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IR-4 Ornamental Horticulture Program Leaf Spots & Anthracnose Efficacy

Alternaria alternata
Apiognomonina quercina
Cercospora cornicola
Cercospora lythracearum
Colletotrichum navitas
Colletotrichum sp.
Corynespora cassicola
Diplocarpon rosae
Discula destructiva
Drechslera setariae)
Elsinoe corni
Entomosporium mespilii
Marssonina populi
Myrothecium roridum
Phaeocryptopus qaeumannii
Septoria sp.

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Date: June 30, 2016

Acknowledgements

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This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2015-34383-23710 with substantial cooperation and support from the State Agricultural Experiment Stations and USDA-ARS.

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Abstract

At the IR-4 Ornamental Horticulture Program Workshop in 2013, leaf spots and anthracnose 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 1987 to 2015 on ornamental horticulture crops. Species tested included: *Alternaria alternata*, *Apiognomonina quercina*, *Cercospora cornicola*, *Cercospora lythracearum*, *Colletotrichum navitas*, *Colletotrichum* sp., *Corynespora cassiicola*, *Diplocarpon rosae*, *Discula destructiva*, *Drechslera setariae*, *Elsinoe corni*, *Entomosporium mespilii*, *Marssonina populi*, *Myrothecium roridum*, *Phaeocryptopus qaeumannii* and *Septoria* sp. During this time period, numerous products representing 45 active ingredients were tested as foliar applications against these species causing various leaf spots and anthracnose. Most products are registered and commercially used. Although there were insufficient data for definitive conclusions, two new products that were included, Orkestra, and Mural, looked promising. Compass, Pageant and Palladium provided variable efficacy depending on species. F9110, Proud 3, MBI-110, Milsana, Disarm, SP2770, SP2773 and ZeroTol were generally ineffective. Limited data on other relatively new products (NUP 09092, S2200, Tourney and Trinity) were inconclusive. The established standards Daconil and Eagle generally provided excellent efficacy; Chipco 26019 provided good efficacy, and Medallion provided variable efficacy depending on species. The data from these trials suggest that the effectiveness of some fungicides in controlling leaf spots and anthracnose is variable, depending on the pathogen species.

Introduction

In 2013, 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 8 experiments from 1987 to 2015 received from the IR-4 Ornamental Horticulture Program. We also reviewed 50 available ornamental trials published in Fungicide & Nematicide Tests and Plant Disease Management Reports to check efficacy of experimental and registered fungicides on species causing various leaf spots and anthracnose on ornamentals; 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 1987 to 2015, numerous products representing 45 active ingredients were tested as foliar sprays against several species causing leaf spots and anthracnose on ornamentals. Treatments were generally applied either a few days or immediately before disease inoculation. Field trials were conducted on ornamentals with a history of natural disease infections. 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. Fifteen researchers were involved in the testing (Appendix 1).

Products were supplied by their respective manufacturers.

For IR-4 testing, the following protocols were used: 14-002 and 15-002. 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 1987 to 2015.

Active Ingredient(s)	Product(s)	Manufacturer		Rate(s) Tested	# Trials
Azoxystrobin	Heritage	Syngenta	Foliar	2 oz per 100 gal 4 oz per 100 gal 8 oz per 100 gal	21
Azoxystrobin + propiconazole	Headway	Syngenta	Foliar	12 fl oz per 100 gal 30 fl oz per 100 gal	4
<i>Bacillus amyloliquifaciens</i> strain F727	MBI-110	Marrone	Foliar	1 gal per 100 gal	3
<i>Bacillus subtilis</i>	QRD 713, Rhapsody	Agraquest	Foliar	5 qt per 100 gal 12 qt per 100 gal	5
<i>Bacillus subtilis</i> strain QST 713	Serenade Disease Control RTU	Agraquest	Foliar	-	2
Benzovindiflupyr + azoxystrobin	Mural	Syngenta	Foliar	4 oz per 100 gal 7 oz per 100 gal	1
Caprylic acid	CG100	Summerdale	Foliar	0.5 gal per 100 gal	2
Chlorothalonil	Bravo WDG	Syngenta	Foliar	5 oz per 100 gal	1
	Daconil 2787 6F			32 fl oz per 100 gal *	3

Active Ingredient(s)	Product(s)	Manufacturer		Rate(s) Tested	# Trials
	Daconil Ultrex			1.0 lb per 100 gal 1.25 lb per 100 gal 1.4 lb per 100 gal	28
	Daconil Weatherstik			24 fl oz per 100 gal 88 fl oz per 100 gal	3
	Fungonil Concentrate	Bonide		1 gal per 100 gal	1
Chlorothalonil + propiconazole	Concert II	Syngenta	Foliar	17 fl oz per 100 gal 35 fl oz per 100 gal 70 fl oz per 100 gal	5
Chlorothalonil + thiophanate methyl	Spectro	Cleary	Foliar	16 oz per 100 gal	2
	Kocide	Dupont	Foliar	*	1
Copper hydroxide	Southern Ag Liquid Copper Fungicide	Southern Ag	Foliar	1.1 qt per 100 gal	2
Copper octanoate	Camelot, Bonide Liquid Copper Fungicide	SePRO, Bonide	Foliar	32 fl oz per 100 gal 48 fl oz per 100 gal 102 fl oz per 100 gal	6
Copper salts of fatty and rosin acids	Liquid Copper Fungicide	Various	Foliar	0.8 gal per 100 gal	2
Copper sulfate pentahydrate	Phyton 27	Phyton	Foliar	25 fl oz per 100 gal 30 fl oz per 100 gal 35 fl oz per 100 gal 40 fl oz per 100 gal	5
Cupric ammonium formate	STBX-304	Phyton	Foliar	25 fl oz per 100 gal 40 fl oz per 100 gal	1
	Medallion			2 oz per 100 gal	1
Cyprodinil	Vanguard	Syngenta	Foliar	5 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	10
	Medallion			2 oz per 100 gal 8 oz per 100 gal	9
Fludioxonil	NUP 09092	Syngenta	Foliar	4 fl oz per 100 gal 8 fl oz per 100 gal	2
Fluoxastrobin	Disarm	Arysta, OHP	Foliar	8 fl oz per 100 gal	2
Fluxapyroxad + pyraclostrobin	Orkestra (BAS 703), Merivon	BASF	Foliar	4 fl oz per 100 gal 8 fl oz per 100 gal	5
Hydrogen dioxide	ZeroTol	Biasafe	Foliar	1 gal per 100 gal	1
Iprodione	Chipco 26019	OHP	Foliar	16 oz per 100 gal	2
Lupinus extract	F9110	FMC	Foliar	24 fl oz per 100 gal	5
Mancozeb	Mancozeb		Foliar	*	1
Mandestrobin	S2200	Nufarm	Foliar	7.5 fl oz per 100 gal 15 fl oz per 100 gal	4
Metconazole	Tourney	Nufarm	Foliar	4 oz per 100 gal	2

Active Ingredient(s)	Product(s)	Manufacturer	Rate(s) Tested		# Trials
Mineral Oil	SunSpray Ultra Fine Oil, Horticultural Oil Spray Conc.	Various	Foliar	0.8 gal per 100 gal 1.0 gal per 100 gal 1.2 gal per 100 gal	14
Myclobutanil	Eagle	Dow	Foliar	6 oz per 100 gal 8 oz per 100 gal	18
	Immunox	Spectrum		100 fl oz per 100 gal	15
Neem Oil extract	Concern Garden Defense RTU	Woodstream	Foliar	-	1
	Neem Concentrate	VPG		0.8 gal per 100 gal	8
	Triact 70	OHP		1 gal per 100 gal	1
Polyoxin D zinc salt	Endorse	Arysta	Foliar	14 oz per 100 gal	1
Potassium bicarbonate	Milstop	BioWorks	Foliar	1.5 lb per 100 gal 2.5 lb per 100 gal 3.0 lb per 100 gal 5 lb per 100 gal 10 lb per 100 gal	6
Propiconazole	Banner MAXX	Syngenta	Foliar	4 fl oz per 100 gal 6 fl oz per 100 gal 7 fl oz per 100 gal 8 fl oz per 100 gal	10
	Liquid Systemic Fungicide	VPG	Foliar	0.4 gal per 100 gal	5
Pyraclostrobin	Insignia	BASF	Foliar	4 oz per 100 gal 8 oz per 100 gal 12 oz per 100 gal	7
Pyraclostrobin + boscalid	BAS 516	BASF	Foliar	8.0 oz per 100 gal 12.5 oz per 100 gal	2
	Pageant			12.5 oz per 100 gal 14 oz per 100 18 oz per 100	5
<i>Reynoutria sachalinensis</i> extract	Milsana	Marrone	Foliar	1 gal per 100 gal	1
SP2770	SP2770	SePRO	Foliar	2.67 lb per 100 gal	2
SP2773	SP2773	SePRO	Foliar	1.25 lb per 100 gal 2.8 lb per 100 gal	1
Sulfur	Bonide Citrus, Fruit, and Nut Orchard Spray Concentrate	Bonide	Foliar	2 gal per 100 gal	2
	Safer Garden Fungicide	Safer	Foliar	150 fl oz per 100 gal	1
Tebuconazole	Tebuconazole	Bayer	Foliar	45 fl oz per 100 gal	1
	Bayer Disease Control			75 fl oz per 100 gal	2
	Torque	NuFarm	Foliar	4 fl oz per 100 gal 8 fl oz per 100 gal	3
Thiophanate methyl	3336	Cleary	Foliar	16 oz per 100 gal 20 fl oz per 100 gal	14

Active Ingredient(s)	Product(s)	Manufacturer		Rate(s) Tested	# Trials
	Topsin	Nisso		*	1
Thyme oil	Proud 3	BioHumanetics	Foliar	4 qt per 100 gal	5
Triadimefon	Bayleton	Bayer	Foliar	2.7 oz per 100 gal *	2
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	14
Triflumizole	Terraguard	Chemtura	Foliar	4 oz per 100 gal 8 oz per 100 gal	3
Triforine	Funginex	Solaris	Foliar	50 fl oz per 100 gal	3
	Triforine			16 fl oz per 100 gal *	2
	Ortho Rose Pride	Ortho		50 fl oz per 100 gal	2
Triticonazole	BAS 595	BASF	Foliar	6 fl oz per 100 gal	1
	Trinity			8 floz per 100 gal 12 fl oz per 100 gal	4

* applied at recommended rate.

Results

Comparative Efficacy for *Alternaria*

In 2014, Norman conducted a greenhouse trial to determine efficacy of several fungicides applied as foliar sprays for the control of *Alternaria* leaf spot (*Alternaria alternata*) on impatiens (*Impatiens* sp.) 'Super Elfin Bright Orange'. Disarm, Chipco 26019, S2200, Torque, Orkestra and Trinity provided excellent control comparable to non-inoculated Check; SP2770 and SP2773 at the high rate with Decree were less effective (Table 2). Proud, F9110 and SP2773 at the low rate with Decree were ineffective. No phytotoxicity was observed from any treatment except Torque which caused unacceptable reduction of flowers.

Table 2. Efficacy for *Alternaria* Leaf Spot (*Alternaria alternata*) on *Impatiens* (*Impatiens* sp.) 'Super Elfin Bright Orange', Norman, FL, 2014.

Treatment	Rate Per 100 Gal	Application Dates	No. of Leaf Spots ^x
Chipco 26019 (iprodione)	16 oz	6/24, 7/8, 7/22	0.6 a
Disarm (fluoxastrobin)	8 fl oz	6/24, 7/8, 7/22	0.3 a
F9110 (<i>Lupinus</i> extract)	24 fl oz	6/24, 7/1, 7/8, 7/15, 7/22	21 d
Orkestra (BAS703 01F) (fluxapyroxad + pyraclostrobin)	8 fl oz	6/24, 7/8, 7/22	1.1 ab
Proud 3 (thyme oil)	4 qt	6/24, 7/1, 7/8, 7/15, 7/22	54 e
SP2770 10 WP (SP2770)	2.66 lb	6/24, 7/1, 7/8, 7/15, 7/22	11.8 c
S2200 (mandestrobin)	7.5 fl oz	6/24, 7/8, 7/22	0.7 a
SP2773 + Decree (SP2773 + fenhexamid)	1.25 lb + 0.5 lb	6/24, 7/8, 7/22	25.4 d
SP2773 + Decree	2.8 lb + 0.5 lb	6/24, 7/8, 7/22	7.6 bc
Torque (tebuconazole)	8 fl oz	6/24, 7/8, 7/22	0.9 ab
Trinity (triticonazole)	12 fl oz	6/24	1.9 ab
Non-Inoculated Check	-	-	0 a
Inoculated Check	-	-	25.6 d

^x Means within column followed by the same letter are not significantly different (LSD, P=0.05).

Comparative Efficacy for *Apiognomonia*

In 2014, Pscheidt conducted a field trial to determine efficacy of several fungicides applied as foliar sprays on Apr 16 (red tip to bud break) and May 2 for the control of oak anthracnose (*Apiognomonia quercina*) on white oak (*Quercus alba*). Bud break was highly variable between trees and replicates. Disease pressure was highest for trees that broke bud earliest. Many trees treated with the first fungicide application, especially in the second replicate, had not completely started to grow. Analysis of the entire data set showed no significant difference among any of the treatments including the nontreated control (Table 3). Analysis of only trees treated at bud break or beyond and excluding the entire second replicate resulted in an acceptable evaluation of only 3 fungicide treatments (F9110, Merivon and Torque). No phytotoxicity was observed from any treatment.

Table 3. Efficacy for oak anthracnose (*Apiognomonina quercina*) on white oak (*Quercus alba*), Pscheidt, OR, 2014.

Treatment	Rate Per 100 Gal	Leaves with Anthracnose (%)	
		5/28 ^x	5/28 ^y
Concert SC (propiconazole+chlorothalonil)	17 fl oz	4.8 a	-
F9110 (<i>Lupinus</i> extract)	24 oz	13.3 a	2.3 b
Merivon (fluxapyroxad + pyraclostrobin)	8 fl oz	2.7 a	3.6 b
Proud 3 SC (thyme Oil)	4 qt	2.2 a	-
S 2200 4 SC (mandestrobin)	7.5 fl oz	3.4 a	-
SP 2700 10%	2.67 lb	30.8 a	-
Torque 3.6 SC (tebuconazole)	8 fl oz	2.0 a	0.3 b
Untreated	-	28.2 a	36.8 a

^x Means within column followed by the same letter are not significantly different (LSD, P=0.05).

^y Analysis based on 3 replicates and trees treated at bud break or beyond. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Comparative Efficacy for *Cercospora* spp.

From 2003 to 2005, Hagan conducted three field trials to determine efficacy of several fungicides for the control of foliar diseases, including high incidence of cercospora leaf spot (*Cercospora cornicola*) on dogwood (*Cornus florida*). Treatments were applied applied at one- or two-week intervals from Apr 7 until Jun 30. In 2003, the most notable reductions in leaf spot defoliation were obtained with Immunox, Eagle, CL 3336, Liquid Systemic Fungicide and to a lesser extent with SunSpray Ultra Fine Oil and Neem Concentrate; Rhapsody looked ineffective (Table 4). In 2004, Eagle, CL 3336, Liquid Systemic Fungicide, and the weekly Neem Concentrate program and Immunox significantly reduced leaf spot defoliation (Table 5). Neem Concentrate and SunSpray Ultra Fine Oil applied biweekly, and Rhapsody showed no significant reduction by Sep 30. In 2005, CL 3336, the Liquid Systemic Fungicide and Eagle provided good reduction of leaf spot defoliation; Immunox, Rhapsody, and the weekly applications of Neem Concentrate and SunSpray Ultra Fine Oil were less effective (Table 6). By Oct 18, Neem Concentrate and SunSpray Ultra Fine Oil applied biweekly showed no significant reduction.

No phytotoxicity was observed, with the exception of SunSpray Ultra Fine Oil. A yellowish and green mosaic pattern, as well as interveinal chlorosis was most noticeable on the trees receiving weekly applications of SunSpray Ultra Fine Oil in 2003. In 2004, it caused leaf chlorosis.

Table 4. * Efficacy for Cercospora Leaf Spot (*Cercospora cornicola*) on Dogwood (*Cornus florida*) ‘Rubra’, Hagan, AL, 2003.

Treatment	Rate Per 100 Gal	Application Interval	Leaf Spot Defoliation Rating (1-12) ^x		
			8/19	10/3	10/30
CL 3336 50W (thiophanate methyl)	1 lb	2 wk	1.0 c	2.5 e	5.0 d
Eagle 40W (myclobutanol)	8 oz	2 wk	1.0 c	2.7 e	5.2 d
Immunox (myclobutanol)	100 fl oz	2 wk	1.0 c	4.0 d	5.0 d
Liquid Systemic Fungicide (propiconazole)	0.4 gal	2 wk	1.0 c	2.6 e	5.2 d
Neem Concentrate (neem oil extract)	0.8 gal	1 wk	1.0 c	4.0 d	5.3 cd
	0.8 gal	2 wk	1.5 bc	4.8 bcd	6.0 bcd
Rhapsody (<i>Bacillus subtilis</i> strain QST 713)	3 gal	1 wk	1.3 c	5.7 ab	6.8 ab
SunSpray Ultra Fine Oil (mineral oil)	0.8 gal	1 wk	1.0 c	4.7 cd	5.8 bcd
	0.8 gal	2 wk	1.5 b	5.4 abc	6.4 bc
Untreated	-	-	2.5 a	6.3 a	7.8 a

* Not an IR-4 Experiment: F &N Tests Vol 60:OT028.

^x Leaf spot defoliation rating scale where 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6 to 12%, 5 = 12 to 25%, 6 = 25 to 50%, 7 = 50 to 75%, 8 = 75 to 87%, 9 = 87 to 94%, 10 = 94 to 97%, 11 = 97 to 100%, and 12 = 100% of the leaves diseased or prematurely shed. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 5. * Efficacy for Cercospora Leaf Spot (*Cercospora cornicola*) on Dogwood (*Cornus florida*) ‘Rubra’, Hagan, AL, 2004.

Treatment	Rate Per 100 Gal	Application Interval	Leaf Spot Defoliation Rating (1-12) ^x		
			8/2	8/24	9/30
CL 3336 50W (thiophanate methyl)	1 lb	2 wk	1.0 a	1.2 c	2.7 f
Eagle 40W (myclobutanol)	8 oz	2 wk	1.0 a	1.2 c	3.0 ef
Immunox (myclobutanol)	100 fl oz	2 wk	1.0 a	1.2 c	4.4 bcd
Liquid Systemic Fungicide (propiconazole)	0.4 gal	2 wk	1.0 a	1.0 c	3.0 ef
Neem Concentrate (neem oil extract)	0.8 gal	1 wk	1.0 a	1.2 c	3.8 def
	0.8 gal	2 wk	1.0 a	1.7 bc	5.5 ab
Rhapsody (<i>Bacillus subtilis</i> strain QST 713)	3 gal	1 wk	1.0 a	1.3 bc	6.0 a
SunSpray Ultra Fine Oil (mineral oil)	0.8 gal	1 wk	1.0 a	1.0 c	4.2 cde
	0.8 gal	2 wk	1.0 a	2.0 b	5.4 abc
Untreated	-	-	1.0 a	3.0 a	6.7 a

* Not an IR-4 Experiment: F &N Tests Vol 60:OT029.

^x Leaf spot defoliation rating scale where 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6 to 12%, 5 = 12 to 25%, 6 = 25 to 50%, 7 = 50 to 75%, 8 = 75 to 87%, 9 = 87 to 94%, 10 = 94 to 97%, 11 = 97 to 100%, and 12 = 100% of the leaves diseased or prematurely shed. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 6. * Efficacy for Cercospora Leaf Spot (*Cercospora cornicola*) on Dogwood (*Cornus florida*) ‘Rubra’, Hagan, AL, 2005.

Treatment	Rate Per 100 Gal	Application Interval	Leaf Spot Defoliation Rating (1-12) ^x		
			7/22	9/2	10/18
CL 3336 50W (thiophanate methyl)	1 lb	2 wk	1.2 ab	2.5 f	5.3 e
Eagle 40W (myclobutanol)	8 oz	2 wk	1.0 b	2.7 f	7.2 de
Immunox (myclobutanol)	100 fl oz	2 wk	1.0 b	4.5 de	7.7 cd
Liquid Systemic Fungicide (propiconazole)	0.4 gal	2 wk	1.0 b	3.3 ef	5.7 e
Neem Concentrate (neem oil extract)	0.8 gal	1 wk	1.0 b	5.7 cd	9.5 bc
	0.8 gal	2 wk	1.0 b	7.5 b	10.0 ab
Rhapsody (<i>Bacillus subtilis</i> strain QST 713)	3 gal	1 wk	1.5 a	6.3 bc	8.8 bcd
SunSpray Ultra Fine Oil (mineral oil)	0.8 gal	1 wk	1.0 b	5.7 cd	8.8 bcd
	0.8 gal	2 wk	1.0 b	7.5 b	10.7 ab
Untreated	-	-	1.2 ab	10.7 a	11.5 a

* Not an IR-4 Experiment: F &N Tests Vol 61:OT006.

^x Leaf spot defoliation rating scale where 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6 to 12%, 5 = 12 to 25%, 6 = 25 to 50%, 7 = 50 to 75%, 8 = 75 to 87%, 9 = 87 to 94%, 10 = 94 to 97%, 11 = 97 to 100%, and 12 = 100% of the leaves diseased or prematurely shed. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2009, Hagan conducted two field trials to determine efficacy of several fungicides applied as foliar sprays for the control of high cercospora leaf spot (*Cercospora lythracearum*) pressure on crapemyrtle (*Lagerstroemia indica*). In the first trial, treatments were applied at 7 to 10-day intervals from Jul 10 to Sep 23. Banner, Heritage, Eagle and 3336 were provided equally effective control, while Palladium at the 2 and 8 oz rates, as well as Medallion were ineffective (Table 7). In the second trial, fungicides were applied at one- or two-week intervals from Jul 10 to Sep 23, except for Heritage which was applied only at 2-week intervals. The organic fungicides Liquid Copper Fungicide and All Seasons Horticultural & Dormant Spray Oil applied at 1- and 2-wk intervals, and the 1-wk MilStop 85WP program significantly reduced disease intensity, while Daconil Ultrex and Heritage looked ineffective (Table 8). No phytotoxicity was observed from any treatment.

Table 7. * Efficacy for Cercospora Leaf Spot (*Cercospora lythracearum*) on Crapemyrtle (*Lagerstroemia indica*) ‘Pink Ruffles’, Hagan, AL, 2009.

Treatment	Rate Per 100 Gal	Leaf Spot Intensity Rating (1-10) ^x
3336 4.5F (thiophanate methyl)	20 fl oz	4.8 cd
Banner MAXX 1.3 MEC (propiconazole)	8 fl oz	4.0 d
Eagle 40WP (myclobutanol)	8 oz	4.5 cd
Heritage 50WG (azoxystrobin)	4 oz	4.5 cd
Medallion 50WP (fludioxonil)	2 oz	6.5 a
Palladium 62.5WDG (cyprodinil+fludioxonil)	2 oz	6.3 a
	4oz	5.3 bc
	8 oz	5.8 ab
Untreated	-	6.6 a

* Not an IR-4 Experiment: PDMR Vol 4: OT007.

^x Leaf spot intensity rating scale where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and <90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Data from the Oct 1 rating date are presented in the table. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 8. * Efficacy for Cercospora Leaf Spot (*Cercospora lythracearum*) on Crapemyrtle (*Lagerstroemia indica*) ‘Wonderful White’, Hagan, AL, 2009.

Treatment	Rate Per 100 Gal	Application Interval	Leaf Spot Intensity Rating (1-10) ^x
Daconil Ultrex (chlorothalonil)	1.4 lb	1 wk	6.5 abc
	1.4 lb	2 wk	7.0 a
Heritage 50WDG (azoxystrobin)	4 oz	2 wk	6.5 abc
Horticultural & Dormant Spray Oil Concentrate (mineral oil)	1.2 gal	1 wk	4.5 e
	1.2 gal	2 wk	4.5 e
Liquid Copper Fungicide 4E (copper salts of fatty and rosin acids)	0.8 gal	1 wk	5.0 de
	0.8 gal	2 wk	5.8 cd
Milstop 85WP (potassium bicarbonate)	2.5 lb	1 wk	6.0 bc
	2.5 lb	2 wk	6.8 ab
Untreated	-	-	7.0 a

* Not an IR-4 Experiment: PDMR Vol 4: OT013.

^x Leaf spot intensity rating scale where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and <90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Data from the Oct 14 rating date are presented in the table. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2012, Hagan conducted two field trials to determine efficacy of several fungicides applied as foliar sprays for the control of high cercospora leaf spot (*Cercospora lythracearum*) pressure on crapemyrtle (*Lagerstroemia indica*). In the first trial, fungicides were applied at one- or two-week intervals from Jun 13 to Sep 10, except for Heritage which was applied only at 2-week intervals. Significant reductions in leaf spot intensity were obtained with all fungicide treatments except for MilStop (Table 9). The organic

fungicides Liquid Copper Fungicide and Horticulture & Dormant Spray Oil Concentrate generally provided control comparable to Heritage and Daconil Ultrex. In the second trial, treatments were applied at 2-week intervals from Jun 13 to Sep 10. Significant reductions in leaf spot intensity were obtained with Banner MAXX, Heritage, Eagle, 3336, and all rates of Palladium, but not Medallion (Table 10). No phytotoxicity was observed from any treatment.

Table 9. * Efficacy for Cercospora Leaf Spot (*Cercospora lythracearum*) on Crapemyrtle (*Lagerstroemia indica*) ‘Byers Wonderful White’, Hagan, AL, 2012.

Treatment	Rate Per 100 Gal	Application Interval	Leaf Spot Intensity Rating (1-10) ^x
Daconil Ultrex (chlorothalonil)	1.4 lb	1 wk	4.8 d
	1.4 lb	2 wk	5.8 bc
Heritage 50WDG (azoxystrobin)	4 oz	2 wk	5.8 bc
Horticultural & Dormant Spray Oil Concentrate (mineral oil)	1.2 gal	1 wk	5.5 cd
	1.2 gal	2 wk	5.6 cd
Liquid Copper Fungicide 4E (copper salts of fatty and rosin acids)	0.8 gal	1 wk	5.4 cd
	0.8 gal	2 wk	5.7 bc
Milstop 85WP (potassium bicarbonate)	2.5 lb	1 wk	6.5 ab
	2.5 lb	2 wk	6.8 a
Untreated	-	-	7.0 a

* Not an IR-4 Experiment: PDMR Vol 7: OT018.

^x Leaf spot intensity rating scale where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and < 90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Data from the Oct 11 rating date are presented in the table. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 10. * Efficacy for Cercospora Leaf Spot (*Cercospora lythracearum*) on Crapemyrtle (*Lagerstroemia indica*) ‘Pink Ruffles’, Hagan, 2012.

Treatment	Rate Per 100 Gal	Leaf Spot Intensity Rating (1-10) ^x
3336 4.5F (thiophanate methyl)	20 fl oz	5.8 bc
Banner MAXX 1.3 MEC (propiconazole)	8 fl oz	4.5 d
Eagle 40WP (myclobutanil)	8 oz	5.3 cd
Heritage 50WG (azoxystrobin)	4 oz	5.5 cd
Medallion 50WP (fludioxonil)	2 oz	6.5 ab
Palladium 62.5WDG (cyprodinil+fludioxonil)	2 oz	5.8 bc
	4oz	5.8 bc
	8 oz	5.5 cd
Untreated	-	6.9 a

* Not an IR-4 Experiment: PDMR Vol 7: OT019.

^x Leaf spot intensity rating scale where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and < 90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Data from the Oct 11 rating date are presented in the table. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Comparative Efficacy for *Colletotrichum* spp.

From 2011 to 2013, Hagan conducted three field trials to determine efficacy of several fungicides for the control of high anthracnose (*Colletotrichum navitas*) pressure on ornamental switchgrass (*Panicum virgatum*). Treatments were applied at 2-wk intervals from Jun 15 to Sep 6 in 2011 and 2012, and from Jun 3 to Sep 9 in 2013. In 2011, Heritage, Banner MAXX, Eagle and Palladium provided effective anthracnose control, which was characterized by the development of no more than few scattered lesions on the leaf sheaths and lower leaves (Table 11). Poor control was obtained from 3336, Insignia and Daconil Ultrex, while Compass provided no significant control. In 2012, Banner MAXX, Eagle, and Insignia provided effective anthracnose control; Heritage and 3336 were less effective (Table 12). Poor control was obtained from Daconil Ultrex, Palladium, and Compass. In 2013, Insignia, Banner MAXX and Eagle provided superior season-long control; Heritage and Compass were less effective, while Palladium, Daconil Ultrex and 3336 were ineffective (Table 13).

Table 11. * Efficacy for Anthracnose (*Colletotrichum navitas*) on Ornamental Switchgrass (*Panicum virgatum*) ‘Prairie Sky’, Hagan, AL, 2011.

Treatment	Rate Per 100 Gal	Severity Rating (1-10) ^x
3336 4.5F (thiophanate methyl)	20 fl oz	3.8 bc
Banner MAXX 1.3 MEC (propiconazole)	8 fl oz	2.0 e
Compass 50W (trifloxystrobin)	4 oz	6.0 ab
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	4.0 bcd
Eagle 40WP (myclobutanol)	8 oz	2.5 de
Heritage 50WDG (azoxystrobin)	4 oz	2.0 e
Insignia 20WDG (pyraclostrobin)	8 oz	4.1 bc
Palladium 62.5WG (cyprodinil+fludioxonil)	6 oz	3.5 cde
Untreated	-	8.5 a

* Not an IR-4 Experiment: PDMR Vol 6: OT010.

^x Severity rating scale where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and < 90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Data from the Sep 23 rating date are presented in the table. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 12. * Efficacy for Anthracnose (*Colletotrichum navitas*) on Ornamental Switchgrass (*Panicum virgatum*) ‘Prairie Sky’, Hagan, AL, 2012.

Treatment	Rate Per 100 Gal	Severity Rating (1-10) ^x	Biomass Yield (lb dry wt)
3336 4.5F (thiophanate methyl)	20 fl oz	3.8 c	2.3 ab
Banner MAXX 1.3 MEC (propiconazole)	8 fl oz	2.3 d	2.3 ab
Compass 50W (trifloxystrobin)	4 oz	5.0 b	2.3 ab
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	6.0 b	1.5 cd
Eagle 40WP (myclobutanol)	8 oz	2.3 d	2.5 a
Heritage 50WDG (azoxystrobin)	4 oz	3.5 c	2.6 a
Insignia 20WDG (pyraclostrobin)	8 oz	2.3 d	2.7 a
Palladium 62.5WG (cyprodinil+fludioxonil)	6 oz	5.8 b	2.0 bc
Untreated	-	8.0 a	1.0 d

* Not an IR-4 Experiment: PDMR Vol 7: OT025.

^x Severity rating scale where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and < 90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Data from the Aug 31 rating date are presented in the table. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 13. * Efficacy for Anthracnose (*Colletotrichum navitas*) on Ornamental Switchgrass (*Panicum virgatum*) ‘Prairie Sky’, Hagan, AL, 2013.

Treatment	Rate Per 100 Gal	Anthracnose		Biomass Yield (lb dry wt)
		Severity Rating (1-10) ^x	AUDPC	
3336 4.5F (thiophanate methyl)	20 fl oz	6.0 bc	313 b	2.3 ab
Banner MAXX 1.3 MEC (propiconazole)	8 fl oz	4.3 e	172 e	2.3 ab
Compass 50W (trifloxystrobin)	4 oz	5.8 cd	255 cd	2.3 ab
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	6.5abc	267 bcd	1.5 cd
Eagle 40WP (myclobutanol)	8 oz	4.8 de	213 de	2.5 a
Heritage 50WDG (azoxystrobin)	4 oz	5.5 cd	280 bc	2.6 a
Insignia 20WDG (pyraclostrobin)	8 oz	3.5 e	192 e	2.7 a
Palladium 62.5WG (cyprodinil+fludioxonil)	6 oz	7.0 ab	296 bc	2.0 bc
Untreated	-	7.8 a	411 a	1.0 d

* Not an IR-4 Experiment: PDMR Vol 8: OT010.

^x Severity rating scale where 1 = no disease, 2 = very few lesions in canopy, 3 = few lesions noticed in lower and upper canopy, 4 = some leaf spotting and < 10% defoliation, 5 = lesions noticeable and < 25% defoliation, 6 = lesions numerous and < 50% defoliation, 7 = lesions very numerous and < 75% defoliation, 8 = numerous lesions on few remaining leaves and < 90% defoliation, 9 = very few remaining leaves covered with lesions and < 95% defoliation, and 10 = plants defoliated. Data from the Aug 21 rating date are presented in the table. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2015, Palmateer conducted a trial to determine efficacy of several fungicides for the control of a high leaf spot (*Colletotrichum* sp.) pressure on sansevieria plants (*Sansevieria* sp.). Treatments were applied from 7- to 14-day intervals from Dec 9, 2014 to Jan 6, 2015. Disease incidence and severity was recorded 0, 7, 14, and 28 days after application. Orkestra provided excellent control and was the only treatment comparable to the non-inoculated check (Table 14). F9110, Proud 3, Disarm, Compass, and S2200

significantly reduced disease incidence and severity, while MBI-110, Palladium, Medallion and ZeroTol looked ineffective. No phytotoxicity was observed from any treatment.

Table 14. Efficacy for Colletotrichum Leaf Spot (*Colletotrichum* sp.) on Sansevieria Plants (*Sansevieria* sp.), Palmateer, FL, 2015.

Treatment	Rate Per 100 Gal	Application Dates	Leaf Spot ^x		Growth Index ^y	
			Incidence ^w	Severity (0-100)	Initial 12/9/14	Final 1/7/15
Compass (trifloxystrobin)	4 oz	Dec 9, 23, Jan 6	6.2 de	19.7 bc	16.2 a	16.8 a
DisArm (fluoxastrobin)	8 fl oz	Dec 9, 23, Jan 6	6.4 de	19.3 bc	18.1 a	18.1 a
F9110 (<i>Lupinus</i> extract)	24 oz	Dec 9, 16, 23, 30, Jan 6	12 bcd	19.7 bc	17.5 a	19.2 a
MBI-110 (<i>Bacillus amyloliquifaciens</i> strain F727)	1 gal	Dec 9, 16, 23, 30, Jan 6	28.6 a-d	34 ab	18 a	19.5 a
Medallion WDG (fludioxonil)	8 oz	Dec 9, 23, Jan 6	35.7 abc	35 ab	17.5 a	17.6 a
Orkestra (BAS 703 01F) (fluxapyroxad + pyraclostrobin)	8 fl oz	Dec 9, 23, Jan 6	0.2 e	1 d	17.8 a	19.5 a
Palladium (cyprodinil + fludioxonil)	6 oz	Dec 9, 16, 23, 30, Jan 6	25.3 a-d	35 ab	17.9 a	19.5 a
Proud 3 (thyme oil)	4 qts	Dec 9, 16, 23, 30, Jan 6	8.6 cd	18.6 bc	18.3 a	20.2 a
S2200 4SC (mandestrobin)	7.5 fl oz	Dec 9, 23, Jan 6	12.8 bcd	19 bc	18.7 a	20.7 a
	15 fl oz	Dec 9, 23, Jan 6	5.3 de	13.7 c	18.3 a	18.4 a
ZeroTol (hydrogen dioxide)	1 gal	Dec 9, 18, 23, 30, Jan 6	40.4 ab	35.7 ab	17.8 a	18 a
Untreated Non-inoculated	-	-	0.3 e	1.3 d	17.7 a	19.8 a
Untreated Inoculated	-	-	38.8 a	46.3 a	17.8 a	19.6 a

^x Means followed by the same letter do not differ significantly (Student Newman Keuls test, $P \leq 0.05$).

^w Number of leaf spots per plant

^y Growth index = Plant height/2 + Plant width/2

Comparative Efficacy for *Corynespora cassiicola*

During 2010 and 2011, Hagan conducted two field trials to determine efficacy of organic and synthetic fungicides for the control of powdery mildew and *Corynespora* leaf spot (*Corynespora cassiicola*) on hydrangea (*H. macrophylla*) 'Dooley'. Treatments were applied at 1-, 2- or 3-week intervals from Jul 7 to Oct 29. In 2010, Bonide Liquid Copper Fungicide, Southern Ag Liquid Copper Fungicide, Immunox and Heritage were equally effective in protecting hydrangea from *Corynespora* leaf spot (Table 15). Bonide Citrus, Fruit, and Nut Orchard Spray, Serenade Disease Control RTU and Green Light Neem Concentrate were ineffective. In 2011, Southern Ag Liquid Copper Fungicide and Bonide Liquid Copper Fungicide were equally effective in protecting hydrangea from *Corynespora* leaf spot, Immunox and Heritage were less effective (Table 16). Bonide Citrus, Fruit, and Nut Orchard Spray, Serenade Disease Control RTU and Green Light Neem Concentrate were ineffective. In both years, Southern Ag Liquid Copper Fungicide and, to a lesser extent, Bonide Liquid Copper Fungicide caused unacceptable phytotoxicity (leaf rugosity, reduced leaf area and stunting) to hydrangea.

Table 15. * Efficacy for *Corynespora* Leaf Spot (*Corynespora cassiicola*) on *Hydrangea* (*H. macrophylla*) 'Dooley', Hagan, AL, 2010.

Treatment	Rate Per 100 Gal	Application Interval	Disease Rating (0-11) ^x
Bonide Citrus, Fruit, and Nut Orchard Spray Concentrate (sulfur+pyrethrins)	2 gal	1 wk	54 ab
Bonide Liquid Copper Fungicide (copper octanoate)	1.5 gal	1 wk	6 e
Green Light Neem Concentrate (neem oil extract)	0.8 gal	1 wk	39 cd
Heritage 50WDG (azoxystrobin)	4 oz	3 wk	2 e
Immunox 1.55% (myclobutanol)	0.8 gal	2 wk	6 e
MilStop 85W (potassium bicarbonate)	1.5 lb	1 wk	26 d
Serenade Disease Control RTU (<i>Bacillus subtilis</i> strain QST 713)		1 wk	57 a
Southern Ag Liquid Copper Fungicide (copper hydroxide)	1.1 qt	1 wk	2 e
Untreated	-	-	42 bc

* Not an IR-4 Experiment: PDMR Vol 5:OT006.

^x Visual rating on Oct 28 using Horsfall and Barratt rating scale scale where 0 = no disease, 1 = 0 to 3%, 2 = 3 to 6%, 3 = 6 to 12%, 4 = 12 to 25%, 5 = 25 to 50%, 6 = 50 to 75%, 7 = 75 to 87%, 8 = 87 to 94%, 9 = 94 to 97%, 10 = 97 to 100 %, and 11 = 100% of leaves displaying symptoms of *Corynespora* leaf spot. Values are transformed to percentages for presentation. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 16. * Efficacy for *Corynespora* Leaf Spot (*Corynespora cassiicola*) on *Hydrangea* (*H. macrophylla*) 'Dooley', Hagan, AL, 2011.

Treatment	Rate Per 100 Gal	Application Interval	Disease Rating (0-11) ^x
Bonide Citrus, Fruit, and Nut Orchard Spray Concentrate (sulfur+pyrethrins)	2 gal	1 wk	54 a
Bonide Liquid Copper Fungicide (copper octanoate)	1.5 gal	1 wk	17 cd
Green Light Neem Concentrate (neem oil extract)	0.8 gal	1 wk	58 a
Heritage 50WDG (azoxystrobin)	4 oz	3 wk	33 bc
Immunox 1.55% (myclobutanol)	0.8 gal	2 wk	26 c
MilStop 85W (potassium bicarbonate)	1.5 lb	1 wk	54 a
Serenade Disease Control RTU (<i>Bacillus subtilis</i> strain QST 713)		1 wk	50 ab
Southern Ag Liquid Copper Fungicide (copper diammonia diacetate)	1.1 qt	1 wk	2 d
Untreated	-	-	58 a

* Not an IR-4 Experiment: PDMR Vol 6:OT003.

^x Visual rating on Oct 28 using Horsfall and Barratt rating scale scale where 0 = no disease, 1 = 0 to 3%, 2 = 3 to 6%, 3 = 6 to 12%, 4 = 12 to 25%, 5 = 25 to 50%, 6 = 50 to 75%, 7 = 75 to 87%, 8 = 87 to 94%, 9 = 94 to 97%, 10 = 97 to 100 %, and 11 = 100% of leaves displaying symptoms of *Corynespora* leaf spot. Values are transformed to percentages for presentation. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2011, Hagan conducted a field trial to determine efficacy of fungicides for the control of *Corynespora* leaf spot (*Corynespora cassiicola*) on hydrangea (*H. macrophylla*) 'Nikko Blue'. Treatments were applied from May 16 to Sep 5 at 2-week intervals for all treatments except Heritage, which was applied at 3-week intervals. Concert II, Palladium, Headway, Headway + Capsil, and Heritage applied at 2- wk intervals provided effective control of a severe disease pressure (Table 17). Banner MAXX and Heritage + Capsil

provided poor control. The addition of Capsil to Heritage, Palladium and Headway decreased efficacy.

Table 17. * Efficacy for *Corynespora* Leaf Spot (*Corynespora cassiicola*) on *Hydrangea* (*H. macrophylla*) 'Nikko Blue', Hagan, AL, 2011.

Treatment	Rate Per 100 Gal	Application Interval	Leaf Spot	
			Intensity ^x (%)	Defoliation (%)
Banner MAXX (propiconazole)	8 fl oz	2	47.5 ab	7.6 bc
Concert II (chlorothalonil+propiconazole)	35 fl oz	2 wk	14.7 d	0.9 cd
Headway (azoxystrobin + propiconazole)	12 fl oz	2 wk	18.5 d	0.0 d
Headway + Capsil	12 + 4 fl oz	2 wk	28.0 cd	0.6 cd
Heritage 50WDG (azoxystrobin)	4 oz	2 wk	21.4 d	0.6 cd
	4 oz	3 wk	57.5 a	3.0 cd
Heritage + Capsil	4 oz + 4 fl oz	2 wk	61.3 a	10.0 b
Palladium 62.5WG (cyprodinil+fludioxonil)	6 oz	2 wk	37.5 bc	1.5 cd
Palladium 62.5WG + Capsil	6 oz + 4 fl oz	2 wk	52.5 ab	1.8 cd
Untreated	-	-	61.3 a	33.7 a

* Not an IR-4 Experiment: PDMR Vol 6:OT023.

^x Visual rating on Sep 23 using Horsfall and Barratt rating scale where 0 = no disease, 1 = 0 to 3%, 2 = 3 to 6%, 3 = 6 to 12%, 4 = 12 to 25%, 5 = 25 to 50%, 6 = 50 to 75%, 7 = 75 to 87%, 8 = 87 to 94%, 9 = 94 to 97%, 10 = 97 to 100 %, and 11 = 100% of leaves displaying symptoms of *Corynespora* leaf spot. Values are transformed to percentages for presentation. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Comparative Efficacy for *Diplocarpon rosae*

In 1998, Pemberton conducted a trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Peace'. Treatments were applied weekly or biweekly from Jun 26 to Nov 25. CGA 279202 at 4 oz, Heritage applied weekly and the standard Daconil provided effective control of a severe disease pressure, while Medallion and Banner MAXX were ineffective (Table 18). A higher rate and/or shorter interval is needed for control on such a highly susceptible variety as 'Peace' at this location.

In 1999, Hagan conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Pearl Meidiland'. Treatments were applied at 1-, 2- and 4-week intervals from Jun 3 to Oct 8. The standards Eagle and Daconil provided excellent control of a moderate disease pressure, Heritage was ineffective (Table 19).

In 2000, McGovern conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Irish Gold'. Treatments were applied biweekly from Aug 3 to Oct 26. All fungicides significantly reduced severity and defoliation from a moderate disease pressure, with Triforine and Folicur being the most effective. No significant fungicide effects were observed on flower production or plant height (Table 20).

Table 18. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Peace', Pemberton, TX, 1998.

Treatment ^y	Rate Per 100 Gal	November 3		November 18		December 3	
		Disease Rating ^x	Defol. Rating	Disease Rating ^x	Defol. Rating	Disease Rating ^x	Defol. Rating
Banner MAXX (propiconazole)	4 fl oz	4.0 bcd	1.8 bcd	5.0 bcd	2.7 bcd	7.8 a	5.8 c
CGA 279202 50W (trifloxystrobin)	1 oz	2.8 cde	1.8 bcd	3.2 def	2.0 cd	4.7 b	3.0 de
	2 oz	4.0 bcd	1.7 bcd	4.0 de	2.0 cd	5.3 b	2.7 def
	4 oz	1.8 e	1.0 d	1.7 fg	1.0 d	2.3 c	1.0 f
Daconil Ultrex (chlorothalonil) ^z	1 lb	2.0 de	1.0 d	2.2 efg	1.0 d	2.2 c	1.7 ef
Heritage 50WG (azoxystrobin) ^z	8 oz	1.5 e	1.0 d	1.7 fg	1.0 d	2.8 c	1.3 ef
Heritage 50WG	8 oz	5.3 ab	3.3 abc	6.0 abc	4.0 abc	7.8 a	6.3 bc
Medallion 50W (fludioxonil)	2 oz	6.3 a	4.7 a	6.7 ab	5.2 a	8.8 a	7.8 ab
Untreated	-	6.3 a	4.0 a	6.8 ab	4.8 ab	9.3 a	9.0 a

* Not an IR-4 Experiment: F & N Tests Vol 55: 564; not all treatments included in table.

^x Disease severity rating on a scale of 1 to 10 (1 = no black spot and 10 = all leaves infected and heavy defoliation) and defoliation rating on a scale of 1 to 10 (1 = 0-10%; 10=91-100%). Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

^y Latron B-1956 was added to all treatments except Banner Maxx and Daconil at the rate of 0.06% VN (2.7 ml/gal).

^z Daconil Ultrex and Heritage applied weekly; all other treatments applied biweekly.

Table 19. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Pearl Meidiland', Hagan, AL, 1999.

Treatment	Rate Per 100 Gal	Application Interval	Disease Incidence ^x	Diseased Leaf Area (%)
Daconil 2787 4F (chlorothalonil)	2 pt	1 wk	1.5 c	0.0 c
Eagle 40W (myclobutanil)	8 oz	1 wk	1.0 c	0.0 c
Heritage 50DG (azoxystrobin)	2 oz	1 wk	5.3 ab	31.7 ab
		2 wk	5.0 b	40.0 a
		4 wk	6.2 a	36.7 a
	4 oz	1 wk	5.2 ab	25.0 ab
		2 wk	5.3 ab	36.7 a
		4 wk	4.5 b	30.0 ab
	8 oz	1 wk	4.3 b	11.7 bc
		2 wk	4.7 b	25.0 ab
		4 wk	4.5 b	12.5 bc
Untreated	-	-	5.2 ab	30.0 ab

* Not an IR-4 Experiment: F & N Tests Vol 55: 560.

^x Visual rating on Jul 17 using Horsfall and Barratt rating scale where 1 = no disease, 2 = 0 to 3%, 3 = 3 to 6%, 4 = 6 to 12%, 5 = 12 to 25%, 6 = 25 to 50%, 7 = 50 to 75%, 8 = 75 to 87%, 9 = 87 to 94%, 10 = 94 to 97%, 11 = 97 to 100%, and 12 = 100% of leaves symptomatic or prematurely shed. On the same day, the percentage (%) of leaf area diseased was also visually estimated and recorded. Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, P=0.05).

Table 20. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Irish Gold', McGovern, FL, 2000.

Treatment	Rate Per 100 Gal	Severity (%) ^x		Defoliation (%) 12/7	No. Flowers Per Plant 8/17-11/7	Plant Ht (in) 11/7
		10/6	11/9			
Folicur 3.6 F (tebuconazole)	4.4 fl oz	3.1 b	2.1 b	13.1 bc	12.1 a	25.5 a
Spectracide Immunox (myclobutanil)	100 fl oz	2.5 b	2.3 b	21.2 b	8.8 a	22.9 a
Triforine EC (triforine)	16 fl oz	2.7 b	2.4 b	9.7 c	11.3 a	25.1 a
Untreated	-	12.2 a	7.5 a	40.5 a	9.6 a	22.4 a

* Not an IR-4 Experiment: F & N Tests Vol 56: OT032.

^x Visual rating of severity of black spot on the foliage (% of leaves diseased) on Oct 6 and Nov 9, and for defoliation on 7 Dec using the 1 -12 Horsfall-Barratt rating scale converted to percentages. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2001, Hagan conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Freedom'. Treatments were applied at 1- and 2-week intervals from Jun 8 to Oct 4. Weekly sprays of all fungicides significantly reduced a severe disease pressure, with Daconil providing excellent control; biweekly applications were ineffective (Table 21). No phytotoxicity was observed from any treatment.

In 2001, Giesler conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Mr. Lincoln'. Treatments were applied at 2- and 3-week intervals from Jun 7 to Aug 30. All products significantly reduced a moderate disease pressure (Table 22). No phytotoxicity was observed from any treatment.

Table 21. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Freedom', Hagan, AL, 2001.

Treatment	Rate Per 100 Gal	Application Interval	Disease Rating ^x
Daconil Ultrex (chlorothalonil)	1.4 lb	1 wk	2.8 e
		2 wk	5.7 bc
Eagle 40W (myclobutanil)	6 oz	1 wk	4.8 d
		2 wk	6.1 ab
Immunox (myclobutanil)	100 fl oz	1 wk	4.4 d
		2 wk	5.8 bc
Untreated	-	-	6.3 ab

* Not an IR-4 Experiment: F & N Tests Vol 57: OT023; not all treatments included in table.

^x Visual rating on Sep 26 using the Florida peanut leaf spot scoring system where 1 = no disease, 2 = light spotting in the lower canopy, 3 = light spotting in the lower and upper canopy, 4 = some spotting with light defoliation (< 10%), 5 = spotting noticeable in upper canopy with some defoliation (< 25%), 6 = spotting heavy with significant defoliation (< 50%), 7 = spotting heavy with considerable defoliation (< 75%), 8 = numerous spots on few remaining leaves (< 90%), 9 = very few remaining leaves covered with spots (< 95%), and 10 = plants defoliated (100%) or dead. Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, P=0.05).

Table 22. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Mr. Lincoln', Giesler, NE, 2001.

Treatment ^y	Rate Per 100 Gal	Disease Rating ^x	
		9/5	9/17
Banner MAXX 14.3% EC (propiconazole)	7 fl oz	1.5 b	1.5 b
Compass 50WG (trifloxystrobin)	1 oz	1.3 b	2.5 b
Daconil Ultrex 82.5WSG (chlorothalonil)	1.4 lb	0.8 b	2.5 b
Funginex 6.5% EC (triforine)	50 fl oz	0.5 b	1.3 b
Immunox 1.55% EC (myclobutanil)	100 fl oz	0.8 b	1.5 b
Untreated	-	3.3 a	5.0 a

* Not an IR-4 Experiment: F & N Tests Vol 57: OT022; not all treatments included in table.

^x Rating scale of 1-10 where 1 = approximately 10% , 5 = approximately 50%, and 10 = 100% of foliage showing disease. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

^y Banner MAXX applied every 3 weeks, all other treatments applied every 2 weeks.

In 2001, Pemberton conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Peace'. Treatments were applied at 7- and 14-day intervals from May 16 to Oct 24. Compass at 4 oz and the Daconil standard were the only treatments that provided effective control of a high disease pressure (Table 23). No phytotoxicity was observed from any treatment.

During 2002, Hagan conducted 3 experiments to study efficacy fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Freedom'. In the first, treatments were applied at 1- and 2-week intervals from Apr 2 to Oct 9. Daconil Ultrex and Eagle applied weekly, and Immunox applied at 2-wk intervals significantly reduced a very high black spot severity; SunSpray Ultra-Fine Oil was ineffective (Table 24). On May 30, an extensive foliar burn was noted on roses treated with Daconil Ultrex, particularly when the fungicide was applied at 1-wk intervals. A similar but less severe burn also was noted on several of the roses treated with SunSpray Ultra-Fine Oil.

In the second experiment, Biophos and Phyton 27 were applied at 1-, 2- and 4-week intervals from Feb 1 to May 22. Phyton 27 at 25 and 40 fl oz per 100 gal applied weekly provided the lowest level of leaf spotting from a low disease pressure; Biophos at 2 gal applied biweekly was less effective (Table 25). Phyton at the higher rate applied weekly caused leaf mottling and marginal burn, and resulted in lower growth index.

In the third experiment, Hagan examined Compass applied at 1- and 2-week intervals from Feb 1 to May 22. Compass at 1 oz per 100 gal applied weekly, and at 2 and 4 oz applied weekly or biweekly, provided excellent control of a low to moderate disease pressure; the standard Heritage was less effective (Table 26). Compass at 4 oz applied weekly significantly reduced plant growth.

In 2002, Mulrooney conducted a field trial to determine efficacy of biorationals for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Tropicana'. Treatments were applied weekly starting on May 1. Of the biorational materials tested, only Sunspray UF Oil provided control that might be acceptable in the home landscape (Table 27). The best control was achieved with the conventional fungicide Eagle. Roses sprayed with Eagle had leaves that were darker green and some stems with shortened internodes, which indicated plant growth regulator effects on 'Tropicana' at the rate and frequency of application used in this test.

Table 23. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Peace', Pemberton , 2001.

Treatment ^y	Rate Per 100 Gal	Jul 10		Sep 7	
		Disease Rating ^x	Defoliation Rating ^w	Disease Rating ^x	Defoliation Rating ^w
Compass 50WG (trifloxystrobin)	1 oz	3.2 a	1.0 a	6.5 ab	4.7 ab
	2 oz	2.2 a	1.0 a	4.2 bcd	2.0 de
	4 oz	2.2 a	1.0 a	2.8 de	1.3 de
Daconil Ultrex 82.5WDG (chlorothalonil)	1 lb	1.3 a	1.0 a	1.3 e	1.0 e
Immunox 1.55% EC (myclobutanil)	100 fl oz	2.0 a	1.0 a	5.3 abcd	3.3 bcd
Funginex 6.5% EC (triforine)	50 fl oz	2.8 a	1.0 a	5.0 abcd	3.3 bcd
Tebuconazole (tebuconazole)	45 fl oz	2.5 a	1.0 a	5.7 ab	3.3 bcd
Untreated	-	3.5 a	1.0 a	7.5 a	6.0 a

* Not an IR-4 Experiment: F & N Tests Vol 57: OT025; not all treatments included in table.

^x Disease Rating: on a scale of 1-10 with 1 = no disease, 10 = all leaves infected and heavy defoliation. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

^w Defoliation Rating: on a scale of 1-10 with 1 = 0-10%, 10 = 91-100%

^y Banner Maxx applied every 7 days, all other treatments applied every 14 days.

Table 24. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Freedom', Hagan, AL, 2002.

Treatment	Rate Per 100 Gal	Application Interval	Disease Rating ^x
Daconil Ultrex (chlorothalonil)	1.4 lb	1 wk	5.5 c
		2 wk	7.0 ab
Eagle 40W (myclobutanil) + NIS	6 oz + 0.06%	1 wk	6.2 bc
		2 wk	7.1 ab
Immunox (myclobutanil)	100 fl oz	1 wk	7.0 ab
		2 wk	6.7 b
SunSpray Ultra Fine Oil (mineral oil)	1 gal		6.9 ab
Untreated Control			7.6 a

* Not an IR-4 Experiment: F & N Tests Vol 58: OT043; not all treatments included in table.

^x Visual rating on Oct 2 using the Florida peanut leaf spot scoring system where 1 = no disease, 2 = light spotting in the lower canopy, 3 = light spotting in the lower and upper canopy, 4 = some spotting with light defoliation (< 10%), 5 = spotting noticeable in upper canopy with some defoliation (< 25%), 6 = spotting heavy with significant defoliation (< 50%), 7 = spotting heavy with considerable defoliation (< 75%), 8 = numerous spots on few remaining leaves (< 90%), 9 = very few remaining leaves covered with spots (< 95%), and 10 = plants defoliated (100%) or dead. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 25. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Freedom', Hagan, AL, 2002.

Treatment	Rate Per 100 Gal	Application Interval (wk)	Disease Rating ^x	Growth Index ^y
Biophos 4.6L (dipotassium phosphate + dipotassium phosphonate)	1 gal	2	3.8 ab	53.2 a
	1 gal	4	5.0 a	55.2 a
	2 gal	2	3.5 b	46.6 b
	2 gal	4	5.7 a	45.8 b
Phyton 27 2EC (copper sulfate pentahydrate)	25 fl oz	1	2.0 c	45.1 bc
	40 fl oz	1	1.7 c	40.1 c
	40 fl oz	2	4.5 a	45.3 bc
Untreated	-	-	4.8 a	48.4 b

* Not an IR-4 Experiment: F & N Tests Vol 58: OT044; not all treatments included in table.

^x Visual rating on May 9 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves damaged or prematurely shed due to black spot. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

^y Growth index = (height + width 1+ width 2)/3.

Table 26. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Freedom', Hagan, AL, 2002.

Treatment	Rate Per 100 Gal	Application Interval (wk)	Disease Rating ^x	Growth Index ^y
Compass 50W (trifloxystrobin)	1 oz	1	1.5 c	53.3 ab
	1 oz	2	3.7 b	55.8 a
	2 oz	1	1.0 c	50.2 b
	2 oz	2	1.5 c	51.3 ab
	4 oz	1	1.0 c	37.8 c
	4 oz	2	1.5 c	45.9 b
Heritage (azoxystrobin)	4 oz	2	3.0 b	48.7 b
Untreated	-	-	5.2 a	47.8 b

* Not an IR-4 Experiment: F & N Tests Vol 58: OT045; not all treatments included in table.

^x Visual rating on May 9 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves damaged or prematurely shed due to black spot. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

^y Growth index = (height + width 1+ width 2)/3.

Table 27. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Tropicana', Mulrooney, DE, 2002.

Treatment	Rate Per 100 Gal	Disease Rating ^x
Eagle 40WP (myclobutanol) + NIS	6 oz + 3 fl oz	1.0 a
FirstStep 85WP (potassium bicarbonate)	3 lb	6.1 d
Milsana 5%SC (Extract of <i>Reynoutria sachalinensis</i>) + NIS	1 gal + 3 fl oz	5.3 c
Sunspray UF Oil (mineral oil)	1 gal	3.3 b
Triact 70%EC (neem oil)	1 gal	5.9 cd
Untreated	-	6.3 d

* Not an IR-4 Experiment: F & N Tests Vol 58: OT035.

^x Visual rating on July 15 using Horsfall-Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves infected or defoliated. Means followed by the same letter are not significantly different (Duncan-Waller *k*-ratio *t* test, *P*=0.05).

In 2003, Hagan conducted a field trial to determine efficacy of Compass for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Freedom'. Treatments were applied at 1- and 2-week intervals from Feb 10 to Jun 10. Compass at 4 oz per 100 gal was as effective at controlling a moderate black spot pressure as the industry standard Daconil Ultrex; the lower rates were less effective, while Heritage was ineffective (Table 28). No phytotoxicity was observed from any treatment.

In 2003, Hagan conducted a field trial to determine efficacy of Biophos and Phyton 27 for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Freedom'. Treatments were applied at 1-, 2- and 4-week intervals from Feb 10 to May 28. The standard Daconil Ultrex provided excellent control of a very high disease pressure; both Biophos and Phyton were ineffective (Table 29). Phyton at the higher rate applied weekly caused leaf mottling and marginal burn, and resulted in lower growth index. A mottling or discoloration of the new leaves, as well as some marginal necrosis was seen on the leaves of the Phyton-treated roses.

In 2003, Mulrooney conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) and powdery mildew on rose (*Rosa* sp.) 'Tropicana'. Treatments were applied at 2-week intervals from Apr 28 to Aug 28. Eagle and the 8 oz rate of Insignia provided the best control of a very high black spot pressure; Sunspray UF Oil was ineffective (Table 30). No phytotoxicity was observed from any treatment.

In 2003, Pscheidt conducted a field trial to determine efficacy of several fungicides for the control of black spot (*Diplocarpon rosae*) and rust on rose (*Rosa* sp.) 'Pink Simplicity'. Treatments were applied on Mar 17 (bud break and early shoot growth), Apr 5, Apr 19, and May 2. The incidence of black spot was determined on May 20 to 22 by examining all leaves from 10 vegetative shoots (average of 84 leaves). Funginex, Daconil alone, or Immunox provided excellent control of a moderate black spot pressure; Safer Garden Fungicide and Terraguard were less effective (Table 31). No phytotoxicity was observed from any treatment.

Table 28. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Freedom', Hagan, AL, 2003.

Treatment	Rate Per 100 Gal	Application Interval (wk)	Disease Rating ^x
Compass 50W (trifloxystrobin)	1 oz	1	3.3 cde
	1 oz	2	4.5 bc
	2 oz	1	3.2 def
	2 oz	2	4.0 bcd
	4 oz	1	2.0 fg
	4 oz	2	2.3efg
Heritage (azoxystrobin)	4 oz	2	5.2 ab
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	2	1.5 g
Untreated	-	-	5.8 a

* Not an IR-4 Experiment: F & N Tests Vol 59: OT041; not all treatments included in table.

^x Visual rating on Jun 5 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves damaged or prematurely shed due to black spot. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 29. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Freedom', Hagan, AL, 2003.

Treatment	Rate Per 100 Gal	Application Interval (wk)	Disease Rating ^x
Biophos 4.6L (dipotassium phosphate + dipotassium phosphonate)	1 gal	2	6.8 a
	1 gal	4	6.4 a
	2 gal	2	7.0 a
	2 gal	4	7.6 a
Phyton 27 2EC (copper sulfate pentahydrate)	25 fl oz	1	7.2 a
	40 fl oz	1	7.8 a
	40 fl oz	2	7.4 a
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	2	2.4 b
Untreated	-	-	7.4 a

* Not an IR-4 Experiment: F & N Tests Vol 59: OT042; not all treatments included in table.

^x Visual rating on Jun 5 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves damaged or prematurely shed due to black spot. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 30. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Tropicana', Mulrooney, DE, 2003.

Treatment	Rate Per 100 Gal	Disease Rating ^x		
		Jul 21	Aug 7	Aug 25
Eagle 40WP (myclobutanol) + NIS	6 oz + 4 fl oz	1.0 a	1.4 a	2.1 a
Insignia 20 DG (pyraclostrobin) + NIS	4 oz + 4 fl oz	1.3 a	2.4 b	5.2 b
	8 oz + 4 fl oz	1.5 a	2.4 b	3.4 a
Sunspray UF Oil (mineral oil)	1 gal	3.4 b	4.9 c	7.2 c
Untreated	-	3.4 b	5.5 cd	8.5 cd

* Not an IR-4 Experiment: F & N Tests Vol 59: OT029.

^x Visual rating on July 15 using Horsfall-Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves infected or defoliated. Means followed by the same letter are not significantly different (Duncan-Waller *k*-ratio *t* test, *P*=0.05).

Table 31. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Pink Simplicity', Pscheidt, 2003.

Treatment	Rate Per 100 Gal	Leaves with Black Spot ^x (%)
Rose Pride Funginex 6.5% (triforine)	50 fl oz	0.3 d
Safer Garden Fungicide 12.0% (sulfur)	150 fl oz	11.6 b
Terraguard 50W (triflumizole)	8 oz	8.2 bc
Ortho Daconil 2787 Multi Purpose Fungicide 29.6% (chlorothalonil)	30 fl oz	4.2 cd
Immunox 1.55% (myclobutanol)	100 fl oz	0.2 d
Untreated	-	36.1 a

* Not an IR-4 Experiment: F & N Tests Vol 59: OT027; not all treatments included in table.

^x Means followed by the same letter are not significantly different (Fisher's Protected LSD, *P*=0.05).

In 2004, Mulrooney conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) and powdery mildew on rose (*Rosa* sp.) 'Tropicana'. Treatments were applied at 1- and 2-week intervals from May 14 to Aug 27. Insignia at all rates and intervals except the low 4 oz rate every two weeks performed well against a moderate black spot pressure early in the season (Table 32). Later in the season when the disease pressure reached very high pressure, all Insignia applications did not perform as well as the standard Eagle. No phytotoxicity was observed from any treatment.

In 2005, Hagan conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Freedom'. Treatments were applied at 2-wk intervals from Jul 8 to Sep 26. With the exception of Daconil WeatherStik, Sil-Spread at 0.06% v/v was added to all fungicide tank mixtures. Daconil Ultrex provided excellent control of a high disease pressure; Heritage, Phyton 27 and STBX-304 were less effective (Table 33). Some phytotoxicity was observed with Daconil Ultrex (leaf scorch) Phyton 27 (slight leaf spotting) and STBX-304 (slight leaf spotting).

Table 32. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Tropicana', Mulrooney, DE, 2004.

Treatment	Rate Per 100 Gal	Spray Interval (wk)	Disease Rating ^x		
			7/2	7/23	9/1
Eagle 40WP (myclobutanil) + NIS	6 oz + 4 fl oz	2	1.3 a	1.8 a	3.5 a
Insignia 20 DG (pyraclostrobin) + NIS	4 oz + 4 fl oz	1	1.8 ab	3.3 b	6.1 b
	4 oz + 4 fl oz	2	2.8 c	6.3 c	6.4 bc
	8 oz + 4 fl oz	2	2.0 b	3.6 b	6.8 c
	16 oz + 4 fl oz	2	1.9 b	3.3 b	6.0 b
Untreated	-	-	5.9 d	8.1 d	7.5 d

* Not an IR-4 Experiment: F & N Tests Vol 60: OT017.

^x Visual rating using Horsfall-Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves infected or defoliated. Means followed by the same letter are not significantly different (Duncan-Waller *k*-ratio *t* test, P=0.05).

Table 33. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Freedom Pink', Hagan, AL, 2005.

Treatment	Rate Per 100 Gal	Disease Rating ^x		
		8/23	9/8	9/26
Phyton 27 2EC (copper sulfate pentahydrate)	25 fl oz	1.8 b	7.0 a	6.3 ab
	40 fl oz	2.2 ab	6.2 a	4.5 bcd
STBX-304 (cupric ammonium formate)	25 fl oz	2.0 ab	6.3 a	4.3 cd
	40 fl oz	2.0 ab	6.3 a	5.8 abc
Heritage (azoxystrobin)	4 oz	2.3 a	6.3 a	4.3 cd
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	0.5 c	1.5 b	1.2 e
Untreated	-	2.0 ab	6.8 a	7.3 a

* Not an IR-4 Experiment: F & N Tests Vol 61: OT008; not all treatments included in table.

^x Visual rating using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves damaged or prematurely shed due to black spot. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2006, Mulrooney conducted a field trial to determine efficacy of BAS 516 and Insignia for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Tropicana'. Treatments were applied at 2-week intervals from May 21 to Aug 2. BAS 516 and the standard Eagle provided excellent control of a high disease pressure; Insignia was less effective (Table 34). The addition of Latron B-1956 improved the performance of Insignia at 4 oz. No phytotoxicity was observed from any treatment.

In 2007, Mulrooney conducted a field trial to determine efficacy of BAS 516 for the control of black spot (*Diplocarpon rosae*) and powdery mildew on rose (*Rosa* sp.) 'Tropicana'. Treatments were applied at 2-week intervals from May 15 to Aug 20. BAS 516 and the standard Eagle provided excellent control of a high black spot pressure (Table 35). BAS 595 controlled black spot early in the season but by the last rating black spot control had reached an unacceptable level. No phytotoxicity was observed from any treatment.

Table 34. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Tropicana', Mulrooney, DE, 2006.

Treatment	Rate Per 100 Gal	Disease Rating ^x		
		7/7	7/25	8/10
Insignia 20 DG (pyraclostrobin)	4 oz	4.3 d	6.0 e	8.0 e
	12 oz	2.8 c	3.2 cd	6.3 d
BAS 516 (pyraclostrobin+boscalid)	8 oz	2.5 bc	3.0 bcd	5.5 c
	12.5 oz	2.0 ab	2.2 ab	3.5 b
Insignia + Latron B-1956	4 oz + 4 fl oz	2.7 bc	3.8 d	6.7 d
BAS 516 + Latron B-1956	8 oz + 4 fl oz	2.2 abc	2.5 abc	5.7 c
Eagle 40 WP (myclobutanil) + Latron B-1956	6 oz + 4 fl oz	1.5 a	1.7 a	2.2 a
Untreated	-	6.0 e	7.5 f	9.3 f

* Not an IR-4 Experiment: PDMR Vol 1: OT002.

^x Visual rating using Horsfall-Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves infected or defoliated. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Table 35. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Tropicana', Mulrooney, DE, 2007.

Treatment	Rate Per 100 Gal	% black spot infected leaves ^x		
		7/16	7/31	8/24
BAS 516 38WG (pyraclostrobin+boscalid)	8 oz	0.0 a	0.0 a	0.7 ab
BAS 516 38WG + Latron B-1956	8 oz + 4 fl oz	0.0 a	0.3 a	4.0 bc
	12.5 oz + 4 fl oz	0.0 a	0.0 a	3.3 abc
BAS 595 1.67 SC (triticonazole)	6 fl oz	2.0 a	7.6 a	65.6 d
Eagle 40WP (myclobutanil + Latron B-1956)	6 oz + 4 fl oz	0.0 a	0.0 a	0.0 a
Untreated	-	29.3 b	53.3 b	89.6 d

* Not an IR-4 Experiment: PDMR Vol 2: OT011; not all treatments included in table.

^x Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2007, Grabowski conducted a container trial to determine efficacy of biorationals for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Morden Centennial'. Treatments were applied at weekly intervals from Jul 5 to Aug 9. Fungonil Concentrate was the only product that significantly reduced both percent infected leaf area and percent defoliation at all rating dates (Table 36). Concern Garden Defense reduced percent defoliation on Aug 8 and 15, while Rhapsody was ineffective at all rating dates. No phytotoxicity were observed from any treatment.

Table 36. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Morden Centennial', Grabowski, MN, 2007.

Treatment	Rate Per 100 Gal	Percent Infected Leaf Area ^x				Percent Defoliation			
		8/3	8/8	8/15	AUDPC	8/3	8/8	8/15	AUDPC
Concern Garden Defense RTU spray (neem oil)		12.4 ab	22.6 a	26.6 ab	400.4 abc	5.6 ab	8.4 b	17.9 bc	169.2 b
Fungonil Concentrate (chlorothalonil)	4 qt	6.4 b	6.0 b	9.1 c	196.7 c	2.4 b	2.4 b	4.9 c	66.8 b
Rhapsody AS (<i>Bacillus subtilis</i>)	5 qt	14.7 ab	21.2 ab	24.6 abc	447.4 ab	7.8 ab	19.9 ab	40.6 ab	334.9 ab
Untreated	-	19.9 a	26.6 a	32.9 a	577.9 a	13.2 a	31.8 a	49.1 a	485.8 a

* Not an IR-4 Experiment: PDMR Vol 2: OT005; not all treatments included in table.

^x Plants were initially rated using the Horsfall-Barratt scale 1=0%, 2=0-3%, 3=3-6%, 4=6-12%, 5=12-25%, 6=25-50%, 7=50-75%, 8=75-87%, 9=87-94%, 10=94-97%, 11=97-100%, 12=100%. All data was converted to the midpoint of the range prior to statistical analysis. Means followed by the same letter are not significantly different (Tukey multiple comparison test at $P \leq 0.05$).

In 2008, Mulrooney conducted a field trial to determine efficacy of BAS 516 for the control of black spot (*Diplocarpon rosae*) and powdery mildew on rose (*Rosa* sp.) 'Tropicana'. Treatments were applied every 13-15 days from May 8 to Aug 26. Pageant at the 8 oz rate, the 4 oz rate + Latron B-1956 and the standard Eagle provided excellent control of a high black spot pressure (Table 37). Trinity plus both adjuvant treatments controlled black spot early in the season but by the Aug 18 rating black spot severity had reached an aesthetically unacceptable level. No phytotoxicity was observed from any treatment.

Table 37. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Tropicana', Mulrooney, DE, 2008.

Treatment	Rate Per 100 Gal	% black spot infected leaves ^x			
		7/15	7/31	8/18	9/2
Eagle 40WP (myclobutanol) + Latron B-1956	6 oz + 4 fl oz	0.0 a	0.0 a	0.0 a	0.5 a
Pageant 38WP (pyraclostrobin+boscalid)	18 oz	0.0 a	0.2 a	1.0 a	3.2 ab
Pageant 38WP + Capsule	12.5 oz + 8 fl oz	0.2 a	0.8 a	11.3 bc	19.7 bc
Pageant 38WP + Latron B-1956	12.5 oz + 4 fl oz	0.3 a	1.0 a	3.3 ab	4.5 ab
Trinity 1.69EC (triticonazole)	12 fl oz	1.7 a	9.0 a	24.2 d	34.2 c
Trinity 1.69EC + Capsule	8 fl oz + 8 fl oz	0.3 a	2.0 a	16.7 cd	25.0 c
Trinity 1.69EC + Latron B-1956	8 fl oz + 4 fl oz	1.0 a	3.8 a	20.8 d	34.2 c
Untreated	-	26.7 b	55.8 b	85.0 e	85.0 d

* Not an IR-4 Experiment: PDMR Vol 3: OT004.

^x Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

In 2011, Hagan conducted a field trial to determine efficacy of fungicides for the control of black spot (*Diplocarpon rosae*) on rose (*Rosa* sp.) 'Tropicana'. Treatments were applied at 1- and 2-week intervals from Apr 26 to Sep 5. Concert II, Headway and the standard Daconil Ultrex provided excellent control of a high disease pressure (Table 38). Palladium applied weekly was less effective, while Heritage + Capsil and Palladium applied biweekly were ineffective. No phytotoxicity was observed, except for an objectionable bronzing of the upper leaf surface on all roses treated with Daconil Ultrex.

Table 38. * Efficacy for Black Spot (*Diplocarpon rosae*) on Rose (*Rosa* sp.) 'Tropicana', Hagan, AL, 2011.

Treatment	Rate Per 100 Gal	Spray Interval	Disease Rating ^x
Concert II (chlorothalonil + propiconazole)	35 fl oz	2 wk	1.0 c
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	1 wk	1.0 c
		2 wk	1.0 c
Headway (azoxystrobin + propiconazole)	12 fl oz	2 wk	1.8 c
Heritage 50WDG (azoxystrobin) + Capsil	4 oz + 4 fl oz	2 wk	5.4 ab
Palladium 62.5 WG	6 oz	1 wk	4.0 b
		2 wk	5.5 ab
Untreated	-	-	6.8 a

* Not an IR-4 Experiment: PDMR Vol 6: OT025; not all treatments included in table.

^x Visual rating on Oct 2 using the Florida peanut leaf spot scoring system where 1 = no disease, 2 = light spotting in the lower canopy, 3 = light spotting in the lower and upper canopy, 4 = some spotting with light defoliation (< 10%), 5 = spotting noticeable in upper canopy with some defoliation (< 25%), 6 = spotting heavy with significant defoliation (< 50%), 7 = spotting heavy with considerable defoliation (< 75%), 8 = numerous spots on few remaining leaves (< 90%), 9 = very few remaining leaves covered with spots (< 95%), and 10 = plants defoliated (100%) or dead. Means followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Comparative Efficacy for *Discula destructiva*

In 2002, Smith conducted a field trial to determine efficacy of Bravo and Phyton for the control of anthracnose (*Discula destructiva*) on dogwood (*Cornus florida*). Treatments were applied every 14 days from Jun 21 to Aug 16. Both products provided excellent control of a high disease pressure (Table 39). Slight phytotoxicity was observed with Phyton 27.

Table 39. * Efficacy for Anthracnose (*Discula destructiva*) on Dogwood (*Cornus florida*), Smith, CT, 2002.

Treatment	Rate Per 100 Gal	Lesions Per 100 Leaves	Severity Rating^x (1-5)
Bravo 90WDG (chlorothalonil)	5 oz	30 c	1.13 b
Phyton 27 2EC (copper sulfate pentahydrate)	25 fl oz	38 b	1.13 b
	35 fl oz	1.4 c	1.00 b
Untreated	-	165 a	3.75 a

* Not an IR-4 Experiment: F & N Tests Vol 58: OT036.

^x Severity rating scale where 1 = < 10 %, 2 = 11-25 %, 3 = 26 -50 %, 4 = 51-75 %, and 5 = > 76 % diseased leaves. Data collected on Sep 30. Means within column followed by the same letter are not significantly different (Kruskal-Wallis, P=0.05).

Comparative Efficacy for *Drechslera*

In 2015, Norman conducted a greenhouse trial to determine efficacy of several fungicides applied at various intervals for the control of *Helminthosporium* leaf spot (*Drechslera setariae*) on peacock plant (*Calathea sp.*) 'Silhouette' (Table 40). NUP 09092 (4 & 8 fl oz rate) and Mural (7 oz rate) provided the best control, followed by Pageant, S2200, Orkestra and Chipco 26019. Proud 3 and F911 were ineffective. No phytotoxicity was observed from any treatment. However, Chipco 26019 left a heavy residue that would make this foliage plant unmarketable.

Table 40. * Efficacy for *Helminthosporium* leaf spot (*Drechslera setariae*) on Peacock Plant (*Calathea sp.*) 'Silhouette', Norman, FL, 2015.

Treatment	Rate Per 100 Gal	Application Dates	Avg. # Leaf Spots ^x
Chipco 26019 (iprodione)	16 oz	06/30, 07/14, 07/28	2.88 bcd
F9110 (<i>Lupinus</i> extract)	24 fl oz	06/30, 07/14, 07/28	4.22 cd
MBI-110 (<i>Bacillus amyloliquifaciens</i> strain F727)	1 gal	06/30, 07/14, 07/28	3.22 bcd
Mural (azoxystrobin + benzovindiflupyr)	4 oz	06/30, 07/14, 07/28	1.77 ab
	7 oz	06/30, 07/14, 07/28	0.55 a
NUP 09092 (fludioxonil)	4 fl oz	06/30, 07/14, 07/28	0.55 a
	8 fl oz	06/30, 07/14, 07/28	0.44 a
Orkestra (BAS 703 01F) (fluxapyroxad + pyraclostrobin)	8 fl oz	06/30, 07/07, 07/14, 07/21, 07/28, 08/04	2.66 a-d
Pageant (pyraclostrobin + boscalid)	14 oz	06/30, 07/14, 07/28	1.55 ab
	18 oz	06/30, 07/14, 07/28	2.33 abc
Proud 3 (thyme oil)	4 qts	06/30, 07/07, 07/14, 07/21, 07/28, 08/04	4.66 d
S2200 (mandestrobin)	7.5 fl oz	06/30, 07/14, 07/28	2.55 a-d
	15 fl oz	06/30, 07/14, 07/28	2 abc
Untreated Non-inoculated	-	06/30, 07/14, 07/28/	1.22 ab
Untreated Inoculated	-	06/30, 07/07, 07/14, 07/21, 07/28, 08/04	4.77 d

^x Individual lesions per plant were counted every 7 days; final evaluation shown on table. Means within column followed by the same letter are not significantly different (LSD, P=0.05).

Comparative Efficacy for *Elsinoe corni*

In 2005, Hagan conducted a field trial to determine efficacy of several fungicides for the control of foliar diseases, including high incidence of spot anthracnose (*Elsinoe corni*) on dogwood (*Cornus florida*). CL 3336, Eagle, Immunox and the Liquid Systemic Fungicide provided the best control of spot anthracnose on both bracts and leaves; Rhapsody and SunSpray Ultra Fine Oil were less effective, while Neem Concentrate was ineffective (Table 41).

Table 41. * Efficacy for Spot Anthracnose (*Elsinoe corni*) on Dogwood (*Cornus florida*) ‘Rubra’, Hagan, AL, 2005.

Treatment	Rate Per 100 Gal	Spray Interval (wk)	Spot Anthracnose Rating (1-12) ^x	
			Bracts	Leaves
CL 3336 50W (thiophanate methyl)	1 lb	2	4.3 b	3.2 c
Eagle 40W (myclobutanol)	8 oz	2	4.0 b	3.0 c
Immunox (myclobutanol)	100 fl oz	2	4.5 b	3.3 c
Liquid Systemic Fungicide (propiconazole)	0.4 gal	2	3.8 b	2.5 c
Neem Concentrate (neem oil extract)	0.8 gal	1	11.7 a	7.5 a
	0.8 gal	2	12.0 a	7.5 a
Rhapsody (<i>Bacillus subtilis</i> strain QST 713)	3 gal	1	11.0 a	6.0 b
SunSpray Ultra Fine Oil (mineral oil)	0.8 gal	1	11.3 a	6.8 a
	0.8 gal	2	12.0 a	6.2 b
Untreated	-	-	11.0 a	6.8 a

* Not an IR-4 Experiment: F &N Tests Vol 61:OT006.

^x Spot anthracnose rating scale on May 12 where 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6 to 12%, 5 = 12 to 25%, 6 = 25 to 50%, 7 = 50 to 75%, 8 = 75 to 87%, 9 = 87 to 94%, 10 = 94 to 97%, 11 = 97 to 100%, and 12 = 100% of the leaves diseased or prematurely shed. Means within column followed by the same letter are not significantly different (Fisher's Protected LSD, P=0.05).

Comparative Efficacy for *Entomosporium mespili*

In 1999, Hagan conducted two field trials to determine efficacy of several fungicides for the control of *Entomosporium* leaf spot (*Entomosporium mespili*) on photinia (*Photinia fraseri*) 'Birmingham'. In the first trial, treatments were applied at various intervals from Jul 26 to Nov 9. Daconil Ultrex provided excellent control of a high disease pressure; Compass and Banner MAXX were less effective, while Medallion was ineffective (Table 42). In the second trial, treatments were applied at 2-week intervals from Aug 10 to Nov 1. Daconil Ultrex provided the best overall control of a high disease pressure; followed by Spectro and CL3336 (Table 43).

Table 42. * Efficacy for *Entomosporium* leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*) 'Birmingham' - Trial 1, Hagan, AL, 1999.

Treatment	Rate Per 100 Gal	Spray Interval (wk)	Disease Incidence ^x	Leaf Area Diseased (%)
Banner MAXX (propiconazole)	6 fl oz	3	9.6 c	36.0 ab
Compass 50WP (trifloxystrobin)	0.5 oz	1	6.6 c	17.0 be
	1.0 oz	2	7.8 c	24.0 b
Daconil Ultrex (chlorothalonil)	1.4 lb	2	1.2 d	0.2 c
Medallion 50WP(fludioxonil)	2.0 oz	1	10.8 a	50.0 a
Untreated	-	-	10.8 a	53.0 a

* Not an IR-4 Experiment: F & N Tests Vol 55: 554.

^x Visual rating on Oct 26 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves diseased or prematurely shed. Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, P=0.05).

Table 43. * Efficacy for *Entomosporium* leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*) 'Birmingham' - Trial 2, Hagan, AL, 1999.

Treatment	Rate Per 100 Gal	Disease Incidence ^x	Leaf Area Diseased (%)
CL 3336 50W (thiophanate-methyl)	1.0 lb	7.6 c	20.0 de
Daconil Ultrex (chlorothalonil)	1.4 lb	2.8 d	5.0 f
Spectro 90WDG (chlorothalonil + thiophanate-methyl)	1.0 lb	6.8 c	16.0 e
Untreated	-	11.4 a	50.0 a

* Not an IR-4 Experiment: F & N Tests Vol 55: 555; not all treatments included in table

^x Visual rating on Oct 26 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves infected or prematurely shed. Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, P=0.05).

In 2000, Hagan conducted two field trials to determine efficacy of several fungicides for the control of *Entomosporium* leaf spot (*E. mespili*) on Indian hawthorn (*Raphiolepis indica*) 'Becky Lynn'. In the first trial, treatments were applied at various intervals from Jul 27, 1999 to Feb 2, 2000. Daconil Ultrex provided the best control of a high disease pressure; Compass was less effective, while Banner MAXX was ineffective (Table 44). In the second trial, treatments were applied at 2-week intervals from from Aug 10, 1999 to Feb 2, 2000. All products (Daconil Ultrex, CL3336 and Spectro) provided excellent control of a high disease pressure (Table 45).

Table 44. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*) 'Birmingham' - Trial 1, Hagan, AL, 2000.

Treatment	Rate Per 100 Gal	Spray Interval (wk)	Disease Incidence ^x
Banner MAXX (propiconazole)	6 fl oz	3	8.8 b
Compass 50WP (trifloxystrobin)	0.5 oz	1	2.8 d
	1.0 oz	2	5.4 c
Daconil Ultrex (chlorothalonil)	1.4 lb	2	1.0 e
Untreated	-	-	11.4 a

* Not an IR-4 Experiment: F & N Tests Vol 56: OT12.

^x Visual rating on Oct 26 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves diseased or prematurely shed. Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, P=0.05).

Table 45. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*) 'Birmingham' - Trial 2, Hagan, AL, 2000.

Treatment	Rate Per 100 Gal	Disease Incidence ^x
CL 3336 50W (thiophanate-methyl)	1.0 lb	2.6 b
Daconil Ultrex (chlorothalonil)	1.4 lb	2.0 b
Spectro 90WDG (chlorothalonil + thiophanate-methyl)	1.0 lb	2.0 b
Untreated	-	8.4 a

* Not an IR-4 Experiment: F & N Tests Vol 56: OT11; not all treatments included in table

^x Visual rating on Oct 26 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves infected or prematurely shed. Means followed by the same letter are not significantly different (Duncan's Multiple Range Test, P=0.05).

In 2001, Hong conducted container and field trials to determine efficacy of several fungicides for the control of Entomosporium leaf spot (*E. mespili*) on photinia (*Photinia fraseri*). Treatments were applied at 2-week intervals starting on Apr 16. Daconil was the only fungicide that consistently suppressed high disease pressure on both container- and field-grown photinias (Table 46). Reduced disease incidence and severity were observed with Banner MAXX and Heritage on field-grown photinias but not on container-grown plants. Phyton 27, a commonly-used fungicide for control of Entomosporium leaf spot in nursery production, was not effective in either plant setting. No phytotoxicity was observed with any fungicide treatments on container- or field-grown photinias.

Table 46. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*), Hong, VA, 2001.

Treatment	Rate Per 100 Gal	Container		Field	
		Diseased Leaves (%) ^x	No. Spots Per Leaf	Diseased Leaves (%)	No. Spots Per Leaf
Banner MAXX 14.3%EC (propiconazole)	8 fl oz	60.8 ab	27.2 b	28.7 bc	2.3 b
Daconil Weather Stik 6F (chlorothalonil)	22 fl oz	25.2 c	16.0 b	14.7 c	1.8 b
Heritage 50WDG (azoxystrobin)	1.8 oz	80.4 a	67.2 a	31.3 bc	1.8 b
Phyton 27 2L (copper sulfate pentahydrate)	30 fl oz	60.3ab	39.5 ab	68.8 a	30.0 a
Untreated	-	70.5 ab	40.5 ab	68.7 a	22.5 ab

* Not an IR-4 Experiment: F & N Tests Vol 58: OT023; not all treatments included in table.

^x Visual Observations for each plant on Jun 12. Means followed by the same letter are not significantly different (LSD, $P=0.05$).

In 2003, Hagan conducted a field trial to determine efficacy of Milstop and Daconil Ultrex for the control of Entomosporium leaf spot (*E. mespili*) on photinia (*Photinia x fraseri*). Treatments were applied at 1- and 2-week intervals from Mar 10 to May 20. Daconil Ultrex applied at 1- and 2-week intervals provided effective control of a moderate disease pressure (Table 47). In contrast, the incidence of Entomosporium leaf spot was significantly higher on all of the MilStop-treated plants than on the unsprayed control plants. No phytotoxicity was observed from any treatment.

Table 47. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*), Hagan, AL, 2003.

Treatment	Rate Per 100 Gal	Spray Interval (wk)	Disease Incidence ^x
MilStop 85W (potassium bicarbonate)	1.25 lb	1	10.8 a
		2	10.6 a
	2.5 lb	1	10.0 abc
		2	10.3 ab
	5.0 lb	1	9.0 d
		2	10.4 ab
10.0 lb	1	9.4 cd	
	2	9.5 bcd	
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	1	2.0 g
		2	3.3 f
Untreated	-	-	6.8 e

* Not an IR-4 Experiment: F & N Tests Vol 59: OT040.

^x Visual rating on May 28 using Horsfall and Barratt rating scale: 1 = no disease, 2 = 0 to 3%, 3 = 3-6%, 4 = 6-12%, 5 = 12-25%, 6 = 25-50%, 7 = 50-75%, 8 = 75-87%, 9 = 87-94%, 10 = 94-97%, 11 = 97-100%, and 12 = 100% of leaves diseased or prematurely shed. Means followed by the same letter are not significantly different (Fisher's Protected LSD, $P=0.05$).

In 2005 and 2006, Hagan conducted two field trials to determine efficacy of several fungicides for the control of Entomosporium leaf spot (*E. mespili*) on photinia (*Photinia x fraseri*) 'Birmingham'. In 2005, treatments were applied at 2-week intervals from Feb 14 to Apr 27. As indicated by a disease rating of 7.2, the Untreated suffered from over 50% premature defoliation and heavy spotting of the remaining leaves. Bayer Disease Control and Ortho Rose Pride provided the best control; the standard Daconil Ultrex and Immunox were less effective (Table 48). In 2006, treatments were applied at 2-week intervals

from Jan 4 to Jul 5. All treatments provided effective control of a low to moderate disease pressure (Table 49).

Table 48. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*), 'Birmingham', Hagan, AL, 2005.

Treatment	Rate Per 100 Gal	Disease Rating ^x
Bayer Disease Control (tebuconazole)	75 fl oz	2.5 c
Daconil Ultrex (chlorothalonil)	1.25 lb	4.2 b
Immunox (myclobutanil)	100 fl oz	4.5 b
Ortho Rose Pride (triforine)	50 fl oz	3.3 c
Untreated	-	7.2 a

* Not an IR-4 Experiment: PDMR Vol 1: OT014; not all treatments included in table.

^x Visual rating on Apr 22 using a modified Florida peanut leaf spot scoring system where 1 = no disease, 2 = light leaf spotting in the lower canopy, 3 = light leaf spotting in the lower and upper canopy, 4 = light to moderate leaf spotting with light defoliation ($\leq 10\%$), 5 = noticeable leaf spotting in upper canopy with some defoliation ($\leq 25\%$), 6 = heavy spotting with significant defoliation ($\leq 50\%$), 7 = heavy spotting with considerable defoliation ($\leq 75\%$), 8 = numerous spots on few remaining leaves ($\leq 90\%$), 9 = very few remaining leaves heavily spotted ($\leq 95\%$), and plant defoliated (100%). Means followed by the same letter are not significantly different (Fisher's Protected LSD, $P=0.05$).

Table 49. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*), 'Birmingham', Hagan, AL, 2006.

Treatment	Rate Per 100 Gal	Disease Rating ^x		
		Mar 22	May 17	Jun 6
Bayer Disease Control (tebuconazole)	75 fl oz	1.2 b	1.0 b	1.2 b
Daconil Ultrex (chlorothalonil)	1.25 lb	1.5 b	1.0 b	1.0 b
Immunox (myclobutanil)	100 fl oz	1.2 b	1.3 b	1.3 b
Ortho Rose Pride (triforine)	50 fl oz	1.5 b	1.8 b	1.8 b
Untreated	-	4.5 a	5.0 a	5.3 a

* Not an IR-4 Experiment: PDMR Vol 2: OT009; not all treatments included in table.

^x Visual rating on Apr 22 using a modified Florida peanut leaf spot scoring system where 1 = no disease, 2 = light leaf spotting in the lower canopy, 3 = light leaf spotting in the lower and upper canopy, 4 = light to moderate leaf spotting with light defoliation ($\leq 10\%$), 5 = noticeable leaf spotting in upper canopy with some defoliation ($\leq 25\%$), 6 = heavy spotting with significant defoliation ($\leq 50\%$), 7 = heavy spotting with considerable defoliation ($\leq 75\%$), 8 = numerous spots on few remaining leaves ($\leq 90\%$), 9 = very few remaining leaves heavily spotted ($\leq 95\%$), and plant defoliated (100%). Means followed by the same letter are not significantly different (Fisher's Protected LSD, $P=0.05$).

In 2010 and 2011, Hagan conducted two field trials to determine efficacy of organic and synthetic fungicides for the control of Entomosporium leaf spot (*E. mespili*) on photinia (*Photinia x fraseri*) 'Birmingham'. In 2010, treatments were applied at 1- and 2-week intervals from Jan 28 to Apr 29. The standard Daconil Ultrex provided the best control of a moderate disease pressure, followed by Bonide Liquid Copper Fungicide and Bonide All Seasons Horticultural and Dormant Spray Oil (Table 50). In 2011, treatments were applied at 2-week intervals from Jan 10 to Apr 11. As in 2010, the standard Daconil Ultrex provided the best control of a moderate disease pressure, followed by Bonide Liquid Copper Fungicide; however, Bonide All Seasons Horticultural and Dormant Spray Oil was ineffective this year (Table 51).

Table 50. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*), 'Birmingham', Hagan, AL, 2010.

Treatment	Rate Per 100 Gal	Spray Interval (wk)	Disease Rating ^x
Bonide All Seasons Horticultural and Dormant Spray Oil (paraffinic oil)	1.2 gal	1	2.8 b
		2	3.2 b
Bonide Liquid Copper Fungicide (copper octanoate)	0.8 gal	1	2.5 bc
		2	2.7 b
Daconil Ultrex (chlorothalonil)	1.4 lb	2	1.2 c
Untreated	-	-	5.2 a

* Not an IR-4 Experiment: PDMR Vol 5: OT005.

^x Visual rating on Jun 10 using a modified Florida peanut leaf spot scoring system where 1 = no disease, 2 = light leaf spotting in the lower canopy, 3 = light leaf spotting in the lower and upper canopy, 4 = light to moderate leaf spotting with light defoliation ($\leq 10\%$), 5 = noticeable leaf spotting in upper canopy with some defoliation ($\leq 25\%$), 6 = heavy spotting with significant defoliation ($\leq 50\%$), 7 = heavy spotting with considerable defoliation ($\leq 75\%$), 8 = numerous spots on few remaining leaves ($\leq 90\%$), 9 = very few remaining leaves heavily spotted ($\leq 95\%$), and plant defoliated (100%). Means followed by the same letter are not significantly different (Fisher's Protected LSD, $P=0.05$).

Table 51. * Efficacy for Entomosporium leaf spot (*Entomosporium mespili*) on Photinia (*Photinia x fraseri*), 'Birmingham', Hagan, AL, 2011.

Treatment	Rate Per 100 Gal	Spray Interval (wk)	Disease Rating ^x
Bonide All Seasons Horticultural and Dormant Spray Oil (paraffinic oil)	1.2 gal	1	4.8 a
		2	5.5 a
Bonide Liquid Copper Fungicide (copper octanoate)	0.8 gal	1	3.2 b
		2	3.6 b
Daconil Ultrex (chlorothalonil)	1.4 lb	2	1.8 c
Untreated	-	-	6.5 a

* Not an IR-4 Experiment: PDMR Vol 6: OT024.

^x Visual rating on Jun 10 using a modified Florida peanut leaf spot scoring system where 1 = no disease, 2 = light leaf spotting in the lower canopy, 3 = light leaf spotting in the lower and upper canopy, 4 = light to moderate leaf spotting with light defoliation ($\leq 10\%$), 5 = noticeable leaf spotting in upper canopy with some defoliation ($\leq 25\%$), 6 = heavy spotting with significant defoliation ($\leq 50\%$), 7 = heavy spotting with considerable defoliation ($\leq 75\%$), 8 = numerous spots on few remaining leaves ($\leq 90\%$), 9 = very few remaining leaves heavily spotted ($\leq 95\%$), and plant defoliated (100%). Means followed by the same letter are not significantly different (Fisher's Protected LSD, $P=0.05$).

Comparative Efficacy for *Marssonina populi*

In 1987, Jacobi conducted two greenhouse trials to determine efficacy of several fungicides for the control of *Marssonina* leaf spot (*Marssonina populi*) on aspen (*Populus sp.*). Seedlings were inoculated 0, 7 or 14 days after fungicide application and held in a lathhouse with weekly irrigation. Disease infection was recorded 30 days after inoculation. All products significantly reduced disease infection when inoculated at 0 and 7 days posttreatment, but not at 14 days (Table 52). Bayleton, Daconil and Topsin provided the best overall control.

Table 52. Efficacy for Marssonina leaf spot (*Marssonina populi*) on Aspen (*Populus sp.*), Jacobi, CO, 1987.

Treatment ^z	Percent Leaf Surface Infected ^x			
	Expt. 1	Expt. 2		
	0 day ^y	0 day	7 days	14 days
Bayleton (triadimefon)	2.5 b	3.8 b	1.2 c	1.2 b
Daconil2787 (chlorothalonil)	0.0 b	6.2 b	5.0 c	0.0 b
Kocide (copper hydroxide)	7.5 b	7.5 b	20.0 b	10.0 a
Mancozeb	5.0 b	7.5 b	13.8 bc	8.5 ab
Topsin (thiophanate methyl)	5.0 b	2.5 b	6.2 c	5.0 b
Triforine	5.0 b	2.5 b	6.2 c	7.5 ab
Untreated	27.5 a	27.5 a	30.0 a	15.0 a

^x Disease infection observed 30 days after inoculation. Means followed by the same letter are not significantly different (LSD, P=0.05).

^y The seedlings were inoculated 0, 7 or 14 days after fungicide application.

^z Treatments applied at recommended rates.

Comparative Efficacy for *Myrothecium roridum*

In 2003, Hausbeck conducted a greenhouse experiment to determine efficacy of several fungicides for the control of *Myrothecium* leaf spot (*Myrothecium roridum*) on New Guinea impatiens (*Impatiens hawkerii*) ‘Super Sonic Lavender’. Fungicides were sprayed at 7-day intervals on Jun 17 and 24. Plants were allowed to dry and inoculum was sprayed until runoff. Daconil Weather Stik, Medallion, Terraguard, 3336 and Camelot significantly reduced the number of leaf lesions from a severe disease pressure on the last rating date (Table 53). The biopesticide, Endorse, and the strobilurin products (Heritage, Compass and Insignia) offered the least protection against lesion development. Disease severity was lowest for Medallion and Daconil Weather Stik, but was not significantly different from the untreated inoculated control. No phytotoxicity was observed from any treatment.

Table 53. * Efficacy for *Myrothecium* leaf spot (*Myrothecium roridum*) on New Guinea Impatiens (*Impatiens hawkerii*) ‘Super Sonic Lavender’, Hausbeck, MI, 2003.

Treatment	Rate Per 100 Gal	No. Leaf Lesions ^x		Disease Severity ^y
		6/24	7/1	7/1
3336 WP 50WP (thiophanate methyl)	16 oz	8.5 a	46.2 abc	2.5 a-d
Camelot 58EC (copper octanoate)	48 fl oz	13.3 ab	45.7 abc	3.2 cd
Compass O 50WDG (trifloxystrobin)	4 oz	38.0 c	81.8 cd	3.3 cd
Daconil Weather Stik 6F (chlorothalonil)	22 fl oz	7.2 a	25.2 ab	2.3 ab
Endorse 2.5WP (polyoxin D zinc salt)	14 oz	40.2 c	83.0 cd	3.5 d
Heritage 50WG (azoxystrobin)	4 oz	50.3 c	93.7 d	3.0 bcd
Insignia 20WG (pyraclostrobin)	4 oz	29.7 bc	83.8 cd	3.2 cd
	8 oz	14.5 ab	61.8 bcd	2.7 a-d
Medallion 50WP (fludioxonil)	2 oz	2.3 a	23.0 ab	2.0 ab
Terraguard 50W (triflumizole)	8 oz	6.8 a	47.7 bc	2.8 bcd
Untreated Inoculated	-	31.2 bc	99.5 d	3.0 bcd

* Not an IR-4 Experiment: F&N Tests Vol 59: OT018.

^x Means followed by the same letter are not significantly different (Tukey’s Studentized Range Test, P=0.05).

^y Rated on a scale of 1 to 5, where 1=no disease; 5=complete defoliation.

In 2005, Warfield conducted two greenhouse experiments to compare efficacy of an experimental fungicide CL EXP 04 with Daconil Ultrex and Medallion for the control of *Myrothecium* leaf spot (*Myrothecium roridum*) on syngonium (*Syngonium podophyllum*) ‘Berry Allusion’ and pansy (*Viola x wittrockiana*) ‘Whiskers Yellow’. For the syngonium test, fungicides were sprayed at 7-day intervals 3 times starting on Jun 3. Plants were allowed to dry and inoculum was sprayed until runoff on Jun 6. Numbers of wounds developing an infection, the diameter of each resulting lesion, and total numbers of foliar lesions, were recorded at the end of the trial on Jun 28. Daconil provided the best control, comparable to the non-inoculated check (Table 54). Medallion, and the 8.0 oz rate of CL EXP 04 were less effective. For the pansy experiment, fungicides were sprayed at 7-day intervals 2 times starting on Jun 3. Daconil Ultrex and Medallion significantly reduced the number of leaf lesions from a high disease pressure on the last rating date; CL EXP 04 was ineffective (Table 55). No phytotoxicity was observed from any treatment; however, fungicide residue could potentially decrease the marketability of plants treated with Daconil in the syngonium test.

Table 54. * Efficacy for *Myrothecium* leaf spot (*Myrothecium roridum*) on Syngonium (*Syngonium podophyllum*) ‘Berry Allusion’, Warfield, NC, 2005.

Treatment	Rate Per 100 Gal	Wound Sites ^w		Total No. Lesions
		No. Infected	Diseased Area	
CL EXP 04	4 oz	3.4 ab	0.2 a	15.0 a
	8 oz	2.0 bc	0.1 a	9.4 bc
	16 oz	3.4 ab	0.2 a	13.6 ab
Daconil Ultrex (chlorothalonil)	1.4 lb	2.4 abc	0.1 a	5.2 cd
Medallion (fludioxonil)	2 oz	3.0 ab	0.1 a	7.8 c
Untreated Non-inoculated	-	0.0 c	0.0 a	2.4 d
Untreated Inoculated	-	4.8 a	0.3 a	16.0 a

* Not an IR-4 Experiment: F&N Tests Vol 61: OT001.

^w Three wounds per each of three leaves for a total of nine wounds per plant.

^x Means followed by the same letter are not significantly different (Waller-Duncan k ratio, t- test, k = 100, $P = 0.05$).

^y Combined total area of affected leaf tissue surrounding wound sites.

^z Combined total of wounded and non-wounded infection sites at the final evaluation on 28 Jun.

Table 55. * Efficacy for *Myrothecium* leaf spot (*Myrothecium roridum*) on Pansy (*Viola x wittrockiana*) ‘Whiskers Yellow’, Warfield, NC, 2005.

Treatment	Rate Per 100 Gal	Wound Sites ^w				Total No. Lesions	
		No. Infected		Diseased Area		6/10	6/17
		6/10	6/17	6/10	6/17		
CL EXP 04	4 oz	6.7 a	8.0 ab	0.1 bc	1.2 ab	6.7 b	81.3 a
	8 oz	6.7 a	8.8 a	0.2 abc	1.1 ab	9.0 a	64.0 a
	16 oz	7.7 a	8.7 ab	0.4 a	1.2 ab	8.2 ab	72.7 a
Daconil Ultrex (chlorothalonil)	1.4 lb	8.3 a	8.8 a	0.1 bc	1.0 ab	8.5 ab	18.3 b
Medallion (fludioxonil)	2 oz	6.7 a	7.8ab	0.3 ab	0.9 b	7.2 ab	18.5 b
Untreated Non-inoculated	-	0.0 b	0.0 c	0.0 c	0.0 c	0.0 c	0.0 b
Untreated Inoculated	-	7.0 a	7.7 b	0.2 abc	1.3 a	7.7 ab	82.8 a

* Not an IR-4 Experiment: F&N Tests Vol 61: OT003.

^w Three wounds per each of three leaves for a total of nine wounds per plant.

^x Means followed by the same letter are not significantly different (Waller-Duncan k ratio, t- test, k = 100, $P = 0.05$).

^y Combined total area of affected leaf tissue surrounding wound sites.

^z Combined total of wounded and non-wounded infection sites at the final evaluation on 28 Jun.

Comparative Efficacy for *Phaeocryptopus qaeumannii* - Swiss needle cast

In 2000-2001, Chastagner conducted a field experiment to determine efficacy of Daconil, TerraGuard and Vangard for the control of Swiss needle cast (*Phaeocryptopus qaeumannii*) on Douglas fir (*Pseudotsuqa menzesii*). The new foliage was sprayed to wet on May 30, 2000. Samples of the 2000 foliage were collected on Apr 2, 2001 and the needles were examined for the presence of pseudothecia of the pathogen. Daconil provided excellent control, while Terraguard and Vangard were ineffective (Table 56). No phytotoxicity was observed from any treatment.

Table 56. Efficacy for Swiss needle cast (*Phaeocryptopus qaeumannii*) on Douglas fir (*Pseudotsuqa menzesii*), Chastagner, WA, 2001.

Treatment	Rate (ai) Per 100 Gal	Disease Rating^x
Daconil Weatherstik (chlorothalonil)	4 lb	0.7
Terraguard 50W (triflumizole)	2.0 oz	21.6
Vangard 75WG (cyprodinil)	3.75 oz	20.6
	7.5 oz	23.0
	15.0 oz	21.8
Untreated	-	28.0

^x Disease infection was observed on Apr 2, 2001 and rated on a scale of 0 to 60 where 0=no disease and 60=>75% of the stomates on 10 needles were plugged with pseudothecia.

During 2010 to 2012, Chastagner conducted two field experiments to determine efficacy of several fungicides for the control of Swiss needle cast (*Phaeocryptopus qaeumannii*) on Douglas fir (*Pseudotsuqa menzesii*). In the first trial, branches with new foliage was sprayed on May 27, 2010. Sprayed branches were collected on May 9, 2011, stored in a cooler, and examined on Jun 6-7 for Swiss needle cast pseudothecia development and loss of needles on the 2010 growth. For the second experiment, fungicides were applied on May 29, 2011, sprayed branches collected on Apr 2, 2012, stored in a cooler, and examined on Apr 3-12. A subjective assessment of disease rating was obtained based on multiplying the average incidence and severity ratings of pseudothecia of *P. qaeumannii* on the previous year's needles, resulting in a possible range from a low of 0 (no disease) to a high of 60. Incidence is the percentage of previous year's needles on the branch with pseudothecia present. rated on a scale: 0 = none, 1 = 1-10%, 2 = 11-20%, 10 = 91-100% of the 2010 needles have pseudothecia present. Severity of pseudothecia rating is the percentage of the stomata on the 2010 needles that have pseudothecia present, with a rating scale: 0 = none, 1 = <1%, 2 = 1-10%, 3 = 11-25%, 4 = 26-50%, 5 = 51-75%, and 6 = 76-100% of the stomata have pseudothecia. Loss of needles was observed to determine if there were differences between the treatments that might indicate any phytotoxicity problems, using a rating scale from 0 to 10, where 0=no needle loss, 1 = 1-10%, 10 = 91-100% needle loss.

Results of the first experiment showed that Compass O, Concert, and CG100 were as effective as the current industry standard Daconil in controlling a moderate disease development (Table 57). Palladium, Pageant, Trinity, Headway, Heritage + Capsil, Tourney and USF 2015A were ineffective. In the second experiment, Headway, CG 100, Compass O, Concert, and Concert II were as effective as the current industry standard (Daconil Weather Stik) in controlling a moderate disease development (Table 58). Trinity, Palladium, Pageant, Tourney, and Heritage + Capsil were ineffective. No phytotoxicity was observed from any treatment in both experiments.

Table 57. Efficacy for Swiss needle cast (*Phaeocryptopus qaeumannii*) on Douglas fir (*Pseudotsuqa menzesii*), Chastagner, WA, 2011.

Treatment	Rate Per 100 Gal	Shoot Length (cm) ^y	Disease Rating ^x	Needle Loss Rating ^z
CG100 (caprylic acid)	0.50%, v/v	2.3 a	9.7 bc	1.0 a
Compass O (triflumizole)	4.0 oz	3.9 a	0.9 c	1.0 a
Concert (chlorothalonil+propiconazole)	69.0 fl oz	3.0 a	3.2 c	1.0 a
Daconil Weather Stik (chlorothalonil)	5.5 pt	3.5 a	0.6 c	1.0 a
Headway (azoxystrobin+propiconazole)	30.0 fl oz	4.3 a	18.0 ab	0.9 a
Heritage (azoxystrobin) +Capsil	8 oz + 6 fl oz	1.8 a	16.1 ab	1.0 a
Pageant 38WG (pyraclostrobin+boscalid)	12.0 oz	3.5 a	19.4 ab	1.0 a
Palladium (cyprodinil+fludioxonil)	12.0 oz	2.9 a	22.6 a	1.1 a
Tourney (metconazole)	4.0 oz	3.5 a	16.1 ab	1.2 a
Trinity (triticonazole)	12.0 fl oz	4.0 a	18.8 ab	1.2 a
USF 2015A	200 ml	3.0 a	16.0 ab	1.0 a
Untreated	-	3.1 a	25.1 a	1.3 a

^x Disease ratings were obtained by multiplying the incidence and severity of pseudothecia ratings on needles (see discussion), resulting a possible range from a low of 0 (no disease) to a high of 60. Numbers in columns followed by the same letter are not significantly different (Tukey's Studentized Range Test, p=0.05).

^y Average shoot length (cm) at the time of treatment.

^z 2010 needle loss ratings at the time of branch evaluation were based on a 0-10 scale, where 0 = no needle loss (see discussion).

Table 58. Efficacy for Swiss needle cast (*Phaeocryptopus qaeumannii*) on Douglas fir (*Pseudotsuqa menzesii*), Chastagner, WA, 2012.

Treatment*	Rate Per 100 Gal	Shoot Length (cm) ^y	Disease Rating ^x	Needle Loss Rating ^z
CG100 (caprylic acid)	0.50%, v/v	2.5 b	8.2 bcd	0.3 a
Compass O (trifloxystrobin)	4.0 oz	3.1 ab	1.4 cd	0.2 a
Concert II (chlorothalonil+propiconazole)	69.0 fl oz	4.1 a	0.0 d	0.2 a
Concert	69.0 fl oz	3.2 ab	0.8 d	0.1 a
Daconil Weather Stik (chlorothalonil)	5.5 pt	3.6 ab	0.9 d	0.0 a
Headway (azoxystrobin+propiconazole)	30.0 fl oz	3.2 ab	10.0 bcd	0.2 a
Heritage (azoxystrobin) +Capsil	8 oz + 6 fl oz	2.9 ab	11.0 abc	0.1 a
Pageant 38WG (pyraclostrobin+boscalid)	12.0 oz	3.1 ab	12.6 ab	0.1 a
Palladium (cyprodinil+fludioxonil)	12.0 oz	3.5 ab	14.4 ab	0.1 a
Tourney (metconazole)	4.0 oz	3.6 ab	11.1 abc	0.0 a
Trinity (triticonazole)	12.0 fl oz	3.5 ab	15.0 ab	0.1 a
Untreated	-	3.4 ab	20.6 a	0.4 a

^x Disease ratings were obtained by multiplying the incidence and severity of pseudothecia ratings on needles (see discussion), resulting a possible range from a low of 0 (no disease) to a high of 60. Numbers in columns followed by the same letter are not significantly different (Tukey's Studentized Range Test, p=0.05).

^y Shoot length measurements for the 12 treated branches on each tree were taken at the time of spray application on May 29 and June 3, 2011.

^z 2011 needle loss ratings at the time of branch evaluation were based on a 0-10 scale, where 0 = no needle loss (see discussion).

* Concert II, did not arrive in time to be applied on May 29th, and it was applied on June 3, 2011. An older formulation on this product (Concert) was included in the treatments that were applied on May 29th.

Comparative Efficacy for *Septoria* sp.

In 1998 Giesler conducted a field trial to determine efficacy of several fungicides for the control of *Septoria* leaf spot (*Septoria* sp.) on black-eyed Susan (*Rudbeckia fulgida* 'Goldsturm'). Fungicides were sprayed every 14 days from Jul 16 to Aug 27. Eagle and Heritage provided excellent control of a low disease pressure; Bayleton and Daconil were less effective (Table 59). No phytotoxicity was observed from any treatment.

Table 59. * Efficacy for *Septoria* Leaf Spot (*Septoria* sp.) on Black-eyed Susan (*Rudbeckia fulgida*) 'Goldsturm', Giesler, NE, 1998.

Treatment	Rate Per 100 Gal	Disease Severity Rating ^x			Plant Quality Rating ^y		
		8/27	9/3	9/10	8/27	9/3	9/10
Bayleton 25DF (triadimefon)	2.7 oz	0.0 b	0.7 b	1.0 bc	5.0 ab	4.3 abc	4.7 bc
Daconil Ultrex 82.5WDG (chlorothalonil)	1.4 lb	0.3 ab	0.7 b	0.3 cd	4.7 ab	4.7 abc	5.3 abc
Eagle 40W (myclobutanil)	4 oz	0.0 b	0.0 b	0.0 d	6.0 a	6.0 ab	7.0 ab
Heritage 50WG (azoxystrobin)	1 oz	0.0 b	0.0 b	0.0 d	4.3 ab	4.7 abc	6.0 abc
	2 oz	0.0 b	0.0 b	0.0 d	5.3 ab	4.7 abc	6.3 abc
	4 oz	0.0 b	0.0 b	0.0 d	6.0 a	6.3 a	7.7 a
	8 oz	0.0 b	0.0 b	0.0 d	4.3 ab	4.0 bc	4.3 c
Untreated	-	1.0 a	2.3 a	1.7 ab	4.7 ab	5.0 abc	6.3 abc

* Not an IR-4 Experiment: F&N Tests Vol 55: 544; not all treatments included in table.

^x Visual estimate of plant disease severity; rated 0-10, 0 = no disease and 10 = completely diseased. Numbers in columns followed by the same letter are not significantly different (LSD, P = 0.05).

^y Visual estimate of plant quality; rated 1-9, 9 = best.

Comparative Efficacy for Unknown Leaf Spot.

In 2015, Kirk conducted a field trial to determine efficacy of several fungicides applied as foliar sprays for the control of leaf spot on orange coneflower (*Rudbeckia fulgida* 'Goldsturm'). All treatments significantly reduced leaf spot infection, with Orkestra providing the most consistent control throughout the duration of trial, followed by Pageant and the standard Medallion (Table 60). No phytotoxicity was observed from any treatment.

Table 60. Efficacy for Leaf Spot on Orange Coneflower (*Rudbeckia fulgida* 'Goldsturm', Kirk, MI, 2015.

Treatment	Rate Per 100 Gal	Application Dates	Alternaria Leaf Spot ^x (%)				RAUDPC ^y 7/31
			7/31	8/7	8/21	9/2	
F9110 (<i>Lupinus</i> extract)	24 oz	Jul 3, 10, 17, 24, 31	1.3 ab	1.9 cde	5.0 c	7.6 cde	2.5 cd
MBI-110 (<i>Bacillus amyloliquifaciens</i> strain F727)	1 gal	Jul 3, 10, 17, 24, 31	1.5 a	3.6 a	7.1 b	13.6 b	3.9 b
Medallion 50WG (fludioxonil)	8 oz	Jul 3, 17, 31	0.8 bc	1.7 def	3.4 d	7.1 de	1.9 ef
NUP 09092 (fludioxonil)	4 fl oz	Jul 3, 17, 31	0.8 bc	1.2 f	5.0 c	12.3 b	2.6 cd
	8 fl oz	Jul 3, 17, 31	0.8 bc	1.7 def	5.0 c	10.4 bc	2.6 cd
Orkestra (BAS 703 01F) (fluxapyroxad + pyraclostrobin)	8 fl oz	Jul 3, 10, 24, 31	0.0 d	1.2 f	2.0 e	5.6 e	1.2 g
Pageant 38WG (pyraclostrobin + boscalid)	14 oz	Jul 3, 17, 31	0.3 cd	1.4 ef	3.1 d	6.7 de	1.6 f
Proud 3 (thyme oil)	4 qt	Jul 3, 10, 17, 24, 31	1.3 ab	3.0 ab	6.3 bc	8.0 cde	3.0 c
S2200 50SC (mandestrobin)	7.5 fl oz	Jul 3, 17, 31	0.8 bc	2.5 bcd	5.0 c	6.0 de	2.3 de
	15 fl oz	Jul 3, 17, 31	1.3 ab	2.5 bcd	5.6 bc	8.5 cd	2.8 cd
Untreated	-	-	1.5 a	2.7 abc	11.1 a	20.8 a	5.1 a

^x Values followed by the same letter are not significantly different at $p = 0.05$ (Fishers LSD) after back transformation from arcsine square root percent transformation to normalize data.

^y RAUDPC, relative area under the disease progress curve calculated from day of appearance of initial symptoms (7/31) to Sep 2 (33 days).

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 2014 and 2015 Leaf Spot &-Anthracnose Efficacy projects.

Azoxystrobin. Heritage generally provided excellent efficacy for *Corynespora cassiicola* in 1 hydrangea experiment and for *Septoria* sp. in 1 black-eyed Susan experiment, good efficacy for *Entomosporium mespilii* in 1 photinia experiment, mediocre to excellent efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass experiments, poor to excellent efficacy for *Corynespora cassiicola* in 3 hydrangea experiments, poor to excellent efficacy for *Diplocarpon rosae* in 6 rose experiments, poor to good efficacy for *Cercospora lythracearum* in 4 crapemyrtle experiments, and poor efficacy for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments and for *Myrothecium roridum* in 1 New Guinea impatiens experiment.

Azoxystrobin + benzovindiflupyr. Mural provided excellent efficacy for *Drechslera setariae* in 1 peacock plant experiment.

Azoxystrobin + propiconazole. Headway provided excellent efficacy for *Corynespora cassiicola* in 1 hydrangea experiment and for *Diplocarpon rosae* in 1 rose experiment, and poor efficacy for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments.

Bacillus amyloliquifaciens strain F727. MBI-110 provided mediocre efficacy for *Drechslera setariae* in 1 peacock plant experiment, and poor efficacy for *Alternaria alternata* in 1 orange coneflower experiment and for *Colletotrichum* sp. in 1 sansevieria plant experiment.

Bacillus subtilis. Rhapsody generally provided poor efficacy for *Cercospora cornicola* in 3 dogwood experiments, for *Corynespora cassiicola* in 2 hydrangea experiments, for *Diplocarpon rosae* in 1 rose experiment and for *Elsinoe corni* in a dogwood experiment.

Chlorothalonil. Daconil generally provided excellent efficacy for *Diplocarpon rosae* in 12 rose experiments, for *Discula destructiva* in 1 dogwood experiment, for *Entomosporium mespilii* in 10 photinia experiments, for *Marssonina populi* in 2 aspen experiments, for *Phaeocryptopus qaeumannii* in 3 Douglas fir experiments, and for *Myrothecium roridum* in 3 experiments on New Guinea impatiens, pansy and syngonium, It provided mediocre to good efficacy for *Septoria* sp. in 1 black-eyed Susan experiment, poor to good efficacy for *Cercospora lythracearum* in 4 crapemyrtle experiments, and poor to good efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass experiments.

Chlorothalonil + thiophanate methyl. Spectro provided poor and excellent efficacy for *Entomosporium mespilii* in 2 photinia experiments.

Copper Compounds. The copper products Camelot, Phytan 27, STBX-304, etc. generally provided excellent efficacy for *Discula destructiva* in 1 dogwood experiment, poor and excellent efficacy for *Corynespora cassiicola* in 2 hydrangea experiments, poor to good efficacy for *Diplocarpon rosae* in 3 rose experiments, poor to good efficacy for *Entomosporium mespilii* in 3 photinia experiments, and poor efficacy for *Cercospora lythracearum* in 2 crapemyrtle experiments, for *Marssonina populi* in 2 aspen experiments and for *Myrothecium roridum* in 1 New Guinea impatiens experiment.

Cyprodinil + Fludioxonil. Palladium provided excellent efficacy for *Corynespora cassiicola* in 1 hydrangea experiment, poor to good efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass

experiments, and poor efficacy for *Cercospora lythracearum* in 2 crapemyrtle experiments, for *Colletotrichum* sp. in 1 sansevieria plant experiment and for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments.

Fludioxonil. Medallion provided good efficacy for *Myrothecium roridum*) in 3 experiments on New Guinea impatiens, pansy and syngonium, poor to good efficacy against *Cercospora lythracearum* in 2 crapemyrtle experiments, and poor efficacy for *Alternaria alternata* in 1 orange coneflower experiment, for *Colletotrichum* sp. in 1 sansevieria plant experiment, for *Diplocarpon rosae* in 2 rose experiments and for *Entomosporium mespilii* in 1 photinia experiment. The experimental product NUP 09092 provided excellent efficacy for *Drechslera setariae* in 1 peacock plant experiment, and poor efficacy for *Alternaria alternata* in 1 orange coneflower experiment.

Fluoxastrobin. Disarm provided excellent efficacy for *Alternaria alternata* in 1 impatiens experiment, and mediocre efficacy for *Colletotrichum* sp. in 1 sansevieria plant experiment.

Fluxapyroxad + pyraclostrobin. Orkestra (BAS 703) and Merivon provided excellent efficacy for *Colletotrichum* sp. in 1 sansevieria plant experiment, good to excellent efficacy for *Alternaria alternata* in two experiments on orange coneflower and impatiens, good efficacy for *Apiognomonium quercina* in 1 white oak experiment, and mediocre efficacy for *Drechslera setariae* in 1 peacock plant experiment.

Hydrogen dioxide. ZeroTol provided poor efficacy for *Colletotrichum* sp. in 1 sansevieria plant experiment.

Iprodione. Chipco 26019 provided excellent efficacy for *Alternaria alternata* in 1 impatiens experiment, and mediocre efficacy for *Drechslera setariae* in 1 peacock plant experiment.

Lupinus extract. F9110 provided good efficacy for *Apiognomonium quercina* in 1 white oak experiment, and poor efficacy for *Alternaria alternata* in two experiments on impatiens and orange coneflower, for *Colletotrichum* sp. in 1 sansevieria plant experiment and for *Drechslera setariae* in 1 peacock plant experiment.

Mandestrobin. S2200 provided good efficacy for *Drechslera setariae* in 1 peacock plant experiment, poor and excellent efficacy for *Alternaria alternata* in two experiments on orange coneflower and impatiens, and mediocre efficacy for *Colletotrichum* sp. in 1 sansevieria plant experiment.

Metconazole. Tourney provided poor efficacy for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments.

Mineral Oil. Horticultural Oil, SunSpray Ultra Fine Oil, etc. generally provided mediocre to good efficacy for *Cercospora lythracearum* in 2 crapemyrtle experiments, poor and good efficacy for *Entomosporium mespilii* in 2 photinia experiments, poor and mediocre efficacy for *Diplocarpon rosae* in 2 rose experiments, and poor efficacy for *Cercospora cornicola* in 3 dogwood experiments and for *Elsinoe corni* in 1 dogwood experiment.

Myclobutanil. Eagle, Immunox, etc. generally provided excellent efficacy for *Diplocarpon rosae* in 13 rose experiments and for *Septoria* sp. in 1 black-eyed Susan experiment, good to excellent efficacy for *Cercospora cornicola* in 3 dogwood experiments, good and excellent efficacy for *Entomosporium mespilii* in 2 photinia experiments, good to excellent efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass experiments, good efficacy for *Elsinoe corni* in 1 dogwood experiment, poor to good efficacy for *Cercospora lythracearum* in 2 crapemyrtle experiments, and poor to good efficacy for *Corynespora cassiicola* in 2 hydrangea experiments.

Neem Oil Extract. Neem Concentrate generally provided poor to good efficacy for *Cercospora cornicola* in 3 dogwood experiments, poor and mediocre efficacy for *Diplocarpon rosae* in 2 rose experiments, and poor efficacy for *Corynespora cassiicola* in 2 hydrangea experiments and for *Elsinoe corni* in 1 dogwood experiment.

Polyoxin D. Endorse provided poor efficacy for *Myrothecium roridum* in 1 New Guinea impatiens experiment.

Potassium bicarbonate. Milstop provided poor and good efficacy for *Cercospora lythracearum* in 2 crapemyrtle experiments, and poor efficacy for *Corynespora cassiicola* in 2 hydrangea experiments, for *Diplocarpon rosae* in 1 rose experiment and for *Entomosporium mespilii* in 1 photinia experiment.

Propiconazole. Banner MAXX, Liquid Systemic Fungicide, etc. generally provided excellent efficacy for *Elsinoe corni* in 1 dogwood experiment, good to excellent efficacy for *Cercospora cornicola* in 3 dogwood experiments, good to excellent efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass experiments, good efficacy for *Cercospora lythracearum* in 2 crapemyrtle experiments, mediocre efficacy for *Corynespora cassiicola* in 1 hydrangea experiment, poor to good efficacy for *Entomosporium mespilii* in 3 photinia experiments, and poor and mediocre efficacy for *Diplocarpon rosae* in 2 rose experiments.

Propiconazole + chlorothalonil. Concert II provided excellent efficacy for *Corynespora cassiicola* in 1 hydrangea experiment, and good to excellent efficacy for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments.

Pyraclostrobin. Insignia provided good to excellent efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass experiments, good efficacy for *Diplocarpon rosae* in 3 rose experiments, and poor efficacy for *Myrothecium roridum* in 1 New Guinea impatiens experiment.

Pyraclostrobin + Boscalid. Pageant and BAS 516 provided excellent efficacy for *Diplocarpon rosae* in 3 rose experiments and for *Drechslera setariae* in 1 peacock plant experiment. Poor efficacy was obtained for *Alternaria alternata* in 1 orange coneflower experiment and for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments.

Reynoutria sachalinensis extract. Milsana provided poor efficacy for *Diplocarpon rosae* in 1 rose experiment.

SP2770. SP2770 provided poor efficacy for *Alternaria alternata* in 1 impatiens experiment.

SP2773. SP2773 generally provided poor efficacy for *Alternaria alternata* in 1 impatiens experiment.

Sulfur. Bonide Citrus, Fruit, and Nut Orchard Spray Concentrate provided mediocre efficacy for *Diplocarpon rosae* in 1 rose experiment, and poor efficacy for *Corynespora cassiicola* in 2 hydrangea experiments.

Tebuconazole. Torque provided excellent efficacy for *Alternaria alternata* in 1 impatiens experiment, for *Apiognomonina quercina* in 1 white oak experiment and for *Entomosporium mespilii* in 1 photinia experiment. Poor and mediocre efficacy was obtained for *Diplocarpon rosae* in 2 rose experiments.

Triflumizole. Terraguard provided mediocre efficacy for *Diplocarpon rosae* in 1 rose experiment, and poor efficacy for *Phaeocryptopus qaeumannii* in 1 Douglas fir experiment.

Thiophanate methyl. 3336 generally provided good to excellent efficacy for *Cercospora cornicola* in 3 dogwood experiments, good efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass experiments, for *Elsinoe corni* in 1 dogwood experiment and for *Marssonina populi* in 2 aspen experiments, mediocre efficacy for *Myrothecium roridum* in 1 New Guinea impatiens experiment, poor and excellent efficacy for *Entomosporium mespilii* in 2 photinia experiments, and poor to good efficacy for *Cercospora lythracearum* in 2 crapemyrtle experiments.

Thyme Oil. Proud 3 generally provided poor efficacy for *Alternaria alternata* in two experiments on impatiens and orange coneflower, for *Colletotrichum* sp. in 1 sansevieria plant experiment, and for *Drechslera setariae* in 1 peacock plant experiment.

Triadimefon. Bayleton provided excellent efficacy for *Marssonina populi* in 2 aspen experiments, and mediocre efficacy for *Septoria* sp. in 1 black-eyed Susan experiment.

Trifloxystrobin. Compass generally provided excellent efficacy for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments, mediocre to excellent efficacy for *Diplocarpon rosae* in 5 rose experiments, mediocre efficacy for *Colletotrichum* sp. in 1 sansevieria plant experiment, poor and excellent efficacy for *Entomosporium mespilii* in 3 photinia experiments, and poor efficacy for *Colletotrichum navitas* in 3 ornamental switchgrass experiments and for *Myrothecium roridum* in 1 New Guinea impatiens experiment.

Triticonazole. Trinity provided good efficacy for *Alternaria alternata* in 1 impatiens experiment, and poor efficacy for *Diplocarpon rosae* in 2 rose experiments and for *Phaeocryptopus qaeumannii* in 2 Douglas fir experiments.

Phytotoxicity

No phytotoxicity was observed with the products listed above with the exception of Phyton 27 and SunSpray Ultra Fine Oil on dogwood and rose, STBX-304 (slight leaf spotting) in a rose experiment, Daconil Ultrex (foliar burn) in 3 of 12 rose experiments, and Compass at 4 oz applied weekly (reduced growth) in 1 of 5 rose experiments. In 1 of 13 rose experiments, plants sprayed with Eagle had leaves that were darker green and some stems with shortened internodes, which indicated plant growth regulator effects on the variety 'Tropicana'.

Table 61. 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 5/31/2016 are included in the table below.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
09974	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.)	Field In-Ground	Peterson	NJ	1986	Foliar	About 60% control of marssonina Leaf Spot with 0.5 lb product per 100 gal; no phytotoxicity observed
27478	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. nigra	Greenhouse	Schreiber	OH	1986	Foliar	No disease developed; no injury with 0.5 and 1.0 lb product per 100 gal.
27478	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 1: Good control of Marssonina populi at 0.5 lb ai per 100 gal; no injury observed.
27478	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Good control of Marssonina populi at 0.5 lb ai per 100 gal; no injury observed.
27478	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: Good control of Marssonina populi at 0.5 lb ai per 100 gal; no injury observed.
27478	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 2: Poor control of Marssonina populi at 0.5 lb ai per 100 gal; no injury observed.
32809	Baycor 25W (Bitertanol)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.)	Field In-Ground	Peterson	NY	1984	Foliar	New Brunswick Experiment Station: Significant reduction of disease incidence and no injury with 214 or 32 oz per 100 gal.
32809	Baycor 25W (Bitertanol)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.)	Field In-Ground	Peterson	NY	1984	Foliar	Princeton Nursery: No injury with 214 or 32 oz per 100 gal.
32760	Bayleton 25WP (Triadimefon)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1984	Foliar	Significant reduction in disease incidence with 4 applications at 10 to 14 day intervals.
32760	Bayleton 25WP (Triadimefon)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1985	Foliar	More than 50% reduction in disease incidence with 4 applications at 10 to 14 day intervals, but not significantly less than non-treated control.
32770	Bayleton 25WP (Triadimefon)	Leaf Spot, Entomosporium (Diplocarpon maculatum)	Photinia (Photinia sp.)	Field Container	Gilliam	AL	1982	Foliar	Moderate to excellent efficacy increasing with rate (2, 4, 8 lb per 100 gal) with minor darkening of foliage but inhibition of flower bud development.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
08022	Bayleton 25WP (Triadimefon)	Leaf Spot, Entomosporium (Diplocarpon maculatum)	Photinia (Photinia sp.) P. fraseri	Shadehouse/ Lathehouse	Lambe	VA	1982	Foliar	No to great efficacy increasing with rate (4, 8, and 16 oz per 100 gal) under sever disease pressure.
32808	Bayleton 25WP (Triadimefon)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.)	Field In-Ground	Peterson	NY	1984	Foliar	East Brunswick Experiment Station: Good statistically significant reduction of disease with 2, 4, and 8 oz per 100 gal.
32808	Bayleton 25WP (Triadimefon)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Field In-Ground	Jacobi	CO	1987	Foliar	Significant reduction of disease with preventative application of 2 oz per 100 gal; no injury observed.
09097	Bayleton 25WP (Triadimefon)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 1: Great control of Marssonina populi at 0.5 oz per 100 gal; no injury.
09097	Bayleton 25WP (Triadimefon)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Great control of Marssonina populi at 0.5 oz per 100 gal; no injury.
09097	Bayleton 25WP (Triadimefon)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: Great control of Marssonina populi at 0.5 oz per 100 gal; no injury.
09097	Bayleton 25WP (Triadimefon)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 2: Poor control of Marssonina populi at 0.5 oz per 100 gal; no injury.
07807	Bayleton 25WP (Triadimefon)	Flower Blight, Ovulinia (Ovulinia azaleae)	Azalea, & Rhododendron (Rhododendron sp.)	Field In-Ground	Peterson	NJ	1981	Foliar	Good efficacy at the highest rate tested 16 oz per 100 gal, but also slight floral necrosis.
32756	Bayleton 25WP (Triadimefon)	Apple Scab (Venturia inaequalis)	Apple & Crabapple (Non-Bearing) (Malus sp.)	Field In-Ground	Peterson	NJ	1982	Foliar	Good control with 4 and 8 oz per 100 gal; mediocre with 2 oz per 100 gal.
32802	Benlate 50WP (Benomyl)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1984	Foliar	Significantly reduced disease incidence with 0.5 lb per 100 gal using 4 applications at 10 to 14 day intervals.
32802	Benlate 50WP (Benomyl)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1985	Foliar	Significantly reduced disease incidence with 0.5 lb per 100 gal using 4 applications at 10 to 14 day intervals.
09971	Benlate 50WP (Benomyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 1: Great efficacy of Marssonina populi at 0.5 lb ai per 100 gal; no injury.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
09971	Benlate 50WP (Benomyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Great efficacy of Marssonina populi at 0.5 lb ai per 100 gal; no injury.
09971	Benlate 50WP (Benomyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: Great efficacy of Marssonina populi at 0.5 lb ai per 100 gal; no injury.
09971	Benlate 50WP (Benomyl)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 2: Great efficacy of Marssonina populi at 0.5 lb ai per 100 gal; no injury.
29849	CG100 (Caprylic acid)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Good control of a moderate disease pressure with 0.5 % v/v; almost comparable to Daconil.
29849	CG100 (Caprylic acid)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Significantly reduced a moderate disease pressure with 0.5% v/v; comparable or inferior to Daconil.
32163	Chipco 26019 N/G 50WP (Iprodione)	Alternaria alternata (Alternaria alternata)	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Significantly reduced leaf spots (by 98%) with 16 oz per 100 gal applied 3 times; comparable to non-inoculated Control.
32762	Chipco 26019 N/G 50WP (Iprodione)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1984	Foliar	Slight but not significant reduction in disease incidence with 2.0 lb per 100 gal applied 4 times at 10 to 14 day intervals.
32769	Chipco 26019 N/G 50WP (Iprodione)	Leaf Spot, Entomosporium (Diplocarpon maculatum)	Photinia (Photinia sp.)	Field Container	Gilliam	AL	1982	Foliar	Some reduction in leaf spot at 2, 4, and 8 lb per 100 gal; no injury.
32578	Chipco 26019 N/G 50WP (Iprodione)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Poor efficacy on Drechslera setariae with 16 oz per 100 gal applied 3 times. Heavy residue on leaves unacceptable.
32741	Compass (Trifloxystrobin)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/ Lathehouse	Palmateer	FL	2015	Foliar	Significant reduction of disease incidence and severity with 4 oz per 100 gal applied 3 times biweekly; better than Medallion but inferior to non-inoculated check.
29850	Compass 0 50WDG (Trifloxystrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Excellent control of a moderate disease pressure with 4 oz per 100 gal; comparable to Daconil.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29850	Compass 0 50WDG (Trifloxystrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Great control of a moderate disease pressure with 4 oz per 100 gal; comparable to Daconil.
32142	Concert II (Propiconazole + chlorothalonil)	Oak Anthracnose (Apiognomonia quercina)	Oak (Quercus sp.) Q. alba	Field In-Ground	Pscheidt	OR	2014	Foliar	Did not significantly reduce disease incidence with 17 fl oz per 100 gal applied twice.
29851	Concert II (Propiconazole + chlorothalonil)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Excellent control of a moderate disease pressure with 69 fl oz per 100 gal; comparable to Daconil.
29851	Concert II (Propiconazole + chlorothalonil)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Excellent control of a moderate disease pressure with 69 fl oz per 100 gal; comparable to Daconil.
08762	Daconil 54EC (Chlorothalonil)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 1: Great efficacy for Marssonina populi at 1.04 lb ai per 100 gal; no injury observed.
08762	Daconil 54EC (Chlorothalonil)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Good control of Marssonina populi at 1.04 lb ai per 100 gal; no injury observed.
08762	Daconil 54EC (Chlorothalonil)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Great efficacy for Marssonina populi at 1.04 lb ai per 100 gal; no injury observed.
08762	Daconil 54EC (Chlorothalonil)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: Poor control of Marssonina populi at 1.04 lb ai per 100 gal; no injury observed.
32772	Daconil Weather Stik (2787 Flowable Fungicide) (Chlorothalonil)	Leaf Spot, Entomosporium (Diplocarpon maculatum)	Photinia (Photinia sp.)	Field Container	Gilliam	AL	1982	Foliar	Excellent efficacy with 2 pints per 100 gal (Daconil 2787 4.17F) and no injury.
29794	Daconil Weather Stik (2787 Flowable Fungicide) (Chlorothalonil)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2002	Foliar	Excellent efficacy at 4 lb ai per 100 gal; no injury.
29794	Daconil Weather Stik (2787 Flowable Fungicide) (Chlorothalonil)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Excellent control of a moderate disease pressure with 5.5 pt per 100 gal.
32162	Disarm 480SC (Fluoxastrobin)	Alternaria alternara (Alternaria alternata)	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Significantly reduced leaf spots (by 99%) with 8 fl oz per 100 gal applied 3 times; comparable to non-inoculated Control.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32738	Disarm 480SC (Fluoxastrobin)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/Lathehouse	Palmateer	FL	2015	Foliar	Significant reduction of disease incidence and severity with 8 oz per 100 gal applied 3 times biweekly; better than Medallion but inferior to non-inoculated check.
27479	Dithane 75DF Rainshield (Mancozeb)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 1: Good efficacy of Marssonina populi at 1 lb ai per 100 gal; no injury.
27479	Dithane 75DF Rainshield (Mancozeb)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Mediocre efficacy of Marssonina populi at 1 lb ai per 100 gal; no injury.
27479	Dithane 75DF Rainshield (Mancozeb)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: Good efficacy of Marssonina populi at 1 lb ai per 100 gal; no injury.
27479	Dithane 75DF Rainshield (Mancozeb)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 2: Good efficacy of Marssonina populi at 1 lb ai per 100 gal; no injury.
32090	F9110 (F9110)	Alternaria alternara (Alternaria alternata)	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Did not significantly reduce leaf spots with 24 fl oz per 100 gal applied 5 times.
31922	F9110 (F9110)	Oak Anthracnose (Apiognomonina quercina)	Oak (Quercus sp.) Q. alba	Field In-Ground	Pscheidt	OR	2014	Foliar	Very good control with 24 oz per 100 gal applied twice.
32733	F9110 (F9110)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/Lathehouse	Palmateer	FL	2015	Foliar	Significant reduction of disease incidence and severity with 24 oz per 100 gal applied 5 times weekly; better than Medallion but inferior to non-inoculated check.
32572	F9110 (F9110)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Poor efficacy on Drechslera setariae with 24 fl oz per 100 gal applied 3 times.
32665	F9110 (F9110)	Unknown Leaf Spot (Unknown)	Coneflower, Orange (Rudbeckia fulgida speciosa) 'Goldsturm'	Field In-Ground	Kirk	MI	2015	Foliar	Significantly reduced a low leaf spot incidence with 24 oz per 100 gal applied 5 times; inferior to Medallion applied 3 times.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32761	Fore 80WP (Manganese + Zinc + Ethylene bis-dithiocarbamate Ion)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1984	Foliar	Significantly reduced disease incidence with 1.5 lb per 100 gal applied 4 times at 10 to 14 day intervals.
32761	Fore 80WP (Manganese + Zinc + Ethylene bis-dithiocarbamate Ion)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1985	Foliar	Slight but not significant reduction in disease incidence with 1.5 lb per 100 gal applied 4 times at 10 to 14 day intervals.
09973	Funginex (Triforine 18.2) (Triforine)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 1: Good efficacy of Marssonina populi at 12 fl oz per 100 gal; no injury.
09973	Funginex (Triforine 18.2) (Triforine)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Good efficacy of Marssonina populi at 12 fl oz per 100 gal; no injury.
09973	Funginex (Triforine 18.2) (Triforine)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: Mediocre efficacy of Marssonina populi at 12 fl oz per 100 gal; no injury.
09973	Funginex (Triforine 18.2) (Triforine)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: No efficacy of Marssonina populi at 12 fl oz per 100 gal; no injury.
29852	Headway (Propiconazole + azoxystrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Did not significantly reduce a moderate disease pressure with 30 fl oz per 100 gal.
29852	Headway (Propiconazole + azoxystrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Significantly reduced a moderate disease pressure with 30 fl oz per 100 gal; comparable or inferior to Daconil.
29853	Heritage (Azoxystrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Did not significantly reduce a moderate disease pressure with 8 oz per 100 gal + Capsil.
29853	Heritage (Azoxystrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Did not significantly reduce a moderate disease pressure with 8 oz + Capsil at 6 oz per 100 gal.
23657	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Cercospora delphinii (Cercospora delphinii)	Larkspur (Delphinium sp.) D. elatum	Field Container	Pennucci	NH	2002	Foliar	No injury observed (0.1, 0.2, 0.5 lb ai per 100 gal); no efficacy data provided, but researcher indicated no efficacy of bacterial leaf spot.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
23656	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Cercospora rudbeckiae (Cercospora rudbeckiae)	Purple Coneflower (Echinacea sp.) E. purpurea	Field Container	Pennucci	NH	2002	Foliar	No to slight leaf curling increasing with rate (0.1, 0.2, 0.5 lb ai per 100 gal); no efficacy data provided, but researcher indicated excellent efficacy comparable to Daconil and Rubigan.
23659	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Iris Leaf Spot (Didymellina macrospora)	German Iris (Iris germanica)	Field Container	Pennucci	NH	2002	Foliar	No to slight leaf curling increasing with rate (0.1, 0.2, 0.5 lb ai per 100 gal); no efficacy data provided, but researcher indicated great control of iris leaf blight with 0.1, 0.2 and 0.5 lb ai per 100 gal; comparable to Rubigan.
28154	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Rose Blackspot (Diplocarpon rosae)	Rose (Rosa sp.)	Field Container	Pennucci	NH	2002	Foliar	Excellent control of black leaf spot with 0.1, 0.2 and 0.5 lb ai per 100 gal; comparable to Rubigan.
28155	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Ramularia viburni (Ramularia viburni)	Viburnum, arrowwood (Viburnum dentatum)	Field Container	Pennucci	NH	2002	Foliar	Excellent control of black spot with 0.1, 0.2 and 0.5 lb ai per 100 gal; comparable to Daconil and Rubigan.
23661	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Liatris Leaf Spot (Septoria liatridis)	Gayfeather (Liatris spicata)	Field Container	Pennucci	NH	2002	Foliar	No to slight leaf curling increasing with rate (0.1, 0.2, 0.5 lb ai per 100 gal); no efficacy data provided, but researcher indicated excellent control of Liatris leaf spot with 0.1, 0.2 and 0.5 lb ai per 100 gal; comparable to Daconil and Rubigan.
09972	Kocide 2000 (Dupont) (Copper Hydroxide)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 1: Good control of Marssonina populi with 0.77 lb ai per 100 gal; some injury.
09972	Kocide 2000 (Dupont) (Copper Hydroxide)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1987	Foliar	Experiment 2: Poor control of Marssonina populi with 0.77 lb ai per 100 gal; some injury.
09972	Kocide 2000 (Dupont) (Copper Hydroxide)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 1: Poor control of Marssonina populi with 0.77 lb ai per 100 gal; significant defoliation occurred as a result of application.
09972	Kocide 2000 (Dupont) (Copper Hydroxide)	Marssonina Leaf Spot (Marssonina sp.)	Aspen, Poplar (Populus sp.) P. tremuloides	Greenhouse	Jacobi	CO	1988	Foliar	Experiment 2: Poor control of Marssonina populi with 0.77 lb ai per 100 gal; significant defoliation occurred as a result of application.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32734	MBI 110 (MBI110)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/ Lathehouse	Palmateer	FL	2015	Foliar	No significant reduction of disease incidence and severity with 1 gal per 100 gal applied 5 times weekly.
32573	MBI 110 (MBI110)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Poor efficacy on Drechslera setariae with 1 gal per 100 gal applied 3 times.
32666	MBI 110 (MBI110)	Unknown Leaf Spot (Unknown)	Coneflower, Orange (Rudbeckia fulgida speciosa) 'Goldsturm'	Field In-Ground	Kirk	MI	2015	Foliar	Significantly reduced a low leaf spot incidence with 1 gal per 100 gal applied 5 times; inferior to Medallion applied 3 times.
32739	Medallion (Fludioxonil)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/ Lathehouse	Palmateer	FL	2015	Foliar	No significant reduction of disease incidence and severity with 8 oz per 100 gal applied 3 times biweekly.
32671	Medallion (Fludioxonil)	Unknown Leaf Spot (Unknown)	Coneflower, Orange (Rudbeckia fulgida speciosa) 'Goldsturm'	Field In-Ground	Kirk	MI	2015	Foliar	Significantly reduced a low leaf spot incidence with 8 oz per 100 gal applied 3 times.
32579	Mural (A18126B) WDG (Azoxystrobin + benzovindiflupyr)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Good efficacy on Drechslera setariae with 4 and 7 oz per 100 gal applied 3 times; comparable to non-inoculated check.
32574	NUP 09092 (fludioxonil)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Good efficacy on Drechslera setariae with 4 and 8 fl oz per 100 gal applied 3 times; better than the non-inoculated check.
32667	NUP 09092 (fludioxonil)	Unknown Leaf Spot (Unknown)	Coneflower, Orange (Rudbeckia fulgida speciosa) 'Goldsturm'	Field In-Ground	Kirk	MI	2015	Foliar	Significantly reduced a low leaf spot incidence with 4 and 8 fl oz per 100 gal applied 3 times; inferior to Medallion applied 3 times.
32089	Orkestra Intrinsic (BAS703 06F/BAS703 01F) (Fluxapyroxad + pyraclostrobin)	Alternaria alternara (Alternaria alternata)	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Significantly reduced leaf spots (by 96%) with 8 fl oz per 100 gal applied 3 times; comparable to non-inoculated Control.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31921	Orkestra Intrinsic (BAS703 06F/BAS703 01F) (Fluxapyroxad + pyraclostrobin)	Oak Anthracnose (Apiognomonina quercina)	Oak (Quercus sp.) Q. alba	Field In-Ground	Pscheidt	OR	2014	Foliar	Very good control with 8 fl oz per 100 gal applied twice.
32732	Orkestra Intrinsic (BAS703 06F/BAS703 01F) (Fluxapyroxad + pyraclostrobin)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/Lathehouse	Palmateer	FL	2015	Foliar	Excellent reduction of disease incidence and severity with 8 fl oz per 100 gal applied 3 times biweekly; best treatment; comparable to non-inoculated check.
32571	Orkestra Intrinsic (BAS703 06F/BAS703 01F) (Fluxapyroxad + pyraclostrobin)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Poor efficacy on Drechslera setariae with 8 fl oz per 100 gal applied 3 times.
32664	Orkestra Intrinsic (BAS703 06F/BAS703 01F) (Fluxapyroxad + pyraclostrobin)	Unknown Leaf Spot (Unknown)	Coneflower, Orange (Rudbeckia fulgida speciosa) 'Goldsturm'	Field In-Ground	Kirk	MI	2015	Foliar	Significantly reduced a low leaf spot incidence with 8 fl oz per 100 gal applied 4 times; best treatment, better than Medallion applied 3 times.
32577	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Good efficacy on Drechslera setariae with 14 and 18 oz per 100 gal applied 3 times; comparable to non-inoculated check.
29854	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Did not significantly reduce a moderate disease pressure with 12 oz per 100 gal.
29854	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Did not significantly reduce a moderate disease pressure with 12 oz per 100 gal.
32735	Palladium (Cyprodinil + fludioxanil)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/Lathehouse	Palmateer	FL	2015	Foliar	No significant reduction of disease incidence and severity with 6 oz per 100 gal applied 5 times weekly.
29855	Palladium (Cyprodinil + fludioxanil)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Did not significantly reduce a moderate disease pressure with 12 oz per 100 gal.
29855	Palladium (Cyprodinil + fludioxanil)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Did not significantly reduce a moderate disease pressure with 12 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32091	Proud 3 (Thyme oil (5.6%))	<i>Alternaria alternata</i> (<i>Alternaria alternata</i>)	New Guinea Impatiens (<i>Impatiens hawkeri</i>) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Did not reduce leaf spots with 4 qt per 100 gal applied 5 times.
31923	Proud 3 (Thyme oil (5.6%))	Oak Anthracnose (<i>Apiognomonina quercina</i>)	Oak (<i>Quercus</i> sp.) <i>Q. alba</i>	Field In-Ground	Pscheidt	OR	2014	Foliar	Did not significantly reduce disease incidence with 128 fl oz per 100 gal applied twice.
32736	Proud 3 (Thyme oil (5.6%))	<i>Colletotrichum</i> sp. (<i>Colletotrichum</i> sp.)	Good-Luck Plant (<i>Sansevieria</i> sp.)	Shadehouse/Lathehouse	Palmateer	FL	2015	Foliar	Significant reduction of disease incidence and severity with 4 qt per 100 gal applied 5 times weekly; better than Medallion but inferior to non-inoculated check.
32575	Proud 3 (Thyme oil (5.6%))	<i>Helminthosporium</i> sp. (<i>Helminthosporium</i> sp.)	Cathedral-Windows Peacock Plant (<i>Calathea</i> sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	No efficacy on <i>Drechslera setariae</i> with 4 qt per 100 gal applied 3 times.
32668	Proud 3 (Thyme oil (5.6%))	Unknown Leaf Spot (Unknown)	Coneflower, Orange (<i>Rudbeckia fulgida speciosa</i>) 'Goldsturm'	Field In-Ground	Kirk	MI	2015	Foliar	Significantly reduced a low leaf spot incidence with 4 qt per 100 gal applied 5 times; inferior to Medallion applied 3 times.
32092	S2200 4SC (Mandestrobin)	<i>Alternaria alternata</i> (<i>Alternaria alternata</i>)	New Guinea Impatiens (<i>Impatiens hawkeri</i>) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Significantly reduced leaf spots (by 97%) with 7.5 fl oz per 100 gal applied 3 times; comparable to non-inoculated Control.
31924	S2200 4SC (Mandestrobin)	Oak Anthracnose (<i>Apiognomonina quercina</i>)	Oak (<i>Quercus</i> sp.) <i>Q. alba</i>	Field In-Ground	Pscheidt	OR	2014	Foliar	Did not significantly reduce disease incidence with 7.5 fl oz per 100 gal applied twice.
32737	S2200 4SC (Mandestrobin)	<i>Colletotrichum</i> sp. (<i>Colletotrichum</i> sp.)	Good-Luck Plant (<i>Sansevieria</i> sp.)	Shadehouse/Lathehouse	Palmateer	FL	2015	Foliar	Significant reduction of disease incidence and severity with 7.5 and 15 fl oz per 100 gal applied 3 times biweekly; better than Medallion but inferior to non-inoculated check.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32576	S2200 4SC (Mandestrobin)	Helminthosporium sp. (Helminthosporium sp.)	Cathedral-Windows Peacock Plant (Calathea sp.) 'Silhouette'	Greenhouse	Norman	FL	2015	Foliar	Poor efficacy on Drechslera setariae with 7.5 and 15 fl oz per 100 gal applied 3 times.
32669	S2200 4SC (Mandestrobin)	Unknown Leaf Spot (Unknown)	Coneflower, Orange (Rudbeckia fulgida speciosa) 'Goldsturm'	Field In-Ground	Kirk	MI	2015	Foliar	Significantly reduced a low leaf spot incidence with 7.5 and 15 fl oz per 100 gal applied 3 times; inferior to Medallion applied 3 times.
32093	SP2770 10WP (SP2770)	Alternaria alternara (Alternaria alternata)	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Significantly reduced leaf spots (by 54%) with 2.66 lb per 100 gal applied 5 times; inferior to Chipco 26019.
32143	SP2770 10WP (SP2770)	Oak Anthracnose (Apiognomonina quercina)	Oak (Quercus sp.) Q. alba	Field In-Ground	Pscheidt	OR	2014	Foliar	No control with 2.67 lb per 100 gal applied twice.
29795	Terraguard 50W (Triflumizole)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2002	Foliar	No apparent efficacy at 2, 4, and 8 oz ai per 100 gal; no injury.
32804	Tilt 3.6E (CGA 64250 3.6E) (Propiconazole)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1985	Foliar	Slight but not significant reduction in disease incidence with 0.75 fl oz per 100 gal applied 4 times at 10 to 14 day intervals.
32771	Tilt 3.6E (CGA 64250 3.6E) (Propiconazole)	Leaf Spot, Entomosporium (Diplocarpon maculatum)	Photinia (Photinia sp.)	Field Container	Gilliam	AL	1982	Foliar	Excellent efficacy at all rates (4, 8, 16 fl oz per 100 gal) but minor to moderate leaf curling and bronzing.
32095	Torque 3.6SC (Tebuconazole)	Alternaria alternara (Alternaria alternata)	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Significantly reduced leaf spots (by 96%) with 8 fl oz per 100 gal applied 3 times; comparable to non-inoculated Control. Unacceptable reduction in number of flowers.
31927	Torque 3.6SC (Tebuconazole)	Oak Anthracnose (Apiognomonina quercina)	Oak (Quercus sp.) Q. alba	Field In-Ground	Pscheidt	OR	2014	Foliar	Excellent control with 8 fl oz per 100 gal applied twice.
29856	Tourney 50WDG (Metconazole)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Did not significantly reduce a moderate disease pressure with 4 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29856	Tourney 50WDG (Metconazole)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Did not significantly reduce a moderate disease pressure with 4 oz per 100 gal.
32161	Trinity 2SC (Triticonazole)	Alternaria alternata (Alternaria alternata)	New Guinea Impatiens (Impatiens hawkeri) 'Super Elfin Bright Orange'	Greenhouse	Norman	FL	2014	Foliar	Significantly reduced leaf spots (by 93%) with 12 fl oz per 100 gal applied once; comparable to non-inoculated Control.
29857	Trinity 2SC (Triticonazole)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2010	Foliar	Did not significantly reduce a moderate disease pressure with 12 fl oz per 100 gal.
29857	Trinity 2SC (Triticonazole)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii)	Field In-Ground	Chastagner	WA	2011	Spray to drip	Did not significantly reduce a moderate disease pressure with 12 fl oz per 100 gal.
23093	Vanguard 75WG (Cyprodinil)	Swiss Needle Cast (Phaeocryptopus gaeumannii)	Fir, Douglas (Pseudotsuga menziesii) p. menziesii	Field In-Ground	Chastagner	WA	2002	Foliar	No impact on disease and no injury.
32740	ZeroTol (Hydrogen dioxide)	Colletotrichum sp. (Colletotrichum sp.)	Good-Luck Plant (Sansevieria sp.)	Shadehouse/ Lathehouse	Palmateer	FL	2015	Foliar	No significant reduction of disease incidence and severity with 1 gal per 100 gal applied 5 times at 10-day intervals.
32805	Zyban 75WP (Mancozeb + thiophanate methyl)	Colletotrichum sp. (Colletotrichum sp.)	Dogwood, Flowering (Cornus florida)	Field In-Ground	Hudler	NY	1985	Foliar	Significant reduction in disease incidence with 1.5 lb per 100 gal applied 4 times at 10 to 14 day intervals.

Label Suggestions

Based upon data contained within this summary, we suggest that BASF consider adding black spot (*Diplocarpon rosae*) to the Pageant label.

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