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**IR-4 Ornamental Horticulture Program
Botrytis Efficacy: A Literature Review**

Botrytis cinerea
Botrytis elliptica
Botrytis paeoniae
Botrytis tulipae

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Abstract

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, Tourney, 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, Phyton 27, STBX-304) generally performed poorly.

Introduction

In 2011, IR-4 initiated a high priority project to determine efficacy of several fungicides on *Botrytis* species to obtain data supporting current and future registrations on ornamentals. This report includes the results of 17 experiments from 2001 to 2014 received from the IR-4 Ornamental Horticulture Program. We also reviewed 23 available ornamental trials published in Fungicide & Nematicide Tests and Plant Disease Management Reports to check efficacy of experimental and registered fungicides on *Botrytis* species; the source of report is included under each data table. This report is a brief summary of available data from these sources.

Materials and Methods

From 1998 to 2014, numerous products representing 38 active ingredients were tested as foliar applications against several *Botrytis* species causing blight and gray mold on ornamentals. Treatments were generally applied either a few days or immediately before *Botrytis* inoculation. Researchers used a minimum of four replications. Disease severity and incidence were recorded at various intervals after initial application. Phytotoxicity or lack of it was generally noted in the reports. Eight researchers were involved in the testing (Appendix 1).

Products were supplied by their respective manufacturers.

For IR-4 testing, the following protocols were used: 11-028, 12-017, 13-017 and 14-001. Please visit <http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm> to view and download these protocols.

For all research data tables, product names have been updated where manufacturers have established trade names, and tables have been rearranged by product alphanumeric order. Where both inoculated and non-inoculated checks were included in the experiment, the inoculated check appears last in the table with the non-inoculated check immediately preceding it.

Table 1. List of Products and Rates Tested on Ornamentals from 1998 to 2014.

Active Ingredient(s)	Product(s)	Manufacturer		Rate(s) Tested	# Trials
Azoxystrobin	Heritage	Syngenta	Foliar	1 oz per 100 gal 2 oz per 100 gal 4 oz per 100 gal 8 oz per 100 gal	13
<i>Bacillus subtilis</i>	QRD 713, Rhapsody	Agraquest	Foliar	4 qt per 100 gal 6 qt per 100 gal 8 qt per 100 gal	3
Boscalid	BAS 510	BASF	Foliar	4 oz per 100 gal 6.8 oz per 100 gal 8 oz per 100 gal 16 oz per 100 gal	4
Boscalid + pyraclostrobin	BAS 516	BASF	Foliar	9.5 oz per 100 gal 18 oz per 100 gal	2
	Pageant			7 oz per 100 gal 9.5 oz per 100 gal 12.5 oz per 100 gal 14 oz per 100 gal 18 oz per 100 gal	10

Active Ingredient(s)	Product(s)	Manufacturer	Rate(s) Tested	# Trials	
Chlorothalonil	Daconil 2787 6F	Syngenta	32 fl oz per 100 gal	3	
	Daconil Ultrex		0.68 lb per 100 gal 1.0 lb per 100 gal 1.35 lb per 100 gal 2.5 lb per 100 gal	4	
			Daconil Weatherstik	22 fl oz per 100 gal 32 fl oz per 100 gal	15
				Sipcam	19 oz per 100 gal 22 fl oz per 100 gal
	Echo 720 6F				
Chlorothalonil + Thiophanate methyl	Spectro	Cleary	Foliar	16 oz per 100 gal	1
Copper hydroxide	Kocide	DuPont	Foliar	1 lb per 100 gal	1
Copper octanoate	Camelot	SePRO	Foliar	32 fl oz per 100 gal 48 flo oz per 100 gal	2
Copper sulfate pentahydrate	Phyton 27	Phyton	Foliar	15 fl oz per 100 gal 20 fl oz per 100 gal	4
Cupric ammonium formate	STBX-304	Phyton	Foliar	20 oz per 100 gal	2
Cyprodinil	Vanguard	Syngenta	Foliar	2 oz per 100 gal	1
Cyprodinil + fludioxonil	Palladium	Syngenta	Foliar	2 oz per 100 gal 4 oz per 100 gal 6 oz per 100 gal 8 oz per 100 gal 12 oz per 100 gal	12
	Switch			3 oz per 100 gal 4 oz per 100 gal 6 oz per 100 gal 12 oz per 100 gal 14 oz per 100 gal	8
F9110	F9110	FMC	Foliar	24 oz per 100 gal	3
Fenhexamid	Decree	SePRO	Foliar	8 oz per 100 gal 12 oz per 100 gal 16 oz per 100 gal 24 oz per 100 gal 28 oz per 100 gal 32 oz per 100 gal	24
Fenpyrazamine	V-10135	Valent	Foliar	7 fl oz per 100 gal 9.6 fl oz per 100 gal 16 fl oz per 100 gal	6
Fluazinam	Omega	Syngenta	Foliar	8 fl oz per 100 gal	2
Fludioxonil	Medallion	Syngenta	Foliar	1 oz per 100 gal 2 oz per 100 gal 4 oz per 100 gal 8 oz per 100 gal	17
Fluoxastrobin	Disarm	Arysta, OHP	Foliar	3 fl oz per 100 gal 4 fl oz per 100 gal 6 fl oz per 100 gal 8 fl oz per 100 gal 21 fl oz per 100 gal	8
Fluxapyroxad + pyraclostrobin	BAS 703	BASF	Foliar	4 oz per 100 gal 8 oz per 100 gal	2

Active Ingredient(s)	Product(s)	Manufacturer	Rate(s) Tested		# Trials
<i>Gliocladium catenulatum</i>	Prestop	Verdera	Foliar	0.5 %	1
GWN-4550	GWN-4550		Foliar	10.0 oz per 100 gal 11.4 oz per 100 gal	1
Hydrogen dioxide	ZeroTol	BioSafe	Foliar	30 fl oz per 100 gal 42 fl oz per 100 gal 4 qt per 100 gal	3
Iprodione	Chipco 26019	OHP	Foliar	0.5 lb per 100 gal 1 lb per 100 gal 2 lb per 100 gal 2.5 lb per 100 gal	12
	Chipco 26GT F	Bayer	Foliar	2.5 qt per 100 gal	1
Mancozeb	Fore	Dow	Foliar	1.5 lb per 100 gal	1
Mandestrobin	S2200	BuFarm	Foliar	7.5 fl oz per 100 gal	1
Metconazole	Tourney	Valent	Foliar	4 oz per 100 gal	1
Polyoxin D	Endorse	Arysta	Foliar	4 oz per 100 gal 8 oz per 100 gal 9 oz per 100 gal 12 oz per 100 gal 18 oz per 100 gal 28 oz per 100 gal 36 oz per 100 gal	10
	Veranda O	OHP		4 oz per 100 gal 8 oz per 100 gal	3
Potassium bicarbonate	Kaligreen		Foliar	2.5 lb per 100 gal	1
	Milstop	BioWorks		5 lb per 100 gal	2
Pyraclostrobin	BAS 500, Cabrio	BASF	Foliar	8 oz per 100 gal 16 oz per 100 gal 40 oz per 100 gal	2
	Insignia			4 oz per 100 gal 8 oz per 100 gal 12 oz per 100 gal 16 oz per 100 gal	6
<i>Reynoutria sachalinensis</i> extract	Regalia 5O	Marrone	Foliar	4 fl oz per 100 gal	3
SP2770	SP2770	SePRO	Foliar	2.66 lb per 100 gal	4
SP2773	SP2773	SePRO	Foliar	1.66 lb per 100 gal	4
STBX-013	STBX -013	Phyton	Foliar	6.4 fl oz per 100 gal 12.8 fl oz per 100 gal	1
<i>Streptomyces griseoviridis</i> Strain K 31	Mycostop	Verdera	Foliar	5 g per 13 gal	1
Tebuconazole	Torque	NuFarm	Foliar	8 fl oz per 100 gal	4
Thiophanate methyl	3336	Cleary	Foliar	16 oz per 100 gal	1
	Fungo	Scotts		12 oz per 100 gal 16 oz per 100 gal	1
	OHP 6672	OHP		20 fl oz per 100 gal	2
Thyme oil	Proud 3	BioHumanetics	Foliar	4 qt per 100 gal	5

Active Ingredient(s)	Product(s)	Manufacturer	Rate(s) Tested	# Trials
Trifloxystrobin	Compass	Bayer	Foliar 0.5 oz per 100 gal 1 oz per 100 gal 2 oz per 100 gal 4 oz per 100 gal	7
Triflumizole	Terraguard	Chemtura	Foliar 4 oz per 100 gal 8 oz per 100 gal	1
Triticonazole	Trinity	BASF	Foliar 8 floz per 100 gal 12 fl oz per 100 gal	3

Results

Comparative Efficacy for *Botrytis cinerea*

From 1998 through 2014, 38 experiments were conducted by researchers throughout the US to examine the activity of new chemical and biologically-based tools for *Botrytis cinerea*. The following experiments are organized chronologically with each crop. The crops are organized first by those grown primarily in greenhouses and then those that are field grown; generally from herbaceous annuals to woody crops.

Begonia

In 2007, Buck conducted a greenhouse trial to determine efficacy of several fungicides for the control of Botrytis blight on begonia. Fungicides were applied as foliar sprays on Apr 5, 12 and 19; plants were sprayed with *B. cinerea* inoculum on Apr 4, 11 and 18. Significantly fewer leaves with Botrytis blight were observed for all fungicide treatments at each evaluation date (Table 2). Significantly less Botrytis blight was observed Apr 30 and May 10 with the 8.0 oz compared to the 2.0 oz rate of Palladium. No phytotoxicity was observed from any treatment.

Table 2. * Efficacy for *Botrytis cinerea* on Begonia (*Begonia* sp.) ‘Doublet Pink’, Buck, GA, 2007.

Treatment	Rate Per 100 Gal	Leaves with Botrytis blight (%) ^x		
		4/20/07	4/30/07	5/10/07
Chipco 26019 50WDG (iprodione)	2.5 lb	16.3 b	14.5 bc	15.7 bc
Medallion (fludioxonil)	2 oz	9.0 b	11.9 c	17.3 bc
Palladium 62.5WG (cyprodinil + fludioxonil)	2 oz	13.4 b	21.2 b	20.8 b
	4 oz	15.3 b	15.2 bc	17.8 bc
	8 oz	10.7 b	13.0 c	11.9 c
Untreated inoculated	-	30.1 a	31.0 a	32.2 a

* Not an IR-4 Experiment: Plant Disease Management Reports 3:OT019.

^x Means followed by same letter do not differ significantly based on Least Significant Difference Test (P=0.05).

Geranium

In 2000, Hausbeck conducted a series of greenhouse experiments to screen several fungicides for their control of Botrytis blight on geranium. No phytotoxicity was observed from any treatment, but efficacy varied as described for each experiment.

In the first experiment, fungicides were applied as foliar sprays on April 10, 17, and 26, and May 1; plants were sprayed with *B. cinerea* inoculum on April 18 and 27, and May 2. All treatments except GWN-4550, significantly decreased the percentage of blighted leaves with sporulation by the last observation date (Table 3). Daconil and Decree were more effective than the other fungicides in this experiment.

In the second greenhouse experiment, fungicides were applied as foliar sprays on on Mar 22, and April 5 and 19 (14-day intervals) for Heritage, and on Mar 22 and 29, April 5, 12, 19 and 26 (7-day intervals) for the other products. Plants were sprayed with *B. cinerea* inoculum on Mar 29, and Apr 6, 13 and 20. At the last observation date (April 25), Chipco, Daconil, and Heritage (1, 2, and 8 oz/100 gal) significantly reduced sporulation (Table 4).

In Hausbeck's third greenhouse experiment, fungicides were applied once as foliar sprays on Mar 29; plants were sprayed with *B. cinerea* inoculum on Mar 30, and Apr 3. On April 3, disease was light and differences among treatments were not noted for the parameters measured. At the next observation (April 7), Compass at 2 oz, Heritage, and Decree all limited Botrytis blight compared to the untreated control, although differences in sporulation were not noted (Table 5). Disease did not progress in the latter portion of the study; however, the incidence of sporulation increased, especially by the last observation date (April 27). At the conclusion of the study, only Decree 50WDG limited sporulation compared to the untreated control.

In her fourth greenhouse experiment with geranium, fungicides were applied as foliar sprays on Nov 7, 14, 21, and 28, and Dec 5; plants were sprayed with *B. cinerea* inoculum on Nov 15 and 22. Disease pressure was severe throughout the duration of this experiment. On the last observation date (12/13), a number of products reduced the incidence of blighting and sporulation, including Compass, Heritage, Decree, and Daconil (Table 6). Switch did not significantly control leaf blight, but did limit sporulation.

Table 3. Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Lavender', Hausbeck, MI, 2000.

Treatment	Rate Per 100 Gal	Leaves with Blight and Sporulation (%) ^x	
		5/5/00	5/12/00
3336 50WP (thiophanate methyl)	16.0 oz	10.6 b	16.6 b
Daconil 2787 6F (chlorothalonil)	32 fl oz	3.7 a	9.9 a
Decree 50WDG (fenhexamid)	2.0 lb	5.5 a	9.7 a
GWN-4550 70WP	11.4 oz	10.4 b	28.3 d
GWN-4500 80WDG	10.0 oz	9.7 b	22.7 c
Untreated inoculated	-	14.7 c	33.5 d

* Not an IR-4 Experiment: F&N Tests Vol 57: OT11.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

Table 4. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Lavender', Hausbeck, MI, 2000.

Treatment	Rate Per 100 Gal	Leaves with Blight and Sporulation (%) ^x			
		4/6/00	4/12/00	4/18/00	4/25/00
Chipco 26019 50W (iprodione)	16.0 oz	0.5 a	2.3 a	3.9 a	3.2 a
Daconil 2787 6F (chlorothalonil)	32 fl oz	1.1 a	4.6 ab	4.8 a	2.5 a
Heritage 50WG (azoxystrobin)	1 oz	2.6 a	4.9 ab	8.1 ab	3.6 a
Heritage 50WG (azoxystrobin)	2 oz	1.2 a	2.7 a	6.7 a	4.8 a
Heritage 50WG (azoxystrobin)	4 oz	4.6 a	9.6 abc	11.4 ab	7.5 ab
Heritage 50WG (azoxystrobin)	8 oz	1.8 a	3.9 ab	5.3 a	3.3 a
Mycostop (<i>Streptomyces griseoviridis</i>)	5 g/13 gal	12.0 c	10.7 abc	12.6 ab	11.5 ab
QRD 713 5AS	190 fl oz	1.7 a	6.1 ab	12.3 ab	9.0 ab
ZeroTol (hydrogen dioxide)	30 fl oz	8.2 b	9.1 abc	11.6 ab	10.7 ab
Untreated inoculated	-	4.8 ab	14.4 c	17.5 b	17.7 b
Untreated non-inoculated		1.8 a	6.8 abc	12.1 ab	13.6 ab

* Not an IR-4 Experiment: F&N Tests Vol 58: OT020. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

Table 5. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit Red', Hausbeck, MI, 2000.

Treatment	Rate per 100 gal	Disease Observations ^x				
		4/3/00	4/7/00	4/12/00	4/21/00	4/27/00
<i>Non-sporulating diseased leaves (%)</i>						
Chipco 26019 50W (iprodione)	32 oz	0.0 a	7.5 d	4.2 a	1.2 a	3.4 a
Compass 50W (trifloxystrobin)	1 oz	0.0 a	3.1 a-d	1.3 a	2.0 a	7.2 a
Compass 50W (trifloxystrobin)	2 oz	1.7 a	1.7 ab	0.0 a	2.7 a	4.8 a
Compass 50W (trifloxystrobin)	4 oz	0.8 a	2.3 abc	0.0 a	3.7 a	7.4 a
Daconil 2787 FL (chlorothalonil)	32 fl oz	0.0 a	5.2 a-d	1.3 a	3.7 a	2.9 a
Decree 50WDG (fenhexamid)	32 oz	1.3 a	0.0 a	0.8 a	5.2 a	8.9 a
Heritage 50WG (azoxystrobin)	2 oz	1.3 a	1.7 ab	2.8 a	6.1 a	4.7 a
Medallion 50W (fludioxonil)	2 oz	2.3 a	6.9 cd	2.8 a	7.2 a	7.8 a
Untreated inoculated	-	1.2 a	7.3 cd	2.3 a	2.9 a	2.4 a
<i>Leaves with sporulating Botrytis (%)^y</i>						
Chipco 26019 50W (iprodione)	32 oz	0.0 a	2.8 a	13.5 de	13.3 d	23.6 c
Compass 50W (trifloxystrobin)	1 oz	2.4 a	1.2 a	1.2 a	5.7 ab	14.9 ab
Compass 50W (trifloxystrobin)	2 oz	1.9 a	3.7 a	2.4 ab	4.4 ab	18.1 bc
Compass 50W (trifloxystrobin)	4 oz	0.0 a	0.8 a	4.2 abc	2.0 a	17.8 bc
Daconil 2787 FL (chlorothalonil)	32 fl oz	0.0 a	0.0 a	9.0 b-e	11.2 cd	20.3 bc
Decree 50WDG (fenhexamid)	32 oz	1.0 a	1.7 a	9.9 cde	5.8 ab	8.1 a
Heritage 50WG (azoxystrobin)	2 oz	1.4 a	0.0 a	5.6 bcde	7.9 bc	18.5 bc
Medallion 50W (fludioxonil)	2 oz	0.0 a	4.4 a	3.1 abc	8.3 bcd	23.6 c
Untreated inoculated	-	2.6 a	7.0 a	13.5 e	13.4 d	18.4 bc

* Not an IR-4 Experiment: F&N Tests Vol 58: OT030. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Fisher's LSD Method (P=0.05).

^y Rating represents percentage of leaves sporulating out of total number of leaves.

Table 6. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit Red', Hausbeck, MI, 2000.

Treatment	Rate Per 100 Gal	Non-sporulating diseased leaves (%) ^x			Leaves sporulating with <i>Botrytis</i> (%) ^y		
		11/28/00	12/5/00	12/13/00	11/28/00	12/5/00	12/13/00
Compass 50WDG (trifloxystrobin)	2 oz	14.7 ab	25.9 b	32.7 b	7.5 a	18.1 a	16.2 ab
Daconil 2787 6F (chlorothalonil)	32 fl oz	9.6 ab	23.6 b	32.2 b	5.2 a	8.8 a	13.6 ab
Decree 50WDG (fenhexamid)	24 oz	1.8 a	13.4 ab	25.9 b	0.9 a	1.5 a	2.4 a
Heritage 50WG (azoxystrobin)	2 oz	6.1 a	18.3 b	25.0 b	6.1 a	7.5 a	21.0 b
Medallion 50WP (fludioxonil)	2 oz	37.9 c	76.8 d	84.4 d	18.3 b	56.6 b	80.2 c
Switch 62.5WG (cyprodinil + fludioxonil)	4 oz	2.6 a	41.3 c	48.3 c	2.6 a	9.5 a	18.6 b
	6 oz	10.1 ab	44.0 c	54.2 c	6.9 a	9.6 a	11.9 ab
Untreated non-inoculated	-	1.0 a	2.8 a	1.4 a	0.0 a	2.8 a	1.4 a
Untreated inoculated	-	20.3 b	47.7 c	60.6 c	18.8 b	43.7 b	56.7 c

* Not an IR-4 Experiment: F&N Tests Vol 58: OT033. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rating represents percentage of leaves sporulating out of total number of leaves.

In 2001, Hausbeck conducted two greenhouse experiments to assess efficacy of several fungicides for the control of *Botrytis* blight on geranium 'Pinto Violet'.

In the first experiment, pyraclostrobin or fenhexamid were applied as foliar sprays at 14-day intervals on May 30, and Jun 13 and 27; plants were sprayed with *B. cinerea* inoculum on Jun 6 and 15. All treatments appeared to limit a high disease pressure, although the differences were not significant, compared to the untreated control, including the standard Decree and Cabrio, at the higher two rates (Table 7). However, significant differences were observed in the incidence of leaves with sporulating *B. cinerea*. All treatments were significantly better than the untreated control in reducing the ability of *B. cinerea* to sporulate on infected leaves. No phytotoxicity was observed from any treatment.

Table 7. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Pinto Violet', Hausbeck, MI, 2001.

Treatment	Rate Per 100 Gal	Non-sporulating diseased leaves (%) ^x			Leaves sporulating with <i>Botrytis</i> (%) ^y		
		6/20/01	6/26/01	7/2/01	6/20/01	6/26/01	7/2/01
Cabrio 20WG (pyraclostrobin)	8 oz	16.8 a	35.5 a	48.2 b	10.6 a	23.0 abc	5.1 a
	16 oz	28.3 ab	31.1 a	28.2 a	15.7 a	17.0 ab	6.3 a
	40 oz	17.2 a	33.4 a	33.0 ab	17.2 a	18.0 ab	9.7 a
Decree 50WDG (fenhexamid)	24 oz	23.3 ab	33.1 a	28.2 a	11.6 a	11.1 a	16.1 a
Decree SC (fenhexamid)	1.5 pt	24.2 ab	27.3 a	29.0 a	15.5 a	18.3 ab	16.0 a
Untreated inoculated	-	31.4 b	38.5 a	43.5 ab	26.2 a	32.3 bc	42.1 b

* Not an IR-4 Experiment: F&N Tests Vol 58: OT027.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rating represents percentage of leaves sporulating out of total number of leaves.

In Hausbeck's second greenhouse experiment, fungicides were applied as foliar sprays at 14-day intervals on May 30, and Jun 13 and 27; plants were sprayed with *B. cinerea* inoculum on Jun 6 and 15. Decree and Heritage 2 oz effectively limited high infection of leaves compared with the untreated non-inoculated control plants by the last observation date of Jul 2 (Table 8). Decree, Heritage (2 oz), and Daconil

Weather Stik significantly decreased the number of leaves with sporulating *B. cinerea* compared with the untreated non-inoculated control plants. Daconil Weather Stik was the only product that significantly reduced disease compared to both untreated controls. Severe phytotoxicity was observed from Switch and Medallion treatments.

Table 8. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Pinto Violet', Hausbeck, MI, 2001.

Treatment	Rate Per 100 Gal	Non-sporulating diseased leaves (%) ^x			Leaves sporulating with <i>Botrytis</i> (%) ^y		
		6/20/01	6/26/01	7/2/01	6/20/01	6/26/01	7/2/01
Compass 50WDG (trifloxystrobin)	2 oz	33.1 bcd	49.2ab	45.3 b	20.0ab	36.4abc	30.5 bc
Daconil Weather Stik (chlorothalonil)	1.375 pt	37.7 cd	52.0ab	52.0 b	12.7a	19.6 a	8.3a
Decree 50WDG (fenhexamid)	32 oz	23.3ab	33.2a	30.2 a	15.4ab	28.9ab	19.6ab
Heritage 50WG (azoxystrobin)	2 oz	24.7ab	34.2a	29.2 a	13.7a	24.5ab	21.8ab
	4 oz	33.8 bcd	45.2ab	46.9 b	29.1 bc	35.0abc	33.9 bc
Medallion 50WP (fludioxonil)	2 oz	42.8 d	63.8b	–	38.0 c	44.3 bc	–
Switch 62.5WG (cyprodinil + fludioxonil)	4 oz	19.1a	59.2 b	–	19.1ab	41.1 bc	–
	6 oz	26.6abc	64.5 b	–	26.6ab	49.2 c	–
Untreated non-inoculated	-	26.6abc	46.9ab	44.2 b	23.2ab	41.1 bc	41.3 c
Untreated inoculated	-	27.0abc	45.9ab	31.7 a	20.0ab	42.7 bc	31.2 bc

* Not an IR-4 Experiment: F&N Tests Vol 58: OT032.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rating represents percentage of leaves sporulating out of total number of leaves.

In 2002, Hausbeck conducted a series of greenhouse trials to study fungicide reduction of *B. cinerea* on three geranium cultivars. No phytotoxicity was observed from any treatment.

In the first experiment, fungicides were applied as foliar sprays at 14-day intervals on May 10 and 24, and Jun 6 to geranium 'Pinto Violet'; plants were sprayed with *B. cinerea* inoculum on May 10 and 17. Decree, Daconil Weather Stik, Spectro, and Endorse at 2.2 lb were especially effective at reducing the amount of foliar infection and sporulation (Table 9). All treatments significantly limited sporulation compared to the untreated inoculated control plants.

In the second greenhouse experiment, foliar fungicide sprays were applied at 14-day intervals on May 17 and 31, and Jun 16 to geranium 'Orbit Red'; plants were sprayed with *B. cinerea* inoculum on May 17 and 31. Differences in foliar infection occurred, but no consistent trends were apparent. The two highest rates of BAS 510 (8.0 and 16.0 oz/100 gal) and Compass (2.0 and 4.0 oz/100 gal) significantly decreased sporulation of *Botrytis* compared with the untreated inoculated plants (Table 10). Other treatments that limited sporulation included BAS 510 (4.0 oz/100 gal), Switch (3.0 oz/100 gal), Decree (24.0 oz/100 gal), and Endorse (1.1 and 1.75 lb/100 gal).

In the third greenhouse experiment, fungicides were applied as foliar sprays at 14-day intervals on March 8 and 22 to geranium 'Red II'; plants were sprayed with *B. cinerea* inoculum on March 8, 15 and 22. Disease pressure was heavy. Daconil Weather Stik and Decree were especially effective in reducing the amount of foliar infection and sporulation (Table 11). Chipco 26GT, Compass and Echo 720 were also effective in limiting sporulation. Increasing rates did not seem helpful in enhancing disease control with Fungo and Terraguard.

Table 9. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Pinto Violet', Hausbeck, MI, 2002.

Treatment	Rate Per 100 Gal	Non-sporulating diseased leaves (%) ^x				Leaves sporulating with <i>Botrytis</i> (%) ^y			
		5/17/02	5/24/02	5/31/02	6/5/02	5/17/02	5/24/02	5/31/02	6/5/02
Daconil Weather Stik (chlorothalonil)	1.375 pt	1.0 a	4.6 a	11.9 a	13.5 a	1.0 a	0.8 a	0.8 a	3.1 a
Decree 50WDG (fenhexamid)	2.0 lb	1.1 a	4.9 a	6.8 a	10.5 a	1.1 a	0.8 a	1.7 a	1.6 a
Endorse 2.5WP (polyoxin D)	0.55 lb	3.4 a	13.2 a	10.3 a	21.0 abc	2.2 a	6.6 a	2.9 a	4.2 a
	1.1 lb	1.0 a	11.8 a	9.6 a	25.5 bc	1.0 a	8.6 a	1.8 a	7.9 a
	2.2 lb	0.0 a	10.0 a	7.4 a	14.2 a	0.0 a	3.0 a	1.1 a	2.0 a
Spectro 90WDG (chlorothalonil + thiophanate methyl)	1.0 lb	1.1 a	10.7 a	9.5 a	17.3 ab	1.1 a	4.6 a	1.5 a	4.5 a
Untreated non-inoculated	-	3.3 a	7.1 a	11.5 a	11.8 a	3.3 a	2.6 a	2.8 a	3.6 a
Untreated inoculated	-	15.0 b	23.3 b	26.3 b	29.6 c	15.0 b	18.7 b	13.0 b	14.2 b

* Not an IR-4 Experiment: F&N Tests Vol 58: OT028.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rating represents percentage of leaves sporulating out of total number of leaves.

Table 10. Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit Red', Hausbeck, MI, 2002.

Treatment	Rate Per 100 Gal	Non-sporulating diseased leaves (%) ^x			Leaves sporulating with <i>Botrytis</i> (%) ^y	
		5/31/02	6/14/02	6/28/02	6/14/02	6/28/02
BAS 510 70WG (boscalid)	4 oz	4.4 a	5.5 a	18.2 ab	9.9 ab	11.6 a-d
	8 oz	5.8 b	3.9 a	8.8 a	7.8 a	6.3 abc
	16 oz	6.6 b	9.4 abc	25.5 ab	16.3 a-d	5.1 ab
Compass 50WDG (trifloxystrobin)	1 oz	9.6 b	8.1 abc	27.3 ab	21.6 a-e	14.7 a-e
	2 oz	6.0 b	9.3 abc	19.5 ab	12.5 abc	6.2 ab
	4 oz	9.9 b	12.5 ab	34.6 b	22.2 a-e	1.0 a
Daconil 54EC (chlorothalonil)	1 qt	15.4 b	5.7 ab	13.5 a	25.6 b-f	25.1 b-e
Decree 50WDG (fenhexamid)	32 oz	9.8 b	5.8 ab	18.2 ab	20.4 a-e	12.5 a-e
Endorse 2.5WP (polyoxin D)	0.55 lb	17.0 b	11.3 abc	12.4 a	31.8 d-g	18.8 a-e
	1.10 lb	11.9 b	8.8 abc	28.6 ab	31.8 d-g	11.4 a-e
	1.75 lb	13.4 b	14.8 abc	17.4 ab	24.0 b-f	9.8 a-d
Medallion 50WP (fludioxonil)	2 oz	18.4 b	9.1 abc	9.6 a	40.8 g	29.3 cde
	4 oz	14.6 b	13.8 abc	21.1 ab	39.2 fg	17.4 a-e
	8 oz	14.0 b	12.4 abc	27.5 ab	34.3 efg	21.9 b-e
Switch 62.5WG (cyprodinil + fludioxonil)	3 oz	7.1 b	25.4 c	21.4 ab	25.0 b-f	12.4 a-e
	6 oz	13.1 b	23.7 bc	24.0 ab	24.0 b-f	18.4 a-e
	12 oz	9.3 b	16.7 abc	17.1 ab	26.0 c-f	48.1 e
Untreated non-inoculated	-	8.3 b	5.3 a	11.7 a	24.6 b-f	28.0 b-e
Untreated inoculated	-	7.1 b	8.0 abc	11.1 a	28.0 c-g	33.9 de

* Series of IR-4 Trials, also published as F&N Tests Vol 58: OT029.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rating represents percentage of leaves sporulating out of total number of leaves.

Table 11. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Red II', Hausbeck, MI, 2002.

Treatment	Rate Per 100 Gal	Non-sporulating diseased leaves (%) ^x		Leaves sporulating with <i>Botrytis</i> (%) ^y	
		3/29/02	4/5/02	3/29/02	4/5/02
Chipco 26GT F (iprodione)	2.5 qt	35.9 a-e	51.7 b	10.4 ab	6.0 a
Compass 50WDG (trifloxystrobin)	2 oz	31.8 abc	57.3 bc	13.6 abc	31.5 cde
Compass 50WDG + Latron B-1956	2 oz + 2 fl oz	52.7 cde	77.0 cd	12.6 ab	19.3 bc
Daconil Weatherstik 6F (chlorothalonil)	1.4 pt	35.0 a-e	29.4 a	9.9 ab	8.5 ab
Decree 50WDG (fenhexamid)	12 oz	18.7 a	16.1 a	1.6 a	1.2 a
Echo 90DF (chlorothalonil)	1.2 lb	39.5 b-e	69.1 bcd	16.7 bc	25.3 cd
Echo 720 6F (chlorothalonil)	1.4 pt	46.7 b-e	69.4 bcd	11.9 ab	10.1 ab
Fungo 50WSB (thiophanate methyl)	12 oz	54.8 def	76.9 cd	38.4 d	46.4 f
	16 oz	72.0 fg	82.4 d	59.4 e	47.2 f
Terraguard 50W (triflumizole)	4 oz	56.2 ef	61.3 bcd	26.4 cd	38.6 def
	8 oz	52.4 cde	62.9 bcd	36.2 d	43.4 ef
Untreated non-inoculated	-	27.9 ab	49.0 b	15.8 abc	25.1 cd
Untreated inoculated	-	34.2 a-e	50.3 b	26.6 cd	36.7 def

* Not an IR-4 Experiment: F&N Tests Vol 58: OT031. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rating represents percentage of leaves sporulating out of total number of leaves.

2003

In 2003, Hausbeck conducted two greenhouse experiments to determine efficacy of several fungicides for the control of *Botrytis* blight on geranium. No phytotoxicity was observed from any treatment.

In the first, fungicides were applied as foliar sprays on April 17 and 24, and May 1, 8 and 15 to geranium 'Orbit White'; plants were sprayed with *B. cinerea* inoculum on April 17 and 24, and May 1. Disease pressure was severe. Daconil at 14-day interval, Insignia at 7-day interval, and Endorse at 1.1 lb, 7-day interval significantly reduced foliar infection, sporulation and disease severity (Table 12). Decree significantly reduced sporulation and disease severity.

In the second experiment, the same fungicide treatments were applied to two cultivars of geranium as seven day treatments on Jan 9, 16, and 23, and fourteen day treatments on Jan 9 and 23; plants were sprayed with *B. cinerea* inoculum on Jan 9. Disease pressure was significant in this trial, especially for the cultivar 'Sonora White.' For cultivar 'Freedom White,' only Decree and Daconil Weather Stik reduced disease severity significantly by the last assessment (Table 13). For cultivar 'Sonora White,' the Endorse, Decree, Daconil Weather Stik, and Chipco 26019 treatments all significantly reduced disease severity on the last rating (Table 14). Only Decree and Daconil Weather Stik significantly reduced the number of leaves with sporulating *B. cinerea*.

Table 12. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit White', Hausbeck, MI, 2003.

Treatment ^z	Rate Per 100 Gal	Leaves with Infection (%) ^x			Leaves with Sporulation (%)			Disease Severity ^y	
		5/1/03	5/8/03	5/15/03	5/1/03	5/8/03	5/15/03	5/8/03	5/22/03
Daconil Weather Stik (chlorothalonil)	32 fl oz	2.5 a	3.4 a	9.2 a	1.5 a	2.2 a	6.1	2.0 a	3.2 a
Decree 50WDG (fenhexamid)	2.0 lb	8.3 ab	8.1 abc	16.2 ab	1.5 a	2.0 a	11.4	2.3 a	5.0 ab
Endorse 2.5WP (polyoxin D)	0.55 lb	11.7 ab	18.1 a-e	17.9 ab	5.9 ab	13.8 a-d	14.4	5.0 ab	4.2 ab
	1.1 lb	8.1 ab	8.8 a-d	11.8 a	2.3 a	4.6 ab	7.1	2.5 a	3.2 a
	2.2 lb	11.8 ab	12.0 a-e	22.1 ab	1.6 a	5.4 ab	15.2	3.7 ab	4.7 ab
Insignia 20WG (pyraclostrobin)	4 oz	6.1 ab	9.2 a-d	10.8 a	4.0 ab	7.7 ab	8.4	3.8 ab	4.2 ab
	8 oz	5.1 ab	6.0 ab	18.1 ab	0.5 a	2.8 ab	12.7	2.7 a	4.0 ab
Untreated inoculated	-	16.3 b	24.2 de	27.1 ab	7.1 ab	20.9 cd	22.9	6.0 b	5.8 ab

* Not an IR-4 Experiment: F&N Tests Vol 59: OT006. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rated on a scale of 1 to 10, where 1=no lesions to 10=plant death.

^z Treatments applied at 7-day intervals except Daconil, Decree and Endorse at 2.2 lb/100 gal applied at 14-day intervals.

Table 13. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Freedom White', Hausbeck, MI, 2003.

Treatment	Rate Per 100 Gal	Spray Schedule (Days)	Leaves with Sporulation (%) ^x			Disease Severity ^y		
			1/16/03	1/23/03	1/30/03	1/16/03	1/23/03	1/30/03
Camelot 58EC (copper octanoate)	32 fl oz	7	2.5 ab	7.7 ab	12.5	3.0 a	5.3 ab	6.0 ab
	32 fl oz	14	6.0 c	9.2 b	13.7	5.3 b	5.8 b	7.3 b
	48 fl oz	14	2.8 ab	6.0 ab	12.5	2.8 a	4.5 ab	6.0 ab
Chipco 26019 50WDG (iprodione)	2.5 lb	14	1.8 ab	4.8 ab	10.5	3.0 a	4.3 ab	5.7 ab
Daconil Weather Stik (chlorothalonil)	32 fl oz	14	0.8 ab	3.0 a	6.2	2.0 a	2.2 a	2.8 a
Decree 50WDG (fenhexamid)	24 oz	14	1.5 ab	3.7 ab	8.7	2.2 a	2.5 ab	3.8 a
Endorse 2.5WP (polyoxin D)	2.2 lb	14	2.5 ab	5.8 ab	7.3	3.3 a	5.2 ab	5.2 ab
Phyton 27 (copper sulfate pentahydrate)	20 fl oz	7	2.8 ab	8.3 ab	10.7	3.2 a	4.8 ab	5.7 ab
Untreated inoculated	-	-	4.2 bc	9.0 b	13.3	4.0 a	5.8 b	7.7 b

* Not an IR-4 Experiment: F&N Tests Vol 59: OT008.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rated on a scale of 1 to 10, where 1=no lesions to 10=plant death.

Table 14. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Sonora White', Hausbeck, MI, 2003.

Treatment	Rate Per 100 Gal	Spray Schedule (Days)	Leaves with Sporulation (%) ^x		Disease Severity ^y	
			1/16/03	1/23/03	1/16/03	1/23/03
Camelot 58EC (copper octanoate)	32 fl oz	7	5.7 bc	29.5 b	3.8 bc	8.5 c
	32 fl oz	14	7.0 c	34.0 b	4.2 bc	8.3 c
	48 fl oz	14	5.3 abc	30.5 b	4.0 bc	8.7 c
Chipco 26019 50WDG (iprodione)	2.5 lb	14	2.2 ab	30.5 b	2.3 ab	7.0 b
Daconil Weather Stik (chlorothalonil)	32 fl oz	14	1.5 ab	12.7 a	1.7 a	3.7 a
Decree 50WDG (fenhexamid)	24 oz	14	1.2 a	10.5 a	1.7 a	3.7 a
Endorse 2.5WP (polyoxin D)	2.2 lb	14	4.0 abc	15.3 b	2.7 abc	4.5 a
Phyton 27 (copper sulfate pentahydrate)	20 fl oz	7	2.8 abc	32.0 b	2.8 abc	8.5 c
Untreated inoculated	-	-	6.5 c	36.5 b	4.5 c	8.8 c

* Not an IR-4 Experiment: F&N Tests Vol 59: OT008.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rated on a scale of 1 to 10, where 1=no lesions to 10=plant death.

During 2004, Hausbeck conducted two greenhouse experiments to determine efficacy of several fungicides for the control of *Botrytis* blight on geranium.

In the first experiment, fungicides were applied as foliar sprays on Aug 25 and 31, and Sep 8 on geranium 'Orbit White'; plants were sprayed with *B. cinerea* inoculum on Aug 25 and 31, and Sep 8. BAS 510, Omega, Captan and Daconil Weather Stik all significantly reduced severe disease infection on the last rating date (Table 15). STBX-013 and ZeroTol did not significantly reduce infection on all rating dates. Although Captan and Omega effectively limited infection, plants treated with these two fungicides showed leaf burning and chlorosis on all three rating dates.

In the second experiment Hausbeck applied fungicides as foliar sprays on Aug 24 and 31, and Sep 7 and 14 to Geranium 'Emperor'; plants were sprayed with *B. cinerea* inoculum 4 hours after each fungicide treatment. All products significantly limited development of a moderate disease pressure (Table 16). Significant differences among treatments were not observed. No phytotoxicity was observed from any treatment.

Table 15. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit White', Hausbeck, MI, 2004.

Treatment	Rate Per 100 Gal	Leaves with Sporulation (%) ^x			Plant Health ^y		
		8/31/04	9/7/04	9/15/04	8/31/04	9/7/04	9/15/04
BAS 510 70WG (boscalid)	6.8 oz	0.4 a	7.3 ab	1.4 a	1.2 a	2.2 a	2.2 a
Captan 80WDG (captan)	2.5 lb	1.3 a	4.7 ab	3.1 a	1.3 a	1.8 a	3.0 a
Daconil Weather Stik (chlorothalonil)	1.4 pt	0.5 a	1.4 a	0.4 a	1.2 a	1.5 a	1.2 a
Omega 500F (fluazinam)	8 fl oz	0.4 a	1.1 a	0.0 a	1.2 a	1.3 a	1.5 a
STBX-013	6.4 fl oz	6.3 ab	31.9 bc	23.2 b	3.3 b	5.0 b	6.0 b
	12.8 fl oz	6.5 ab	30.7 bc	22.9 b	3.2 b	5.2 b	5.3 b
ZeroTol 27% (hydrogen dioxide)	42.2 fl oz	5.1 ab	29.7 bc	41.7 c	2.7 ab	5.2 b	6.3 b
Untreated inoculated	-	10.9 b	35.2 c	32.5 bc	4.3 b	4.7 b	6.2 b

* Not an IR-4 Experiment: F&N Tests Vol 60: OT005. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Student-Newman-Keul (P=0.05).

^y Rated on a scale of 1 to 10, where 1=no lesions to 10=plant death.

Table 16. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x domesticum*) 'Emperor', Hausbeck, MI, 2004.

Treatment	Rate Per 100 Gal	Number of Lesions ^x	Number of Sporulating Lesions	Disease Severity ^y
BAS 510 70WG (boscalid)	4.5 oz	7.0 a	4.7 a	3.0 a
Daconil Weatherstik 6F (chlorothalonil)	1.4 pt	2.2 a	1.7 a	1.7 a
Decree 50WDG (fenhexamid)	12 oz	2.2 a	2.0 a	2.0 a
Endorse 2.5WP (polyoxin D)	2.2 lb	1.5 a	1.2 a	1.7 a
Heritage 50WG (azoxystrobin)	8 oz	5.3 a	3.3 a	2.7 a
Insignia 20WDG (pyraclostrobin)	8 oz	3.8 a	2.5 a	2.3 a
Rhapsody 1.34% AS (<i>Bacillus subtilis</i> QST 713 strain)	8 qt	3.0 a	2.3 a	2.2 a
Untreated inoculated	-	21.5 b	19.0 b	6.3 b

* Not an IR-4 Experiment: F&N Tests Vol 60: OT009. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Tukey's Studentized Range Test (P=0.05).

^y Severity was rated on a scale of 1 to 10; where 1=healthy, 2 to 8=varying degrees of blighting, and 10=dead.

In 2008, Hausbeck screened several fungicides for efficacy against *Botrytis* blight on geranium 'Orbit Pink'. Fungicides were applied as foliar sprays on Jun 20 and 27. Two hours after the initial fungicide application, plants were inoculated with the *B. cinerea* conidial suspension. All treatments significantly reduced a high disease pressure, with Daconil Weather Stik and Palladium at 4 oz having the lowest disease severity on both rating dates (Table 17). Plants treated with Palladium at the 4 oz rate had the lowest percent infected leaves. However, the two rates of Palladium were the only treatments resulting in phytotoxicity. Plants showing phytotoxicity symptoms had chlorotic leaves with some necrosis.

Table 17. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit Pink', Hausbeck, MI, 2008.

Treatment	Rate Per 100 Gal	Infected Leaves (%) ^x		Disease Severity ^y		Phytotoxicity ^z
		6/27/08	7/2/08	6/27/08	7/2/08	7/2/08
Daconil Weather Stik (chlorothalonil)	1.4 pt	11.0 ab	12.8 a	1.8 a	2.3 a	1.0 a
Endorse 2.5WP (polyoxin D)	2.2 lb	11.7 ab	30.2 ab	2.2 ab	3.0 ab	1.0 a
Palladium 62.5WG (cyprodinil + fludioxonil)	4 oz	8.1 a	12.5 a	2.0 ab	2.3 a	6.3 b
	6 oz	13.7 ab	25.3 a	2.0 ab	3.0 ab	5.8 b
V-10135 (fenpyrazamine)	7 fl oz	23.0 bc	32.6 ab	2.6 ab	3.4 ab	1.0 a
Untreated inoculated	-	38.0 d	65.0 c	3.8 c	5.8 d	1.0 a

* Not an IR-4 Experiment: Plant Disease Management Reports 3:OT002. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Fisher's Protected LSD Test (P=0.05).

^y Disease severity rated on a scale of 1 to 10, where 1=healthy/no disease, 2=few/small necrotic areas, 3=few/moderate necrotic areas, 4=few/moderate sized necrotic areas throughout foliage, 5=moderate necrotic areas/1-9% defoliation, 6=large necrotic areas/10-29% defoliation, 7=large necrotic areas/30-59% defoliation, 8=60-79% defoliation, 9=80-99% defoliation, 10=100% defoliated/plant death.

^z Phytotoxicity was rated on a scale of 1 to 10, where 1=healthy, 2-9=varying degrees of chlorosis/necrosis, and 10=plant death.

In 2009, Hausbeck conducted a greenhouse experiment to determine efficacy of several fungicides for the control of *Botrytis* blight on geranium 'Orbit Red'. Fungicides were applied as foliar sprays on Apr 26 and May 6. After the Apr 26 application, plants were inoculated by spraying with the *B. cinerea* conidial solution after fungicide application. All treatments significantly a reduced severe disease pressure, and statistical differences were observed among treatments (Table 18). Fluazinam completely prevented infection, and the industry standard Daconil Weather Stick and Palladium were very effective also. A rate response was not observed with Disarm O or the biopesticide Veranda O treatments. Phytotoxicity in the form of chlorosis and necrotic leaf margins was observed on plants treated with Palladium.

Table 18. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit Red', Hausbeck, MI, 2009.

Treatment	Rate Per 100 Gal	Sporulating Leaves (%) ^x		Disease Severity ^y	
		5/6/09	5/12/09	5/6/09	5/12/09
Daconil Weather Stik (chlorothalonil)	1.4 pt	0.3 ab	1.3 a	1.5 ab	1.8 ab
Decree 50WG (fenhexamid)	1.5 lb	2.5 abc	9.0 b	2.3 bcd	4.0 cd
Disarm O 480SC (fluoxastrobin)	3 fl oz	2.0 abc	9.5 bc	2.8 cd	4.3 de
	6 fl oz	4.5 cd	12.8 cd	3.0 de	5.0 de
Fluazinam 500F (fluazinam)	8 fl oz	0.0 a	0.0 a	1.0 a	1.0 a
OHP 6672 (thiophanate methyl)	20 fl oz	5.8 d	13.3 d	4.0 e	5.5 e
Pageant 38WG (boscalid + pyraclostrobin)	12.5 oz	0.8 ab	3.3 a	1.8 abc	2.3 ab
Palladium 62.5WG (cyprodinil + fludioxonil)	8 oz	0.0 a	0.8 a	1.0 a	1.5 ab
V-10135 4SC (fenpyrazamine)	9.6 fl oz	3.0 bcd	9.0 b	2.3 bcd	3.8 cd
Veranda O 11.3WDG (polyoxin D)	4 oz	0.5 ab	3.5 a	2.0 abc	2.8 bc
	8 oz	0.0 a	2.3 a	1.0 a	1.5 ab
Untreated inoculated	-	12.5 e	26.0 e	6.3 f	8.0 f

* Not an IR-4 Experiment: Plant Disease Management Reports 4:OT011. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Fisher's Protected LSD Test (P=0.05).

^y Rated on a scale of 1-10, where 1=healthy, 2=small, isolated lesions, 3=moderate-sized, isolated lesions, 4=numerous moderate-sized lesions, 5=large necrotic areas, 6=large necrotic areas with 30-50% defoliation, 7=large necrotic areas with 51-70% defoliation, 8= large necrotic areas with 71-90% defoliation, 9=>91% defoliation, 10=plant death.

In 2010, Hausbeck conducted a greenhouse experiment to determine efficacy of several fungicides for the control of *Botrytis* blight on geranium. Fungicides were applied as foliar sprays on Jan 6, 14 and 21. On Jan 6 and 15, plants were inoculated by spraying with the *B. cinerea* conidial solution after fungicide application. The number of leaves with *B. cinerea* lesions, the number of leaves with sporulating lesions, and disease severity ratings were recorded on Jan 28. Disease pressure was severe in this trial with the untreated control plants averaging 12.8 sporulating leaves per plant. All treatments significantly reduced the number of leaves with sporulating lesions (

Table 19). Pageant did not limit infection based on the presence of leaf lesions; however, the infected leaves did not sporulate at any time during the trial. No phytotoxicity was observed from any treatment.

Table 19. * Efficacy for *Botrytis cinerea* on Geranium (*Pelargonium x hortorum*) 'Orbit White', Hausbeck, MI, 2010.

Treatment	Rate Per 100 Gal	No. Leaves with Sporulating Lesions ^x	Total Number of Leaves with Lesions	Disease Severity ^y
Daconil Weatherstik 6F (chlorothalonil)	1.4 pt	0.5 a	4.8 ab	2.0 a
Decree 50WG (fenhexamid)	4 oz	0.8 a	5.5 ab	2.3 a
	8 oz	0.0 a	3.5 a	2.0 a
Pageant 38WG (boscalid + pyraclostrobin)	12.5 oz	0.0 a	10.8 c	2.8 b
Veranda O 11.3WDG (polyoxin D)	8 oz	0.0 a	4.5 ab	2.0 a
Untreated inoculated	-	12.8 c	13.8 c	3.8 c

* Not an IR-4 Experiment: Plant Disease Management Reports 5:OT017. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Fisher's Protected LSD Test (P=0.05).

^y Rated on a scale of 1-5, where 1=healthy; 2=small isolated lesions; 3=large lesions, minimal defoliation; 4=numerous large lesions, moderate defoliation; 5=severe defoliation.

Lisianthus

In 2004, Wegulo studied the efficacy of several fungicides for the control of Botrytis blight on lisianthus grown in a greenhouse. Fungicides were applied as foliar sprays at 10-day intervals starting on Feb 17. All products significantly reduced a low disease incidence on the final rating date (Table 20). Significant differences among treatments were not observed. No phytotoxicity was observed from any treatment.

Table 20. * Efficacy for *Botrytis cinerea* on Lisianthus (*Eustoma grandiflorum*) 'Avila Purple', Wegulo, CA, 2004.

Treatment	Rate Per 100 Gal	Disease Incidence (%) ^x		
		4/9/04	4/20/04	4/30/04
BAS 500 (pyraclostrobin)	8 oz	5.4 ab	5.7 ab	7.0 b
BAS 510 70WG (boscalid)	8 oz	5.2 ab	4.9 b	5.2 b
Daconil Ultrex (chlorothalonil)	1.4 lb	1.0 b	1.8 b	2.8 b
Decree 50WDG (fenhexamid)	12 oz	4.1 b	4.6 b	4.9 b
Fore (mancozeb)	1.5 lb	0.8 b	2.3 b	3.1 b
Heritage 50WG (azoxystrobin)	2 oz	1.0 b	1.0 b	4.9 b
Kaligreen (potassium bicarbonate)	2.5 lb	1.3 b	1.0 b	3.1 b
Medallion (fludioxonil)	2 oz	3.4 b	4.1 b	5.4 b
Rhapsody (<i>Bacillus subtilis</i> QST 713 strain)	4 qt	3.4 b	3.6 b	6.4 b
	6 qt	2.6 b	1.0 b	2.3 b
Untreated	-	11.6 a	12.9 a	14.7 a

* Not an IR-4 Experiment: F&N Tests Vol 61: OT030. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Least Significant Difference Test (P=0.05).

Pansy

In 2013, Benson examined the efficacy of several fungicides for the control of Botrytis blight on pansy. Fungicides were applied as foliar sprays at 7- or 14-day intervals starting on Nov 5 to Dec 10. Plants were inoculated with *B. cinerea* on Nov 7, 12 and 20. On the last three rating dates, there was no significant

difference between the treatments even though a moderate amount of Botrytis blight was present on many plants at the final evaluation 41 days after the first inoculation (Table 21). Please note that the Regalia rate in the protocol was lower than the lowest labeled rate of 2 quarts per 100 gal. No phytotoxicity was observed from any treatment except Torque (stunting, smaller and cupped leaves).

Table 21. Efficacy for *Botrytis cinerea* on Pansy (*Viola x wittrockiana*), ‘Delta Premium Pure White’, Benson, NC, 2013.

Treatment	Rate Per 100 Gal	Application Interval	Severity Rating ^{z,y}			
			11/12/13	11/19/13	12/3/13	12/17/13
Decree (fenhexamid)	1.5 lb	14 Days	1.8 abc	2.1 a	1.8 a	3.5 a
Disarm (fluoxastrobin)	8 fl oz	14 Days	1.5 abc	1.9 a	1.6 a	3.4 a
F9110	24 fl oz	7 Days	1.8 ab	1.8 a	1.9 a	4.9 a
Medallion (fludioxonil)	8 oz	14 Days	1.4 bc	1.6 a	1.8 a	4.0 a
Pageant 38WG (boscalid + pyraclostrobin)	14 oz	14 Days	1.1 c	1.5 a	2.0 a	2.9 a
Palladium (cyprodinil + fludioxonil)	6 oz	7 Days	1.5 abc	1.5 a	1.9 a	3.8 a
Proud 3 (thyme oil)	128 fl oz	7 Days	1.5 abc	2.6 a	2.3 a	4.3 a
Regalia 50 (extract of <i>Reynoutria sachalinensis</i>) ^x	4 fl oz	7 Days	1.5 abc	2.1 a	2.5 a	2.8 a
SP2770	2.66 lb	7 Days	1.6 abc	2.0 a	2.5 a	5.0 a
SP2773	1.66 lb	7 Days	1.3 bc	1.6 a	1.6 a	3.3 a
Torque (tebuconazole)	8 fl oz	14 Days	1.5 abc	1.5 a	2.3 a	5.1 a
V-10135 (fenpyrazamine)	16 fl oz	7 Days	1.9 ab	1.6 a	2.8 a	4.4 a
Untreated non-inoculated	-	-	1.6 abc	1.8 a	2.1 a	3.3 a
Untreated inoculated	-	-	2.1 a	1.6 a	2.0 a	3.9 a

^z Means followed by same letter do not differ significantly based on Waller-Duncan k-ratio, t-test (P=0.05).

^y Severity rating: scale of 1-10, where 1= healthy, 3= chlorotic, 5= distinct lesions on some leaves and flowers, 8= numerous spots on several leaves or flowers, and 10= completely collapsed leaves or blossoms.

^x This Regalia rate is lower than the lowest labeled rate of 2 quarts per 100 gal.

Miniature Rose

In 2013, Jiang conducted an experiment to determine efficacy of several fungicides for the control of Botrytis blight on miniature rose. Fungicides were applied as foliar sprays at 7- or 14-day intervals on March 10 to 21. The collection of efficacy data for *B. cinerea* was compromised by the presence of powdery mildew also. Symptoms included necrotic or blackened petals, an indication of botrytis, or petals with visible sporulation from powdery mildew. Therefore, Jiang collected a combined disease rating for both diseases. Only BAS 703 significantly reduced total disease rating caused by Botrytis and powdery mildew (Table 22). Please note that the Regalia rate in the protocol was lower than the lowest labeled rate of 2 quarts per 100 gal. No phytotoxicity was observed from any treatment.

Table 22. Efficacy for *Botrytis cinerea* on Miniature Rose (*Rosa* sp.) 'Karina', Jiang, CA, 2013.

Treatment	Rate Per 100 Gal	Application Interval	Mean Total Disease Rating (\pm SD) ^{z,y}				Mean Growth (cm)
			0 DAT	7 DAT	14 DAT	21 DAT	0-28 DAT
BAS 703 (Fluxapyroxad + pyraclostrobin)	4 oz	7 Days	0.0(\pm 0)	0.0(\pm 0)	*1.6(\pm 1.0)	*4.6(\pm 1.7)	7.2
	8 oz	7 Days	0.0(\pm 0)	0.0(\pm 0)	*0.9(\pm 0.4)	*3.7(\pm 1.4)	8.6
Disarm (fluoxastrobin)	8 fl oz	14 Days	0.0(\pm 0)	0.0(\pm 0)	4.6(\pm 0.9)	8.1(\pm 1.0)	4.5
F9110	32 oz	7 Days	0.0(\pm 0)	0.0(\pm 0)	2.4(\pm 1.5)	6.8(\pm 1.4)	6.9
Medallion (fludioxonil)	8 oz	14 Days	0.0(\pm 0)	0.0(\pm 0)	5.3(\pm 1.7)	8.7(\pm 0.4)	2.6
Palladium (cyprodinil)	6 oz	7 Days	0.0(\pm 0)	0.0(\pm 0)	4.2(\pm 2.3)	*9.3(\pm 0.9)	3.2
Proud 3 (thyme oil)	4 qt	7 Days	0.0(\pm 0)	0.0(\pm 0)	3.9(\pm 1.0)	8.4(\pm 0.6)	1.4
Regalia (<i>Reynoutria sachalinensis</i> extract) ^x	4 oz	7 Days	0.0(\pm 0)	0.0(\pm 0)	5.9(\pm 2.4)	7.9(\pm 2.2)	3.1
SP2770	2.66 lb	7 Days	0.0(\pm 0)	0.0(\pm 0)	5.7(\pm 2.0)	8.7(\pm 1.6)	3.8
SP2773	1.66 lb	7 Days	0.0(\pm 0)	0.0(\pm 0)	*5.3(\pm 0.9)	8.5(\pm 0.9)	4.1
V10135 SC (fenpyrazamine)	16 fl oz	7 Days	0.0(\pm 0)	0.0(\pm 0)	4.5(\pm 1.8)	9.0(\pm 1.6)	-0.7
Control	-	-	0.0(\pm 0)	0.0(\pm 0)	4.1(\pm 0.5)	7.5(\pm 1.0)	4.8

^z Bolded and asterisks values show results with statistical significance when compared to untreated controls based on Student's t test (P=0.05). Data collected at Day 28 should be interpreted with caution because almost all flowers senesced and the shelf-life of the minirose were terminated.

^y Total disease rating: scale of 0-10, where 0 = no infection, 10 = 100 % infection with *Botrytis* and powdery mildew.

^x This Regalia rate is lower than the lowest labeled rate of 2 quarts per 100 gal.

Poinsettia

In 1998, Benson conducted an experiment to determine efficacy of several fungicides for the control of Botrytis blight on poinsettia. Fungicides were applied as foliar sprays at 7-day intervals starting on March 16 to April 27. The day following fungicide application, plants were sprayed with a spore suspension of *Botrytis cinerea*. All rates of Decree, Daconil and Chipco 26019 manage a high level of Botrytis blight severity (Table 23). No phytotoxicity was observed from any treatment.

Table 23. * Efficacy for *Botrytis cinerea* on Poinsettia (*Euphorbia pulcherrima*), 'Angelica White', Benson, NC, 1998.

Treatment	Rate Per 100 Gal	Disease Severity (1-10) ^{x,y}				
		3/24/98	4/2/98	4/8/98	4/15/98	4/23/98
Chipco 26019 (iprodione)	0.50 lb	1.7 b	3.4 b	2.9 bc	2.7 bc	2.5 bc
Daconil Ultrex 82.5WP (chlorothalonil)	0.68 lb	1.9 b	2.5 bc	3.4 b	3.4 b	2.9 b
	1.35 lb	1.3 b	2.1 c	1.8 cd	2.2 cd	1.5 c
Decree 50WDG (fenhexamid)	0.50 lb	1.5 b	1.5 c	1.6 cd	1.8 cd	1.6 bc
	0.75 lb	1.5 b	1.7 c	1.7 cd	1.6 d	1.4 c
	1.0 lb	1.9 b	2.5 bc	2.4 bcd	2.0 cd	1.8 bc
	2.0 lb	1.5 b	1.4 c	1.4 d	1.3 d	1.4 c
Untreated non-inoculated	-	1.2 b	1.7 c	2.3 bcd	2.3 bcd	2.6 bc
Untreated inoculated	-	3.2 a	5.3 a	6.5 a	7.0 a	5.0 a

* Not an IR-4 Experiment: F&N Tests Vol 55: 557. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Waller-Duncan k-ratio, t-test (P=0.05).

^y Severity rating: 1= healthy, no infection; 2= leaf spots in at least one leaf; 5= about 50% of leaves with spots, 8= about 80% of leaves with spots, defoliation; and 10= most leaves infected, large expanding leaf spots, severe defoliation.

In 1999, Benson conducted two experiments to study fungicide efficacy for Botrytis blight on poinsettia. No phytotoxicity was observed from any treatment.

In the first experiment, fungicides were applied as foliar sprays at 7-day intervals starting on March 16 to April 27. The day following fungicide application, plants were sprayed with a spore suspension of *Botrytis cinerea*. Although all rates of Compass were effective in controlling a severe Botrytis blight infection, the lower two rates were not as effective as the higher two (Table 24). Chipco 26019, Heritage and Medallion, were all comparable to Compass.

In the second experiment, Benson compared Compass, Daconil Ultrex, and Heritage as foliar sprays at 14-day intervals starting on March 29 to May 26. The wetting agent Lesco 78L was used with all Heritage applications. The day following fungicide application, plants were sprayed with a spore suspension of *Botrytis cinerea*. Compass, Daconil and all rates of Heritage provided excellent control of a high Botrytis blight severity (Table 25). No phytotoxicity was observed from any treatment.

Table 24. * Efficacy for *Botrytis cinerea* on Poinsettia (*Euphorbia pulcherrima*), 'Angelica White', Benson, NC, 1999a.

Treatment	Rate Per 100 Gal	Disease Severity (1-10) ^{x,y}				
		4/1/98	4/9/98	4/15/98	4/23/98	4/30/98
Chipco 26019 50W (iprodione)	16.0 oz	1.6 b	1.4 bc	1.7 c	1.6 c	2.0 cd
Compass 50W (trifloxystrobin)	0.5 oz	2.0 b	2.1 bc	2.5 bc	3.3 b	3.1 bc
	1.0 oz	1.9 b	2.4 b	3.1 b	3.3 b	3.9 b
	2.0 oz	1.9 b	2.1 bc	2.3 bc	2.2 bc	2.1 cd
	4.0 oz	1.4 b	1.1 c	1.8 c	2.0 c	1.7 d
Heritage 50WDG (azosystrobin)	1.0 oz	2.3 b	2.4 b	2.2 bc	2.5 bc	2.1 cd
Medallion 50W (fludioxonil)	1.0 oz	1.4 b	1.8 bc	1.7 c	1.3 c	1.5 d
Untreated non-inoculated	-	1.7 b	1.4 bc	1.4 c	1.6 c	2.0 cd
Untreated inoculated	-	4.6 a	5.3 a	5.6 a	7.0 a	6.9 a

* Not an IR-4 Experiment: F&N Tests Vol 55: 556.

^x Means followed by same letter do not differ significantly based on Waller-Duncan k-ratio, t-test (P=0.05).

^y Severity rating: 1= healthy,no infection; 2= leaf spots in at least one leaf; 5= about 50% of leaves with spots, 8= about 80% of leaves with spots, defoliation; and 10= most leaves infected, large expanding leaf spots, severe defoliation.

Table 25. * Efficacy for *Botrytis cinerea* on Poinsettia (*Euphorbia pulcherrima*), 'Angelica White', Benson, NC, 1999b.

Treatment	Rate Per 100 Gal	Disease Severity (1-10) ^{x,y}			
		4/15/98	4/30/98	5/14/98	5/28/98
Compass 50W (trifloxystrobin)	2.0 oz	2.2 b	2.4 b	2.8 bc	2.6 b
Daconil Ultrex 82.5WP (chlorothalonil)	16.0 oz	1.3 c	2.3 bc	2.4 bc	2.3 b
Heritage 50WDG (azosystrobin)	1.0 oz	1.4 bc	2.6 b	3.6 b	2.8 b
	2.0 oz	1.3 c	1.3 c	2.2 c	2.3 b
	4.0 oz	1.3 c	1.8 bc	2.2 c	2.2 b
	8.0 oz	1.9 bc	2.3 bc	2.7 bc	2.3 b
Untreated non-inoculated	-	1.8 bc	2.1 bc	2.2 c	2.7 b
Untreated inoculated	-	3.6 a	5.3 a	6.3 a	6.2 a

* Not an IR-4 Experiment: F&N Tests Vol 55: 558.

^x Means followed by same letter do not differ significantly based on Waller-Duncan k-ratio, t-test (P=0.05).

^y Severity rating: 1= healthy,no infection; 2= leaf spots in at least one leaf; 5= about 50% of leaves with spots, 8= about 80% of leaves with spots, defoliation; and 10= most leaves infected, large expanding leaf spots, severe defoliation.

In 2008, Beckerman studied the efficacy of several fungicides for the control of Botrytis blight on greenhouse-grown poinsettia. Fungicides were applied as foliar sprays on Dec 11; plants were sprayed with *B. cinerea* inoculum 2 days after fungicide application. Although no fungicide gave complete disease control, all treatments significantly reduced disease severity (Table 26). Decree and Pageant had the lowest disease severity nine days after inoculation (Dec 22); Medallion, Chipco 26019, and Disarm showed the highest disease severity. No phytotoxicity was observed from any treatment.

Table 26. * Efficacy for *Botrytis cinerea* on Poinsettia (*Euphorbia pulcherrima*) ‘Prestige Red’, Beckerman, IN, 2008.

Treatment	Rate Per 100 gal	Disease Severity ^{x, y}		
		12/16/08	12/19/08	12/22/08
Chipco 26019 50WDG (iprodione)	2 lb	28.5 de	40.1 bc	52.2 b
Decree 50WG (fenhexamid)	1.75 lb	41.9 abc	34.3 cd	30.5 ef
Disarm 480SC (fluoxastrobin)	21 fl oz	17.8 ef	30.0 d	50.4 bc
Heritage 50WG (azoxystrobin)	8 oz	29.9 cd	33.9 cd	41.7 cd
Insignia 20WDG (pyraclostrobin)	12 oz	43.1 ab	47.9 b	39.2 de
Medallion (fludioxonil)	4 oz	47.0 a	41.8 ab	58.7 b
Pageant 38WG (boscalid + pyraclostrobin)	18 oz	32.3 bcd	34.5 cd	34.2 def
Untreated non-inoculated	-	8.8 f	19.5 e	27.0 f
Untreated inoculated		48.5 a	58.0 a	71.0 a

* Not an IR-4 Experiment: Plant Disease Management Reports 4:OT014.

^x Means followed by same letter do not differ significantly based on Waller-Duncan k ratio t-test, k= 100, $P < 0.0001$.

^y Disease Severity= (average number of bracts with lesions/ average total number of bracts)*100

In 2011, Hausbeck screened several fungicides for the control of *Botrytis* blight on greenhouse-grown poinsettia. Fungicides were applied as foliar sprays on Dec 23; plants were inoculated by spraying with the *B. cinerea* conidial solution 4 hr after fungicide application. The number of leaves sporulating with *B. cinerea* on each plant were counted and a plant health rating was observed on Jan 6. Disease pressure was severe in this trial with the untreated control plants averaging 65.4% of leaves sporulating with *B. cinerea*. Although no products completely prevented infection, Medallion limited infection to less than one leaf sporulating with *B. cinerea* per plant (Table 27). Chipco 26019, Daconil Weatherstik, Pageant and Palladium were all effective and may be good rotation products in a disease control program. No phytotoxicity was observed from any treatment.

Table 27. * Efficacy for *Botrytis cinerea* on Poinsettia (*Euphorbia pulcherrima*) 'Freedom Pink', Hausbeck, MI, 2011.

Treatment	Rate Per 100 Gal	Leaves Sporulating with <i>B. cinerea</i> ^x	Health Rating ^y
Chipco 26019 50WP (iprodione)	2 lb	6.0 a	1.8 ab
Daconil Weatherstik 6SC (chlorothalonil)	1.4 pt	7.0 a	2.0 ab
Decree 50DF (fenhexamid)	1.5 lb	19.1 abc	3.3 bcd
Disarm O 480SC (fluoxastrobin)	4 fl oz	37.7 cd	4.5 d
Heritage 50WG (azoxystrobin)	8 oz	35.8 bcd	4.0 cd
Medallion 50WP (fludioxonil)	4 oz	0.5 a	1.3 a
OHP 6672 F (thiophanate methyl)	20 fl oz	69.4 e	6.8 e
Pageant 38WG (boscalid + pyraclostrobin)	18 oz	5.2 a	1.8 ab
Palladium 62.5WDG (cyprodinil + fludioxonil)	6 oz	13.0 ab	2.3 abc
Veranda O 11.3WDG (polyoxin D)	8 oz	12.3 ab	3.0 a-d
Untreated inoculated	-	65.4 e	7.0 e

* Not an IR-4 Experiment: Plant Disease Management Reports 6:OT007. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Fisher's Protected LSD Test ($P=0.05$).

^y Rated on a scale of 1-10, where 1=healthy, 2=small isolated lesions, 3=moderate-sized isolated lesions, 4=numerous moderate-sized lesions, 5=large necrotic areas, 6=large necrotic areas with 30-50% defoliation, 7=large necrotic areas with 51-70% defoliation, 8=large necrotic areas with 71-90% defoliation, 9=>91% defoliation, 10=plant death.

Primrose

In 2007, Hausbeck studied the efficacy of several fungicides for the control of Botrytis blight on primrose in a greenhouse. Fungicides were applied as foliar sprays at seven-day intervals on Feb 6, 13, 20, 27 and Mar 7, 13, 20, 28; plants were sprayed with *B. cinerea* inoculum 4 hours after each fungicide treatment. The percentage of infected leaves, the number of sporulating *B. cinerea* lesions, and disease severity ratings were recorded on Feb 13, 20, 27 and Mar 7, 13, 20, 28. All fungicide treatments significantly reduced a moderate disease severity (Table 28). Daconil Weather Stik, Endorse, and Heritage received the lowest disease severity ratings. With the exception of Heritage, all products significantly limited the number of sporulating lesions. There was no significant difference between any fungicide treatments compared to the untreated control in the percentage of infected leaves. No phytotoxicity was observed from any treatment.

Table 28. * Efficacy for *Botrytis cinerea* on Primrose (*Primula acaulis*) 'Orion Mix', Hausbeck, MI, 2007.

Treatment	Rate Per 100 Gal	Infected Leaves (%)^x	Number of Sporulating Lesions	Disease Severity^y
Daconil Weatherstik 6F (chlorothalonil)	22 fl oz	16.9 ab	0.0 a	3.7 a
Endorse 2.5WP (polyoxin D)	2.2 lb	34.6 d	0.2 a	3.3 a
Heritage 50WG (azoxystrobin)	2 oz	19.2 abc	0.8 ab	3.2 a
Pageant 38WG (boscalid + pyraclostrobin)	9.5 oz	12.8 a	0.2 a	4.0 a
Switch 62.5 WG (cyprodinil + fludioxonil)	14 oz	30.0 bcd	0.0 a	4.0 a
Untreated inoculated	-	21.9 a-d	2.3 b	6.2 b

* Not an IR-4 Experiment: Plant Disease Management Reports 3:OT025. Not all products tested included in table.

^x Means followed by same letter do not differ significantly based on Fisher's Protected LSD Test (P=0.05).

^y Severity of foliar symptoms was rated on a visual scale of 1 to 10; where 1=no symptoms, 2 to 8=varying degrees of blighting that ranged from a few, necrotic lesions and no defoliation up to large necrotic areas accompanied by defoliation, and 10=100% defoliation and plant death.

Chrysanthemum

In 2008, Buck conducted a greenhouse experiment to determine efficacy of several fungicides for the control of Botrytis blight on chrysanthemum. Fungicides were applied as foliar sprays at 7-day intervals on Sept 19, 26 and Oct 3; plants were inoculated with a mixture of three isolates of *B. cinerea* 3-hr after each treatment. The percentage of infected flowers on each plant was recorded 2 weeks after the final treatment. All products significantly reduced the percentage of infected flowers (Table 29). No phytotoxicity was observed from any treatment.

Table 29. * Efficacy for *Botrytis cinerea* on Chrysanthemum (*Chrysanthemum x morifolium*) ‘Brandi’, Buck, GA, 2008.

Treatment	Rate Per 100 Gal	Infected Flowers (%) ^x
Daconil Ultrex (chlorothalonil)	2.5 lb	11.0 b
Decree 50WG (fenhexamid)	0.75 lb	4.2 b
Heritage 50WG (azoxystrobin)	2 oz	5.8 b
Medallion (fludioxonil)	2 oz	6.9 b
Palladium 62.5 WG (cyprodinil + fludioxonil)	2 oz	5.0 b
	4 oz	15.9 b
	8 oz	6.6 b
Untreated inoculated	-	51.0 a

* Not an IR-4 Experiment: Plant Disease Management Reports 6:OT017.

^x Means followed by same letter do not differ significantly based on Fisher's Protected LSD Test (P=0.05).

Douglas Fir

In 2000 and 2001, Lambe studied the efficacy of Switch 62.5WG (cyprodinil + fludioxonil) for the control of Botrytis gray mold needle disease on Douglas fir seedlings in the greenhouse.

In the 2000 experiment, fungicides were applied as foliar sprays 3 times at 7-day intervals starting at first sign of foliage infection. Approximately 6 weeks after first application, Switch at 6 oz reduced the number of infected plants under low Botrytis levels infecting needles (During 2001, similar methods were used with fungicides applied as foliar sprays 3 times at 7-day intervals starting on September 16; four days after treatment plants were inoculated with a spore suspension of *B. cinerea*. Switch reduced the percentage of plants infected under moderate to high pressure (Table 31); however, there was no statistical different among treatments. No phytotoxicity was observed from any treatment.

Table 30); however, significance of this trend was not able to be determined. Low phytotoxicity was observed from the higher rates, with less than 1% of the plants showing yellowing of the lowest needles.

During 2001, similar methods were used with fungicides applied as foliar sprays 3 times at 7-day intervals starting on September 16; four days after treatment plants were inoculated with a spore suspension of *B. cinerea*. Switch reduced the percentage of plants infected under moderate to high pressure (Table 31); however, there was no statistical different among treatments. No phytotoxicity was observed from any treatment.

Table 30. Efficacy for *Botrytis cinerea* on Douglas Fir (*Pseudotsuga menziesii*), Lambe, WA, 2000.

Treatment	Rate Per 100 Gal	Number of infected plants on 10/23/00
Switch 62.5WG (cyprodinil + fludioxonil)	3 oz	10.0
	6 oz	1.0
	12 oz	6.0
Untreated	-	18.0

Data reviewed in 2014: data collected were counts of disease plants for the entire treated set of plants. No statistics could be performed.

Table 31. Efficacy for *Botrytis cinerea* on Douglas Fir (*Pseudotsuga menziesii*), Lambe, WA, 2001.

Treatment	Rate Per 100 Gal	Infection (%)	
		10/12/01	10/20/01
Switch 62.5WG (cyprodinil + fludioxonil)	3 oz	4.3 a	5.7 a

	6 oz	8.0 a	8.0 a
	12 oz	6.3 a	6.3 a
Untreated inoculated	-	13.0 a	28.0 a

Data analyzed in 2014 using Stata/MP 13.1; means followed by same letter do not differ significantly based on Scheffe's pairwise mean comparison at p=0.05.

Continuing in 2005 with this disease system, Lambe conducted another greenhouse experiment on Douglas fir seedlings expanding to nine different fungicides. All fungicide applications were applied as foliar sprays beginning 3 days before artificial inoculation with a spore suspension of *Botrytis cinerea* on September 23, 2005 and repeated 3 times at 7-day intervals. In general, BAS 516, Endorse at 8 oz, Insignia, Medallion and Milstop performed better than the standard Decree against a low disease infection (Table 32). Phyton 27 and STBX-304 were ineffective. No phytotoxicity was observed from any treatment except Phyton 27 and STBX-304.

Table 32. Efficacy for *Botrytis cinerea* on Douglas Fir (*Pseudotsuga menziesii*), Lambe, WA, 2005.

Treatment	Rate Per 100 Gal	% Diseased ^{x, y}		Phytotoxicity ^z	
		10/13/05	10/27/05	10/13/05	10/27/05
BASF 516 UFF 28% WG (boscalid + pyraclostrobin)	9.5 oz	11.0 cde	5.3 a-d	1.8	1.0
	18.0 oz	0.0 a	3.7 ab	1.2	1.0
Decree (fenhexamid)	1.0 lb	6.3 a-d	8.7 d	1.0	1.0
Endorse CL EXP 04 10% (polyoxin D)	4.0 oz	11.8 de	6.5 a-d	2.0	1.8
	8.0 oz	1.9 a	4.5 a-d	1.2	1.0
	12.0 oz	14.4 ef	8.4 cd	1.2	1.0
Insignia 20% WG (pyraclostrobin)	8.0 oz	1.9 a	4.9 a-d	2.0	1.0
	16.0 oz	2.7 ab	4.6 a-d	1.5	1.0
Medallion (fludioxonil)	2.0 oz	4.6 ab	3.0 ab	1.0	1.0
	4.0 oz	8.3 b-e	3.8 ab	1.2	1.0
	8.0 oz	0.0 a	2.6 a	1.2	1.0
Milstop (potassium bicarbonate)	5.0 lb	8.7 b-e	4.9 a-d	1.2	1.0
Pageant 38WG (boscalid + pyraclostrobin)	12.5 oz	3.0 ab	2.6 a	1.2	1.5
	18.5 oz	3.4 ab	7.3 bcd	1.5	1.0
Phyton 27 (copper sulfate pentahydrate)	15 oz	20.3 f	11.7 de	2.2	1.8
	20 oz	19.7 f	14.8 e	2.5	3.0
STBX-304 (cupric ammonium formate)	15 oz	0.2 ab	9.2 d	2.0	4.0
	20 oz	0.2 ab	11.6 de	2.0	4.0
Untreated non-inoculated	-	5.3 abc	4.2 abc	na	na
Untreated inoculated	-	1.5 a	2.6 a	na	na

^x Means followed by the same letter do not differ significantly at the 0.05 level.

^y Seedlings with sporulating lesions on the needles were counted as diseased.

^z Phytotoxicity occurred as yellowing and needle necrosis where 1= no seedling injury, 2= slight, 3= medium, 4 = severe injury, and 5 = seedlings dead.

Rose

In 2006, Wegulo conducted an outdoor field experiment to determine efficacy of several fungicides for the control of *Botrytis* blight on rose. Fungicides were applied as foliar sprays on Jul 10, 19, and 28. All products significantly reduced a high disease severity (Table 33). Significant differences among treatments were not observed. No phytotoxicity was observed from any treatment.

Table 33. * Efficacy for *Botrytis cinerea* on Rose (*Rosa* sp) ‘Mr. Lincoln’, Wegulo, NE, 2006.

Treatment	Rate Per 100 Gal	Disease Severity ^{x,y}			
		7/20/06	8/6/06	8/16/06	8/25/06
Heritage 50WG (azoxystrobin)	2 oz	3.3 b	0.2 b	0.4 bc	0.9 b
Insignia 20WDG (pyraclostrobin)	8 oz	2.3 bcd	0.1 b	0.4 bc	0.5 b
Medallion (fludioxonil)	2 oz	1.5 d	0.7 b	0.3 c	0.1 b
Palladium 62.5 WG (cyprodinil + fludioxonil)	2 oz	2.5 bcd	0.4 b	0.4 bc	0.3 b
	4 oz	2.2 cd	0.3 b	0.9 bc	0.5 b
Vanguard (cyprodinil)	2 oz	2.6 bc	0.6 b	1.0 b	0.3 b
Untreated	-	4.4 a	3.8 a	2.5 a	2.9 a

* Not an IR-4 Experiment: Plant Disease Management Reports 1:OT019.

^x Means followed by same letter do not differ significantly based on Least Significant Difference Test (P=0.05).

^x Rating of 0 to 5 scale with 0 representing no visible signs of disease and 5 representing 100% flower blight.

Western Hemlock

During 2000 and 2001, Lambe conducted two greenhouse experiments to determine efficacy of Switch 62.5WG (cyprodinil + fludioxonil) for the control of *Botrytis* gray mold needle disease on western hemlock. Fungicides were applied as foliar sprays 3 times at 7-day intervals starting at first sign of foliage infection. In the 2000 experiment, Switch at 3 oz provided excellent control of a very low *Botrytis* infection of needles (Table 34); however results were not statistically different from nontreated controls. No phytotoxicity was observed from any treatment. In the 2001 experiment, Switch significantly reduced the percentage of plants infected under moderate to high *Botrytis* infection of needles (Table 35). No phytotoxicity was observed from any treatment.

Table 34. Efficacy for *Botrytis cinerea* on Western Hemlock (*Tsuga heterophylla*), Lambe, WA, 2000.

Treatment	Rate Per 100 Gal	Percent Infection on 10/23/00
Switch 62.5WG (cyprodinil + fludioxonil)	3 oz	0.0 a
	6 oz	0.5 a
	12 oz	0.9 a
Untreated	-	2.4 a

Data analyzed in 2014 using Stata/MP 13.1; means followed by same letter do not differ significantly based on Scheffe’s pairwise mean comparison at $p=0.05$.

Table 35. Efficacy for *Botrytis cinerea* on Western Hemlock (*Tsuga heterophylla*), Lambe, WA, 2001.

Treatment	Rate Per 100 Gal	Infection (%)	
		10/12/01	10/20/01
Switch 62.5WG (cyprodinil + fludioxonil)	3 oz	3.0 a	3.7 a
	6 oz	2.0 a	2.0 a
	12 oz	4.3 a	4.0 a
Untreated inoculated	-	25.7 b	34.0 b

Data analyzed in 2014 using Stata/MP 13.1; means followed by same letter do not differ significantly based on Scheffe's pairwise mean comparison at $p=0.05$.

In 2005, Lambe screened several fungicides for efficacy of *Botrytis* gray mold needle and stem disease on western hemlock seedlings. All fungicide applications were applied as foliar sprays beginning 3 days before artificial inoculation with a spore suspension of *Botrytis cinerea* on September 23, 2005 and repeated 3 times at 7-day intervals. BAS 516, Endorse at 12 oz, Insignia at 16 oz, Medallion at 2 and 4 oz, and the standard Decree provided significant control of a low infection (Table 36). Milstop, Phyton 27 and STBX-304 were ineffective. No phytotoxicity was observed from any treatment except Phyton 27 and STBX-304.

Table 36. Efficacy for *Botrytis cinerea* on Western Hemlock (*Tsuga heterophylla*), Lambe, WA, 2005.

Treatment	Rate Per 100 Gal	% Diseased ^{x, y}		Phytotoxicity	
		10/18/05	11/3/05	10/18/05	11/3/05
BASF 516 UFF 28% WG (boscalid + pyraclostrobin)	9.5 oz	0.4 a	2.0 b-e	2.0	1.0
	18.0 oz	1.6 ab	0.8 abc	3.0	1.0
Decree (fenhexamid)	1.0 lb	1.2 ab	1.2 a-d	1.0	2.0
Endorse CL EXP 04 10% (polyoxin D)	4.0 oz	0.8 a	1.6 a-d	2.0	1.0
	8.0 oz	2.4 ab	2.0 b-e	2.0	1.0
	12.0 oz	2.8 ab	0.8 abc	2.0	1.0
Insignia 20% WG (pyraclostrobin)	8.0 oz	0.4 a	2.0 b-e	2.0	2.0
	16.0 oz	1.6 ab	0.4 ab	1.5	1.0
Medallion (fludioxonil)	2.0 oz	0.8 a	0.0 a	1.0	1.0
	4.0 oz	0.4 a	0.4 ab	1.0	1.0
	8.0 oz	4.3 ab	2.0 b-e	2.0	2.0
Milstop (potassium bicarbonate)	5.0 lb	2.4 ab	2.4 cde	1.0	1.0
Pageant 38WG (boscalid + pyraclostrobin)	12.5 oz	1.2 ab	0.4 ab	2.0	3.0
	18.5 oz	1.2 ab	0.8 ab	3.0	2.0
Phyton 27 (copper sulfate pentahydrate)	15 oz	9.0 c	6.3 g	2.0	2.0
	20 oz	14.9 d	7.8 gh	3.0	3.0
STBX-304 (cupric ammonium formate)	15 oz	2.7 a	4.7 cd	2.0	3.0
	20 oz	2.3 a	2.4 cde	2.0	3.0
Untreated non-inoculated	-	4.3 b	3.5 ef	na	na
Untreated inoculated	-	2.0 ab	2.7 de	na	na

^x Means followed by the same letter do not differ significantly at the 0.05 level.

^y Seedlings with sporulating lesions on the needles were counted as diseased.

Comparative Efficacy for Botrytis elliptica

In 2011 and 2012, Chastagner conducted two field trials to test the efficacy of several fungicides for control of *Botrytis elliptica* on Asiatic hybrid lily. Treatments were applied on 1-week, 10-day and 2-week intervals starting on May 18, 2011 and June 11, 2012 (Table 37, Table 38). Overall disease incidence and severity ratings of whole cells were taken on a weekly basis starting from Day 0 until Day 80 (August 5, 2011) and on June 11, 2012 to September 19, 2012 (Day 100). On Day 83 (August 8, 2011) and Day 115 (October 4, 2012), 5 plants from each cell were randomly selected and rated for disease severity (0-10 scale) and the extent of foliage dieback on the lower portion of the stem. In 2011, moderate levels of disease developed. Compared to the Check, applications of Pageant at both rates, Disarm at both rates, and Medallion had significantly less foliage dieback and low severity ratings (Table 37). In 2012, low levels of disease developed. Compared to the Check, applications of Palladium and Proud 3 had significantly lower incidence ratings. Treatments had no effect on overall disease severity, plant growth, or the rate of foliage dieback (Table 38). Please note that the Regalia rate in the protocol was lower than the lowest labeled rate of 2 quarts per 100 gal. Given that only low and moderate levels of disease developed during these trials, additional tests should be conducted to determine the effectiveness of these fungicides in providing acceptable disease control under higher disease pressure. No phytotoxicity was observed from any treatment.

Table 37. Efficacy for *Botrytis elliptica* on Asiatic hybrid Lily (*Lilium sp.*), 'Elite', Chastagner WA, 2011.

Treatment	Rate Per 100 Gal	Application Dates ^y	Application Interval	Length Foliar dieback (cm) ^x	
				8/8/11	Disease Severity 8/8/11
Chipco 26019 (iprodione)	16 oz	B	14-day	11.8 abc	1.72 abc
Disarm (fluoxastrobin)	4 fl oz	B	14-day	7.4 d	1.20 c
	8 fl oz	B	14-day	10.0 bcd	1.44 bc
Medallion (fludioxonil)	8 oz	B	14-day	8.6 cd	1.12 c
Pageant 38WG (boscalid + pyraclostrobin)	7 oz	B	14-day	9.5 bcd	1.36 c
	14 oz	B	14-day	8.4 cd	1.24 c
Palladium (cyprodinil + fludioxonil)	12 oz	B	14-day	12.0 abc	1.80 abc
Trinity (triticonazole)	8 fl oz	A	7-day	12.7 ab	2.12 ab
	12 fl oz	A	7-day	11.1 abcd	1.72 abc
Untreated Check	-	-	-	14.8 a	2.28 a

^x Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.05).

^y Dates: 1 = 5/18/11, 2= 5/28/11, 3 = 6/4/11, 4 = 6/12/11, 5 = 6/20/11, 6 = 6/28/11, 7 = 7/6/11, 8 = 7/12/11, 9 = 7/19/11, 10 = 7/26/11. A = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10; B = 1, 3, 5, 7, 9

Table 38. Efficacy for *Botrytis elliptica* on Asiatic hybrid Lily (*Lilium sp.*), 'London', Chastagner WA, 2012.

Treatment	Rate Per 100 Gal	Application Dates^z	Application Interval	Disease Incidence^y 9/19/12	Foliage Dieback 10/4/12	Disease Severity 10/4/12	Growth (cm)^x
Chipco 26019 (iprodione)	16 oz	A	14-day	9.0 a	6.0 a	3.0 a	14.3 a
Disarm (fluoxastrobin)	8 fl oz	A	14-day	9.0 a	5.3 a	3.0 a	17.8 a
Pageant 38WG (boscalid + pyraclostrobin)	14 oz	A	14-day	8.5 ab	4.0 a	3.8 a	15.0 a
Palladium (cyprodinil + fludioxonil)	12 oz	B	7-day	2.3 c	8.3 a	1.3 a	14.2 a
Proud 3 (thyme oil)	4 qt	B	7-day	6.5 b	4.3 a	4.0 a	14.7 a
Regalia 50 (extract of <i>Reynoutria sachalinensis</i>) ^w	4 fl oz	B	7-day	8.3 ab	5.0 a	3.8 a	13.0 a
Torque (tebuconazole)	8 fl oz	A	14-day	8.3 ab	6.8 a	2.5 a	15.7 a
Tourney 50WDG (metconazole)	4 oz	A	14-day	8.3 ab	5.3 a	3.5 a	13.1 a
Trinity (triticonazole)	12 fl oz	A	14-day	8.3 ab	6.5 a	1.8 a	14.2 a
V-10135 (fenpyrazamine)	16 oz	B	7-day	8.0 ab	4.5 a	4.3 a	16.1 a
ZeroTol (hydrogen peroxide)	1 gal	C	10-day	9.5 a	5.0 a	4.5 a	15.5 a
Untreated Check	-	-	-	9.3 a	4.8 a	4.3 a	15.3 a

^z Dates: 1 = 6/11/12, 2 = 6/20/12, 3 = 6/25/12, 4 = 6/27/12, 5 = 6/29/12, 6 = 7/5/12, 7 = 7/9/12, 8 = 7/12/12, 9 = 7/19/12, 10 = 7/24/12, 11 = 7/26/12, 12 = 8/2/12, 13 = 8/9/12, 14 = 8/17/12, 15 = 8/23/12, 16 = 8/24/12, 17 = 8/28/12, 18 = 8/31/12, 19 = 9/7/12. A = 1, 3, 7, 10, 13, 15, 19; B = 1, 2, 4, 6, 8, 9, 11, 12, 13, 14, 16, 18, 19; C = 1, 2, 5, 8, 10, 12, 14, 17, 19

^y Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.05).

^x Numbers represent the difference between average plant heights taken on June 11 and July 26, 2012.

^w This Regalia rate is lower than the lowest labeled rate of 2 quarts per 100 gal.

Comparative Efficacy for *Botrytis paeoniae*

In 2013, Chastagner studied the efficacy of several fungicides for control of *Botrytis paeoniae* on peony. The first fungicide application was made on March 22, 2013 and the last application was made on June 17, 2013 (see Table 39 for specific intervals and dates). Although *Botrytis paeoniae* and *Botrytis cineria* were associated with irregular shaped leaf lesions and a shoot blight/dieback on plants during this trial, insufficient disease caused by these *Botrytis* spp. developed to evaluate the control of these pathogens (Table 39). However, sufficient red spot or blotch infection, caused by *Cladosporium paeoniae*, developed to determine effectiveness of the fungicide treatments. All of the treatments, except Medallion, Prestop, Chipco 26019, SP2770 and Proud 3, reduced the severity of red spots compared to the non-treated check. Torque, Pageant, Disarm, Daconil WeatherStik, Kocide, Trinity, Palladium, and SP2773 were the most effective materials tested. Compared to the non-treated checks, none of the treatments had any effect on overall vigor of the plants in this trial. Kocide and Daconil sprays resulted in visible residues on the plants.

Table 39. Efficacy for *Botrytis paeoniae* on Peony (*Paeonia* sp.), Chastagner WA, 2013.

Treatment	Rate Per 100 Gal	Application Dates ^z	Severity Ratings ^{x,y} 7/2/13			Plant Vigor ^w
			Red Spots	Botrytis		
				Leaf Lesions	Shoot Blight	
Chipco 26019 N/G (iprodione)	16 oz	2	3.5 abc	0.0 a	0.4 ab	2.5 ab
Daconil (chlorothalonil)	1.4 pt	2	1.4 cd	0.4 a	0.7 ab	2.3 ab
Decree (fenhexamid)	1.5 lb	2	2.6 bc	0.5 a	0.2 b	2.2 ab
Disarm 480SC (fluoxastrobin)	8 fl oz	2	1.2 cd	0.3 a	0.2 b	2.2 ab
F9110 (extract of <i>Lupinus</i>)	24 oz	1	2.6 bc	0.6 a	0.1 b	2.2 ab
Kocide DF (copper hydroxide)	1 lb	2	1.6 cd	0.1 a	0.3 ab	2.4 ab
Medallion 50WDG (fludioxonil)	8 oz	2	3.3 abc	0.1 a	0.3 ab	2.1 ab
Pageant 38WG (boscalid + pyraclostrobin)	14 oz	2	0.2 d	0.7 a	0.5 ab	2.4 ab
Palladium 62.5WG (cyprodinil + fludioxonil)	6 oz	2	2.3 bcd	0.2 a	0.2 b	2.2 ab
Prestop (<i>Gliocladium catenulatum</i>)	0.5 %	3	3.3 abc	0.1 a	1.0 a	2.6 a
Proud 3 (thyme oil)	4 qt	2	5.2 a	0.7 a	0.8 ab	2.3 ab
SP2770 10WP	2.66 lb	2	4.6 ab	0.4 a	0.3 ab	2.5 ab
SP2773	1.66 lb	2	2.4 bcd	0.5 a	0.1 b	2.3 ab
Torque 3.6 SC (tebuconazole)	8 fl oz	2	0.2 d	0.4 a	0.2 b	2.0 b
Trinity 2SC (triticonazole)	12 fl oz	2	2.2 cd	0.2 a	0.2 ab	2.2 ab
V-10135 SC (fenpyrazamine)	16 oz	1	2.8 bc	0.0 a	0.2 b	2.4 ab
Untreated Check	-	-	5.5 a	0.0 a	0.4 ab	2.3 ab

^x Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.05).

^y Rated on a scale of (0-10) where: 0 = none, 1 = 1-10%, 2 = 11-20%,...10 = 91-100% foliage exhibiting symptoms of red leaf spot or Botrytis leaf lesions. Botrytis shoot blight was rated on a 0-10 scale: where: 0 = none, 1 = 1-10%, 2 = 11-20%,...10 = 91-100% of the shoots on the plants exhibited symptoms of shoot dieback.

^w Vigor (1-3) where: 1 = plant < 12" tall, 2 = plant 12-25" tall, 3 = plant > 25" tall.

^z Date 1 = 3/22/13, 3/29/13, 4/3/13, 4/12/13, 4/18/13, 4/26/13, 5/2/13, 5/10/13, 5/20/13, 5/31/13, 6/7/13, 6/17/13; Date 2 = 3/22/13, 4/3/13, 4/18/13, 5/2/13, 5/20/13, 6/3/13, 6/17/13; Date 3 = 3/22/13, 4/12/13, 4/18/13, 5/20/13, 6/17/13.

^z Numbers represent the difference between average plant heights taken on June 11 and July 26, 2012.

Comparative Efficacy for *Botrytis tulipae*

In 2014, Chastagner conducted two field trials to test the efficacy of several fungicides for control of *Botrytis tulipae* on tulips. The first application was made on Feb 27, 2014 and the last application was made on April 22, 2014 (see Table 40 for specific intervals and dates). In the first trial, all treatments except Proud 3 had severity ratings and percent blighted flowers that were significantly less than the non-treated control plants (Table 40). Pageant and BAS 703 were the most effective materials in reducing disease development. The biofungicide F9110 significantly reduce disease development of the foliage and flowers. BAS 703 and Pageant treated plants also had significantly more flowers that were greater than 13" tall and yielded more bulbs greater than 12cm than the control plants (Table 41). In the second trial, both rates of SP2773 had significantly lower severity ratings than the non-treated control plants (Table 42). The high rate of SP2773 had significantly less blighted flowers and more flowers greater than 13" tall than the controls and also yielded significantly more bulbs that were 10-12 cm (Table 43). SP2770 was ineffective. No phytotoxicity was observed from any treatment.

Table 40. Efficacy for *Botrytis tulipae* on Tulip flowers (*Tulipa* sp.), 'Dynasty' - Trial 1, Chastagner WA, 2014.

Treatment	Rate Per 100 Gal	Application Dates / Interval ^y	% Blighted Flowers on 4/30/14 ^x	Severity (0-10) on 5/12/2014 ^z	Flower Height (inches) ^x			
					< 10	10-13	> 13	Total
BAS 703 01F (fluxapryoxad + pyraclostrobin)	8 oz	A / 14-day	19.2 d	1.3 c	2.0 b	11.8 a	21.0 a	34.8 ab
Chipco 26019 N/G (iprodione)	16 oz	A / 14-day	59.4 b	3.3 b	5.5 ab	15.8 a	13.3 abc	34.5 ab
F9110 (extract of <i>Lupinus</i>)	24 fl oz	B / 7-day	30.2 cd	3.3 b	10.8 ab	15.5 a	6.0 abc	32.3 ab
Pageant 38WG (boscalid + pyraclostrobin)	14 oz	A / 14-day	20.1 d	1.5 c	6.3 ab	9.3 a	17.8 ab	33.3 ab
Proud 3 (thyme oil)	4 qts	B / 7-day	100.0 a	8.8 a	11.5 ab	16.5 a	2.0 bc	30.0 ab
S2200 (mandestrobin)	7.5 fl oz	A / 14-day	72.0 b	2.8 bc	5.3 ab	15.0 a	15.0 abc	35.3 ab
Torque 3.6SC (tebuconazole)	8 fl oz	A / 14-day	56.6 bc	2.8 bc	8.8 ab	13.8 a	14.0 abc	36.5 a
Untreated Check	-	-	100.0 a	8.0 a	16.0 a	11.5 a	1.0 c	28.5 b

^x Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.05).

^y Dates: : 1 = 2/27/14, 2= 3/7/14, 3 3/13/14, 4 = 3/21/14, 5 = 3/31/14, 6 = 4/8/14, 7 = 4/14/14, 8 = 4/22/14. A = 1, 3, 5, 7; B = 1, 2, 3, 4, 5, 6, 7, 8.

^z Scale of 0 to 10 where 0 = none, 1 = 1-10%, 2 = 11-20%,, and 10 = 91-100% of plant foliage were diseased.

Table 41. Efficacy for *Botrytis tulipae* on Tulip bulb weight (*Tulipa* sp.), 'Dynasty' - Trial 1, Chastagner WA, 2014.

Treatment	Rate Per 100 Gal	Application Dates / Interval ^y	Wt (g) of Bulbs on 4/10/2014 ^x				Total
			< 8 cm	8-10 cm	10-12 cm	> 12 cm	
BAS 703 01F (fluxapryoxad + pyraclostrobin)	8 oz	A / 14-day	225.6 a	95.2 ab	314.1 ab	416.0 a	1050.9 a
Chipco 26019 N/G (iprodione)	16 oz	A / 14-day	216.2a	114.3 ab	289.8 ab	136.3 bc	756.6 ab
F9110 (extract of <i>Lupinus</i>)	24 fl oz	B / 7-day	241.6 a	110.9 ab	271.1 ab	163.6 abc	787.2 ab
Pageant 38WG (boscalid + pyraclostrobin)	14 oz	A / 14-day	206.6 a	91.7 b	166.7 ab	314.6 ab	779.6 ab
Proud 3 (thyme oil)	4 qts	B / 7-day	183.8 a	134.7 ab	110.2 b	0.0 c	428.7 b
S2200 (mandestrobin)	7.5 fl oz	A / 14-day	238.8 a	126.4 ab	343.1 a	156.4 abc	864.6 ab
Torque 3.6SC (tebuconazole)	8 fl oz	A / 14-day	223.9 a	204.5 a	238.6 ab	151.3 bc	818.3 ab
Untreated Check	-	-	200.7 a	125.1 ab	124.5 ab	0.0 c	450.3 b

^x Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.05).

^y Dates: : 1 = 2/27/14, 2= 3/7/14, 3 3/13/14, 4 = 3/21/14, 5 = 3/31/14, 6 = 4/8/14, 7 = 4/14/14, 8 = 4/22/14. A = 1, 3, 5, 7; B = 1, 2, 3, 4, 5, 6, 7, 8.

Table 42. Efficacy for *Botrytis tulipae* on Tulip flowers (*Tulipa* sp.), 'Dynasty' - Trial 2, Chastagner WA, 2014.

Treatment	Rate Per 100 Gal	Application Dates ^y	% Blighted Flowers on 4/30/2014 ^x	Severity (0-10) on 5/12/2014 ^z	Flower Height on 4/10/2014 (inches) ^x			
					< 10	10-13	> 13	Total
SP2770	2.66 lb	1, 4, 5, 6, 7, 8	100.0 a	9.8 a	24.0 a	7.0 b	0.0 b	31.0 a
SP2773	1.66 lb	1, 4, 5, 7	99.1 ab	6.0 bc	12.0 b	18.0 a	1.8 ab	31.8 a
SP2773	3.313 lb	1, 4, 5, 7	93.4 b	5.3 c	6.8 b	17.0 ab	9.0 a	32.8 a
Untreated Check	-	-	100.0 a	8.0 a	16.0 ab	11.5 ab	1.0 ab	28.5 a

^x Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.05).

^y Dates: : 1 = 2/27/14, 2= 3/7/14, 3 3/13/14, 4 = 3/21/14, 5 = 3/31/14, 6 = 4/8/14, 7 = 4/14/14, 8 = 4/22/14.

^z Scale of 0 to 10 where 0 = none, 1 = 1-10%, 2 = 11-20%,....., and 10 = 91-100% of plant foliage were diseased.

*Although initially planned as 7-day or 14-day interval regimes, there was a 3-week interval between the first and second applications of these products.

Table 43. Efficacy for *Botrytis tulipae* on Tulip bulb weight (*Tulipa* sp.), 'Dynasty' - Trial 2, Chastagner WA, 2014.

Treatment	Rate Per 100 Gal	Application Dates ^y	Wt (g) of Bulbs ^x				
			< 8 cm	8-10 cm	10-12 cm	> 12 cm	Total
SP2770	2.66 lb	1, 4, 5, 6, 7, 8	229.2 a	124.0 a	22.7 c	0.0 a	375.9 c
SP2773	1.66 lb	1, 4, 5, 7	220.5 a	156.2 a	175.1 ab	7.3 a	559.0 ab
SP2773	3.313 lb	1, 4, 5, 7	219.8 a	198.3 a	220.6 a	20.2 a	658.9 a
Untreated Check	-	-	200.7 a	125.1 a	124.5 b	0.0 a	450.3 bc

^x Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.05).

^y Dates: : 1 = 2/27/14, 2= 3/7/14, 3 3/13/14, 4 = 3/21/14, 5 = 3/31/14, 6 = 4/8/14, 7 = 4/14/14, 8 = 4/22/14.

*Although initially planned as 7-day or 14-day interval regimes, there was a 3-week interval between the first and second applications of these products.

Efficacy Summary by Product/Active Ingredient

A brief efficacy summary for select products is given below, with a reminder that there are very limited data available to draw definitive conclusions for many products. Products were selected based on interest in these products for testing in 2012, 2013 and 2014 Botrytis efficacy projects.

Azoxystrobin. Heritage generally provided good to excellent efficacy against *B. cinerea* in 13 experiments on geranium, poinsettia, lisianthus, rose, primrose and chrysanthemum experiments.

Bacillus subtilis. Rhapsody and QRD 713 provided good efficacy against *B. cinerea* in 2 experiments on geranium and lisianthus.

Boscalid + Pyraclostrobin. Pageant and BAS 516 generally provided excellent efficacy against *B. cinerea* in seven experiments on Douglas fir, geranium, poinsettia, primrose and western hemlock, and excellent efficacy for *B. elliptica* in an experiment on Asiatic hybrid lily and on *B. tulipae* in a tulip experiment. Results of 2 experiments on *B. cinerea* on pansy and *B. paeoniae* on peony were inconclusive.

Chlorothalonil. Daconil generally provided excellent efficacy against *B. cinerea* in 21 experiments on chrysanthemum, geranium, lisianthus, poinsettia and primrose. Results of an experiment on *B. paeoniae* on peony were inconclusive because insufficient disease developed. Echo was very effective against *B. cinerea* in a geranium experiment.

Chlorothalonil + Thiophanate methyl. Spectro provided excellent efficacy against *B. cinerea* in a single experiment with geranium.

Copper Products. The copper products Camelot, Phyton 27 and STBX-304 generally provided poor efficacy against *B. cinerea* in 5 experiments on Douglas fir, geranium and western hemlock. Results of an experiment with Kocide on *B. paeoniae* on peony were inconclusive because insufficient disease developed.

Cyprodinil + Fludioxonil. Palladium and Switch generally provided excellent efficacy against *B. cinerea* in 15 experiments on begonia, chrysanthemum, Douglas fir, geranium, poinsettia, rose and western hemlock; some experiments on Douglas fir, western hemlock and pansy produced inconclusive data. Results of experiments on *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* were inconclusive.

Fenhexamid. Decree generally provided excellent efficacy against Botrytis cinerea in 23 experiments on Douglas fir, geranium, lisianthus, poinsettia, and western hemlock; an experiment on pansy produced inconclusive data. Also, results of an experiment on *B. paeoniae* were inconclusive.

F9110. F9110 provided significant efficacy for *B. tulipae* in a tulip experiment. Results of 2 experiments on *B. cinerea* on pansy and *B. paeoniae* on peony were inconclusive.

Fenpyrazamine. V-10135 provided good efficacy against *B. cinerea* in 2 geranium experiments; a experiment on pansy produced inconclusive data. Also, results of experiments on *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* on peony were inconclusive. It provided no efficacy for *B. cinerea* and powdery mildew in a miniature rose experiment.

Fludioxonil. Medallion generally provided good to excellent efficacy against *B. cinerea* in 13 experiments on begonia, chrysanthemum, Douglas fir, geranium, lisianthus, poinsettia, rose and western

hemlock; an experiment on pansy produced inconclusive data. Results of experiments on *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* on peony were inconclusive.

Fluoxastrobin. Disarm provided mediocre efficacy against *B. cinerea* in 3 experiments on geranium and poinsettia, but no efficacy in a miniature rose experiment; an experiment on pansy produced inconclusive data. Also, results of experiments on *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* on peony were inconclusive.

Fluxapyroxad + pyraclostrobin. BAS 703 provided good efficacy for *B. cinerea* and powdery mildew in a miniature rose experiment and on *B. tulipae* in a tulip experiment.

Gliocladium catenulatum. Results of an experiment with Prestop on *B. paeoniae* on peony were inconclusive.

Hydrogen dioxide. ZeroTol provided mediocre efficacy against *B. cinerea* in 2 geranium experiments. Results of an experiment on *B. elliptica* on Asiatic hybrid lily were inconclusive.

Iprodione. Chipco 26019 and Chipco 26GT generally provided good efficacy against *B. cinerea* in 9 experiments on begonia, geranium and poinsettia, but provided mediocre efficacy for *B. tulipae* in a tulip experiment. Results of experiments on *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* on peony were inconclusive.

Mandestrobin. S2200 provided significant efficacy for *B. tulipae* in a tulip experiment.

Metconazole. Results of a experiment with Tourney on *B. elliptica* on Asiatic hybrid lily were inconclusive.

Polyoxin D. Endorse and Veranda O generally provided good efficacy against *B. cinerea* in 13 experiments on, Douglas fir, geranium, primrose, and western hemlock.

Potassium bicarbonate. Kaligreen and Milstop generally provided good efficacy against *B. cinerea* in 3 experiments on Douglas fir, lisianthus and western hemlock.

Pyraclostrobin. Insignia, Cabrio and BAS 500 generally provided excellent efficacy against *B. cinerea* in 8 experiments on Douglas fir, geranium, poinsettia, rose, and western hemlock.

Reynoutria sachalinensis extract. Results of 2 experiments with Regalia 50 on *B. cinerea* on pansy and *B. elliptica* on Asiatic hybrid lily were inconclusive. It provided no Efficacy for *B. cinerea* and powdery mildew in a miniature rose experiment.

SP2770. Results of 2 experiments with SP2770 on on *B. cinerea* on pansy and *B. paeoniae* on peony were inconclusive. It provided no Efficacy for *B. cinerea* and powdery mildew in a miniature rose experiment and on *B. tulipae* in a tulip experiment.

SP2773. Results of 2 experiments with SP2773 on *B. cinerea* on pansy and *B. paeoniae* on peony were inconclusive. It provided significant efficacy for *B. tulipae* in a tulip experiment but no efficacy for *B. cinerea* and powdery mildew in a miniature rose experiment.

Tebuconazole. Torque provided good efficacy for *B. tulipae* in a tulip experiment. Results of 3 experiments on *Botrytis cinerea* on pansy, *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* on peony were inconclusive.

Thiophanate methyl. OHP6672, 3336 and Fungo provided poor efficacy against *B. cinerea* in 4 experiments on geranium and poinsettia.

Thyme Oil. Results of experiments with Proud 3 on *B. cinerea* on pansy, *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* on peony were inconclusive. It provided no efficacy for *B. cinerea* and powdery mildew in a miniature rose experiment and on *B. tulipae* in a tulip experiment.

Trifloxystrobin. Compass generally provided good to excellent efficacy against *B. cinerea* in 7 experiments on geranium and poinsettia.

Triticonazole. Results of 3 experiments with Trinity on *B. elliptica* on Asiatic hybrid lily and *B. paeoniae* on peony were inconclusive.

Phytotoxicity

No phytotoxicity was observed with the products listed above with the exception of Switch and Medallion in a 2001 geranium experiment, Captan in a 2004 geranium experiment, and Palladium in two 2008 and 2009 geranium experiments. Also, Phyton 27 and STBX-304 caused phytotoxicity in a 2005 Douglas fir experiment, and Torque in a 2013 poinsettia experiment.

Table 44. Summary of product efficacy by pathogen and crop.

Note: Table entries are sorted by product, pathogen Latin name, and then by crop Latin name. Only those IR-4 trials received by 9/25/2014 are included in the table below.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25046	BAS 516 UFF (boscalid + pyraclostrobin)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 9.5 oz and 18 oz per 100 gal.
25047	BAS 516 UFF (boscalid + pyraclostrobin)	<i>B. cinerea</i>	Hemlock, Western (Tsuga heterophylla)	Field Container	Lambe	WA	2005	Foliar	Significantly reduced low disease infection at 9.5 and 18 oz per 100 gal; comparable to Decree.
31894	BAS703 01F (Fluxapyrosad + pyraclostrobin)	<i>B. cinerea</i>	Rose (Rosa sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Significantly reduced Botrytis and powdery mildew severity with 4 and 8 oz per 100 gal; best treatment.
31946	BAS703 01F (Fluxapyrosad + pyraclostrobin)	<i>B. tulipae</i>	Tulip (Tulipa sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Significantly reduced high % blighted flowers and disease severity with 8 fl oz per 100 gal; one of two most effective treatments.
31532	Chipco 26019 N/G (Iprodione)	<i>B. cinerea</i>	Peony (Paeonia sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Did not significantly reduce severity of red spot/blotch caused by Cladosporium paeoniae with 16 oz per 100 gal.
30556	Chipco 26019 N/G (Iprodione)	<i>B. elliptica</i>	Lily (Lilium sp.) 'Elite'	Field In-Ground	Chastagner	WA	2011	Foliar	Did not significantly reduce foliage dieback and severity of a moderate disease pressure with 16 oz per 100 gal.
30556	Chipco 26019 N/G (Iprodione)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 16 oz per 100 gal applied every 14 days.
32042	Chipco 26019 N/G (Iprodione)	<i>B. tulipae</i>	Tulip (Tulipa sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Significantly reduced high % blighted flowers and disease severity with 16 oz per 100 gal.
29793	Daconil 54EC (Chlorothalonil)	<i>B. cinerea</i>	Geranium, Zonal (Pelargonium x hortorum)	Greenhouse	Hausbeck	MI	2002	Foliar	No significant impact on disease at 17.3 fl oz per 100 gal under severe pressure; no injury.
31533	Decree (Fenhexamid)	<i>B. cinerea</i>	Peony (Paeonia sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Significantly reduced severity of red spot/blotch caused by Cladosporium paeoniae with 1.5 lb per 100 gal.
25740	Decree (Fenhexamid)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 1 lb per 100 gal.
25744	Decree (Fenhexamid)	<i>B. cinerea</i>	Hemlock, Western (Tsuga heterophylla)	Field Container	Lambe	WA	2005	Foliar	Significantly reduced low disease infection at 1 lb per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
32068	Decree (Fenhexamid)	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
31529	Disarm 480SC (Fluoxastrobin)	<i>B. cinerea</i>	Peony (<i>Paeonia</i> sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Significantly reduced severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 0.08 g + 1 oz per 100 gal.
31569	Disarm 480SC (Fluoxastrobin)	<i>B. cinerea</i>	Rose (<i>Rosa</i> sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce Botrytis and powdery mildew severity with 8 fl oz per 100 gal.
32065	Disarm 480SC (Fluoxastrobin)	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
30448	Disarm 480SC (Fluoxastrobin)	<i>B. elliptica</i>	Lily (<i>Lilium</i> sp.) 'Elite'	Field In-Ground	Chastagner	WA	2011	Foliar	Significantly reduced foliage dieback and severity of a moderate disease pressure with 4 and 8 fl oz per 100 gal.
30448	Disarm 480SC (Fluoxastrobin)	<i>B. elliptica</i>	Lily (<i>Lilium</i> sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 8 fl oz per 100 gal applied every 14 days.
25228	Endorse (Polyoxin D)	<i>B. cinerea</i>	Geranium (<i>Pelargonium</i> sp.) P. x hortorum	Greenhouse	Hausbeck	MI	2002	Foliar	Some reduction in sporulation; no injury.
25218	Endorse (Polyoxin D)	<i>B. cinerea</i>	Fir, Douglas (<i>Pseudotsuga menziesii</i>)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 4, 8 and 12 oz per 100 gal.
25203	Endorse (Polyoxin D)	<i>B. cinerea</i>	Hemlock, Western (<i>Tsuga heterophylla</i>)	Field Container	Lambe	WA	2005	Foliar	Significantly reduced low disease infection at 4, 8 and 12 oz per 100 gal; comparable to Decree.
31522	F9110 (F9110)	<i>B. cinerea</i>	Peony (<i>Paeonia</i> sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Significantly reduced severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 24 oz per 100 gal.
31562	F9110 (F9110)	<i>B. cinerea</i>	Rose (<i>Rosa</i> sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not significantly reduce Botrytis and powdery mildew severity with 32 oz per 100 gal.
32058	F9110 (F9110)	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
31947	F9110 (F9110)	<i>B. tulipae</i>	Tulip (<i>Tulipa</i> sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Significantly reduced high % blighted flowers and disease severity with 24 fl oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25741	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 8 and 16 oz per 100 gal.
25745	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	<i>B. cinerea</i>	Hemlock, Western (Tsuga heterophylla)	Field Container	Lambe	WA	2005	Foliar	Significantly reduced low disease infection at 8 and 16 oz per 100 gal; comparable to Decree.
31534	Medallion (Fludioxonil)	<i>B. cinerea</i>	Peony (Paeonia sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Did not significantly reduce severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 8 oz per 100 gal.
23120	Medallion (Fludioxonil)	<i>B. cinerea</i>	Geranium, Zonal (Pelargonium x hortorum)	Greenhouse	Hausbeck	MI	2002	Foliar	No significant impact on disease at 1, 2, and 4 oz per 100 gal under severe pressure; no injury.
25048	Medallion (Fludioxonil)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 4 and 8 oz per 100 gal.
31572	Medallion (Fludioxonil)	<i>B. cinerea</i>	Rose (Rosa sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce Botrytis and powdery mildew severity with 8 oz per 100 gal.
24809	Medallion (Fludioxonil)	<i>B. cinerea</i>	Hemlock, Western (Tsuga heterophylla)	Field Container	Lambe	WA	2005	Foliar	Significantly reduced low disease infection at 2 and 4 oz per 100 gal; comparable to Decree.
32069	Medallion (Fludioxonil)	<i>B. cinerea</i>	Pansy (Viola sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
30555	Medallion (Fludioxonil)	<i>B. elliptica</i>	Lily (Lilium sp.) 'Elite'	Field In-Ground	Chastagner	WA	2011	Foliar	Significantly reduced foliage dieback and severity of a moderate disease pressure with 8 oz per 100 gal.
25042	MilStop (Potassium bicarbonate)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 5 lb per 100 gal.
25043	MilStop (Potassium bicarbonate)	<i>B. cinerea</i>	Hemlock, Western (Tsuga heterophylla)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 5 lb per 100 gal.
25742	Pageant 38WG (boscalid + pyraclostrobin)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Effective control of red spot/blotch caused by <i>Cladosporium paeoniae</i> on peony with 14 oz per 100 gal.
25742	Pageant 38WG (boscalid + pyraclostrobin)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Not significantly different from untreated Check at 12.5 and 16.5 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25746	Pageant 38WG (boscalid + pyraclostrobin)	<i>B. cinerea</i>	Hemlock, Western (Tsuga heterophylla)	Field Container	Lambe	WA	2005	Foliar	Statistically less Botrytis with 12.5 and 18.5 oz per 100 gal than untreated controls, but infection level was very low; moderate level of injury with the BAS 516-04 38% WG formulation.
32066	Pageant 38WG (boscalid + pyraclostrobin)	<i>B. cinerea</i>	Pansy (Viola sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
30480	Pageant 38WG (boscalid + pyraclostrobin)	<i>B. elliptica</i>	Lily (Lilium sp.) 'Elite'	Field In-Ground	Chastagner	WA	2011	Foliar	Significantly reduced foliage dieback and severity of a moderate disease pressure with 7 and 14 oz per 100 gal.
30480	Pageant 38WG (boscalid + pyraclostrobin)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 14 oz per 100 gal applied every 14 days.
32041	Pageant 38WG (boscalid + pyraclostrobin)	<i>B. tulipae</i>	Tulip (Tulipa sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Significantly reduced high % blighted flowers and disease severity with 14 oz per 100 gal; one of two most effective treatments.
31523	Palladium (Cyprodinil + fludioxanil)	<i>B. cinerea</i>	Peony (Paeonia sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Significantly reduced severity of red spot/blotch caused by Cladosporium paeoniae with 6 oz per 100 gal.
31563	Palladium (Cyprodinil + fludioxanil)	<i>B. cinerea</i>	Rose (Rosa sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce Botrytis and powdery mildew severity with 6 oz per 100 gal.
32059	Palladium (Cyprodinil + fludioxanil)	<i>B. cinerea</i>	Pansy (Viola sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
30554	Palladium (Cyprodinil + fludioxanil)	<i>B. elliptica</i>	Lily (Lilium sp.) 'Elite'	Field In-Ground	Chastagner	WA	2011	Foliar	Did not significantly reduce foliage dieback and severity of a moderate disease pressure with 12 oz per 100 gal.
30554	Palladium (Cyprodinil + fludioxanil)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Significantly reduced incidence but not severity of a low disease pressure with 12 oz per 100 gal applied every 7 days; best treatment.
25044	Phyton-27 (Copper sulfate pentahydrate)	<i>B. cinerea</i>	Fir, Douglas (Pseudotsuga menziesii)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Higher than untreated Check at 1.5 and 2 oz per 100 gal; phytotoxic
25045	Phyton-27 (Copper sulfate pentahydrate)	<i>B. cinerea</i>	Hemlock, Western (Tsuga heterophylla)	Field Container	Lambe	WA	2005	Foliar	Low disease infection. Higher than untreated Check at 1.5 and 2 oz per 100 gal; phytotoxic
31535	Prestop (Gliocladium catenulatum Strain J1446)	<i>B. cinerea</i>	Peony (Paeonia sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Did not significantly reduce severity of red spot/blotch caused by Cladosporium paeoniae with 0.5 % dilution.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31524	Proud 3 (Thyme oil (5.6%))	<i>B. cinerea</i>	Peony (<i>Paeonia</i> sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient <i>Botrytis</i> spp. infection. Did not significantly reduce severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 4 qt per 100 gal.
31564	Proud 3 (Thyme oil (5.6%))	<i>B. cinerea</i>	Rose (<i>Rosa</i> sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce <i>Botrytis</i> and powdery mildew severity with 4 qt per 100 gal.
32060	Proud 3 (Thyme oil (5.6%))	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
31356	Proud 3 (Thyme oil (5.6%))	<i>B. elliptica</i>	Lily (<i>Lilium</i> sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Significantly reduced incidence but not severity of a low disease pressure with 4 qt per 100 gal applied every 7 days.
31948	Proud 3 (Thyme oil (5.6%))	<i>B. tulipae</i>	Tulip (<i>Tulipa</i> sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Did not reduce high % blighted flowers and disease severity with 4 qt per 100 gal.
31571	Regalia 50 (MOI-10605) (Extract of <i>Reynoutria sachalinensis</i>)	<i>B. cinerea</i>	Rose (<i>Rosa</i> sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce <i>Botrytis</i> and powdery mildew severity with 4 oz per 100 gal.
32067	Regalia 50 (MOI-10605) (Extract of <i>Reynoutria sachalinensis</i>)	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
31360	Regalia 50 (MOI-10605) (Extract of <i>Reynoutria sachalinensis</i>)	<i>B. elliptica</i>	Lily (<i>Lilium</i> sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 4 fl oz per 100 gal applied every 7 days.
31949	S2200 4SC (Mandestrobin)	<i>B. tulipae</i>	Tulip (<i>Tulipa</i> sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Significantly reduced high % blighted flowers and disease severity with 7.5 fl oz per 100 gal.
31525	SP2770 10WP (SP2770)	<i>B. cinerea</i>	Peony (<i>Paeonia</i> sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient <i>Botrytis</i> spp. infection. Did not significantly reduce severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 2.66 lb per 100 gal.
31565	SP2770 10WP (SP2770)	<i>B. cinerea</i>	Rose (<i>Rosa</i> sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce <i>Botrytis</i> and powdery mildew severity with 2.66 lb per 100 gal.
32061	SP2770 10WP (SP2770)	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31950	SP2770 10WP (SP2770)	<i>B. tulipae</i>	Tulip (<i>Tulipa</i> sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Did not reduce high % blighted flowers and disease severity with 2.66 lb per 100 gal.
31526	SP2773 (SP2773)	<i>B. cinerea</i>	Peony (<i>Paeonia</i> sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Significantly reduced severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 1.66 lb per 100 gal.
31566	SP2773 (SP2773)	<i>B. cinerea</i>	Rose (<i>Rosa</i> sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce Botrytis and powdery mildew severity with 1.33 lb per 100 gal.
32062	SP2773 (SP2773)	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
31951	SP2773 (SP2773)	<i>B. tulipae</i>	Tulip (<i>Tulipa</i> sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Significantly reduced a high disease severity with 1.66 and 3.31 lb per 100 gal.
20266	Switch 62.5WG (cyprodinil + fludioxonil)	<i>B. cinerea</i>	Geranium, Zonal (<i>Pelargonium</i> x hortorum) P. x hortorum	Greenhouse	Hausbeck	MI	2002	Foliar	No consistent impact on disease with 3, 6, and 12 oz per 100 gal; no injury observed.
18663	Switch 62.5WG (cyprodinil + fludioxonil)	<i>B. cinerea</i>	Fir, Douglas (<i>Pseudotsuga menziesii</i>) douglas fir	Greenhouse	Lambe	WA	2000	Foliar	Good control of a low infection at 3, 6, and 12 oz per 100 gal per acre; no phytotoxicity. NOTE: Data reviewed in 2014 and data collected were counts of disease plants for the entire treated set of plants. No statistics could be performed.
18663	Switch 62.5WG (cyprodinil + fludioxonil)	<i>B. cinerea</i>	Fir, Douglas (<i>Pseudotsuga menziesii</i>) douglas fir	Greenhouse	Lambe	WA	2001	Foliar	Good control at 3, 6, and 12 oz per acre; no injury. NOTE: Data analyzed in 2014, and, while there is a trend for good efficacy, it was not statistically different from untreated inoculated controls.
18665	Switch 62.5WG (cyprodinil + fludioxonil)	<i>B. cinerea</i>	Hemlock, Western (<i>Tsuga heterophylla</i>) douglas fir	Greenhouse	Lambe	WA	2000	Foliar	Good control of a low level infection with 3, 6, and 12 oz per 100 gal with 100 gal per acre; slight chlorosis of lower needles at 6 and 12 oz per 100 gal. NOTE: statistics performed in 2014 indicate no statistical difference among treatments.
18665	Switch 62.5WG (cyprodinil + fludioxonil)	<i>B. cinerea</i>	Hemlock, Western (<i>Tsuga heterophylla</i>) t. heterophylla	Greenhouse	Lambe	WA	2001	Foliar	Great control with 3, 6, and 12 oz per acre; no injury.
31527	Torque 3.6SC (Tebuconazole)	<i>B. cinerea</i>	Peony (<i>Paeonia</i> sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Effective control of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 8 fl oz per 100 gal.
32063	Torque 3.6SC (Tebuconazole)	<i>B. cinerea</i>	Pansy (<i>Viola</i> sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31357	Torque 3.6SC (Tebuconazole)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 8 fl oz per 100 gal applied every 14 days.
31952	Torque 3.6SC (Tebuconazole)	<i>B. tulipae</i>	Tulip (Tulipa sp.) 'Dynasty'	Field In-Ground	Chastagner	WA	2014	Foliar	Significantly reduced high % blighted flowers and disease severity with 8 fl oz per 100 gal.
31358	Tourney 50WDG (Metconazole)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 4 oz per 100 gal applied every 14 days.
31531	Trinity 2SC (Triticonazole)	<i>B. cinerea</i>	Peony (Paeonia sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Significantly reduced severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 12 fl oz per 100 gal.
30449	Trinity 2SC (Triticonazole)	<i>B. elliptica</i>	Lily (Lilium sp.) 'Elite'	Field In-Ground	Chastagner	WA	2011	Foliar	Did not significantly reduce foliage dieback and severity of a moderate disease pressure with 8 fl oz per 100 gal.
30449	Trinity 2SC (Triticonazole)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 12 fl oz per 100 gal applied every 14 days.
31528	V-10135 (Fenpyrazamine)	<i>B. cinerea</i>	Peony (Paeonia sp.)	Field In-Ground	Chastagner	WA	2013	Foliar	Insufficient Botrytis spp. infection. Significantly reduced severity of red spot/blotch caused by <i>Cladosporium paeoniae</i> with 16 fl oz per 100 gal.
31568	V-10135 (Fenpyrazamine)	<i>B. cinerea</i>	Rose (Rosa sp.) 'Karina miniature rose'	Greenhouse	Jiang	CA	2013	Foliar	Did not reduce Botrytis and powdery mildew severity with 16 fl oz per 100 gal.
32064	V-10135 (Fenpyrazamine)	<i>B. cinerea</i>	Pansy (Viola sp.) V. x wittrockiana 'Delta Premium Pure White'	Greenhouse	Benson	NC	2013	Foliar	Data inconclusive because there was no significant difference between treatments, including untreated inoculated and untreated non-inoculated.
31359	V-10135 (Fenpyrazamine)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 16 oz per 100 gal applied every 7 days.
31361	ZeroTol (Hydrogen dioxide)	<i>B. elliptica</i>	Lily (Lilium sp.) London	Field In-Ground	Chastagner	WA	2012	Foliar	Did not significantly reduce incidence or severity of a low disease pressure with 1 gal per 100 gal applied every 10 days.

Appendix 1: Contributing Researchers

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Appendix 2: Submitted Data Reports

The IR-4 reports in this Appendix cover multiple PR numbers and are arranged alphabetically by the researchers' last names. Only those reports received by 9/25/2014 are included.

These reports can also be found at www.rutgers.ir4.edu by searching under the Botrytis Efficacy project.