inoculated; F = statistically equivalent to both untreated inoculated and untreated non-inoculated; P = statistically equivalent to untreated inoculated. For trials without non-inoculated check, efficacy determined on author's conclusions, % control or comparisons to standard product(s).

Efficacy ratings taken from 24 PDMR efficacy reports for *Botrytis cinerea*

* Not for development in ornamental horticulture

^a Will be replaced with Armada 50WDG/Strike Plus (triadimefon + trifloxystrobin). Anthracnose in nursery grown fruit and ornamental varieties.

^b Bayer comments: Leafspot and blight disease in foliage, annual and perennial crops. Anthracnose in nursery grown fruit and ornamental varieties.

^c Insignia is labeled for use in landscape and turf use only. Empress Intrinsic has replaced Insignia for use in production ornamentals applied as drench to control soil-borne diseases caused by *Fusarium*, *Phytophthora*, *Pythium* and *Rhizoctonia* spp.

^d Bayer supports testing.

^e Fame will be replacing DisArm