



[Environment Horticulture Program Research Summaries](#)

**IR-4 Environmental Horticulture Program
Rhizoctonia Efficacy: Summary & Literature Review**

Rhizoctonia solani

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Abstract

From 1999 to 2023, 44 products or active ingredients were evaluated for *Rhizoctonia solani* management in greenhouse experiments as soil drench, soil incorporation, foliar or soak application, and in field experiments as soil drenches. Experiments were conducted on begonia, boxwood, chrysanthemum, dianthus, garden impatiens, juniper, maple, marigold, petunia, poinsettia, rhododendron, snapdragon, viburnum, vinca, and zinnia. The relatively new registered products Affirm/Endorse/Veranda O (polyoxin D), Empress Intrinsic (pyraclostrobin), Heritage (azoxystrobin), Medallion (fludioxonil), Mural (azoxystrobin + benzovindiflupyr) and Pageant Intrinsic (pyraclostrobin + boscalid) showed excellent efficacy. For those not yet registered for this disease, sufficient efficacy was observed with Astun, Avelyo, BAS 673, MBI-121, and SP2478 to recommend adding *R. solani* to target pathogens. SP2700 shows promise as part of an overall resistance and disease management plan.

Introduction

In 2018, IR-4 initiated a high priority project to determine efficacy of several fungicides on non-Oomycete root rot pathogens, including *Rhizoctonia* species, and obtain data supporting current and future registrations on ornamentals. We reviewed available ornamental trials published in Biological & Cultural Tests, Fungicide & Nematicide Tests and Plant Disease Management Reports to check efficacy of experimental and registered fungicides on *Rhizoctonia* species. This report is a brief summary of data available from this literature review and data from 8 experiments sponsored by the Environmental Horticulture program.

Materials and Methods

From 1999 to 2023, 44 products or active ingredients were evaluated in greenhouse and field trials as soil drench, soil incorporation, foliar, soak application against *Rhizoctonia solani*. Experiments were conducted with chrysanthemum, garden impatiens, petunia, poinsettia, snapdragon, viburnum and zinnia. Treatments were generally applied as soil drench either a few days before *Rhizoctonia* inoculation or immediately after inoculation and reapplied biweekly. 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. Eleven researchers were involved in the testing (Appendix 1).

Products were supplied by their respective manufacturers.

For IR-4 testing, the following protocols were used: 18-005 and 19-004. Please visit <https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-researcher-resources/#Protocols> to view and download this protocol.

Table 1. List of Active Ingredients / Products and Rates Tested on Environmental Horticulture Plants from 1999 to 2023.

Active Ingredient(s)	Trade Name(s)	Manufacturer	Rate(s) Tested		# Trials
A14912A	A14912A	Syngenta	Pot substrate incorporation	0.6 oz/ cu ft 1.2 oz/ cu ft 1.8 oz/ cu ft	1
A14912F	A14912F	Syngenta	Pot substrate incorporation	0.6 oz/ cu ft 1.2 oz/ cu ft 1.8 oz/ cu ft	1
Azoxystrobin	Heritage 50WG	Syngenta	Drench	0.23 oz per 100 gal	2
				0.45 oz per 100 gal	2
				0.90 oz per 100 gal	6
				1.80 oz per 100 gal	1
				4 oz per 100 gal	2
			Soak	1 oz per 100 gal	1
				2 oz per 100 gal	
			Spray	2 oz per 100 gal	1
				4 oz per 100 gal	
			Sprenc	4 oz per 100 gal	1
Azoxystrobin + Benzovindiflupyr	Mural 45WG	Syngenta	Drench	3 oz per 100 gal	3
<i>Bacillus amyloliquifaciens</i> strain F727	Stargus/MBI 110	Marrone	Drench	1 gal per 100 gal	5
				2 gal per 100 gal	3
BAS 673	BAS 673	BASF	Drench	6 fl oz per 100 gal	1
				12 fl oz per 100 gal	2
Boscalid pyraclostrobin	Pageant	BASF	Drench	18 oz per 100 gal	5
BW161N	BW161N	BioWorks	Drench	3 oz per 100 gal	2
				5 oz per 100 gal	2
CGA173506	CGA173506	Syngenta	Sprenc	1.5 oz per 100 gal	1
Cyazofamid	Segway	OHP	Drench	1.5 oz per 100 gal	1
				3.0 oz per 100 gal	1
Dipotassium phosphate and phosphonate	BioPhos	Agrisel	Drench	1 gal per 100 gal	1
				2 gal per 100 gal	1
Etridiazole + Thiophanate methyl	Banrot 40WP	Scotts	Drench	8 oz per 100 gal	2
Fenamidone	Fenstop	OHP	Drench	7 oz per 100 gal	1
				14 oz per 100 gal	1
Fludioxonil	Medallion	Syngenta	Drench	1 oz per 100 gal	1
				2 oz per 100 gal	4
				4 oz per 100 gal	1
Fludioxonil + Mefenoxam	Hurricane	Syngenta	Sprenc	4 oz per 100 gal	1
Fluopyram + Trifloxystrobin	Broadform	Bayer	Sprenc	4 fl oz per 100 gal	3
				6 fl oz per 100 gal	3
Fluopicolide	Adorn	Valent	Drench	30 ml per 100 gal	1
				60 ml per 100 gal	1
Fluoxastrobin	Disarm O	OHP	Drench	3 oz per 100 gal	1
Flutolanil	Prostar	Bayer	Sprenc	6 oz per 100 gal	1
Fluxapyroxad + Pyraclostrobin	Orkestra/BAS 703 01F	BASF	Drench	7 fl oz per 100 gal	1
				10 fl oz per 100 gal	2
				14 fl oz per 100 gal	1
Furfural	Multiguard	AgriGuard	Drench	250 ppm	1

Active Ingredient(s)	Trade Name(s)	Manufacturer	Rate(s) Tested	# Trials	
			500 ppm	1	
<i>Gliocladium catenulatum</i> strain J1446	Pvent	BioSafe	Drench	0.1% w/v	1
<i>Gliocladium virens</i> strain GL-21	SoilGard	Certis	Drench	2 lb per 100 gal	3
Hydrogen dioxide + Peroxyacetic acid	ZeroTol	BioSafe	Drench	1 gal per 100 gal	1
Hymexazole	Hymexazole	Sumitomo	Drench	6 oz per 100 gal	1
				12 oz per 100 gal	1
Isofetamid	Astun	OHP	Sprench	13.5 fl oz per 100 gal	5
				17 fl oz per 100 gal	3
Mandipropamid	Micora	Syngenta	Drench	2 oz per 100 gal	1
				8 oz per 100 gal	1
MBI-121	MBI-121	ProFarm	Drench	128 fl oz per 100 gal	4
Mefentrifluconazole	Aveylo, BAS 750	BASF	Sprench	3 fl oz per 100 gal	2
				5 fl ao per 100 gal	1
Metconazole	Tourney	Valent	Drench	4 oz per 100 gal	1
MGCI	MGCI		Drench	2.5 fl oz per 100 gal	1
				10 fl oz per 100 gal	1
<i>Muscodor albus</i> strain SA-13	MBI-601	Marrone	Pot substrate incorporation	5 g/cu ft soil	3
				10 g/cu ft soil	3
OHPF-1904	OHPF-1904	OHP	Sprench	4.7 fl oz per 100 gal	1
Pentachloronitro-benzene	Terraclor 75WP	Chemtura	Drench	4 oz per 100 gal	2
				8 oz per 100 gal	1
Polyoxin D	Affirm	Nufarm	Drench	8 oz per 100 gal	1
	Endorse	Arysta	Drench	1.1 lb per 100 gal	1
				2.2 lb per 100 gal	1
Veranda O	OHP	Drench	8 oz per 100 gal	2	
Potassium phosphite	Vital	Luxembourg	Drench	2 pt per 100 gal	1
				4 pt per 100 gal	1
<i>Pseudomonas chlororaphis</i> strain AFS009	Howler	AgBiome	Drench	67 oz per 100 gal	1
	Zio	SePRO	Drench	67 oz per 100 gal	1
100 oz per 100 gal				1	
Pydiflumetofen	Picatina	Syngenta	Drench	13.7 fl oz per 100 gal	1
Pydifluremtofen + difenoconazole	Postiva	Syngenta	Drench	14 fl oz per 100 gal	4
				21 fl oz per 100 gal	4
Pyraclostrobin	Empress Intrinsic	BASF	Drench	3 fl oz per 100 gal	3
				6 fl oz per 100 gal	1
Pyraziflumid	Pyraziflumid	Envu	Drench	3.1 fl oz per 100 gal	1
				4.67 fl oz per 100 gal	1
				6.2 fl oz per 100 gal	1
RD00AS-1	RD00AS-1	BioWorks	Drench	128 fl oz per 100 gal	1
SP2478	SP2478	SePro	Drench	3.1 fl oz per 100 gal	2
				4.6 fl oz per 100 gal	3
SP2480	SP2480	SePro	Drench	15 fl oz per 100 gal	1
				25 fl oz per 100 gal	1
SP2700	SP2700AS	SePro	Drench	11 fl oz per 100 gal	3
	SP2700 WP	SePro	Drench	11 oz per 100 gal	2
				12 oz per 100 gal	1
				16 oz per 100 gal	1
				22 oz per 100 gal	2
				24 oz per 100 gal	1

Active Ingredient(s)	Trade Name(s)	Manufacturer	Rate(s) Tested		# Trials	
<i>Streptomyces lydicus</i>	Actinovate	Novozymes	Drench	10 oz per 100 gal	1	
Thiophanate methyl	3336 50W	Cleary	Drench	4 oz per 100 gal	2	
				16 oz per 100 gal	2	
			Spray	16 oz per 100 gal	1	
	3336 F	Cleary	Drench	8 fl oz per 100 gal	1	
				17 fl oz per 100 gal	1	
				20 fl oz per 100 gal	1	
OHP 6672 4.5L	OHP	Drench	20 fl oz per 100 gal	1		
Topsin	UPI	Sprench	10.9 oz per 100 gal	1		
Thyme oil	Promax	HumaGro	Drench	2 gal per 100 gal	1	
	Tril-21	Kemin	Drench	64 fl oz per 100 gal	2	
				128 fl oz per 100 gal	2	
	TXC2020	Kemin	Drench	64 fl oz per 100 gal	1	
<i>Trichoderma harzianum</i>	RootShield	BioWorks	Drench	5 oz per 100 gal	1	
<i>Trichoderma harzianum</i> + <i>T. virens</i>	RootShield Plus	BioWorks	Drench	8 oz per 100 gal	3	
<i>Trichoderma</i> spp.	IT-5103 WP	Italpollina	Drench	2 g per plant	3	
Trifloxystrobin	Compass 50WG	Bayer	Drench	0.5 oz per 100 gal	1	
Triflumizole	Terraguard	UPI NA	Drench	4 fl oz per 100 gal	3	
Triticonazole	Trinity	BASF	Drench	6 fl oz per 100 gal	1	
V-10190	V-10190 2.5SC	Valent		8 fl oz per 100 gal		1
				16 fl oz per 100 gal		1

Results

Comparative Efficacy on *Rhizoctonia solani*

Forty-four different products or formulations of active ingredients being developed have been screened by IR-4 for the management of *Rhizoctonia solani*. From 1999 through 2023, IR-4 sponsored 117 research trials. Of those that are not yet registered for this disease, sufficient efficacy was observed with Astun, Avelyo, BAS 673, MBI-121, and SP2478 to recommend adding *R. solani* to target pathogens. SP2700 shows promise as part of an overall resistance and disease management plan.

Table 2. Overall Efficacy Summary for managing *Rhizoctonia solani*.

Product (Active Ingredients)	Mode of Action Group	<i>Rhizoctonia solani</i>
3336 F (Thiophanate-methyl)	FRAC 1	2.0 (1 - 3) n2 Labeled
3336 WP (50%) (Thiophanate-methyl)	FRAC 1	2.9 (1 - 4) n12 Labeled
3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	3.5 (3 - 4) n2 Labeled
Actinovate Soluble (<i>Streptomyces lydicus</i> WYEC 108)	FRAC BM02	1.0 (1 - 1) n1 Labeled
Adorn 4F (Fluopicolide)	FRAC 43	2.0 (2 - 2) n1
Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	FRAC P07	3.0 (3 - 3) n1
Astun (isofetamid)	FRAC 7	2.0 (1 - 4) n4
Avelyo Fungicide (Mefentrifluconazole)	FRAC 3	4.3 (3 - 5) n4
BAS 673 05F (BAS 673 05F)	unknown	3.5 (2 - 5) n2
Benlate 50WP (Benomyl)	FRAC 1	4.0 (3 - 5) n2
Broadform SC500 (Fluopyram + Trifloxystrobin)	FRAC 7 + FRAC 11	3.7 (1 - 5) n3 Labeled
BW161N (BW161N)	unknown	3.0 (1 - 5) n2
Captan (Captan)	FRAC M4	1.0 (1 - 1) n1 Labeled
Disarm 480SC (Fluoxastrobin)	FRAC 11	2.0 (2 - 2) n1 Labeled
Empress Intrinsic Brand Fungicide (Pyraclostrobin)	FRAC 11	5.0 (5 - 5) n1 Labeled
Endorse (Polyoxin D)	FRAC 19	3.0 (1 - 5) n2 Labeled
Fenstop (Fenamidon)	FRAC 11	1.0 (1 - 1) n1 Labeled
Heritage (Azoxystrobin)	FRAC 11	1.0 (1 - 1) n1 Labeled
Hymexazol 30L (Hymexazol)	FRAC 32	1.0 (1 - 1) n1
MBI 121 (MBI 121)	unknown	2.0 (1 - 4) n4
MBI 601 (<i>Muscodora albus</i>)	FRAC BM02	2.3 (1 - 3) n3
Medallion (Fludioxonil)	FRAC 12	5.0 (5 - 5) n2 Labeled
MGCI (MGCI)	unknown	1.0 (1 - 1) n1
Micora (Mandipropamid)	FRAC 40	2.0 (2 - 2) n1
MultiGuard (Furfural)	unknown	2.0 (2 - 2) n1 Labeled
Orkestra Intrinsic (Fluxapyroxad + pyraclostrobin)	FRAC 7 + FRAC 11	5.0 (5 - 5) n1
Pageant Intrinsic (Boscalid + pyraclostrobin)	FRAC 7 + FRAC 11	4.0 (4 - 4) n1
Picatina (Pydiflumetofen)	FRAC 7	3.0 (3 - 3) n1
Postiva (pydiflumetofen + difenoconazole)	FRAC 7 + FRAC 3	3.0 (1 - 5) n4 Labeled
Promax (Thyme oil)	FRAC BM01	1.0 (1 - 1) n1
ProStar 70WP/WG (Flutalonil)	FRAC 7	5.0 (5 - 5) n1
Pvent (<i>Gliocladium catenulatum</i> Strain J1446)	FRAC BM02	3.0 (3 - 3) n1
RD00AS-1 (BW159) (BW159)	unknown	1.0 (1 - 1) n1
Segway (Cyazofamid)	FRAC 21	1.5 (1 - 2) n2
SP2478 (SP2478)	unknown	4.0 (2 - 5) n3
SP2480 (SP2480)	unknown	1.0 (1 - 1) n1
SP2700 AS (SP2700)	unknown	1.7 (1 - 3) n3
SP2700 WP (SP2700)	unknown	2.0 (1 - 4) n4
Stargus (<i>Bacillus nakamurai</i> strain F727)	IRAC UNF & FRAC BM02	1.7 (1 - 3) n3 Labeled
Tril-21 (Thyme oil)	FRAC BM01	1.0 (1 - 1) n3
TXC2020 (Thyme oil)	FRAC BM01	1.0 (1 - 1) n1
Vital 4L (Potassium phosphite)	FRAC P07	3.0 (3 - 3) n1
ZeroTol (Hydrogen dioxide)	FRAC NC	1.0 (1 - 1) n1
Zio (<i>Pseudomonas chlororaphis</i> strain AFS009)	FRAC BM02	1.0 (1 - 1) n1

Average rating on a scale of 1 – 5 with 1 = 0 to about 70% efficacy and 5 = 100 efficacy or equivalent to non-inoculated control; minimum to maximum rating; number of trials. A rating of 2 or lower is considered unacceptable. A rating of 3 or higher is considered commercially acceptable.

Begonia

In 2018, Norman conducted a greenhouse trial to determine efficacy of several fungicides applied as drench, sprench or soil incorporation for the control of *Rhizoctonia* root and crown rot, *Rhizoctonia solani*, on wax begonia (*Begonia semperflorens*). Treatments were applied at various dates shown in Table 3 All fungicide treatments gave some control of *Rhizoctonia* root and crown rot of begonia, with Broadform and Prostar providing 100% control that was similar to Uninoculated control. However, by day 42 only 5 products were still significantly better than the inoculated control. These treatments were BAS 750, Broadform, MBI-601, ProStar and Stargus/MBI-110. No evidence of phytotoxicity was observed for any treatment.

Table 3. Efficacy for Rhizoctonia Stem Rot, *Rhizoctonia solani*, on Wax Begonia (*Begonia semperflorens*) ‘Bada Bing Scarlet’, Norman, FL, 2018.

Treatment	Rate Per 100 Gal	Application Method	Application Dates	% Leaf Damage ^x at 42 DAT
Astun (isofetamid)	13.5 fl oz	Sprenc	4/26, 5/3	43.5 e
BAS750 (mefentrifluconazole)	3 fl oz	Sprenc	4/23, 5/10, 5/24	4.5 ab
Broadform (fluopyram + trifloxystrobin)	4 fl oz	Sprenc	4/26, 5/10	0 a
	6 fl oz	Sprenc	4/26, 5/10	0 a
MBI-601 (<i>Muscodor albus</i> strain SA-13)	5g/cu ft soil	Pot substrate incorp.	4/12, Potted 4/18	4.5 bc
	10g/cu ft soil	Pot substrate incorp.	4/12, Potted 4/18	39.5 de
ProStar (flutalonil)	6 oz	Sprenc	4/26, 5/10	0 a
SP2700 (SP2700)	11 fl oz	Drench	4/23, 5/10, 5/24	32 cde
Stargus/MBI-110 (<i>Bacillus amyloliquefaciens</i> strain F727)	1%	Drench	4/26, 5/10, 5/24	27.5 cd
	2%	Drench	4/26, 5/10, 5/24	27 cd
Untreated uninoculated	-	-	-	0 a
Untreated inoculated	-	-	-	45 e

^x Means followed by same letter do not differ significantly based on LSD test, (P=0.05).

Chrysanthemum

In 2011, Beckerman conducted a greenhouse trial to determine efficacy of several fungicides applied as sprench for the control of *Rhizoctonia* stem rot, *Rhizoctonia solani*, on chrysanthemum (*Chrysanthemum morifolium*). Hurricane and CGA173506 were applied on May 27, and plants inoculated 14 days later. Topsin M was applied on Jun 24 when the first symptoms of stem discoloration were observed and was re-applied on Jul 4. All treatments provided excellent control of a moderate disease pressure (Table 4). No evidence of phytotoxicity was observed for any treatment.

Table 4. * Efficacy for Rhizoctonia Stem Rot, *Rhizoctonia solani*, on Chrysanthemum (*Chrysanthemum morifolium*) ‘Goldcrest Yellow’, Beckerman, IN, 2011.

Treatment	Rate Per 100 Gal	Disease Severity Rating ^x		
		Oct 28	Nov 4	Nov 11
CGA173506 32WG	1.5 oz	1.0 a	1.0 a	1.2 b
Hurricane 48WP (fludioxonil + mefenoxam)	1.5oz	1.0 a	1.0 a	1.0 b
Topsin M 70WP (thiophanate methyl)	10.9 oz	1.0 a	1.0 a	1.0 b
Untreated uninoculated	-	1.0 a	1.0 a	1.0 b
Untreated inoculated	-	1.3 a	2.2 a	4.0 a

* Not an IR-4 Experiment: Plant Disease Management Reports 7:OT013.

^x Disease severity was on a 1 - 10 scale where 1=0-10%, 2=11-20%, 3=21-30%, 4=31-40%, 5=41-50%, 6=51-60%, 7=61- 70%, 8=71-80%, 9=81-90%, 10=91-100% of leaves wilted and discolored on a stem, or stems, with basal stem rot. Means followed by same letter do not differ significantly based on Waller-Duncan *k*-ratio, *t*-test, *k*=100, (P=0.05).

Garden Impatiens

In 1999, Benson conducted a greenhouse trial to determine efficacy of several fungicides, applied as drench at 2 pt per sq ft, for the control of *Rhizoctonia* crown rot, *Rhizoctonia solani*, on garden impatiens (*Impatiens balsamina*). A single application of Heritage at the lowest rate gave complete control of a high *Rhizoctonia* crown rot pressure for up to 41 days after inoculation (Table 5). Because control was so effective with Heritage, the effect of including a wetting agent could not be assessed. Compass and Cleary's 3336 also gave very good control of crown rot, but the low rate of Compass began to lose effectiveness after 27 days.

In 2013, Hand conducted a greenhouse trial to determine efficacy of several fungicides for the control of *Rhizoctonia* crown rot, *Rhizoctonia solani*, on garden impatiens (*Impatiens balsamina*). Treatments were applied as a drench at transplanting on Sep 13. All treatments, except 3336 WP, provided excellent protection against a severe disease pressure (Table 6). No statistically significant differences were observed between Medallion and the low rate of Heritage. Treatments receiving the high rate of Heritage had significantly greater biomass compared to all other treatments with the exception of the low rate of Heritage. No evidence of phytotoxicity was observed for any treatment.

In 2018, Hand conducted a greenhouse trial to determine efficacy of several fungicides for the control of *Rhizoctonia* crown rot, *Rhizoctonia solani*, on impatiens (*Impatiens walleriana*). Treatments were applied preventatively as a spray to the plant stems and foliage on May 22 and Jun 5. On May 23, plants were transplanted into a growing medium in which *Rhizoctonia solani*-infested millet had been previously incorporated. Astun at 17 fl oz/100 gal provided very good control of a severe disease pressure, almost comparable to the untreated uninoculated check, and better than Terraguard (Table 6). No evidence of phytotoxicity was observed for any treatment.

In 2019, Beckerman screened 6 active ingredients and products. Disease incidence was moderate, but the inoculated and noninoculated controls were not statistically different from each other (Table 9), so no conclusions can be drawn about performance.

In 2019, Norman conducted a greenhouse trial to determine efficacy of several fungicides applied as drench, sprench or soil incorporation for the control of *Rhizoctonia* root and crown rot, *Rhizoctonia solani*, on buzzy lizzy impatiens (*Impatiens walleriana*). Treatments were applied at various dates shown in Table 9. Efficacy for *Rhizoctonia* Stem Rot, *Rhizoctonia solani*, on Impatiens (*Impatiens walleriana*) ‘Super Elfin Red’, Norman, FL, 2019. Products that were effective include BAS750,

Broadform, MBI-601, Orkestra Intrinsic, Postiva, Pvent, and Cleary's 3336. There was some leaf burn with Orkestra Int. on impatiens. The final evaluation of plant height did not reflect disease control.

In 2019, Hand conducted a greenhouse trial to determine efficacy of several fungicides for the control of *Rhizoctonia* crown rot on impatiens (*Impatiens walleriana*). Treatments were applied preventatively as a spray to the plant stems on Jul 31 and Aug 14. On Aug 2, plants were transplanted into a growing medium in which *Rhizoctonia solani*-infested millet had been previously incorporated. OHPF-1904 and Heritage provided 100% control of a severe disease pressure, comparable to the Untreated uninoculated treatment (Table 10) Astun at 17 fl oz/100 gal provided 90% control and was statistically similar to that of Heritage and OHPF-1904. No evidence of phytotoxicity was observed for any treatment.

During 2021, Hand screened 7 active ingredients and products for *R. solani* management on *Impatiens walleriana* 'Dazzler Lilac Splash'. Disease pressure was heavy with both disease incidence and severity reaching 100% in the inoculated controls (Table 11). The non-inoculated controls exhibited no disease. Treatments also demonstrating no disease incidence included the 21 fl oz rate of Postiva, the low rate of SP2478, and Empress. The high rate of SP2478 showed some low level infection but by the end of the experiment had no disease incidence. The 14 fl oz rate of Postiva exhibited low level infections throughout the experiment. The other treatments were similar to the inoculated control with 100% disease incidence and severity.

During 2022, Hand screened 9 active ingredients and products for *R. solani* management on *Impatiens walleriana* 'Beacon White'. Disease pressure was moderate to heavy with both disease incidence and severity reaching 67% in the inoculated controls (Table 12). The non-inoculated controls exhibited no disease. Treatments also demonstrating no disease incidence included BAS 673 05F at 6 and 12 fl oz, Medallion at 4 fl oz, Postiva at 21 fl oz, and SP2478 at 3.1 and 4.67 fl oz. Avelyo at 5 oz and Postiva at 14 fl oz showed some low level infection but by the end of the experiment had no disease incidence. MBI 121 performed similarly to the inoculated controls. MGCI, SP2700 WP and Tril 21 exhibited 100% disease severity and incidence by the end of the experiment. Some stunting was observed with BAS 673, Medallion, Postiva and BAS 673 at 6 fl oz.

Table 5. * Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani*, on Garden Impatiens (*Impatiens balsamina*) 'Super Elfin Mix', Benson, NC, 1999.

Treatment	Rate Per 100 Gal	Infected Transplants (%) ^x at Days After Treatment				
		14	22	27	34	41
3336 50W (thiophanate methyl)	16 oz	0 b	0 b	0 b	0 c	0 c
Compass 50W (trifloxystrobin)	0.5 oz	3.3 b	3.3 b	0 b	13.3 b	56.7 b
Heritage 50WG (azoxystrobin)	0.23 oz	0 b	0 b	0 b	0 c	0 c
Heritage 50WG	0.45 oz	0 b	0 b	0 b	0 c	0 c
Heritage 50WG	0.9 oz	0 b	0 b	0 b	0 c	0 c
Heritage 50WG	0.23 oz	0 b	0 b	0 b	0 c	0 c
Heritage 50WG	0.45 oz	0 b	0 b	0 b	0 c	0 c
Heritage 50WG	0.9 oz	0 b	0 b	0 b	0 c	0 c
Heritage 50WG +Lescoc	0.23 oz + 8 fl oz	0 b	0 b	0 b	3.3 c	0 c
Heritage 50WG +Lescoc	0.45 oz + 8 fl oz	0 b	0 b	0 b	3.3 c	0 c
Heritage 50WG +Lescoc	0.9 oz + 8 fl oz	0 b	0 b	0 b	0 c	0 c
Untreated inoculated	-	53.3	63.3 a	76.7 a	86.7 a	93.3 a

* Not an IR-4 Experiment: F&N Tests 55:547. Not all treatments included in table.

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

Table 6. Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani*, on Garden Impatiens (*Impatiens balsamina*) ‘Super Elfin Salmon XP’, Hand, OH, 2013.

Treatment	Rate Per 100 Gal	Sep 17	Sep 20	Sep 23	Sep 26	Sep 29	Oct 2	Dry Wt (oz) ^y Oct 2
<i>Plant Death (%)^x</i>								
Cleary's 3336 50W (thiophanate methyl)	16 oz	0.0 a	0.0 a	0.0 a	30.0 ab	100.0 b	100.0 b	0.000 c
Heritage 50WG (azoxystrobin)	0.9 oz	0.0 a	0.0 a	10.0 a	10.0 a	10.0 a	10.0 a	0.022 ab
Heritage 50WG (azoxystrobin)	1.8 oz	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.025 a
Medallion 50WP (fludioxonil)	1 oz	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.016 b
Untreated inoculated	-	10.0 a*	20.0 a	20.0 a	60.0 b	90.0 b	100.0 b	0.000 c
<i>Leaf Wilt (%)</i>								
Cleary's 3336 50W (thiophanate methyl)	16 oz	0.0 a	53.2 b	64.0 b	88.0 b	100.0 b	100.0 b	
Heritage 50WG (azoxystrobin)	0.9 oz	0.0 a	10.0 a	10.0 a	10.0 a	10.0 a	10.0 a	
Heritage 50WG (azoxystrobin)	1.8 oz	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	
Medallion 50WP (fludioxonil)	1 oz	0.0 a	0.0 a	0.0 a	5.0 a	7.5 a	12.5 a	
Untreated inoculated	-	10.0 a*	26.0 a	26.0 a	60.0 b	90.0 b	100.0 b	

* Not an IR-4 Experiment: Plant Disease Management Reports 8:OT007.

^x Column means followed by the same letter are not significantly different based on Tukey's HSD test ($P=0.05$).

^y Column means followed by the same letter are not significantly different based on the Wilcoxon test ($P=0.05$).

Table 7. * Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani*, on Impatiens (*Impatiens walleriana*) ‘Super Elfin Lipstick’, Hand, OH, 2018.

Treatment	Rate Per 100 Gal	Obervation Dates			
		May 29	Jun 4	Jun 11	Jun 18
<i>Disease Incidence (%)^x</i>					
Astun™ SC (isofetamid)	13.5 fl oz	60.0 ab	90.0 a	90.0 a	90.0 a
	17.0 fl oz	20.0 bc	20.0 b	20.0 b	50.0 b
Terraguard SC (triflumizole)	6.0 fl oz	0.0 c	90.0 a	100.0 a	100.0 a
Untreated uninoculated	-	0.0 c	0.0 b	0.0 b	0.0 c
Untreated inoculated	-	70.0 a	80.0 a	80.0 a	90.0 a
<i>Disease Severity (%)^x</i>					
Astun™ SC (isofetamid)	fl oz	22.5 ab	86.0 a	87.0 a	87.5 a
	fl oz	6.5 ab	7.5 b	16.5 b	33.0 b
Terraguard SC (triflumizole)	fl oz	0.0 b	74.0 a	86.0 a	95.5 a
Untreated uninoculated	-	0.0 b	0.0 b	0.0 b	0.0 b
Untreated inoculated	-	35.0 a	80.0 a	80.0 a	82.0 a

* Not an IR-4 Experiment: Plant Disease Management Reports 13:OT009.

^x Means followed by same letter do not differ significantly based on Tukey HSD test ($P=0.05$).

Table 8. Efficacy for Rhizoctonia Stem Rot, *Rhizoctonia solani*, on Impatiens (*Impatiens walleriana*), Beckerman, IN, 2019.

Treatment and amount per 100 gallons	DAI ^z	% Severity			% Root Rot		
		13 May	13 Jun	18 Jul	13 May	13 Jun	18 Jul
Astun SC 13.5 fl oz	0, 14, 28	0.0	0.8 a ^y	20.0 bc	0.0	0.7 a	27.5 b
BASF 750 02 F 3 fl oz	-3, 14, 28	0.0	0.0 a	25.0 bc	0.0	0.0 a	29.2 b
Broadform F 4 fl oz	0, 14	0.0	21.7 a	50.0 ab	0.0	21.7 a	52.5 ab
Broadform F 6 fl oz	0, 14	0.0	47.5 a	66.7 a	0.0	50.0 a	78.8 a
MBI-110 EP 1% v/v	0, 14, 28	0.0	26.7 a	16.7c	0.0	35.8 a	25.0 b
MBI-110 EP 2% v/v	0, 14, 28	0.0	16.7 a	18.3 bc	0.0	20.0 a	38.3 ab
MBI-601 EP 0.18 oz/ft ³	-7	0.0	19.2 a	25.8 bc	0.0	22.5 a	29.2 b
MBI-601 EP 0.35 oz/ft ³	-7	0.0	9.2 a	17.5 c	0.0	15.0 a	44.2 ab
SP2700 SP 11 oz	-3, 28	0.0	9.2 a	25.0 bc	0.0	15.8 a	27.5 b
Inoculated Control	--	0.0	26.3 a	29.2 bc	0.0	29.2 a	51.7 ab
Noninoculated Control	--	0.0	5.0 a	17.5 c	0.0	4.2 a	21.7 b

^z Days after inoculation that fungicides were applied

^y Comparison of means by Tukey-HSD. Treatments connected by the same letters are not significantly

Table 9. Efficacy for Rhizoctonia Stem Rot, *Rhizoctonia solani*, on Impatiens (*Impatiens walleriana*) 'Super Elfin Red', Norman, FL, 2019.

Treatment	Rate Per 100 Gal	Application Method	Application Dates	% Leaf Damage ^x at 42 DAT
Astun (isofetamid)	13.5 fl oz	Drench	10/10, 10/24	46.0 b-e
BAS750 (mefentrifluconazole)	3 fl oz	Drench	10/7, 10/24	18.5 ab
Broadform (fluopyram + trifloxystrobin)	4 fl oz	Sprench	10/10, 10/24	0.0 a
	6 fl oz	Sprench	10/10, 10/24	0.0 a
Cleary's 3336 50W (thiophanate methyl)	8 fl oz	Drench	10/7	17.5 ab
MBI-601 (<i>Muscodor albus</i> strain SA-13)	5g/cu ft soil	Pot substrate incorp.	09/26	23.5 abc
	10g/cu ft soil		09/26	19.0 ab
Orkestra Int. (fluxapyroxad + pyraclostrobin)	10 fl oz	Drench	10/7, 10/24	1.0 a
Picatina (pydiflumetofen)	13.7 fl oz	Drench	10/7	28.5 a-d
Pvent (<i>Gliocladium catenulatum</i> strain J1446)	0.1% w/v	Drench	10/7, 10/10, 10/24	21.0 ab
SP2700 (SP2700)	11 fl oz	Drench	10/7, 10/24	58.0 e
Stargus/MBI-110 (<i>Bacillus amyloliquefaciens</i> strain F727)	2%	Drench	10/10, 10/24	56.0 de
ZeroTol 2.0 (hydrogen dioxide + peroxyacetic acid)	1 gal	Drench	10/10, 10/24	90.5 ef
Zio (<i>Pseudomonas chlororaphis</i> strain AFS009)	67 oz	Drench	10/7, 10/24	52.5 cde
	100 oz	Drench	10/7, 10/24	62.0 ef
Untreated uninoculated	-		-	0.0 a
Untreated inoculated	-		-	67.0 ef

^x Means followed by same letter do not differ significantly based on LSD test, (P=0.05).

Table 10. * Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani*, on Impatiens (*Impatiens walleriana*) ‘Super Elfin Lipstick, Hand, OH, 2019.

Treatment	Rate Per 100 Gal	Disease Severity (%) ^x	AUDPC
Astun SC (isofetamid)	13.5 fl oz	60 a	945.0 b
	17.0 fl oz	10 b	105.0 c
Heritage 50 WG (azoxystrobin)	4.0 oz	0 c	0.0 c
OHPF-1904	4.7 fl oz	0 c	0.0 c
Untreated uninoculated	-	0 c	0.0 c
Untreated inoculated	-	90 a	1767.5 a

* Not an IR-4 Experiment: Plant Disease Management Reports 13:OT009.

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

Table 11. Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani*, on Impatiens (*Impatiens walleriana*) ‘Dazzler Lilac Splash’, Hand, OH, 2021.

Product	Active Ingredient	Rate per 100 gal	Disease Incidence			Disease Severity		
			AUDPC*	Final (%)		AUDPC*	Final (%)	
BW161N	BW161N	5 oz	2650	a	100	2650	a	100
		3 oz	2650	a	100	2650	a	100
MBI-121	MBI-121	128 fl oz	2266.6	ab	83	2214	ab	83
Postiva	Pydiflumetofen + Difenconazole	14 fl oz	883.3	bc	33	778	bc	33
		21 fl oz	0	c	0	0	c	0
SP2478	SP2478	4.67 fl oz	58.3	c	0	18	c	0
		3.1 fl oz	0	c	0	0	c	0
SP2700 WP	SP2700	11 oz	2650	a	100	2650	a	100
		22 oz	2650	a	100	2650	a	100
Tril-21 (pre-inoculation)	Thyme Oil	64 fl oz	2650	a	100	2650	a	100
Tril-21 (post-inoculation)		64 fl oz	2650	a	100	2650	a	100
Empress Intrinsic	Pyraclostrobin	6 fl oz	0	c	0	0	c	0
Inoculated Control	Distilled water	N/A	2650	a	100	2650	a	100
Non-inoculated Control	Distilled water	N/A	0	c	0	0	c	0

*The area under the disease progress curve (AUDPC) was calculated for both incidence and severity data using the formula $\sum[(x_i+x_{i+1})/2] (t_{i+1}-t_i)$, where x_i is the disease level at a specific time interval ($t_{i+1} - t_i$). Because data were not normally distributed, the Kruskal-Wallis test and Pairwise Wilcoxon Rank Sum test were used for ANOVA and post-hoc analysis, respectively. Levels connected by the same letter are not significantly different ($p<0.05$).

Table 12. Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani*, on Impatiens (*Impatiens walleriana*) ‘Beason White’, Hand, OH, 2022.

Product/Rate per 100 gal	Disease Incidence*		Disease Severity	
	Final %	AUDPC	Final %	AUDPC
Avelyo 5 oz	0 a	35.7 a	0 a	3.2 a
BAS 673 05F 12 fl oz	0 a	0 a	0 a	0 a
BAS 673 05F 6 fl oz	0 a	0 a	0 a	0 a
MBI-121 128 fl oz	66.7 b	132.1 b	66.7 b	95.2 bc
Medallion 4 fl oz	0 a	0 a	0 a	0 a
MGCI 2.5 fl oz	100 b	169.1 b	100 b	158.4 c
MGCI 10 fl oz	100 b	169.1 b	100 b	147.7 c
Postiva 14 fl oz	0 a	42.3 a	0 a	8.15 ab
Postiva 21 fl oz	0 a	0 a	0 a	0 a
SP2478 4.67 fl oz	0 a	0 a	0 a	0 a
SP2478 3.1 fl oz	0 a	0 a	0 a	0 a
SP2700 WP 12 oz	100 b	169.1 b	100 b	151.6 c
SP2700 WP 24 oz	100 b	169.1 b	100 b	122.9 c
Tril-21 64 fl oz (pre-inoculation)	100 b	169.1 b	100 b	164.7 c
Tril-21 64 fl oz (post-inoculation)	100 b	169.1 b	100 b	160.8 c
Non-inoculated control	0 a	0 a	0 a	0 a
Inoculated control	66.7 b	133.7 b	66.7 b	107.1 c

*Data were analyzed using the Kruskal-Wallis test and means were separated using Pairwise Wilcoxon Ranks Sum ($\alpha=0.05$) as data were not normally distributed. Means followed by the same letter are not statistically significant.

Maple

During 2023, Baysal-Gurel studied 9 active ingredients and products to manage *R. solani* on maple (*Acer rubrum*) ‘October Glory’. Disease pressure was moderate to high with inoculated controls reaching 67% root rot severity. Nontreated, noninoculated controls exhibited no disease. All treatments exhibited statistically significant disease reduction except Tril-21. Pageeant provided 90 percent reduction in disease compared to inoculated controls, while the others ranged from 28 to 78 percent reduction. There was no impact on plant growth among treatments.

Table 13. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Maple (*Acer rubrum*) 'October Glory', Baysal-Gurel, TN, 2023.

Treatment (per 100 gal)	Height Increase (cm)	Width Increase (cm)	Total Plant Fresh Weight (g)	Root Fresh Weight (g)	Root Rot Severity (%)
BAS 673 05F 12 fl oz	19.0 a	6.9 a	109.9 a	40.5 a	21.7 b-f
MBI-121 128 fl oz	17.2 a	6.8 a	85.9 a	30.8 a	20.0 b-f
RD00AS-1 128 fl oz	19.2 a	7.6 a	102.3 a	31.7 a	36.7 bcd
SP2478 4.6 fl oz	17.0 a	7.3 a	83.3 a	34.9 a	15.8 efg
SP2700 WP 16 fl oz	18.3 a	7.7 a	106.9 a	38.3 a	18.3 d-g
Tril-21 64 fl oz	19.2 a	7.3 a	77.8 a	31.5 a	48.3 ab
Tril-21-preventative 64 fl oz	18.7 a	6.8 a	88.9 a	34.5 a	38.3 bc
Postiva-low 14 fl oz	19.7 a	6.4 a	103.4 a	29.9 a	32.5 b-e
Postiva-high 21 fl oz	19.0 a	6.0 a	78.5 a	34.5 a	35.8 bcd
Pageant 18 fl oz	20.7 a	7.3 a	92.6 a	39.5 a	6.7 fg
Non-treated, inoculated control	15.8 a	6.1 a	85.8 a	37.0 a	66.7 a
Non-treated, non-inoculated control	20.8 a	7.6 a	99.6 a	32.1 a	0.0 g
<i>P</i> -value	0.108	0.5115	0.6449	0.8741	<.0001

*Values are the means of six replications; means followed by the same lowercase letters within a column are not significantly different at $P \leq 0.05$. Means were separated using the Tukey test.

Petunia

In 1999, Moorman conducted a greenhouse trial to determine efficacy of several fungicides applied as drench for the control of Rhizoctonia crown rot, *Rhizoctonia solani*, on petunia (*Petunia x hybrida*). All treated plants were healthier than the untreated checks, but Heritage protected plants better than Banrot or 3336 F.). The addition of wetting agent did not significantly improve the performance of Heritage. Slight chlorosis developed in all Heritage treated plants.

In 2006, Reddy conducted a greenhouse trial for IR-4 to determine efficacy of several fungicides applied as drench for the control of Rhizoctonia root rot, *Rhizoctonia solani*, on petunia (*Petunia x hybrida*). Treatments were applied at 1 and 2 weeks after transplanting. All treatments provided excellent protection against a severe disease pressure resulting in higher healthy plant stand and vigor (Table 15). No evidence of phytotoxicity was observed for any treatment.

In 2020, Beckerman examined 9 active ingredients and products for management of *R. solani* on Petunia. Disease pressure was moderate, and noninoculated controls had low level infections with inoculated controls exhibiting increasing severity through 2 months after inoculation (Table 16). Treatments with severity consistent with the noninoculated controls include BW161N WP 3 oz, MBI 121 128 fl oz, SP2700 SP 11 oz, and Pyraziflumid 20SC 4.67 fl oz. All other treatments were statistically equivalent to the inoculated control even if some disease reduction occurred. No injury occurred with treatments with the exception of TXC2020 which exhibited severe injury.

Table 14. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Petunia (*Petunia x hybrida*) 'Fantasy Hybrid Crystal Red', Moorman, PA, 1999.

Treatment	Rate Per 100 Gal	Amount per sq ft	Disease Rating (%) ^x	
			Nov 16	Nov 23
3336 F (thiophanate methyl)	20 fl oz	1 pt	2.0 c	3.1 d
Banrot 40WP (etr Diazole + thiophanate methyl)	8 oz	1 pt	2.9 d	3.1 d
Heritage 50WG (azoxystrobin)	0.23 oz	1 pt	1.4 ab	1.5 ab
Heritage 50WG	0.45 oz	1 pt	1.1 a	2.0 b
Heritage 50WG	0.9 oz	1 pt	1.0 a	1.7 ab
Heritage 50WG	0.23 oz	2 pt	1.0 a	1.4 ab
Heritage 50WG	0.45 oz	2 pt	1.0 a	1.1 a
Heritage 50WG	0.9 oz	2 pt	1.0 a	1.0 a
Heritage 50WG +Lesco	0.23 oz + 4 fl oz	1 pt	2.2 c	2.4 bc
Heritage 50WG +Lesco	0.45 oz + 4 fl oz	1 pt	1.0 a	1.0 a
Heritage 50WG +Lesco	0.9 oz + 4 fl oz	1 pt	1.3 ab	2.3 bc
Untreated inoculated	-	-	4.0 e**	4.0 e

* Not an IR-4 Experiment: F&N Tests 56:OT021.

^x 1 = no disease; 2 = slight yellowing or stunting, plants marketable; 3 = moderate yellowing and some wilting, not marketable; 4 = obvious lesion, dying leaves or stems, not marketable; 5 = dead. Means followed by same letter do not differ significantly based on Tukey's Studentized Range (HSD) test (P=0.05).

Table 15. Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Petunia (*Petunia x hybrida*), Reddy, AL, 2006.

Treatment	Rate Per 100 Gal	Vigor ^x	% Healthy Stand	% Pre-emergence Damping-off	% Post-emergence Damping-off	Root rot Severity ^y
Actinovate (<i>Streptomyces lydicus</i>)	10 oz	4.5*	65.4*	21.1*	12.8*	4.7*
Adorn (fluopicolide)	30 ml	4.5*	57.8*	12.9*	11.2*	5.3*
	60 ml	5.0*	62.1*	7.9*	6.9*	3.1*
BioPhos (Dipotassium phosphate)	1 gal	4.6*	61.2*	34.5	18.8	4.9*
	2 gal	4.8*	69.9*	22.1*	8.7*	2.3*
Disarm (fluoxastrobin)	3 oz	5.0*	52.6*	31.3	12.7*	2.2*
Fenstop (fenamidone)	7 oz	3.9*	49.8*	17.9*	16.9	5.6*
	14 oz	4.7*	66.7*	11.3*	6.8*	3.1*
Hymexazole (hymexazole)	6 oz	4.5*	65.7*	25.8*	23.1	6.7
	12 oz	4.5*	75.6*	11.8*	7.9*	4.1*
Micora (mandipropamid)	2 oz	4.0*	49.5*	31.8	16.9	6.5
	8 oz	4.2*	65.1*	17.9*	5.4*	3.3*
Multiguard (furfural)	250 ppm	4.1*	58.2*	15.9*	8.9*	4.7*
	500 ppm	5.0*	68.7*	8.9*	4.2*	2.8*
Promax (thyme oil)	2 gal	4.5*	48.9*	22.6*	19.9	4.1*
Segway (cyazofamid)	1.5 oz	3.9*	58.9*	22.6*	11.3*	5.1*
	3.0 oz	4.5*	64.7*	12.8*	5.9*	2.3*
Vital (potassium phosphite)	2 pt	4.0*	58.7*	35.7	19.7	5.6
	4 pt	4.5*	67.9*	25.7*	7.8*	2.1*
Untreated uninoculated	-	4.3*	85.7*	12.2*	4.9*	1.3*
Untreated inoculated	-	2.2	31.6	41.1	21.9	7.1
LSD $P = 0.05$	-	0.9	11.2	12.3	6.5	1.5

^x Vigor is rated as 1 = very poor, 2 = Poor, 3 = better, 4 = Good, and 5 = very good.

^y Root rot severity rated on a scale of 1-10. 1 = no symptoms, very healthy. 2 = 10-20% discoloration, 3 = 20-30% discoloration, 4 = 30-40% discoloration, 5 = 40-50% discoloration, 6 = 50-60% discoloration, 7 = 60-70% discoloration, 8 = 70-80% discoloration, 9 = 80-90% discoloration, and 10 = dead.

*Significantly different from pathogen control according to Fisher's protected LSD at $P = 0.05$

Pre-emergence damping-off was rated 21 days after transplanting. Post-emergence was rated 45 days after transplanting.

Table 16. Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Petunia (*Petunia x hybrida*), Beckerman, IN, 2023.

Treatment and amount per 100 gallon	Fungicide application DAI ^z	Mean Severity (%)			Mean Phytotoxicity (%)	
		20 Jun	20 Jul	20 Aug	20 Jun	20 Aug
Noninoculated Control	-	0	27.5 cd ^y	25.0 cd	0	0 c
Inoculated Control	-	0	30.0 cd	79.2 a	0	0 c
BW161N WP 3 oz	-3, 14	0	9.2 d	12.5 d	0	0 c
BW161N WP 5 oz	-3, 14	0	45.0 bcd	39.2 abcd	0	0 c
MBI 121 128 fl oz	-3, 7, 14	0	25.0 cd	22.5 cd	0	0 c
Postiva SC 14 fl oz	-3, 14	0	30.0 cd	30.8 abcd	0	0 c
Postiva SC 21 fl oz	-3, 14	0	47.5 bcd	60.0 abcd	0	0 c
SP2480 SC 15 fl oz	0, 7, 14	0	45.0 bcd	35.8 abcd	0	0 c
SP2480 SC 25 fl oz	0, 7, 14	0	34.2 cd	39.2 abcd	0	0 c
SP2700 SP 11 oz	0, 7, 14	0	17.5 cd	24.0 cd	0	0 c
SP2700 SP 22 oz	0, 7, 14	0	45.0 bcd	34.2 abcd	0	0 c
TXC2020 64 fl oz	-3, 3	0	97.5 a	70.0 abc	0	97.5 a
TXC2020 64 fl oz	7, 14	0	90.0 ab	78.3 ab	0	93.3 b
Pyraziflumid 20SC 3.1 fl oz	-3, 14	0	25.8 cd	30.0 bcd	0	0 c
Pyraziflumid 20SC 4.67 fl oz	-3, 14	0	30.8 cd	25.0 cd	0	0 c
Pyraziflumid 20SC 6.2 fl oz	-3, 14	0	50.8 abcd	35.8 abcd	0	0 c
Astun SC 17 fl oz	-3, 7, 14	0	42.5 abcd	31.7 abcd	0	0 c
Topsin 4.5 FL (3336) 12 fl oz	-3, 7, 14	0	59.2 abc	63.3 abc	0	0 c

^z Days after inoculation

^y Comparison of means by Tukey-HSD. Treatments connected by the same letters are not significantly different.

Poinsettia

In 2000, Benson conducted a greenhouse trial to determine efficacy of 2 fungicides for the control of Rhizoctonia stem and root rot, *Rhizoctonia solani*, on poinsettia (*Euphorbia pulcherrima*). Both soak and spray treatments of Heritage even at the lowest rate provided very effective control of a severe Rhizoctonia stem rot pressure (Table 17). Rooted cuttings initially soaked or sprayed with Heritage and transplanted for finishing grew as well as plants in the non-infested control and did not develop stem or root rot. The standard 3336 provided inferior control.

In 2008, Beckerman conducted a greenhouse trial to determine efficacy of several fungicides for the control of Rhizoctonia crown rot, *Rhizoctonia solani*, on poinsettia (*Euphorbia pulcherrima*). Granular fungicides A14912A and A14912F were incorporated into the potting substrate prior to transplanting. Medallion and Heritage were applied as soil drenches 3 days after transplant. Plants were allowed to establish for 11 days prior to inoculation. Plants treated with fungicides showed no cankering or infection sites on either the stem or the leaves (Table 18). The lowest and highest rates of A14912A and the two lowest rates of A14912F had plant quality ratings statistically similar to Medallion and Heritage. The highest rate of A14912A and the middle rate of A14912F were statistically similar to the non-inoculated control in plant quality at the final evaluation date. No evidence of phytotoxicity was observed for any treatment.

Table 17. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Poinsettia (*Euphorbia pulcherrima*) 'Angelica White', Benson, NC, 2000.

Treatment	Rate Per 100 Gal	Applic Method	Propagation				Finishing			
			Stem Rot ^x			Root Rating ^y	Ht (cm)	Wt (g)	Root Rot ^z	Stem Rot
			Day 6	Day 27	Day 41	Day 41	Day 87	Day 88	Day 88	Day 88
Cleary's 3336 50W (thiophanate methyl)	16 oz	Spray	1.1 b	3.0 b	4.2 b	2.0 c	22.7 c	25.3 b	1.0 a	3.3 a
Heritage 50WG (azoxystrobin)	1 oz	Soak	1.0 b	1.2 c	1.8 c	4.0 b	27.0 a	45.7 a	1.1 a	1.1 b
Heritage 50WG	2 oz	Soak	1.2 b	1.3 c	1.5 cd	4.2 b	26.8 a	43.4 a	1.0 a	1.1 b
Heritage 50WG	2 oz	Spray	1.1 b	1.3 c	1.8 c	4.2 b	25.6 abc	46.2 a	1.2 a	1.3 b
Heritage 50WG	4 oz	Spray	1.2 b	1.2 c	1.7 c	4.1 b	26.3 ab	39.3 a	1.2 a	1.0 b
Untreated uninoculated	-		1.0 b	1.0 c	1.0 d	4.9 a	23.6 bc	36.7 ab	1.3 a	1.0 b
Untreated inoculated	-	-	4.2 a	5.0 a	5.0 a	1.0 d	n.a.	n.a.	n.a.	n.a.

* Not an IR-4 Experiment: F&N Tests 56:OT023.

^x Stem rot was on a 1-5 scale: 1 = healthy, no infection; 2 = stem lesions less than 25% of stem; 3 = stem lesions 25-50% of stem; 4 = stem girdled, but foliage still green; and 5 = stem girdled, plant dead. Means followed by same letter do not differ significantly based on Waller-Duncan k-ratio, t-test, k=100 (P=0.05).

^y Rooting of cuttings was rated as 1 = no roots visible on any of the four sides of the wedge; 2 = roots protruded through one side of the wedge; 3 = roots protruded through two sides of the wedge; 4 = roots protruded through three sides of the wedge; and 5 = roots protruded through all four sides of the wedge

^z Root rot was on a 1-5 scale: 1 = healthy, no infection; 2 = 25% of roots rotted; and 5 = plant dead.

Table 18. * Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani*, on Poinsettia (*Euphorbia pulcherrima*) ‘Prestige Red’, Beckerman, IN, 2008.

Treatment	Rate Per 100 Gal	Disease Severity Rating ^x			Infected Area ^y	Plant Quality ^z
		Oct 28	Nov 4	Nov 11	Nov 11	Nov 11
A14912A	0.6 oz/ cu ft	1.0 a	1.0 a	1.0 a	1.0 a	1.6 cd
A14912A	1.2 oz/ cu ft	1.0 a	1.0 a	1.0 a	1.0 a	1.8 d
A14912A	1.8 oz/ cu ft	1.0 a	1.0 a	1.0 a	1.0 a	1.3 abc
A14912F	0.6 oz/ cu ft	1.0 a	1.0 a	1.0 a	1.0 a	1.4 bc
A14912F	1.2 oz/ cu ft	1.0 a	1.0 a	1.0 a	1.0 a	1.1 ab
A14912F	1.8 oz/ cu ft	1.0 a	1.0 a	1.0 a	1.0 a	1.8 d
Heritage 50WG (azoxystrobin)	0.9 oz	1.0 a	1.0 a	1.0 a	1.0 a	1.4 bc
Medallion 50WP (fludioxonil)	2 oz	1.0 a	1.0 a	1.0 a	1.0 a	1.4 bc
Untreated uninoculated	-	1.0 a	1.0 a	1.0 a	1.0 a	1.0 a
Untreated inoculated	-	1.8 b	2.0 b	4.2 b	2.4 b	4.1 e

* Not an IR-4 Experiment: Plant Disease Management Reports 3:OT028.

^x Disease severity was on a 1-6 scale: 1=0%, 2=20%, 3=40%, 4=60%, 5=80%, 6=100% stem infection. Means followed by same letter do not differ significantly based on Waller-Duncan *k*-ratio, *t*-test, *k*=100, (P=0.0001).

^y Infected leaf area was on a 1-6 scale: 1=0%, 2=20%, 3=40%, 4=60%, 5=80%, 6=100 leaf area infected.

^z Plant quality was on a 1-5 scale: 1=plant symptom free, 2=callusing visible on stem, 3=small canker visible at the base of plant, 4=cankering and lesions advanced along stem, 5=severe infection of the stem and leaves

Snapdragon

In 2003, Daughtrey conducted a greenhouse trial to determine efficacy of several fungicides applied as drench for the control of Rhizoctonia stem canker, *Rhizoctonia solani*, on snapdragon (*Antirrhinum majus*). Terraclor provided the best control of a severe disease pressure resulting in plant dry weights similar to the uninoculated control plants; Terraguard was less effective, while Banrot and Cleary 3336 were ineffective (Table 19). No evidence of phytotoxicity was observed with any of the treatments.

Table 19. * Efficacy for Rhizoctonia Stem Canker, *Rhizoctonia solani*, on Snapdragon (*Antirrhinum majus*) ‘Rocket Golden’, Daughtrey, NY, 2009.

Treatment	Rate Per 100 Gal	Stem Canker (%) ^x		Dry Wt (oz)
		Jun 2	Jun 17	Jun 17
Banrot 40WP (etridiazole + thiophanate methyl)	8 oz	45.0 c	65.0 d	0.05 a
Cleary 3336 50W (thiophanate methyl)	4 oz	40.0 c	45.0 cd	0.06 ab
Terraclor 75WP (PCNB)	4 oz	10.0 ab	10.0 ab	0.11 cd
Terraguard 50W (triflumizole)	4 oz	10.0 ab	25.0 abc	0.09 c
Untreated uninoculated	-	0.0 a	0.0 a	0.13 d
Untreated inoculated	-	55.0 c	70.0 d	0.05 a

* Not an IR-4 Experiment: F&N Tests 59:OT047. Not all treatments included in table.

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

Viburnum

In 2016, Baysal-Gurel conducted a field trial to determine efficacy of several fungicides for the control of Rhizoctonia root rot, *Rhizoctonia solani*, on viburnum (*Viburnum odoratissimum*). Treatments were applied as drench at various times from Jul 28 to Oct 20. All treatments significantly reduced Rhizoctonia root rot severity from a high disease pressure, with Mural, Empress Intrinsic and Pageant Intrinsic providing excellent control (Table 20). No evidence of phytotoxicity was observed for any treatment.

Table 20. *Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Viburnum (*Viburnum odoratissimum*), Baysal-Gurel, TN, 2016.

Treatment	Rate Per 100 Gal	Applic Interval	Disease severity (%) ^y	Plant weight (oz)	Root weight (oz)	Plant height (in)	Plant width (in)
Empress Intrinsic (pyraclostrobin)	3 fl oz	2, 5, 8, 11, 14	6.7 de	1.3 ab	0.8 ab	7.8 a	5.7 abc
IT-5103 WP	2 g/plant	2, 5, 8, 11, 14	37.7 b	0.9 c	0.5 bc	7.2 abc	5.4 bc
MBI 110 (<i>Bacillus amyloliquifaciens</i>)	1%	2-14	28.4 c	0.9 c	0.6 abc	6.5 bc	5.0 c
Mural 45WG (azoxystrobin + benzovindiflupyr)	3 oz	2, 5, 8, 11, 14	5.9 de	1.4 ab	0.9 a	8.5 a	6.1 abc
Pageant Intrinsic 38WG (pyraclostrobin + boscalid)	18 oz	2, 5, 8, 11, 14	13.6 d	1.5 a	0.8 ab	8.0 a	6.9 a
RootShield PLUS WP (<i>Trichoderma harzianum</i> + <i>T. virens</i>)	8 oz	2, 10	26.5 c	0.9 c	0.6 abc	7.8 a	5.5 bc
SoilGard (<i>Gliocladium virens</i>)	2 lb	2	24.3 c	1.0 bc	0.6 abc	7.4 abc	5.7 abc
Untreated uninoculated	-	-	3.7 e	1.5 a	0.8 ab	8.5 a	6.7 ab
Untreated inoculated	-	-	63.3 a	0.7 c	0.4 c	6.2 c	5.3 c
P-value	-	-	≤0.0001	0.0008	0.0643	0.0799	0.0150

* Not an IR-4 Experiment: Plant Disease Management Reports 11:OT003. Not all treatments included in table.

^z Application dates: 2=Jul 28; 3=Aug 4; 4=Aug 11; 5=Aug 18; 6=Aug 25; 7=Sep 8; 8=Sep 11; 9=Sep 15; 10=Sep 22; 11=Sep 29; 12=Oct 6; 13=Oct 13; 14=Oct 20.

^y Disease severity was based on the percentage of roots affected.

^x Columns means with a letter in common are not significantly different based on Fisher's LSD test.

In 2017, Baysal-Gurel conducted a greenhouse trial to determine efficacy of several fungicides for the control of Rhizoctonia root rot, on viburnum. Treatments were applied as drench weekly from Feb 27 to May 16. All treatments, except RootShield *PLUS*⁺, MBI 110 and SoilGard, significantly reduced Rhizoctonia root rot severity from a moderate to high disease pressure; Mural, Empress Intrinsic, Pageant Intrinsic, and IT-5103 provided the most effective control (Table 21). No evidence of phytotoxicity was observed for any treatment.

Table 21. *Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Viburnum (*Viburnum odoratissimum*), Baysal-Gurel, TN, 2017, Greenhouse Trial.

Treatment	Rate Per 100 Gal	Applic Dates ^y	Disease severity (%) ^x	Plant height (in)	Plant width (in)
Empress Intrinsic 23.8SC (pyraclostrobin)	3 fl oz	2,5,8,11	16.0 b	2.1	4.8
IT-5103 WP (<i>Trichoderma</i> spp.)	2g/plant	2,5,8,11	19.0 b	1.1	3.5
MBI 110 (<i>Bacillus amyloliquifaciens</i>)	1 %	2-13	26.0 ab	1.7	3.0
Mural 45WG (azoxystrobin + benzovindiflupyr)	3 oz	2,5,8,11	10.0 b	2.8	3.7
Pageant Intrinsic 38WG (pyraclostrobin + boscalid)	18 oz	2,5,8,11	22.0 b	2.2	5.6
RootShield Plus (<i>Trichoderma harzianum</i> + <i>T. virens</i>)	8 oz	2,10	38.0 ab	3.6	3.2
SoilGard (<i>Gliocladium virens</i> strain GL-21)	2 lb	2	32.0 ab	2.3	3.9
Untreated uninoculated	-	-	10.0 b	2.1	5.7
Untreated inoculated	-	-	60.0 a	2.3	4.4
<i>P</i> -value	-	-	0.0010	0.2139	0.2373

* Not an IR-4 Experiment: Plant Disease Management Reports 12:OT020. Not all treatments included in table.

^y Application dates: 1=Feb 27; 2=Feb 28; 3=Mar 7; 4=Mar 14; 5=Mar 21; 6=Mar 28; 7=Apr 4; 8=Apr 11; 9=Apr 18, 10= Apr 25, 11=May 2; 12=May 9; 13=May 16.

^x Disease severity was based on the percentage of roots affected. Columns means with a letter in common are not significantly different based on Tukey test.

In 2017, Baysal-Gurel also conducted a field trial to determine efficacy of several fungicides for the control of *Rhizoctonia* root rot, on viburnum. Treatments were applied as drench at different time intervals starting after transplanting from Aug 8 to Oct 31 according to the table below. All treatments significantly reduced *Rhizoctonia* root rot severity from a high disease pressure; Mural, Empress Intrinsic and Pageant Intrinsic provided the most effective control (Table 22). No evidence of phytotoxicity was observed for any treatment.

Zinnia

In 2003, Hausbeck conducted a greenhouse trial to determine efficacy of several fungicides for the control of *Rhizoctonia* root rot, *Rhizoctonia solani*, on zinnia (*Zinnia elegans*). Treatments were applied as drench on Jun 27, Jul 3, 10, 18 and 25. All treatments, except Banrot, completely prevented plant death from a severe disease pressure (Table 23).

Table 22. *Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on *Viburnum* (*Viburnum odoratissimum*), Baysal-Gurel, TN, 2017, Field Trial.

Treatment	Rate Per 100 Gal	Applic Interval	Disease severity (%) ^y	Plant weight (oz)	Root weight (oz)	Plant height (in)	Plant width (in)
Empress Intrinsic (pyraclostrobin)	3 fl oz	2, 5, 8, 11, 14	6.7 de	1.3 ab	0.8 ab	7.8 a	5.7 abc
IT-5103 WP	2 g/plant	2, 5, 8, 11, 14	37.7 b	0.9 c	0.5 bc	7.2 abc	5.4 bc
MBI 110 (<i>Bacillus amyloliquifaciens</i>)	1%	2-14	28.4 c	0.9 c	0.6 abc	6.5 bc	5.0 c
Mural 45WG (azoxystrobin + benzovindiflupyr)	3 oz	2, 5, 8, 11, 14	5.9 de	1.4 ab	0.9 a	8.5 a	6.1 abc
Pageant Intrinsic 38WG (pyraclostrobin + boscalid)	18 oz	2, 5, 8, 11, 14	13.6 d	1.5 a	0.8 ab	8.0 a	6.9 a
RootShield PLUS WP (<i>Trichoderma harzianum</i> + <i>T. virens</i>)	8 oz	2, 10	26.5 c	0.9 c	0.6 abc	7.8 a	5.5 bc
SoilGard (<i>Gliocladium virens</i>)	2 lb	2	24.3 c	1.0 bc	0.6 abc	7.4 abc	5.7 abc
Untreated uninoculated	-	-	3.7 e	1.5 a	0.8 ab	8.5 a	6.7 ab
Untreated inoculated	-	-	63.3 a	0.7 c	0.4 c	6.2 c	5.3 c
P-value	-	-	≤0.0001	0.0008	0.0643	0.0799	0.0150

* Not an IR-4 Experiment: Plant Disease Management Reports 12:OT025. Not all treatments included in table.

^z Application dates: 2=Jul 28; 3=Aug 4; 4=Aug 11; 5=Aug 18; 6=Aug 25; 7=Sep 8; 8=Sep 11; 9=Sep 15; 10=Sep 22; 11=Sep 29; 12=Oct 6; 13=Oct 13; 14=Oct 20.

^y Disease severity was based on the percentage of roots affected.

^x Columns means with a letter in common are not significantly different based on Fisher's LSD test.

Table 23. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Zinnia (*Zinnia elegans*) ‘Oklahoma Mix’, Hausbeck, MI, 2003.

Treatment	Rate Per 100 Gal	Applic Interval	Jul 3	Jul 10	Jul 17	Jul 25	Aug 4
<i>Plant Health^x</i>							
3336 50W (thiophanate methyl)	4.0 oz	14	1.3 a	1.3 a	1.3 a	1.3 a	1.3 a
Banrot 40WP (etrifiazole + thiophanate methyl)	8.0 oz	14	1.5 ab	1.6 a	1.6 a	1.6 a	1.6 a
Endorse (polyoxin D)	1.1 lb	7	1.0 a	1.1 a	1.1 a	1.3 a	1.3 a
Endorse (polyoxin D)	2.2 lb	14	1.0 a	1.1 a	1.1 a	1.3 a	1.3 a
Heritage 50WG (azoxystrobin)	4.0 oz	14	1.0 a	1.0 a	1.0 a	1.0 a	1.0 a
Medallion 50WP (fludioxonil)	2.0 oz	14	1.0 a	1.0 a	1.0 a	1.0 a	1.0 a
Terraclor 75WP (PCNB)	4.0 oz	14	1.3 a	1.3 a	1.3 a	1.3 a	1.3 a
Terraguard 50W (triflumizole)	4.0 oz	14	1.1 a	1.3 a	1.3 a	1.3 a	1.3 a
Untreated uninoculated	-	-	1.0 a	1.0 a	1.0 a	1.0 a	1.0 a
Untreated inoculated	-	-	1.5 ab	3.3 b	3.4 b	3.4 b	3.4 b
<i>Plant Death (%)</i>							
3336 50W (thiophanate methyl)	4.0 oz	14	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Banrot 40WP (etrifiazole + thiophanate methyl)	8.0 oz	14	12.5 b	12.5 b	12.5 b	12.5 b	12.5 b
Endorse (polyoxin D)	1.1 lb	7	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Endorse (polyoxin D)	2.2 lb	14	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Heritage 50WG (azoxystrobin)	4.0 oz	14	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Medallion 50WP (fludioxonil)	2.0 oz	14	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Terraclor 75WP (PCNB)	4.0 oz	14	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Terraguard 50W (triflumizole)	4.0 oz	14	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Untreated uninoculated	-	-	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Untreated inoculated	-	-	12.5 b	37.5 c	50.0 d	50.0 c	50.0 c

* Not an IR-4 Experiment: F&N Tests 59:OT015. Not all treatments included in table.

^x Rated on a scale of 1-5, where 1=healthy, 5=dead. Column means with a letter in common are not significantly different LSD test ($P=0.05$).

In 2010, Hausbeck conducted a greenhouse trial to determine efficacy of several fungicides for the control of *Rhizoctonia* crown and root rot, *Rhizoctonia solani*, on zinnia (*Zinnia elegans*). Fungicides were applied as drench on Apr 26 and May 24. All products provided excellent control a severe disease pressure (Table 24). No evidence of phytotoxicity was observed for any treatment.

In 2011, Hausbeck conducted a greenhouse trial to determine efficacy of several fungicides for the control of *Rhizoctonia* root rot, *Rhizoctonia solani*, on zinnia (*Zinnia elegans*). Fungicides were applied as drench on Mar 14 and 29. All treatments provided excellent control of a severe disease pressure, preventing death and resulting in significantly better plant health ratings (Table 25). A rate response was not observed among the 4 rates of Trinity tested. Only Trinity at 8 fl oz and Heritage had plant height

ratings statistically similar to the untreated uninoculated control. The biopesticide Veranda O was the only fungicide treatment that maintained a plant health rating of 1 by the Apr 5. No evidence of phytotoxicity was observed for any treatment.

In 2014, Hausbeck conducted a greenhouse trial to determine efficacy of several fungicides for the control of Rhizoctonia root rot, *Rhizoctonia solani*, on zinnia (*Zinnia elegans*). Fungicides were applied as drench on Jun 17. All treatments provided excellent control of a severe disease pressure (Table 26). BAS 703, Medallion and Pageant treated plants did not display any symptoms of *Rhizoctonia* infection throughout the trial. No evidence of phytotoxicity was observed for any treatment.

In 2016, Hausbeck conducted a greenhouse trial to determine efficacy of several fungicides for the control of Rhizoctonia root rot, *Rhizoctonia solani*, on zinnia (*Zinnia elegans*). Fungicides were applied as drench on Feb 24 and Mar 1. Except for RootShield, all treatments had significantly better disease severity ratings compared to the untreated control (Table 27). The industry standard Affirm was highly efficacious and resulted in symptomless plants for all rating dates. A rate response was observed between the Howler treatments with the 100 oz rate resulting in less plant death and a lower disease severity rating for all dates. No evidence of phytotoxicity was observed for any treatment.

Table 24. * Efficacy for Rhizoctonia Crown and Root Rot, *Rhizoctonia solani*, on Zinnia (*Zinnia elegans*) ‘Sahara Fire’, Hausbeck, MI, 2010.

Treatment	Rate Per 100 Gal	Health Rating ^x			Death (%)			Height (in.)
		May 6	May 12	Jun 8	May 6	May 12	Jun 8	Jun 8
Heritage 50WG (azoxystrobin)	0.9 oz	1.3 a	1.9 a	1.5 ab	0.0 a	0.0 a	0.0 a	5.6 abc
Medallion 50WP (fludioxonil)	2 oz	1.0 a	1.6 a	1.6 ab	0.0 a	0.0 a	0.0 a	5.8 abc
OHP 6672 4.5L (thiophanate methyl)	20 fl oz	1.0 a	1.1 a	1.4 ab	0.0 a	0.0 a	0.0 a	6.1 abc
Terraclor 75WP (PCNB)	8 oz	1.0 a	1.4 a	1.4 ab	0.0 a	0.0 a	0.0 a	5.4 bc
Tourney 50WDG (metconazole)	4 oz	1.1 a	1.6 a	2.1 ab	0.0 a	0.0 a	0.0 a	4.6 cd
V-10190 2.5SC	8 fl oz	1.3 a	3.0 b	3.3 c	0.0 a	25.0 b	50.0 b	3.1 de
V-10190 2.5SC	16 fl oz	1.0 a	1.6 a	1.5 ab	0.0 a	0.0 a	0.0 a	5.7 abc
Veranda O 11.3DF (polyoxin D)	8 oz	1.0 a	1.4 a	1.3 ab	0.0 a	0.0 a	0.0 a	6.8 ab
Untreated uninoculated	-	1.0 a	1.0 a	1.0 a	0.0 a	0.0 a	0.0 a	7.3 a
Untreated inoculated	-	3.1 b	3.5 b	3.6 c	25.0 b	50.0 c	62.5 b	2.4 e

* Not an IR-4 Experiment: Plant Disease Management Reports 5:OT016.

^x Rated on a scale of 1 to 5, where 1=healthy, 2=chlorosis/minor wilting, 3=moderate wilting, 4=severe wilting, 5=plant death. Column means with a letter in common are not significantly different based on Fishers Protected LSD test ($P=0.05$).

Table 25. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Zinnia (*Zinnia elegans*) ‘Exquisite Pink’, Hausbeck, MI, 2011.

Treatment	Rate Per 100 Gal	Health Rating ^x			Height (in.)	Death (%)
		Mar 24	Mar 31	Apr 5	Apr 5	Apr 5
Heritage 50WG (azoxystrobin)	4 oz	1.3 a	1.3 a	1.3 a	6.4 ab	0.0 a
Trinity SC (triticonazole)	6 fl oz	1.0 a	1.3 a	1.5 a	5.0 b	0.0 a
Trinity SC (triticonazole)	8 fl oz	1.0 a	1.0 a	1.3 a	6.7 ab	0.0 a
Trinity SC (triticonazole)	12 fl oz	1.0 a	1.0 a	1.2 a	4.5 b	0.0 a
Trinity SC (triticonazole)	24 fl oz	1.0 a	1.2 a	1.3 a	4.1 b	0.0 a
Veranda O 11.3DF (polyoxin D)	8 oz	1.0 a	1.0 a	1.0 a	5.3 b	0.0 a
Untreated uninoculated	-	1.0 a	1.0 a	1.0 a	8.4 a	0.0 a
Untreated inoculated	-	3.5 b	3.8 b	3.8 b	2.0 c	50.0 b

* Not an IR-4 Experiment: Plant Disease Management Reports 6:OT005.

^x Rated on a scale of 1 to 5, where 1=healthy, 2=chlorosis/stunting, 3=minor wilting, 4=moderate to severe wilting, 5=dead plant. Column means with a letter in common are not significantly different based on Student-Newman-Keuls test ($P=0.05$).

Table 26. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Zinnia (*Zinnia elegans*) ‘Exquisite Pink’, Hausbeck, MI, 2014.

Treatment	Rate Per 100 Gal	Health Rating ^x		Plant Death (%)	
		Jun 23	Jul 3	Jun 23	Jul 3
BAS 703 01F (fluxapyroxad + pyraclostrobin)	7 fl oz	1.0 a	1.0 a	0.0 a	0.0 a
BAS 703 01F	10 fl oz	1.0 a	1.0 a	0.0 a	0.0 a
BAS 703 01F	13 fl oz	1.0 a	1.0 a	0.0 a	0.0 a
Heritage 50WG (azoxystrobin)	0.9 oz	1.5 a	1.5 a	0.0 a	16.7 a
Medallion 50WP (fludioxonil)	2 oz	1.0 a	1.0 a	0.0 a	0.0 a
Pageant 38WG (pyraclostrobin + boscalid)	18 oz	1.0 a	1.0 a	0.0 a	0.0 a
Untreated uninoculated	-	1.0 a	1.0 a	0.0 a	0.0 a
Untreated inoculated	-	4.0 b	4.3 b	50.0 b	83.3 b

* Not an IR-4 Experiment: Plant Disease Management Reports 9:OT014.

^x Rated on a scale of 1 to 5, where 1=healthy, 2=stunting/chlorosis, 3=minor stunting, 4=moderate/severe stunting, 5=plant death. Column means with a letter in common are not significantly different based on LSD test ($P=0.05$).

Table 27. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Zinnia (*Zinnia elegans*) ‘Persian Carpet’, Hausbeck, MI, 2016.

Treatment	Rate Per 100 Gal	Health Rating ^x			Plant Death (%)		
		Mar 7	Mar 10	Mar 14	Mar 7	Mar 10	Mar 14
Affirm WDG (polyoxin D)	8 oz	1.0 a	1.0 a	1.0 a	0.0 a	0.0 a	0.0 a
Howler (<i>Pseudomonas chlororaphis</i>) + Capsil	67 oz + 6 fl oz	2.2 a	3.0 b	3.2 bc	16.7 ab	33.3 b	33.3 a
Howler + Capsil	100 oz + 6 fl oz	1.0 a	2.0 ab	1.8 ab	0.0 a	0.0 a	0.0 a
RootShield (<i>Trichoderma harzianum</i>)	5 oz	3.8 b	4.5 c	4.5 cd	50.0 b	83.3 c	83.3 b
Howler + Affirm WDG	67 oz + 4 oz	1.0 a	1.0 a	1.2 a	0.0 a	0.0 a	0.0 a
Untreated uninoculated	-	1.0 a	1.3 a	1.7 a	0.0 a	0.0 a	16.7 a
Untreated inoculated	-	4.2 b	5.0 c	5.0 d	50.0 b	100.0 c	100.0 b

* Not an IR-4 Experiment: Plant Disease Management Reports 6:OT005.

^x Rated on a scale of 1 to 5, where 1=healthy, 2=chlorosis/stunting, 3=minor wilting, 4=moderate to severe wilting, 5=dead plant. Column means with a letter in common are not significantly different based on Student-Newman-Keuls test ($P=0.05$).

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 product efficacy on *Rhizoctonia solani*. Products were selected based on interest in these products for testing in the 2019 Non-Oomycete Root Rot efficacy project, and on whether product is registered or not for this root rot species.

Azoxystrobin. Heritage applied as drench provided excellent efficacy on severe Rhizoctonia crown rot infections in 2 garden impatiens experiments and a poinsettia trial, and on a severe Rhizoctonia root rot infection in a petunia trial. It also provided excellent efficacy on Rhizoctonia stem rot in an impatiens greenhouse trial. When applied as a soak or spray, excellent Rhizoctonia root rot control was obtained in a poinsettia trial. When applied as drench, it provided excellent efficacy on severe Rhizoctonia root rot infections in 4 zinnia experiments.

Azoxystrobin + Benzovindiflupyr. Mural applied as drench provided excellent efficacy on severe Rhizoctonia root rot infection in 3 viburnum greenhouse and field trials.

Bacillus nakamurai (amyloliquifaciens) strain F727. MBI 110/Stargus applied as drench provided excellent efficacy on severe Rhizoctonia root rot infection in a viburnum field trial, but mediocre efficacy in a begonia greenhouse trial. It provided poor efficacy on Rhizoctonia stem rot infection in a garden impatiens experiment and mediocre efficacy on severe Rhizoctonia root rot infections in 2 viburnum greenhouse and field trials.

BAS 673. Excellent efficacy was observed in a greenhouse experiment with impatiens. In an experiment with maple, there was significant reduction in root rot.

Boscalid + Pyraclostrobin. Great reduction in root rot in maple with 18 fl oz per 100 gal.

BW161N. Variable efficacy observed in two experiments with impatiens and petunia.

Etridiazole + Thiophanate methyl. Banrot provided poor efficacy on a severe Rhizoctonia root rot infection in a petunia experiment and on a severe Rhizoctonia stem canker infection in a snapdragon trial.

Fludioxonil. Medallion applied as drench provided excellent efficacy on severe Rhizoctonia crown rot infections in two impatiens and a poinsettia experiment; it provided excellent efficacy on severe Rhizoctonia root rot infections in 3 zinnia experiments.

Fludioxonil + Mefenoxam. Hurricane applied as sprench provided excellent efficacy on a moderate Rhizoctonia stem rot infection in a chrysanthemum experiment.

Fluopyram + Trifloxystrobin. Broadform applied as sprench provided excellent efficacy on Rhizoctonia root and crown rot in a begonia and two impatiens greenhouse experiments.

Fluoxastrobin. Disarm applied as drench provided good efficacy on a severe Rhizoctonia root rot infection in a petunia experiment.

Flutolanil. Prostar applied as sprench provided excellent efficacy on Rhizoctonia root and crown rot in a begonia greenhouse trial.

Fluxapyroxad + Pyraclostrobin. BAS 703/Orchestra applied as drench provided excellent efficacy on a severe Rhizoctonia root rot infection in a zinnia trial, and good efficacy on Rhizoctonia stem rot in an impatiens greenhouse trial.

Furfural. Multiguard applied as drench provided good efficacy on a severe Rhizoctonia root rot infection in a petunia experiment.

Gliocladium catenulatum. Pvent applied as drench provided good efficacy on Rhizoctonia stem rot in an impatiens greenhouse trial.

Gliocladium virens. SoilGard applied as drench provided excellent efficacy on severe Rhizoctonia root rot infection in a viburnum field trial. It provided mediocre efficacy on severe Rhizoctonia root rot infections in 2 viburnum greenhouse and field trials.

Hydrogen dioxide + Peroxyacetic acid. ZeroTol applied as drench provided no efficacy on Rhizoctonia stem rot in an impatiens greenhouse trial.

Isofetamid. Astun applied as sprench provided poor efficacy on Rhizoctonia root and crown rot in greenhouse experiments with begonia and petunia. Applied as spray or drench, it provided poor to great efficacy in 4 impatiens experiments.

MBI-121. This active provided little impact on R. solani in two impatiens experiments, but great efficacy in an experiment with petunia.

Mefentriconazole. Aveylo applied as sprench provided excellent efficacy Rhizoctonia root and crown rot in a begonia greenhouse trial; as a drench, it provided good efficacy on Rhizoctonia stem rot in three impatiens greenhouse experiments.

Metconazole. Tourney applied as drench provided excellent efficacy on a severe Rhizoctonia root rot infection in a zinnia trial.

Muscodor albus strain SA-13. MBI-601 applied as pot substrate incorporation provided mixed efficacy (poor and excellent) on Rhizoctonia root and crown rot in a begonia greenhouse trial, and good efficacy on Rhizoctonia stem rot in an impatiens greenhouse trial.

Pentachloronitro-benzene. Terraclor applied as drench provided excellent efficacy on severe Rhizoctonia stem canker infection in a snapdragon trial, and on severe Rhizoctonia root rot infections in 2 zinnia trials.

Polyoxin D. This active ingredient applied as drench provided excellent efficacy on severe Rhizoctonia root rot infections in 4 zinnia trials.

Pseudomonas chlororaphis. Howler applied as drench provided good to excellent efficacy on a severe Rhizoctonia root rot infection in a zinnia trial. Zio applied as drench provided poor efficacy on Rhizoctonia stem rot in an impatiens greenhouse trial.

Pydiflumetofen. Picatina applied as drench provided good efficacy on Rhizoctonia stem rot in an impatiens greenhouse trial.

Pydiflumetofen + Difenconazole. Postiva provided excellent of *R. solani* in two impatiens experiments, but less control was observed in experiments with maple and petunia.

Pyraclostrobin. Empress Intrinsic applied as drench provided excellent efficacy on a severe Rhizoctonia root rot infection in 3 viburnum greenhouse and field experiments and one experiment with impatiens.

Pyraclostrobin + Boscalid. Pageant Intrinsic applied as drench provided good to excellent efficacy on severe Rhizoctonia root rot infections in 3 viburnum greenhouse and field trials, and excellent efficacy on severe Rhizoctonia root rot infections in 2 zinnia trials.

RD00AS-1. Some reduction of root rot in a single maple experiment.

SP2478. SP2478 provided excellent of *R. solani* in two impatiens experiments, but less control was observed in an experiment with maple.

SP2700. This active ingredient applied as drench provided good efficacy on Rhizoctonia stem rot infection in a garden impatiens experiment, but poor efficacy on Rhizoctonia root and crown rot in a begonia greenhouse trial.

Streptomyces lydicus. Actinovate applied as good provided excellent efficacy on a severe Rhizoctonia root rot infection in a petunia experiment.

Thiophanate methyl. Topsin applied as sprench provided excellent efficacy against a moderate Rhizoctonia stem rot infection in a chrysanthemum experiment. Applied as drench, 3336 provided excellent efficacy on severe Rhizoctonia root rot infections in 2 zinnia trials, excellent and poor efficacy on severe Rhizoctonia crown rot infections in 2 garden impatiens experiments, good efficacy on Rhizoctonia stem rot infection in a garden impatiens experiment, poor efficacy on severe Rhizoctonia root rot infections in a petunia and a poinsettia trial, and on a severe Rhizoctonia stem canker infection in a snapdragon trial.

Thyme oil. Promax applied as drench provided good efficacy on a severe Rhizoctonia root rot infection in a petunia experiment. No efficacy was observed with TXC2020 in a petunia experiment. Insufficient efficacy was observed with Tril-21 in two experiments with impatiens and one with maple.

Trichoderma harzianum. RootShield applied as drench provided poor efficacy on a severe Rhizoctonia root rot infection in a zinnia trial.

Trichoderma harzianum* & *T. virens. RootShield PLUS applied as drench provided mediocre to excellent efficacy on severe Rhizoctonia root rot infections in 3 viburnum greenhouse and field trials.

Trichoderma spp. IT-5103 applied as drench provided excellent and mediocre efficacy on severe Rhizoctonia root rot infections in 2 viburnum greenhouse and field trials.

Trifloxystrobin. Compass applied as drench provided excellent efficacy on a severe Rhizoctonia crown rot infection in a garden impatiens experiment.

Triflumizole. Terraguard applied as drench provided good efficacy on severe Rhizoctonia stem canker infection in a snapdragon trial; and on a severe Rhizoctonia root rot infection in a zinnia trial. However it was ineffective in an impatiens trial.

Triticonazole. Trinity applied as drench provided excellent efficacy on a severe Rhizoctonia root rot infection in a zinnia trial.

V-10190. This active ingredient applied as drench provided excellent efficacy on a severe Rhizoctonia root rot infection in a zinnia trial.

Phytotoxicity

No phytotoxicity was observed with the products listed above with the exception of Heritage causing a slight chlorosis in a petunia trial and Orkestra causing some leaf burn in an impatiens experiment.

Table 28. Summary of product efficacy for *Rhizoctonia solani* 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 11/20/23 are included in the table below.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
34270	3336 F (Thiophanate-methyl)	FRAC 1	Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 8 fl oz per 100 gal applied once; inferior to uninoculated check.
28103	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	American Evergreen (<i>Syngonium podophyllum</i>) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 16 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
27480	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Garden Snapdragon (<i>Antirrhinum majus</i>)	Greenhouse	Benson	NC	1997	Drench	Good efficacy at 8, 16, and 32 oz per 100 gal; no injury.
27480	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Garden Snapdragon (<i>Antirrhinum majus</i>)	Greenhouse	Benson	NC	1998	Drench	Good control of <i>Rhizoctonia solani</i> with 8, 16, and 32 oz per 100 gal; no injury at any rate.
27480	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Garden Snapdragon (<i>Antirrhinum majus</i>)	Greenhouse	Benson	NC	1999	Drench	Good control with 8, 16, and 32 oz per 100 gal; no injury.
27485	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Impatiens; Touch-me-not (<i>Impatiens</i> sp.) <i>I. wallerana</i>	Greenhouse	Benson	NC	1998	Drench	Good control with 8, 16, and 32 oz per 100 gal drenched at seeding into infested media.
27485	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Impatiens; Touch-me-not (<i>Impatiens</i> sp.) <i>I. wallerana</i>	Greenhouse	Benson	NC	1999	Drench	Great control with 8, 16, and 32 oz per 100 gal drenched at seeding into infested media.
27481	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Periwinkle, Madagascar (<i>Catharanthus roseus</i>)	Greenhouse	Benson	NC	1997	Drench	Good control of damping off with 8, 16, and 32 oz per 100 gal, but some germination inhibition was observed.
27481	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Periwinkle, Madagascar (<i>Catharanthus roseus</i>)	Greenhouse	Benson	NC	1998	Drench	Good control with 8, 16, and 32 oz per 100 gal; no injury observed.
27481	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Periwinkle, Madagascar (<i>Catharanthus roseus</i>)	Greenhouse	Benson	NC	1999	Drench	Good control with 8, 16, and 32 oz per 100 gal; no injury.
12261	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Petunia (<i>Petunia</i> sp.) <i>P. x hybrida</i>	Greenhouse	Benson	NC	1997	Drench	All three rates (8, 16, 32 oz per 100 gal) significantly improved seedling stands with no visible signs of phytotoxicity.
12261	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Petunia (<i>Petunia</i> sp.) <i>P. x hybrida</i>	Greenhouse	Benson	NC	1998	Drench	Good control with 8, 16, and 32 oz per 100 gal drenched at seeding; no injury.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
12261	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Petunia (Petunia sp.) P. x hybrida	Greenhouse	Benson	MD	1999	Drench	Good control with 8, 16, and 32 oz per 100 gal drenched at seeding; no injury.
11587	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Holly, Chinese (Ilex cornuta) 'Rotunda'	Field Container	Gill	GA	1977	Drench	Not enough disease to rate; no injury at 0.7 and 1.4 lb product per 100 gal.
11586	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Holly, Japanese (Ilex crenata) 'Rotundifolia'	Field Container	Gill	GA	1977	Drench	Not enough disease to rate; no injury at 0.7 and 1.4 lb product per 100 gal.
01329	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Azalea (Rhododendron sp.) 'Hershey's Red'	Field Container	Gill	GA	1977	Drench	Good efficacy at 0.7 and 1.4 lb per 100 gal with 1 cup solution per container.
01329	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Azalea (Rhododendron sp.) 'Hinodegiri'	Field Container	Gill	GA	1977	Drench	Good efficacy at 0.7 and 1.4 lb per 100 gal with 1 cup solution per container.
01330	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Boxwood (Buxus sp.) B. microphylla	Field Container	Gill	GA	1977	Drench	Not enough disease to rate; no phytotoxicity.
01333	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Juniper (Juniperus sp.) J. conferta	Field Container	Gill	GA	1977	Drench	Not enough disease to rate; no injury at 11.2 oz product per 100 gal.
26782	Actinovate Soluble (Streptomyces lydicus WYEC 108)	FRAC NC	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 10 oz per 100 gal
26781	Adorn 4F (Fluopicolide)	FRAC 43	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 30 and 60 ml per 100 gal
26788	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	FRAC 33	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 1 and 2 gal per 100 gal
33776	Astun (isofentamid)	FRAC 7	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Sprench	No efficacy with 13.5 fl oz per 100 gal applied twice weekly.
34259	Astun (isofentamid)	FRAC 7	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control with 13.5 fl oz per 100 gal applied twice; inferior to uninoculated check.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28101	Banrot I 30WP (Ethazole + thiabendazole)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 500 ppm, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was significantly higher than the untreated.
28102	Banrot II 40WP (Ethazole + thiophanate methyl)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 12 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
28102	Banrot II 40WP (Ethazole + thiophanate methyl)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Soil Incorporation	At 6 oz per cu yd, the number of surviving cuttings was equivalent to the untreated controls.
28102	Banrot II 40WP (Ethazole + thiophanate methyl)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Soil Incorporation	At 6 oz per cu yd, the number of surviving cuttings was higher than the untreated controls.
33777	BAS 750 02F (Mefentrifluconazole)	FRAC 3	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Sprenc	Excellent efficacy with 3 fl oz per 100 gal applied 3 times biweekly; comparable to non-inoculated check.
34260	BAS 750 02F (Mefentrifluconazole)	FRAC 3	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 3 fl oz per 100 gal applied twice; inferior to uninoculated check.
27940	Benlate 50WP (Benomyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	An equivalent number of roots between infested and uninfested treatments of 1.0 lb per 100 gal, both better than untreated infested and uninfested.
27940	Benlate 50WP (Benomyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	An equivalent number of roots between infested and uninfested treatments of 1.0 lb per 100 gal, both better than untreated infested and uninfested. The top weights of the Benomyl treated plants were higher than the control plants.
27940	Benlate 50WP (Benomyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was significantly higher than the untreated.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
27940	Benlate 50WP (Benomyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 8 and 16 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
27940	Benlate 50WP (Benomyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Soil Incorporation	At 6 and 12 oz per cu yd, the number of surviving cuttings was higher than the untreated controls.
27891	Benlate 50WP (Benomyl)	FRAC 1	Poinsettia (Euphorbia pulcherrima) 'Top Star'	Greenhouse	Neely	IL	1978	Drench	Excellent efficacy and no injury at 8, 16, and 32 oz per 100 gal.
33778	Broadform SC500 (Fluopyram + Trifloxystrobin)	FRAC 7 + 11	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Spreng	Excellent efficacy with 3 fl oz per 100 gal applied twice biweekly; comparable to non-inoculated check.
34261	Broadform SC500 (Fluopyram + Trifloxystrobin)	FRAC 7 + 11	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Excellent control with 4 and 6 fl oz per 100 gal applied twice; comparable to uninoculated check.
28074	Daconil 54EC (Chlorothalonil)	FRAC M5	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.5 lb per 100 gal) infested plants had more roots than untreated infested plants but not as many as uninfested plants. Top weights of the Daconil treated plants were equivalent to infested untreated plants. Top weights of the Daconil treated
28075	Demosan 65WP (Chloroneb)		American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was higher than the untreated but top weight was slightly higher than the untreated.
28075	Demosan 65WP (Chloroneb)		American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was slightly higher than the untreated.
28075	Demosan 65WP (Chloroneb)		American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.5 lb per 100 gal) infested plants had more roots than untreated infested plants but not as many as uninfested plants. Top weights of the Demosan treated plants were equivalent to infested untreated plants. Top weights of the Demosan treated

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
26787	Disarm 480SC (Fluoxastrobin)	FRAC 11	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor efficacy at 3 oz per 100 gal
26983	Endorse (Polyoxin D)	FRAC 19	Pink (Dianthus sp.) D. chinensis	Greenhouse	Hausbeck	MI	2002	Drench	No efficacy but also no injury.
26784	Fenstop (Fenamidone)	FRAC 11	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 7 and 14 oz per 100 gal
28076	Fermate 76WP (Ferbam)	FRAC M3	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	An equivalent number of roots between infested and uninfested treatments of 3.0 lb per 100 gal, both better than untreated infested and uninfested.
28076	Fermate 76WP (Ferbam)	FRAC M3	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, the number of surviving cuttings was equivalent to the untreated controls and sprouting was delayed compared to the other treatments.
28076	Fermate 76WP (Ferbam)	FRAC M3	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, the number of surviving cuttings was lower than the untreated controls, plus sprouting was delayed when compared to other treatments.
26789	Hymexazol 30L (Hymexazol)	FRAC 32	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 6 and 12 oz per 100 gal
33780	MBI 601 (Muscodor albus)		Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Soil Incorporation	Good efficacy with 5, but poor with 10, g per cu ft soil applied before potting; inferior to non-inoculated check.
34263	MBI 601 (Muscodor albus)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Soil Incorporation	Good control with 5 and 10 g per cu ft soil applied once; inferior to uninoculated check.
28098	Mertect 160 (60 WP) (Thiabendazole)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was equivalent to the untreated.
28098	Mertect 160 (60 WP) (Thiabendazole)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was significantly higher than the untreated.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28098	Mertect 160 (60 WP) (Thiabendazole)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.0 lb per 100 gal) infested plants had more roots than untreated infested plants equivalent to the uninfested plants. Top weights of the Mertect treated plants were almost equivalent to uninfested untreated plants.
26786	Micora (Mandipropamid)	FRAC 40	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 2 and 8 oz per 100 gal
26780	MultiGuard (Furfural)		Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 250 and 500 ppm
34265	Orkestra Intrinsic (Fluxapyroxad + pyraclostrobin)	FRAC7 + FRAC 11	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Excellent control with 10 fl oz per 100 gal applied twice; comparable to uninoculated check. Some leaf injury.
34266	Picatina (Pydiflumetofen)	FRAC 7	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 13.7 fl oz per 100 gal applied once; inferior to uninoculated check.
28077	Potassium azide (Potassium azide)		American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1000 ppm, there were no roots on the treated plants.
33622	Promax (Thyme Oil (3%))		Petunia (Petunia hybrida)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 1 gal per 100 gal.
33782	ProStar 70WP/WG (Flutaloniol)	FRAC 7	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Sprench	Excellent efficacy with 6 oz per 100 gal applied twice biweekly; comparable to non-inoculated check.
34267	Pvent (Gliocladium catenulatum Strain J1446)	FRAC NC	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 0.1% w/v applied 3 times; inferior to uninoculated check.
26783	Segway (Cyazofamid)	FRAC 21	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 1.5 and 3 oz per 100 gal
33781	SP2700 AS (SP2700)		Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Drench	Poor efficacy with 11 fl oz per 100 gal applied 3 times biweekly; inferior to non-inoculated check.
34264	SP2700 AS (SP2700)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control with 11 fl oz per 100 gal applied twice; inferior to uninoculated check.
33779	Stargus (Bacillus amyloliquefaciens strain F727)		Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Drench	Good efficacy with 1 and 2 % applied 3 times biweekly; inferior to non-inoculated check.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
34262	Stargus (Bacillus amyloliquefaciens strain F727)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control with 2 % per 100 gal applied twice; inferior to uninoculated check.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	An equivalent number of roots between infested and uninfested treatments of 1.0 lb per 100 gal, both better than untreated infested and uninfested.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was equivalent to the untreated but top weight was significantly higher than the untreated.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was slightly higher than the untreated.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 12 oz per 100 gal, the number of surviving cuttings was equivalent to the untreated controls.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 12 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.5 lb per 100 gal) infested plants had more roots than untreated infested plants but not as many as uninfested plants. Top weights of the Terraclor treated plants were equivalent to infested untreated plants. Top weights of the Terrachlor tr
26785	Vital 4L (Potassium phosphite)	FRAC 33	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 2 and 8 oz per 100 gal
34269	ZeroTol (Hydrogen dioxide)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	No control with 1 gal per 100 gal applied twice; inferior to uninoculated check.
34268	Zio (Pseudomonas chlororaphis strain AFS009)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control 100 oz per 100 gal applied twice; inferior to uninoculated check.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28100	Zyban 25WP (Thiophanate-methyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 3.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated but top weight was drastically lower than the untreated.

PR#	Product Actives	MOA Class	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
34270	3336 F (Thiophanate-methyl)	FRAC 1	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 8 fl oz per 100 gal applied once; inferior to uninoculated check.
34584	3336 F (Thiophanate-methyl)	FRAC 1	Petunia (Petunia x hybrida)	Greenhouse	Beckerman	IN	2020	Foliar	Poor efficacy on a moderate disease pressure at 12 fl oz per 100 gal applied 3 times; no visible phytotoxicity.
27480	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Garden Snapdragon (Antirrhinum majus)	Greenhouse	Benson	NC	1997	Drench	Good efficacy at 8, 16, and 32 oz per 100 gal; no injury.
27480	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Garden Snapdragon (Antirrhinum majus)	Greenhouse	Benson	NC	1998	Drench	Good control of Rhizoctonia solani with 8, 16, and 32 oz per 100 gal; no injury at any rate.
27480	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Garden Snapdragon (Antirrhinum majus)	Greenhouse	Benson	NC	1999	Drench	Good control with 8, 16, and 32 oz per 100 gal; no injury.
27481	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Periwinkle, Madagascar (Catharanthus roseus)	Greenhouse	Benson	NC	1997	Drench	Good control of damping off with 8, 16, and 32 oz per 100 gal, but some germination inhibition was observed.
27481	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Periwinkle, Madagascar (Catharanthus roseus)	Greenhouse	Benson	NC	1998	Drench	Good control with 8, 16, and 32 oz per 100 gal; no injury observed.
27481	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Periwinkle, Madagascar (Catharanthus roseus)	Greenhouse	Benson	NC	1999	Drench	Good control with 8, 16, and 32 oz per 100 gal; no injury.
27485	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Impatiens; Touch-me-not (Impatiens sp.) I. wallerana	Greenhouse	Benson	NC	1998	Drench	Good control with 8, 16, and 32 oz per 100 gal drenched at seeding into infested media.
27485	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Impatiens; Touch-me-not (Impatiens sp.) I. wallerana	Greenhouse	Benson	NC	1999	Drench	Great control with 8, 16, and 32 oz per 100 gal drenched at seeding into infested media.
12261	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Petunia (Petunia sp.) P. x hybrida	Greenhouse	Benson	NC	1997	Drench	All three rates(8, 16, 32 oz per 100 gal) significantly improved seedling stands with no visible signs of phytotoxicity.

12261	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Petunia (Petunia sp.) P. x hybrida	Greenhouse	Benson	NC	1998	Drench	Good control with 8, 16, and 32 oz per 100 gal drenched at seeding; no injury.
12261	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Petunia (Petunia sp.) P. x hybrida	Greenhouse	Benson	MD	1999	Drench	Good control with 8, 16, and 32 oz per 100 gal drenched at seeding; no injury.
28103	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 16 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
28103	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 16 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
25767	3336 WP (50%) (Thiophanate-methyl)	FRAC 1	Zinnia (Zinnia sp.) 'Oklahoma Mix'	Greenhouse	Hausbeck	MI	2005	Drench	Poor control of severe disease pressure at 1 lb per 100 gal.
01330	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Boxwood (Buxus sp.) B. microphylla	Field Container	Gill	GA	1977	Drench	Not enough disease to rate; no phytotoxicity.
01333	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Juniper (Juniperus sp.) J. conferta	Field Container	Gill	GA	1977	Drench	Not enough disease to rate; no injury at 11.2 oz product per 100 gal.
01329	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Azalea (Rhododendron sp.) 'Hershey's Red'	Field Container	Gill	GA	1977	Drench	Good efficacy at 0.7 and 1.4 lb per 100 gal with 1 cup solution per container.
01329	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	FRAC 1	Azalea (Rhododendron sp.) 'Hinodegiri'	Field Container	Gill	GA	1977	Drench	Good efficacy at 0.7 and 1.4 lb per 100 gal with 1 cup solution per container.
26782	Actinovate Soluble (Streptomyces lydicus WYEC 108)	FRAC BM02	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 10 oz per 100 gal
26781	Adorn 4F (Fluopicolide)	FRAC 43	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 30 and 60 ml per 100 gal
26788	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	FRAC P07	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 1 and 2 gal per 100 gal
33776	Astun (isofetamid)	FRAC 7	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Sprench	No efficacy with 13.5 fl oz per 100 gal applied twice weekly.
34259	Astun (isofetamid)	FRAC 7	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana)	Greenhouse	Beckerman	IN	2019	Drench	Reduction in disease severity and percent root rot at 13.5 fl oz per 100 gal at 3 weeks after inoculation, but no means separation between inoculated and noninoculated controls.
34259	Astun (isofetamid)	FRAC 7	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control with 13.5 fl oz per 100 gal applied twice; inferior to uninoculated check.

34583	Astun (isofetamid)	FRAC 7	Petunia (Petunia x hybrida)	Greenhouse	Beckerman	IN	2020	Foliar	Mediocre efficacy on a moderate disease pressure at 17 fl oz per 100 gal applied 3 times; no visible phytotoxicity.
33777	Avelyo Fungicide (Mefentrifluconazole)	FRAC 3	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Sprenc	Excellent efficacy with 3 fl oz per 100 gal applied 3 times biweekly; comparable to non-inoculated check.
34260	Avelyo Fungicide (Mefentrifluconazole)	FRAC 3	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana)	Greenhouse	Beckerman	IN	2019	Drench	Reduction in disease severity and percent root rot at 3 fl oz per 100 gal at 3 weeks after inoculation, but no means separation between inoculated and noninoculated controls.
34260	Avelyo Fungicide (Mefentrifluconazole)	FRAC 3	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Excellent efficacy with 5 oz per 100 gal.
34260	Avelyo Fungicide (Mefentrifluconazole)	FRAC 3	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 3 fl oz per 100 gal applied twice; inferior to uninoculated check.
28101	Banrot I 30WP (Ethazole + thiabendazole)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 500 ppm, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was significantly higher than the untreated.
28102	Banrot II 40WP (Ethazole + thiophanate methyl)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 12 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
28102	Banrot II 40WP (Ethazole + thiophanate methyl)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 12 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
28102	Banrot II 40WP (Ethazole + thiophanate methyl)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Soil Incorporation	At 6 oz per cu yd, the number of surviving cuttings was equivalent to the untreated controls.
28102	Banrot II 40WP (Ethazole + thiophanate methyl)	FRAC 14 + FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Soil Incorporation	At 6 oz per cu yd, the number of surviving cuttings was higher than the untreated controls.
35433	BAS 673 05F (BAS 673 05F)		Maple, Red (Acer rubrum) 'October Glory'	Field Container	Baysal-Gurel	TN	2023	Drench	Statistically significant reduction in root rot (68% control) with 12 fl oz per 100 gal.
35523	BAS 673 05F (BAS 673 05F)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Excellent efficacy with 6 and 12 fl oz per 100 gal.
27891	Benlate 50WP (Benomyl)	FRAC 1	Poinsettia (Euphorbia pulcherrima) 'Top Star'	Greenhouse	Neely	IL	1978	Drench	Excellent efficacy and no injury at 8, 16, and 32 oz per 100 gal.

27891	Benlate 50WP (Benomyl)	FRAC 1	Poinsettia (<i>Euphorbia pulcherrima</i>) 'Eckespoint C-1'	Greenhouse	Strider	NC	1977	Drench	Good curative efficacy after inoculation, but limited efficacy 0.5, 1, 2, 3, 4, and 7 days after inoculation with 4 oz per 100 gal.
33778	Broadform SC500 (Fluopyram + Trifloxystrobin)	FRAC 7 + FRAC 11	Clubed Begonia (<i>Begonia semperflorens</i>) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Sprenc	Excellent efficacy with 3 fl oz per 100 gal applied twice biweekly; comparable to non-inoculated check.
34261	Broadform SC500 (Fluopyram + Trifloxystrobin)	FRAC 7 + FRAC 11	Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>)	Greenhouse	Beckerman	IN	2019	Drench	Disease severity and percent root rot at 4 and 6 fl oz per 100 gal at 3 weeks after inoculation were the same or higher than the inoculated and noninoculated controls.
34261	Broadform SC500 (Fluopyram + Trifloxystrobin)	FRAC 7 + FRAC 11	Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Excellent control with 4 and 6 fl oz per 100 gal applied twice; comparable to uninoculated check.
34549	BW161N (BW161N)		Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Dazzler Lilac Splash'	Greenhouse	Hand	OH	2021	Drench	Insufficient efficacy with 3 and 5 oz per 100 gal under heavy disease pressure.
34576	BW161N (BW161N)		Petunia (<i>Petunia x hybrida</i>)	Greenhouse	Beckerman	IN	2020	Drench	Excellent efficacy on a moderate disease pressure at 3 oz per 100 gal applied twice, mediocre at 5 oz; no visible phytotoxicity.
25769	Captan (Captan)	FRAC M4	Zinnia (<i>Zinnia</i> sp.) 'Oklahoma Mix'	Greenhouse	Hausbeck	MI	2005	Drench	Poor control of severe disease pressure at 2 lb per 100 gal; some injury (leaf tip burn).
28074	Daconil 54EC (Chlorothalonil)	FRAC M5	American Evergreen (<i>Syngonium podophyllum</i>) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.5 lb per 100 gal) infested plants had more roots than untreated infested plants but not as many as uninfested plants. Top weights of the Daconil treated plants were equivalent to infested untreated plants. Top weights of the Daconil treated
28075	Demosan 65WP (Chloroneb)		American Evergreen (<i>Syngonium podophyllum</i>) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar <i>Rhizoctonia</i> was higher than the untreated but top weight was slightly higher than the untreated.
28075	Demosan 65WP (Chloroneb)		American Evergreen (<i>Syngonium podophyllum</i>) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar <i>Rhizoctonia</i> was reduced compared to

									the untreated and top weight was slightly higher than the untreated.
28075	Demosan 65WP (Chloroneb)		American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.5 lb per 100 gal) infested plants had more roots than untreated infested plants but not as many as uninfested plants. Top weights of the Demosan treated plants were equivalent to infested untreated plants. Top weights of the Demosan treated
26787	Disarm 480SC (Fluoxastrobin)	FRAC 11	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor efficacy at 3 oz per 100 gal
35054	Empress Intrinsic Brand Fungicide (Pyraclostrobin)	FRAC 11	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Dazzler Lilac Splash'	Greenhouse	Hand	OH	2021	Drench	Excellent efficacy with no disease incidence with 6 fl oz per 100 gal. No injury observed.
26983	Endorse (Polyoxin D)	FRAC 19	Pink (Dianthus sp.) D. chinensis	Greenhouse	Hausbeck	MI	2002	Drench	No efficacy but also no injury.
25766	Endorse (Polyoxin D)	FRAC 19	Zinnia (Zinnia sp.) 'Oklahoma Mix'	Greenhouse	Hausbeck	MI	2005	Drench	100 % control of severe disease pressure at 1.6 lb per 100 gal.
26784	Fenstop (Fenamidone)	FRAC 11	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 7 and 14 oz per 100 gal
28076	Fermate 76WP (Ferbam)	FRAC M3	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	An equivalent number of roots between infested and uninfested treatments of 3.0 lb per 100 gal, both better than untreated infested and uninfested.
28076	Fermate 76WP (Ferbam)	FRAC M3	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, the number of surviving cuttings was equivalent to the untreated controls and sprouting was delayed compared to the other treatments.
28076	Fermate 76WP (Ferbam)	FRAC M3	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, the number of surviving cuttings was lower than the untreated controls, plus sprouting was delayed when compared to other treatments.
25768	Heritage (Azoxystrobin)	FRAC 11	Zinnia (Zinnia sp.) 'Oklahoma Mix'	Greenhouse	Hausbeck	MI	2005	Drench	Poor control of severe disease pressure at 0.9 oz per 100 gal.
26789	Hymexazol 30L (Hymexazol)	FRAC 32	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 6 and 12 oz per 100 gal
35434	MBI 121 (MBI 121)		Maple, Red (Acer rubrum) 'October Glory'	Field Container	Baysal-Gurel	TN	2023	Drench	Statistically significant reduction in root rot (70% control) with 128 fl oz per 100 gal.

34550	MBI 121 (MBI 121)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Dazzler Lilac Splash'	Greenhouse	Hand	OH	2021	Drench	Insufficient efficacy with 128 fl oz per 100 gal under heavy disease pressure.
34550	MBI 121 (MBI 121)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Little impact on disease development with 128 fl oz per 100 gal.
34577	MBI 121 (MBI 121)		Petunia (Petunia x hybrida)	Greenhouse	Beckerman	IN	2020	Drench	Great efficacy on a moderate disease pressure at 128 fl oz per 100 gal applied 3 times; no visible phytotoxicity.
33780	MBI 601 (Muscodor albus)	FRAC BM02	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Soil Incorporation	Good efficacy with 5, but poor with 10, g per cu ft soil applied before potting; inferior to non-inoculated check.
34263	MBI 601 (Muscodor albus)	FRAC BM02	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana)	Greenhouse	Beckerman	IN	2019	Soil Incorporation	Disease severity and percent root rot at 0.18 and 0.35 oz per cubic foot at 3 weeks after inoculation were the same or higher than the inoculated and noninoculated controls.
34263	MBI 601 (Muscodor albus)	FRAC BM02	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Soil Incorporation	Good control with 5 and 10 g per cu ft soil applied once; inferior to uninoculated check.
35890	Medallion (Fludioxonil)	FRAC 12	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Excellent efficacy with 4 fl oz per 100 gal.
25770	Medallion (Fludioxonil)	FRAC 12	Zinnia (Zinnia sp.) 'Oklahoma Mix'	Greenhouse	Hausbeck	MI	2005	Drench	100 % control of severe disease pressure at 2 oz per 100 gal.
28098	Mertect 160 (60 WP) (Thiabendazole)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was equivalent to the untreated.
28098	Mertect 160 (60 WP) (Thiabendazole)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was significantly higher than the untreated.
28098	Mertect 160 (60 WP) (Thiabendazole)	FRAC 1	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.0 lb per 100 gal) infested plants had more roots than untreated infested plants equivalent to the uninfested plants. Top weights of

									the Mertect treated plants were almost equivalent to uninfested untreated plants.
35522	MGCI (MGCI)		Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Little impact on disease development with 2.5 and 10 fl oz per 100 gal.
26786	Micora (Mandipropamid)	FRAC 40	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 2 and 8 oz per 100 gal
26780	MultiGuard (Furfural)		Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 250 and 500 ppm
34265	Orkestra Intrinsic (Fluxapyroxad + pyraclostrobin)	FRAC 7 + FRAC 11	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Excellent control with 10 fl oz per 100 gal applied twice; comparable to uninoculated check. Some leaf injury.
35893	Pageant Intrinsic (Boscalid + pyraclostrobin)	FRAC 7 + FRAC 11	Maple, Red (Acer rubrum) 'October Glory'	Field Container	Baysal-Gurel	TN	2023	Drench	Statistically significant reduction in root rot (90% control) with 18 fl oz per 100 gal.
34266	Picatina (Pydiflumetofen)	FRAC 7	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 13.7 fl oz per 100 gal applied once; inferior to uninoculated check.
35892	Postiva (pydiflumetofen + difenoconazole)	FRAC 7 + FRAC 3	Maple, Red (Acer rubrum) 'October Glory'	Field Container	Baysal-Gurel	TN	2023	Sprenc	Statistically significant reduction in root rot (46-51% control) with 14 and 21 fl oz per 100 gal.
34551	Postiva (pydiflumetofen + difenoconazole)	FRAC 7 + FRAC 3	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Dazzler Lilac Splash'	Greenhouse	Hand	OH	2021	Drench	Excellent efficacy with no to some disease incidence and severity with 14 and 21 fl oz per 100 gal. No injury observed.
34551	Postiva (pydiflumetofen + difenoconazole)	FRAC 7 + FRAC 3	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Excellent efficacy with 14 and 21 fl oz per 100 gal.
34578	Postiva (pydiflumetofen + difenoconazole)	FRAC 7 + FRAC 3	Petunia (Petunia x hybrida)	Greenhouse	Beckerman	IN	2020	Sprenc	Mediocre efficacy on a moderate disease pressure at 14 and 21 fl oz per 100 gal applied twice; no visible phytotoxicity.
28077	Potassium azide (Potassium azide)		American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1000 ppm, there were no roots on the treated plants.
33622	Promax (Thyme oil)	FRAC BM01	Petunia (Petunia x hybrida)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 1 gal per 100 gal.
33782	ProStar 70WP/WG (Flutalonil)	FRAC 7	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Sprenc	Excellent efficacy with 6 oz per 100 gal applied twice biweekly; comparable to non-inoculated check.
34267	Pvent (Gliocladium catenulatum Strain J1446)	FRAC BM02	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Good control with 0.1% w/v applied 3 times; inferior to uninoculated check.

35436	RD00AS-1 (BW159) (BW159)		Maple, Red (<i>Acer rubrum</i>) 'October Glory'	Field Container	Baysal- Gurel	TN	2023	Drench	Statistically significant reduction in root rot (45% control) with 128 fl oz per 100 gal.
26783	Segway (Cyazofamid)	FRAC 21	Petunia (<i>Petunia</i> sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 1.5 and 3 oz per 100 gal
25765	Segway (Cyazofamid)	FRAC 21	Zinnia (<i>Zinnia</i> sp.) 'Oklahoma Mix'	Greenhouse	Hausbeck	MI	2005	Drench	No control of severe disease pressure at 1.5 and 3 fl oz per 100 gal.
35437	SP2478 (SP2478)		Maple, Red (<i>Acer rubrum</i>) 'October Glory'	Field Container	Baysal- Gurel	TN	2023	Drench	Statistically significant reduction in root rot (76% control) with 4.6 fl oz per 100 gal.
34552	SP2478 (SP2478)		Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens</i> <i>walleriana</i>) 'Dazzler Lilac Splash'	Greenhouse	Hand	OH	2021	Drench	Excellent efficacy with no to slight disease incidence and severity with 3.1 and 4.67 fl oz per 100 gal. No injury observed.
34552	SP2478 (SP2478)		Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens</i> <i>walleriana</i>) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Excellent efficacy with 3.1 and 4.67 fl oz per 100 gal.
34579	SP2480 (SP2480)		Petunia (<i>Petunia</i> x <i>hybrida</i>)	TBD	Beckerman	IN	2020	Drench	Mediocre efficacy on a moderate disease pressure at 15 and 24 fl oz per 100 gal applied 3 times; no visible phytotoxicity.
33781	SP2700 AS (SP2700)		Clubed Begonia (<i>Begonia</i> <i>semperflorens</i>) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Drench	Poor efficacy with 11 fl oz per 100 gal applied 3 times biweekly; inferior to non-inoculated check.
34264	SP2700 AS (SP2700)		Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens</i> <i>walleriana</i>)	Greenhouse	Beckerman	IN	2019	Drench	Some reduction in disease severity and percent root rot at 11 oz per 100 gal at 3 weeks after inoculation, but no means separation between inoculated and noninoculated controls.
34264	SP2700 AS (SP2700)		Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens</i> <i>walleriana</i>) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control with 11 fl oz per 100 gal applied twice; inferior to uninoculated check.
35438	SP2700 WP (SP2700)		Maple, Red (<i>Acer rubrum</i>) 'October Glory'	Field Container	Baysal- Gurel	TN	2023	Drench	Statistically significant reduction in root rot (73% control) with 16 fl oz per 100 gal.
34553	SP2700 WP (SP2700)		Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens</i> <i>walleriana</i>) 'Dazzler Lilac Splash'	Greenhouse	Hand	OH	2021	Drench	Insufficient efficacy with 11 and 22 oz per 100 gal under heavy disease pressure.
34553	SP2700 WP (SP2700)		Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens</i> <i>walleriana</i>) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Little impact on disease development with 12 and 24 oz per 100 gal.
34580	SP2700 WP (SP2700)		Petunia (<i>Petunia</i> x <i>hybrida</i>)	Greenhouse	Beckerman	IN	2020	Drench	Great efficacy on a moderate disease pressure at 311 fl oz per 100 gal

									applied 3 times, mediocre at 22 fl oz; no visible phytotoxicity.
33779	Stargus (Bacillus nakamurai strain F727)	IRAC UNF & FRAC BM02	Clubed Begonia (Begonia semperflorens) 'Bada Bing Scarlet'	Greenhouse	Norman	FL	2018	Drench	Good efficacy with 1 and 2 % applied 3 times biweekly; inferior to non-inoculated check.
34262	Stargus (Bacillus nakamurai strain F727)	IRAC UNF & FRAC BM02	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana)	Greenhouse	Beckerman	IN	2019	Drench	Disease severity and percent root rot at 1% and 2% v:v at 3 weeks after inoculation were the same or higher than the inoculated and noninoculated controls.
34262	Stargus (Bacillus nakamurai strain F727)	IRAC UNF & FRAC BM02	Impatiens, Common Garden; Buzzy Lizzy (Impatiens walleriana) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control with 2 % per 100 gal applied twice; inferior to uninoculated check.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	An equivalent number of roots between infested and uninfested treatments of 1.0 lb per 100 gal, both better than untreated infested and uninfested.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was equivalent to the untreated but top weight was significantly higher than the untreated.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated and top weight was slightly higher than the untreated.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 12 oz per 100 gal, the number of surviving cuttings was equivalent to the untreated controls.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 12 oz per 100 gal, the number of surviving cuttings was higher than the untreated controls.
28099	Terraclor 75WP (PCNB)	FRAC 14	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	The treated (1.5 lb per 100 gal) infested plants had more roots than untreated infested plants but not as many as uninfested plants. Top weights of the Terraclor treated plants were equivalent to infested untreated

									plants. Top weights of the Terrachlor tr
35439	Tril-21 (Thyme oil)	FRAC BM01	Maple, Red (<i>Acer rubrum</i>) 'October Glory'	Field Container	Baysal-Gurel	TN	2023	Drench	Statistically significant reduction in root rot (28% control curative, 43% control preventative) with 64 fl oz per 100 gal.
34554	Tril-21 (Thyme oil)	FRAC BM01	Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Dazzler Lilac Splash'	Greenhouse	Hand	OH	2021	Drench	Insufficient efficacy with 64 fl oz per 100 gal applied pre or post inoculation under heavy disease pressure.
34554	Tril-21 (Thyme oil)	FRAC BM01	Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Beacon White'	Greenhouse	Hand	OH	2022	Drench	Little impact on disease development with 64 fl oz per 100 gal applied pre or post inoculation.
34581	TXC2020 (Thyme oil)	FRAC BM01	Petunia (<i>Petunia x hybrida</i>)	Greenhouse	Beckerman	IN	2020	Sprenc	No efficacy on a moderate disease pressure at 64 fl oz per 100 gal applied twice, with first applic. pre- or post-inoculation; severe injury occurred with both pre- and -post inoculation applications.
26785	Vital 4L (Potassium phosphite)	FRAC P07	Petunia (<i>Petunia</i> sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 2 and 8 oz per 100 gal
34269	ZeroTol (Hydrogen dioxide)	FRAC NC	Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	No control with 1 gal per 100 gal applied twice; inferior to uninoculated check.
34268	Zio (<i>Pseudomonas chlororaphis</i> strain AFS009)	FRAC BM02	Impatiens, Common Garden; Buzzy Lizzy (<i>Impatiens walleriana</i>) 'Super Elfin Red'	Greenhouse	Norman	FL	2019	Drench	Poor control 100 oz per 100 gal applied twice; inferior to uninoculated check.
28100	Zyban 25WP (Thiophanate-methyl)	FRAC 1	American Evergreen (<i>Syngonium podophyllum</i>) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 3.5 lb per 100 gal, there was no impact on root development, but the number of pots infested with foliar Rhizoctonia was reduced compared to the untreated but top weight was drastically lower than the untreated.

Appendix 1: Contributing Researchers

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