https://www.ir4project.org/ehc/environmental-horticulture-research-summaries/

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

Rhizoctonia solani

Authors: Ely Vea and Cristi Palmer
Date: September 5, 2018

Acknowledgements
Amy Abate
Susan Bierbrunner

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

Table of Contents

Table of Contents 2
Table of Tables 3
Abstract 4
Introduction 4
Materials and Methods 4
Results 7
Comparative Efficacy on Rhizoctonia solani 7
Chrysanthemum 7
Garden Impatiens 7
Petunia 8
Poinsettia 11
Snapdragon 13
Viburnum 14
Zinnia 15
Efficacy Summary by Product/Active Ingredient 18
Azoxystrobin. 18
Azoxystrobin + Benzovindiflupyr 18
Bacillus amyloliquifaciens 18
Etridiazole + Thiophanate methyl 18
Fludioxonil. 18
Fludioxonil+Mefenoxam. 18
Fluoxastrobin. 18
Fluxapyroxad + Pyraclostrobin 18
Furfural 18
Gliocladium virens 18
Metconazole. 18
Pentachloronitro-benzene 18
Polyoxin D 18
Pseudomonas chlororaphis. 19
Pyraclostrobin. 19
Pyraclostrobin + Boscalid. 19
Streptomyces lydicus 19
Thiophanate methyl. 19
Thyme oil 19
Trichoderma harzianum 19
Trichoderma harzianum & T. virens. 19
Trifloxystrobin. 19
Triflumizole 19
Triticonazole. 19
V-10190 19
Phytotoxicity 19
Appendix 1: Contributing Researchers 28

Table of Tables

Table 1. List of Products and Rates Tested on Ornamental Horticulture Plants from 1999 to 2016. 5
Table 2. * Efficacy for Rhizoctonia Stem Rot, Rhizoctonia solani, on Chrysanthemum (Chrysanthemum morifolium) ‘Goldcrest Yellow', Beckerman, IN, 2011. 7
Table 3. * Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani,* on Garden Impatiens (*Impatiens balsamina*) ‘Super Elfin Mix', Benson, NC, 1999. 8
Table 4. Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani,* on Garden Impatiens (*Impatiens balsamina*) ‘Super Elfin Salmon XP', Hand, OH, 2013. 8
Table 5. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Petunia (*Petunia x hybrida*) ‘Fantasy Hybrid Crystal Red', Moorman, PA, 1999. 9
Table 6. Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani*, on Petunia (*Petunia x hybrida*), Reddy, AL, 2006. 10
Table 7. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani,* on Poinsettia (*Euphorbia pulcherrima*) ‘Angelica White', Benson, NC, 2000. 12
Table 8. * Efficacy for Rhizoctonia Crown Rot, *Rhizoctonia solani,* on Poinsettia (*Euphorbia pulcherrima*) ‘Prestige Red', Beckerman, IN, 2008. 13
Table 9. * Efficacy for Rhizoctonia Stem Canker, *Rhizoctonia solani,* on Snapdragon (*Antirrhinum majus*) ‘Rocket Golden', Daughtrey, NY, 2009. 13
Table 10. *Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani,* on Viburnum (*Viburnum odoratissimum*), Baysal-Gurel, TN, 2016. 14
Table 11. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani,* on Zinnia (*Zinnia elegans*) ‘Oklahoma Mix', Hausbeck, MI, 2003. 15
Table 12. * Efficacy for Rhizoctonia Crown and Root Rot, *Rhizoctonia solani,* on Zinnia (*Zinnia elegans*) ‘Sahara Fire', Hausbeck, MI, 2010. 16
Table 13. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani,* on Zinnia (*Zinnia elegans*) ‘Exquisite Pink’, Hausbeck, MI, 2011. 17
Table 14. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani,* on Zinnia (*Zinnia elegans*) ‘Exquisite Pink’, Hausbeck, MI, 2014. 17
Table 15. * Efficacy for Rhizoctonia Root Rot, *Rhizoctonia solani,* on Zinnia (*Zinnia elegans*) ‘Persian Carpet’, Hausbeck, MI, 2016. 17
Table 16. Summary of product efficacy by pathogen and crop. 20

Abstract

From 1999 to 2016, numerous products representing 36 active ingredients were evaluated in several greenhouse experiments as soil drench, soil incorporation, foliar or soak application, and in one field trial as soil drench, against *Rhizoctonia solani*. Trials were conducted on chrysanthemum, garden impatiens, petunia, poinsettia, snapdragon, viburnum and zinnia. The relatively new registered products Affirm/Endorse/Veranda O (polyoxin D), Heritage (azoxystrobin), Medallion (fludioxonil) and Pageant Intrinsic (pyraclostrobin + boscalid) showed excellent efficacy. Although there were insufficient data for definitive conclusions, BAS 703/Orkestra, Compass, Disarm, Empress Intrinsic, Hurricane, Promax, Tourney and Trinity generally provided excellent efficacy. The biological products Actinovate, Howler, MBI-110, RootShield PLUS and SoilGard also provided good to excellent efficacy in limited number of tests. Of the established standards, Terraclor provided excellent efficacy, while 3336 generally provided inconsistent efficacy.

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 available data from 14 ornamental reports presented in individual tables. The source of report is included under each data table. One trial from 8 reports submitted to the IR-4 project before 2018 is included as one of the individual tables in this report. Efficacy data from the 7 other trials from 1973 to 1999 are included in the 'Summary of product efficacy by pathogen and crop' table. Additional data will be added when received from researchers.

Materials and Methods

From 1999 to 2016, numerous products representing 36 active ingredients were evaluated in greenhouse and field trials as soil drench, soil incorporation, foliar, soak application against *Rhizoctonia solani*. Trials were conducted on 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.Eight researchers were involved in the testing (Appendix 1).

Products were supplied by their respective manufacturers.

For IR-4 testing, the following protocol was used: 18-005. Please visit http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm to view and download this protocol.

Table 1. List of Products and Rates Tested on Ornamental Horticulture Plants from 1999 to 2016.

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 ga1	2
				0.45 oz per 100 ga1	2
				0.90 oz per 100 ga1	6
				1.80 oz per 100 ga1	1
				4 oz per 100 ga1	2
			Soak	1 oz per 100 ga1	1
				2 oz per 100 ga1	
			Spray	2 oz per 100 ga1	1
				4 oz per 100 ga1	
Azoxystrobin + Benzovindiflupyr	Mural 45WG	Syngenta	Drench	3 oz per 100 ga1	1
Bacillus amyloliquifaciens	MBI 110	Marrone	Drench	1 gal per 100 ga1	1
CGA173506	CGA173506	Syngenta	Sprench	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 ga1	1
				2 gal per 100 ga1	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
Fludioxonil + Mefenoxam	Hurricane	Syngenta	Sprench	4 oz per 100 gal	1
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
Fluxapyroxad + Pyraclostrobin	BAS 703 01F	BASF	Drench	7 fl oz per 100 gal 10 fl oz per 100 gal 14 fl oz per 100 gal	1
Furfural	Multiguard	Agriguard	Drench	250 ppm	1
				500 ppm	1
Gliocladium virens	SoilGard	Certis	Drench	2 lb per 100 gal	1
Hymexazole	Hymexazole	Sumitomo	Drench	6 oz per 100 gal	1
				12 oz per 100 gal	1
IT-5103	IT-5103 WP		Drench	2 g per plant	1
Mandipropamid	Micora	Syngenta	Drench	2 oz per 100 gal	1
				8 oz per 100 gal	1
Metconazole	Tourney	Valent	Drench	4 oz per 100 gal	1
	Terraclor 75WP	Chemtura	Drench	4 oz per 100 gal	2

Active Ingredient(s)	Trade Name(s)	Manufacturer	Rate(s) Tested		# Trials
Pentachloronitro-benzene				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
Pseudomonas chlororaphis	Howler	AgBiome	Drench	67 oz per 100 gal	1
Pyraclostrobin	Empress Intrinsic	BASF	Drench	3 fl oz per 100 gal	1
Pyraclostrobin Boscalid +	Pageant Intrinsic	BASF	Drench	18 oz per 100 gal	2
Streptomyces lydicus	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	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
Trichoderma harzianum	RootShield	BioWorks	Drench	5 oz per 100 gal	1
Trichoderma harziamum + T. virens	RootShield Plus	BioWorks	Drench	8 oz per 100 gal	1
Trifloxystrobin	Compass 50WG	Bayer	Drench	0.5 oz per 100 gal	1
Triflumizole	Terraguard	Chemtura	Drench	4 oz per 100 gal	2
Triticonazole	Trinity	BASF	Drench	6 fl oz per 100 gal 8 fl oz per 100 gal 12 fl oz per 100 gal 24 fl oz per 100 gal	1
V-10190	V-10190 2.5SC	Valent	Drench	8 fl oz per 100 gal	1
				16 fl oz per 100 gal	1

Results

Comparative Efficacy on Rhizoctonia solani

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 2). No evidence of phytotoxicity was observed for any treatment.

Table 2. * 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 3). 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 4). 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.

Table 3. * 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 +Lesco	0.23 oz + 8 fl oz	0 b	0 b	0 b	3.3 c	0 c
Heritage 50WG +Lesco	0.45 oz + 8 fl oz	0 b	0 b	0 b	3.3 c	0 c
Heritage 50WG +Lesco	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 4. 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
		Plant Death (%) [x]						
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
		Leaf Wilt (%)						
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 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).

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 (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 6). No evidence of phytotoxicity was observed for any treatment.

Table 5). 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 6). No evidence of phytotoxicity was observed for any treatment.

Table 5. * 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 (etridiazole + 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 6. 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 (*Streptomyces lydicus*)	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.

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 7). 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 8). 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 7. * 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 8. * 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 9). No evidence of phytotoxicity was observed with any of the treatments.

Table 9. * 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 10). No evidence of phytotoxicity was observed for any treatment.

Table 10. *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 (*Bacillus amyloliquifaciens*)	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 (*Trichoderma harzianum + T. virens*)	8 oz	2, 10	26.5 c	0.9 c	0.6 abc	7.8 a	5.5 bc
SoilGard (*Gliocladium virens*)	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.

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 11).

Table 11.* 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
Plant Health [x]							
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 (etridiazole + 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
Plant Death (%)							
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 (etridiazole + 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 12). 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 13). 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 14). 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. With the exception of RootShield, all treatments had significantly better disease severity ratings compared to the untreated control (Table). 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 12. * 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 13.* 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 14.* 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 15.* 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 (*Pseudomonas chlororaphis*) + 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 (*Trichoderma harzianum)*	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 2018 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. 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 a viburnum field trial.

Bacillus amyloliquifaciens. MBI 110 applied as drench provided excellent efficacy on severe Rhizoctonia root rot infection in a viburnum field trial.

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 an 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.

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

Fluxapyroxad + Pyraclostrobin. BAS 703 applied as drench provided excellent efficacy on a severe Rhizoctonia root rot infection in a zinnia trial.

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

Gliocladium virens. SoilGard applied as drench provided excellent efficacy on severe Rhizoctonia root rot infection in a viburnum field trial.

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

Pyraclostrobin. Empress Intrinsic applied as drench provided excellent efficacy on a severe Rhizoctonia root rot infection in a viburnum field trial.

Pyraclostrobin + Boscalid. Pageant Intrinsic applied as drench provided excellent efficacy on severe Rhizoctonia root rot infection in a viburnum field trial, and on severe Rhizoctonia root rot infections in 2 zinnia trials.

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, 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.

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 excellent efficacy on severe Rhizoctonia root rot infection in a viburnum field trial.

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.

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.

Table 16. Summary of product efficacy by pathogen and crop.

Note: Table entries are sorted by product, pathogen Latin name, and then by crop Latin name. Only those IR-4 trials received by 8/24/2018 are included in the table below.

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
27480	3336 WP (50%) (Thiophanate-methyl)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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.

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
12261	3336 WP (50%) (Thiophanate-methyl)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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.
11587	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Phytotoxicity (Phytotoxicity)	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)	Phytotoxicity (Phytotoxicity)	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.
01330	3336 WP 70% (Pennwalt) (Thiophanate-methyl)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani	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.

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
	(Thiophanate-methyl)	(Rhizoctonia solani)							
26782	Actinovate Soluble (Streptomyces lydicus WYEC 108)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 10 oz per 100 gal
26781	Adorn 4F (Fluopicolide)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 30 and 60 ml per 100 gal
26788	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 1 and 2 gal per 100 gal
28101	Banrot I 30WP (Ethazole + thiabendazole)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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.
27878	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Maple, Silver (Acer saccharinum) 'saccharum'	Field In-Ground	Neely	IL	1978	Foliar	No Injury
27901	Benlate 50WP (Benomyl)	Rhizoctonia solani	Devil's Ivy (Epipremnum pinnatum) 'scindapsus'	Greenhouse	Knauss	FL	1978	Drench	no injury

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
		(Rhizoctonia solani)							
27897	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Spindletree (Euonymus sp.) 'coloratus'	Greenhouse	Hora	MD	1977	Drench	no injury
27891	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Poinsettia (Euphorbia pulcherrima) 'Top Star'	Greenhouse	Neely	IL	1978	Drench	Excellent efficacy and no injury at 8, 16, and 32 oz per 100 gal.
27881	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Ash, White (Fraxinus americana) 'benlate'	Field In-Ground	Worf	WI	1978	Foliar	no injury
27879	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Ash, White (Fraxinus americana) 'fraxinus americana'	Field In-Ground	Neely	IL	1978	Foliar	no injury
27848	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Holly, Japanese (Ilex crenata) 'command performance'	Field Container	Powell	OH	1977	Foliar	no injury
27848	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Holly, Japanese (Ilex crenata) 'peace'	Field Container	Powell	OH	1977	Foliar	no injury
27848	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Holly, Japanese (Ilex crenata) 'rotundifolia'	Field Container	Gill	GA	1977	Drench	no injury
27899	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Holly, Japanese (Ilex crenata) 'var.compacta'	Greenhouse	Hora	MD	1977	Drench	no injury
27896	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Juniper, Chinese Pyramid (Juniperus chinensis) 'Blue Rug'	Greenhouse	Gill	GA	1978	Foliar	no injury

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
27896	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Juniper, Chinese Pyramid (Juniperus chinensis) 'Nicks compacti'	Greenhouse	Gill	GA	1978	Foliar	no injury
27900	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Juniper (Juniperus sp.) 'pftizer var.nana'	Greenhouse	Hora	MD	1977	Drench	no injury
01840	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	Azalea (Rhododendron sp.) 'Hinodegiri'	Field Container	Gill	GA	1977	Drench	No Injury
27940	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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.
27940	Benlate 50WP (Benomyl)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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.
28074	Daconil 54EC (Chlorothalonil)	Rhizoctonia solani (Rhizoctonia solani)	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

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
									equivalent to infested untreated plants. Top weights of the Daconil treated
28075	Demosan 65WP (Chloroneb)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor efficacy at 3 oz per 100 gal
26983	Endorse (Polyoxin D)	Rhizoctonia solani (Rhizoctonia solani)	Pink (Dianthus sp.) D. chinensis	Greenhouse	Hausbeck	MI	2002	Drench	No efficacy but also no injury.
26784	Fenstop (Fenamidone)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 7 and 14 oz per 100 gal
28076	Fermate 76WP (Ferbam)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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.

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28076	Fermate 76WP (Ferbam)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 6 and 12 oz per 100 gal
28098	Mertect 160 (60 WP) (Thiabendazole)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 2 and 8 oz per 100 gal
26780	MultiGuard (Furfural)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair and good efficacy at 250 and 500 ppm
28077	Potassium azide (Potassium azide)	Rhizoctonia solani (Rhizoctonia solani)	American Evergreen (Syngonium podophyllum) 'Green Gold'	Greenhouse	Knauss	FL	1973	Drench	At 1000 ppm, there were no roots on the treated plants.
26783	Segway (Cyazofamid)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 1.5 and 3 oz per 100 gal

PR#	Product Actives	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28099	Terraclor 75WP (PCNB)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	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)	Rhizoctonia solani (Rhizoctonia solani)	Petunia (Petunia sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and fair efficacy at 2 and 8 oz per 100 gal
28100	Zyban 25WP (Thiophanate-methyl)	Rhizoctonia solani (Rhizoctonia solani)	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.

Appendix 1: Contributing Researchers

Dr. Fulya Baysal-Gurel	Tennessee State University Otis L. Floyd Research Center 472 Cadillac Lane McMinnville, TN 37110
Dr. Janna L. Beckerman	Purdue University Department of Botany and Plant Pathology West Lafayette, IN 47907
Dr. Mike Benson *(retired)*	North Carolina State University Department. of Plant Pathology 840 Method Rd. – Unit 3 Raleigh, NC 27695
Ms. M. L. Daughtrey	Cornell Cooperative Extension Long Island Horticulture Research & Experiment Center 3059 Sound Avenue Riverhead, NY 11901
Dr. Francesca Hand	Ohio State University Department of Plant Pathology 475C Kottman Hall Columbus, OH 43210
Dr. Mary Hausbeck	Michigan State University Dept. of Plant Pathology 140 Plant Pathology Building East Lansing, MI 48824
G. W. Moorman *(retired)*	Pennsylvania State University Dept. of Plant Pathology University Park, PA 16802
Dr. M. S. Reddy	Auburn University Department of Entomology and Plant Pathology 209 Life Sciences Building Auburn University, AL 36849