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

*Pythium aphanidermatum*  
*Pythium dissotocum*  
*Pythium irregulare*  
*Pythium mamillatum*  
*Pythium myriotylum*  
*Pythium* spp.  
*Pythium ultimum*  
*Pythium vipa*

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## Abstract

At the IR-4 Ornamental Horticulture Program Workshop in 2009, Pythium Efficacy was selected as a high priority project to expand the knowledge and list of fungicides available to growers for these diseases. In addition to research collected through the IR-4 program, this summary includes a review of experiments conducted from 1999 to 2013 on ornamental horticulture and vegetable crops. During this time period, numerous products representing 40 active ingredients were tested as drench, foliar or soil applications against several *Pythium* species causing root rot and damping-off on ornamentals, and root rot, cottony leak, damping-off and cavity spot on vegetables. *Pythium* species tested included: *P. aphanidermatum*, *P. irregulare*, *P. mamillatum*, *P. dissotocum*, *P. myriotylum*, *P. ultimum* and *P. viciae*. Most trials were conducted on *P. aphanidermatum* and *P. ultimum*. Although there were insufficient data for definitive conclusions, several relatively new products that are included in the Pythium efficacy project looked promising. These were Adorn, Disarm, Fenstop, Heritage and Pageant. V-10208 also looked promising. The phosphorus acids/phosphorus acid generators (Agri-Fos, Alude, K-Phite, Magellan, Phostrol or Vital) provided mix results. Acibenzolar, BW240/Rootshield Plus and CG100 were generally ineffective. The established standards Subdue Maxx and Terrazole/Truban generally performed well. Conversely, the registered biological products Companion/QRD 713, PlantShield/RootShield and SoilGard generally looked ineffective. The data from these trials suggest that the effectiveness of some fungicides in controlling Pythium root rot may vary, depending on the species of *Pythium* or crop.

## Introduction

In 2010, IR-4 initiated a high priority project to determine efficacy of several fungicides on *Pythium* species to obtain data supporting current and future registrations on ornamentals. There are many different species of *Pythium* causing ornamental diseases and an extensive project may be required to generate sufficient efficacy data. This report includes the results of 25 experiments from 2010 to 2013 received from the IR-4 Ornamental Horticulture Program. We also reviewed 10 available ornamental and 9 vegetable trials published in Biological and Cultural Tests, Fungicide & Nematicide Tests and Plant Disease Management Reports to check efficacy of experimental and registered fungicides on *Pythium* species; the source of report is included under each data table. This report is a brief summary of available data from these sources.

## Materials and Methods

From 1999 to 2013, numerous products representing 40 active ingredients were tested as drench, foliar or soil applications against several *Pythium* species causing root rot and damping-off on ornamentals, and cottony leak, damping-off and cavity spot on vegetables (Table 1 and Table 2). *Pythium* species tested included: *P. aphanidermatum*, *P. dissotocum*, *P. irregulare*, *P. mamillatum*, *P. myriotylum*, *P. ultimum* and *P. vipa*. Treatments were generally applied either a few days before *Pythium* inoculation or immediately after inoculation. Four of the eight vegetable trials had natural *Pythium* infections. Researchers used a minimum of four replications. Disease severity and incidence were recorded at various intervals after initial application. Phytotoxicity or lack of it was generally noted in the reports. Eighteen researchers were involved in the testing (Appendix 1).

Products were supplied by their respective manufacturers.

For IR-4 testing, the following protocols were used: 06-003, 07-003, 10-017, 11-011, 12-009, and 13-009. Please visit <http://ir4.rutgers.edu/ornamental/OrnamentalDrafts.cfm> to view and download these protocols.

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

**Table 1. List of Products and Rates Tested on Ornamental Horticulture Crops from 1999 to 2013.**

Active Ingredient(s)	Trade Name(s)		Manufacturer	Rate(s) Tested		# Trials
	Food Use	Orn.Hort./Turf Use				
A13839B		A13839B		Drench	1 fl oz per 100 gal	2
A14658C	-	-	Syngenta	Drench	10 oz per 100 gal 20 oz per 100 gal	2
A14658C + Azoxystrobin	-	-	Syngenta	Drench	10 + 0.5 oz per 100 gal	1
Acibenzolar	Actigard	-	Syngenta	Drench	0.125 oz per 100 gal 0.25 oz per 100 gal	7
				Foliar	0.125 oz per 100 gal 0.25 oz per 100 gal 0.5 oz per 100 gal	2
Acibenzolar + Azoxystrobin	-	-	Syngenta	Spray	0.125 + 0.45 oz per 100 gal 0.25 + 0.9 oz per 100 gal 0.5 + 1.8 oz per 100 gal	4
Azoxystrobin	Abound, Amistar, Quadris	Heritage	Syngenta	Drench	0.45 oz per 100 gal 0.9 oz per 100 gal 1 oz per 100 gal 1.8 oz per 100 gal	35
				Spray	0.9 oz per 100 gal 1.8 oz per 100 gal	1
<i>Bacillus subtilis</i>	QRD 713	QRD 713	AgraQuest	Drench	0.5 lb per 100 gal	1
<i>Bacillus subtilis</i> GB03	Companion	Companion	Growth Products	Drench	16 fl oz per 100 gal	1
Boscalid+Pyraclostrobin	Pristine	Pageant	BASF	Drench	12 oz per 100 gal 16 oz per 100 gal	27
BSEF-11 <sup>w</sup>		BSEF-11 <sup>w</sup>		Drench	25.6 fl oz per 100 gal	2
Caprylic Acid	CG100	CG100	Summerdale	Drench	0.6 pt per 100 gal 0.8 pt per 100 gal 1.2 pt per 100 gal 2.4 pt per 100 gal	18
Cyazofamid	Ranman	Segway	FMC	Drench	1.5 fl oz per 100 gal 3 fl oz per 100 gal	6
Dipotassium phosphonate + Dipotassium phosphate)	Agri-Fos	Agri-Fos	AgBio	Drench	67 fl oz per 100 gal	1

Active Ingredient(s)	Trade Name(s)		Manufacturer	Rate(s) Tested		# Trials
	Food Use	Orn.Hort./Turf Use				
Etridiazole	Terrazole	Terrazole	Chemtura, OHP	Drench	8 oz per 100 gal 10 oz per 100 gal 7 fl oz per 100 gal	15
		Truban	Scotts	Drench	6 oz per 100 gal 10 oz per 100 gal 4 fl oz per 100 gal 7 fl oz per 100 gal	5
Etridiazole + Thiophanate-methyl		Banrot	Scotts	Drench	8 oz per 100 gal 12 oz per 100 gal	4
Fenamidone	Reason	Fenstop	Bayer	Drench	10 fl oz per 100 gal 14 fl oz per 100 gal	18
Fluopicolide	Presidio	Adorn, V-10161	Valent	Drench	1 fl oz per 100 gal 2 fl oz per 100 gal 4 fl oz per 100 gal	25
Fluoxastrobin	Evito	Disarm	OHP	Drench	0.18 fl oz per 1000 sq ft 0.4 fl oz per 100 gal 0.6 fl oz per 100 gal	16
Fosetyl-Al	Aliette	Aliette	Bayer	Drench	9.6 oz per 100 gal 10.4 oz per 100 gal 12.8 oz per 100 gal	17
<i>Gliocladium virens</i>	SoilGard	SoilGard	Certis, OHP	Soil incorp.	1 lb per cu yd 1.5 lb per cu yd 0.75 g per L	1
Hydrogen Dioxide	Oxidate	ZeroTol	BioSafe	Drench	2 gal per 100 gal	1
Hymexazol	Tachigaren		Sankyo, Cleary	Drench	6 fl oz per 100 gal 12 fl oz per 100 gal	2
Mandipropamid	Revus	Mandipropamid NOA 446510	Syngenta	Drench	2 fl oz per 100 gal 8.2 fl oz per 100 gal	3
Mefenoxam	Ridomil Gold	Subdue Maxx	Syngenta	Drench	0.5 fl oz per 100 gal 1 fl oz per 100 gal 2 fl oz per 100 gal	32
Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites	Magellan	Magellan	NuFarm	Drench	8 fl oz per 100 gal 12 fl oz per 100 gal	4
Mono- and Di-potassium salts of Phosphorus Acid		Alude	Cleary	Drench	12.8 fl oz per 100 gal 64 fl oz per 100 gal	7



Active Ingredient(s)	Trade Name(s)		Manufacturer	Rate(s) Tested		# Trials
	Food Use	Orn.Hort./Turf Use				
Potassium Phosphite		Vital	Luxembourg	Spray	12.7 fl oz per 100 gal 20 fl oz per 100 gal 64 fl oz per 100 gal	3
				Drench	1.2 pt per 100 gal	1
Propamocarb Hydrochloride	Previcur Flex	Banol	Bayer	Drench	0.9 qt per 100 gal 1.2 qt per 100 gal	2
Pyraclostrobin	Cabrio, Headline	Insignia, BAS 500	BASF	Drench	6 oz per 100 gal 8 oz per 100 gal 16 oz per 100 gal	3
SP2770		SP2770	SePro	Drench	2.7 lb per 100 gal	4
SP2771		SP2771	SePro	Drench	3 fl oz per 100 gal	4
<i>Trichoderma asperellum</i> and <i>T. gamsii</i>	Tenet	Remedier	Isagro	Drench	2.5 oz per 100 gal 7.5 oz per 100 gal	2
<i>Trichoderma harzianum</i> T-22	PlantShield, RootShield	PlantShield, RootShield	Bioworks	Drench	9 oz per 100 gal 12 oz per 100 gal	3
<i>Trichoderma harzianum</i> and <i>T. virens</i>		BW240, RootShield Plus	Bioworks	Root Dip	3 oz per 100 gal	1
				Drench	3 oz per 100 gal 6 oz per 100 gal	26
V-10208	V-10208	V-10208	Valent	Drench	8 fl oz per 100 gal	1

**Table 2. List of Products and Rates Tested on Vegetables from 2002 to 2009.**

Active Ingredient(s)	Trade Name(s)		Manufacturer	Rate(s) Tested		# Trials
	Food Use	Orn.Hort./Turf Use				
Azoxystrobin	Abound, Amistar, Quadris	Heritage	Syngenta	Spray	12.3 fl oz per acre 15.4 fl oz per acre	3
				Drench	9 fl oz per 100 gal	2
<i>Bacillus subtilis</i> GB03	Companion	Companion	Growth Products	Drench	19.2 fl oz per 100 gal	1
Copper Hydroxide	Kocide		Griffin	Spray	1-1.25 lb per acre 2 lb per acre	3
				Drench	1.5 lb per 100 gal	2
Cyazofamid	Ranman	Segway	FMC/ISK	Spray	1.5 fl oz per acre 2.25-2.75 fl oz per acre 3.2 fl oz per acre 6 fl oz per acre	5

Active Ingredient(s)	Trade Name(s)		Manufacturer	Rate(s) Tested		# Trials
	Food Use	Orn.Hort./Turf Use				
				Drench	2.75 fl oz per 100 gal	2
Dimethomorph	Acrobat, Forum	Stature	BASF, SePro	Spray	6.4 oz per acre	2
Etridiazole + Thiophanate-methyl		Banrot	Scotts	Drench	12 oz per 100 gal	2
Famoxadone + Cymoxanil	Tanos		DuPont	Spray	6 oz per acre 8 oz per acre	2
Fenamidone	Reason	Fenstop	Bayer	Spray	8.2 fl oz per acre	4
				Drench	8.2 fl oz per 100 gal	2
Fluopicolide	Presidio, V-10161	Adorn, V-10161	Valent	Spray	4 fl oz per acre	1
				Drench	4 fl oz per 100 gal 7.7 fl oz per 100 gal 10.2 fl oz per 100 gal	3
Fosetyl-Al	Aliette	Aliette	Bayer	Drench	4 lb per 100 gal	2
<i>Gliocladium virens</i>	SoilGard	SoilGard	Certis, OHP	Drench	2 lb per 100 gal	1
				Potting mix incorp.	1.1 g per L	1
Hydrogen dioxide	Oxidate	ZeroTol	BioSafe	Spray	1 gal per 100 gal	1
				Drench	100 fl oz per 100 gal	1
Mandipropamid	Revus	NOA 446510	Syngenta	Spray	8 fl oz per acre	1
				Drench	8.2 fl oz per 100 gal	2
Mefenoxam	Ridomil Gold	Subdue Maxx	Syngenta	Spray	4 fl oz per acre 8 fl oz per acre 1 pt per acre 2 pt per acre	3
				Drench	1 fl oz per 100 gal	2
Mefenoxam + Copper Hydroxide	Ridomil Gold Copper		Syngenta	Spray	2.5 lb per acre	1
Metalaxyl + Copper Hydroxide	Ridomil Copper		Syngenta	Spray	2.5 lb per acre	2
Mono- and Di-basic Sodium, Potassium and Ammonium Phosphites	Phostrol	Phostrol	NuFarm	Drench	2.5 pt per 100 gal	2
				Spray	4 pt per acre 5 pt per acre	2
Mono- and Di-potassium salts of Phosphorus Acid	K-Phite		Plant Food Systems	Spray	6 pt per acre	1
Propamocarb Hydrochloride	Previcur Flex	Banol	Bayer	Spray	1.2 pt per acre 2 pt per acre	1
				Drench	3 fl oz per 100 gal 1.2 pt per 100 gal	2

Active Ingredient(s)	Trade Name(s)		Manufacturer	Rate(s) Tested		# Trials
	Food Use	Orn.Hort./Turf Use				
Pyraclostrobin	Cabrio, Headline	Insignia, BAS 500	BASF	Spray	1 lb per acre 9 fl oz per acre	2
<i>Trichoderma harzianum</i> T-22	PlantShield, RootShield	PlantShield, RootShield	Bioworks	Drench	3.3 lb per 100 gal	1

## Results and Summary

### Overview

In a series of 44 experiments covering 7 identified species and unidentified *Pythium* species, 40 different active ingredients were screened for efficacy for root and stem rots. Throughout this document both ornamental horticulture and vegetable formulations of products were used. Within the test for each researcher's experiment, the name of the product used will be included. In this overview, products will be referred to by their trade name in ornamental horticulture followed by the active ingredient in parentheses. The data collected in the experiments varied and included assessments such as the number of emerged seedlings, root rot ratings, plant health and stand vigor. These assessments were converted to a performance scale from 0 to 100, where 100 represents comparable or better assessments than the untreated uninoculated controls and 0 represents the same or worse assessments as the untreated inoculated controls or untreated controls, if relying on natural infections. This scale does not factor in disease pressure which ranged from light to extreme in some of the experiments where *Pythium* was inoculated into soil media.

Products showed variability in efficacy among the different *Pythium* species (Table 3); in this table, the performance calculation is averaged across crops and only those products with a total of three or more trials across *Pythium* species are included. For example, Adorn (fluopicolide) provided very good performance for *P. aphanidermatum* but was not as effective for the other *Pythium* species. Heritage (azoxystrobin), Pageant (boscalid + pyraclostrobin), and Subdue Maxx (mefenoxam) also exhibited different performance levels among the species tested with each possessing a different pattern. Host crop may contribute to performance variability, but not enough experiments have been conducted on some crops to make solid conclusions.

**Table 3. Summary of Efficacy across *Pythium* Species.**

Product (Active Ingredient)	Efficacy Average Across Experiments (Trial Count)								
	<i>Pythium aphanidermatum</i>	<i>Pythium dissotocum</i>	<i>Pythium irregulare</i>	<i>Pythium mamillatum</i>	<i>Pythium myriotylum</i>	<i>Pythium spp.</i>	<i>Pythium ultimum</i>	<i>Pythium vipa</i>	Across All <i>Pythium</i> Species
Acibenzolar	38% (4)		67 % (3)				0% (1)		44.2% (8)
Adorn 4F (fluopicolide, V-10161)	83.9% (14)	43% (2)	31.3% (3)	58% (1)		45.5% (2)	53.8% (8)	66% (2)	64.6% (32)
Aliette WDG (fosetyl Al)	73.3% (3)	37% (1)	66.2% (5)	50% (1)		81.5% (2)	21% (3)	46% (1)	56.9% (16)
Alude (potassium phosphite)		67% (1)	56% (1)				15.3% (3)	81% (1)	41.6% (6)
Banol (propamocarb hydrochloride)			45% (1)			11% (1)	89% (1)		48.3% (3)
BW240, RootShield Plus ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	14.3% (7)	46% (2)	50% (5)	8% (1)			12.5% (5)	57% (2)	29.5% (22)
CG100 (caprylic acid)	45.4% (5)	22% (1)	4.7% (3)	50% (1)			12% (5)	21% (1)	24.4% (16)
Disarm 480SC (fluoxastrobin)	73.2% (5)	17% (1)	14.5% (2)	100% (1)			26.2% (5)	12% (1)	43.7% (15)
Fenstop (fenamidone)	80.2% (8)	0% (1)	15% (2)	100% (1)		44% (3)	47.8% (6)	5% (1)	54.3% (22)
Heritage (azoxystrobin)	65% (16)	62% (2)	53.9% (8)	92% (1)	87% (2)	13.5% (2)	29.4% (14)	30% (1)	52.4% (47)
Hymexazol 30L (hymexazol)	68.8% (4)								68.8% (4)
Insignia 20WG (pyraclostrobin)	50% (2)		57.3% (3)						54.4% (5)
Kocide 2000 (copper hydroxide)	39.3% (3)					26% (2)			34% (5)
Magellan (mono- and dibasic phosphites)				0% (1)			40.5% (2)		27% (3)
NOA 446510 (mandipropamid)	54.6% (5)					19% (2)	3% (1)		39.3% (8)
Pageant 38WG (boscalid + pyraclostrobin)	62.9% (7)	38% (2)	42.1% (7)	100% (1)			20.2% (9)	7% (1)	43.1% (28)
Phostrol (phosphorus acid salts)	76.5% (2)					76% (2)			76.3% (4)
Plant Shield ( <i>Trichoderma harzianum</i> T22)	8% (1)				0% (1)		3% (1)		3.7% (3)
Remedier ( <i>Trichoderma asperellum</i> + <i>Trichoderma gamsii</i> )				0% (2)			0% (2)		0% (4)
Rotation: BW240 / Aliette	100% (1)	20% (1)	16.5% (2)				1% (1)	9% (1)	27.2% (6)
Segway (cyazofamid)	59.4% (8)		30% (1)	100% (1)		44% (3)	51% (2)		55.9% (15)
SoilGard 12G ( <i>Gliocladium virens</i> )	27.5% (2)						14% (1)		23% (3)
SP2770		74% (1)	65% (1)				6% (1)	72% (1)	54.2% (4)
SP2771		77% (1)	67% (1)				3% (1)	76% (1)	55.8% (4)
Subdue MAXX (mefenoxam)	78.5% (7)	65.5% (2)	72% (3)	100% (1)	86% (1)	25.7% (3)	51.8% (10)	72.5% (2)	64.3% (29)
Tank Mix: Acibenzolar + Heritage	25% (4)		27% (2)				0 (2)		19.2% (8)
Tank Mix: Adorn + Subdue MAXX	66.5% (2)		12% (1)				77% (1)		55.5% (4)
Tank Mix: Heritage + Subdue MAXX	100% (1)						100% (2)		100% (3)
Terrazole 35% WP (etridiazole)	100% (1)						85.2% (5)		87.7% (6)

Product (Active Ingredient)	Efficacy Average Across Experiments (Trial Count)								
	<i>Pythium aphani- dermatum</i>	<i>Pythium dissotocum</i>	<i>Pythium irregulare</i>	<i>Pythium mamillatum</i>	<i>Pythium myriotylum</i>	<i>Pythium spp.</i>	<i>Pythium ultimum</i>	<i>Pythium vipa</i>	Across All <i>Pythium</i> Species
Terrazole L (etr Diazole)	72.9% (5)		87 (1)	100% (1)			47% (3)		76.0% (10)
Truban (etr Diazole)	100% (1)		0% (1)				92% (1)		64% (3)
Untreated	0% (2)					0% (1)			0% (3)
Untreated inoculated	0% (12)	0% (2)	0% (6)	0% (1)	0% (1)	0% (2)	0% (9)	0% (2)	0% (35)
Untreated uninoculated	100% (12)	100% (1)	100% (5)	100% (1)	0% (0)	100% (2)	100% (7)	100% (1)	100% (29)

### Comparative Efficacy on *Pythium aphanidermatum*

In 2000, Benson conducted a trial to determine efficacy of Aliette, Heritage, Subdue Maxx and SoilGard for control of *Pythium* root rot (*P. aphanidermatum*) on poinsettia (*Euphorbia pulcherrima*). All products were drenched on the day of disease inoculation (July 19) except SoilGard which was incorporated into the potting mix on the day of transplanting (July 18). Drenched treatments were repeated on a 14-day schedule for Heritage and 28-day schedule for Aliette and Subdue Maxx for a total of 6 and 3 applications. The best control of *Pythium* root rot was obtained with Heritage while Aliette and SoilGard provided no significant control (Table 4). No phytotoxicity was observed from any treatment.

In 2001, Daughtrey conducted a trial on geranium (*Pelargonium x hortorum*) comparing QRD 713 with several registered biological and standard fungicides. All products were drenched on the day of disease inoculation except SoilGard which was incorporated into the potting mix 2 days before transplanting. QRD 713 and the registered biologicals (Companion, PlantShield and SoilGard) did not significantly reduce root rot severity while Subdue Maxx and Truban provided excellent control (Table 5). No phytotoxicity was observed from any treatment.

**Table 4. \* Efficacy on *Pythium* Root Rot (*Pythium aphanidermatum*.) on Poinsettia (*Euphorbia pulcherrima*.) ‘Angelica White’, Benson, NC, 2000.**

Treatment	Rate Per 100 Gal	Height (cm) <sup>x</sup> 17 Aug	Height (cm) 04 Oct	Top wt (g) 04 Oct	Root Rating <sup>y</sup> 04 Oct
Aliette 80W (fosetyl Al)	12.8 oz	7.4 ef	27.7 de	26.1 e	2.6 ab
Heritage 50W (azoxystrobin)	0.9 oz	12.9	41.9 b	77.4 b	1.6 cd
SoilGard 12G ( <i>Gliocladium virens</i> )	1.5 lb/yd <sup>3</sup>	10.8 c	35.1 c	49.8 c	2.4 ab
Subdue Maxx 2E (mefenoxam)	0.5 oz	9.9 cd	32.1 cd	47.5 cd	2.2 bc
Untreated uninoculated	-	18.4 a	56.2 a	133.4 a	1.0 d
Untreated inoculated	-	6.9 f	23.0 e	20.2 e	3.0 a

\* Not an IR-4 Experiment: F&N Tests Vol 56: OT22. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Waller-Duncan k-ratio, t-test, k=100 (P=0.05).

<sup>y</sup> 1= roots healthy with a vigorous root system that wrapped completely around the edge of the potting mix ball; 2= roots healthy but the root volume noticeably less not reaching bottom of pot; 3= many roots necrotic and root volume concentrated in top half of pot; 4= most roots necrotic and few roots visible; and 5= plant dead.

**Table 5. \* Efficacy on Pythium Root Rot (*Pythium aphanidermatum*.) on Geranium (*Pelargonium x hortorum*) ‘Multibloom White’, Daughtrey, NY, 2001.**

Treatment	Rate Per 100 Gal	Symptoms (%) <sup>w, x</sup>	Size <sup>y</sup>	Root Rating <sup>z</sup>	Dry Weight (g)
Companion 0.03% FL ( <i>Bacillus subtilis</i> GB03)	16 oz	16.7	3.3 a	2.9 cd	0.7 a
QRD 713 AS ( <i>Bacillus subtilis</i> )	0.5 gal	8.3	4.4 bcd	2.9 cd	1.2 cd
PlantShield 1.15% WP ( <i>Trichoderma harzianum</i> T-22)	9 oz	29.2	3.7 ab	3.0 d	1.0 abc
SoilGard 12G ( <i>Gliocladium virens</i> )	1.0 lb/cu yd	16.7	4.1 abc	2.8 cd	1.0 abc
Subdue Maxx 2E (mefenoxam)	1 fl oz	0.0	4.9 d	1.7 a	1.4 d
Truban 30 WP (etridiazole)	6 oz	4.2	4.6 bcd	1.9 ab	1.2 bcd
Untreated uninoculated	-	0.0	4.9 cd	1.9 ab	1.2 bcd
Untreated inoculated	-	8.3	3.4 a	3.1 d	0.8 ab

\* Not an IR-4 Experiment: B&C Tests Vol 17: 009. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=0.05).

<sup>w</sup> Percent of plants that developed above-ground symptoms of black stems, wilt and/or death.

<sup>y</sup> Size rated visually on a scale of 1-5, with 1=most stunted plant and 5=largest plant.

<sup>z</sup> Scale of 1-4, with 1=white roots, 2=some visible root rot, 3=some white roots, and 4=complete root rot.

In 2007, Wick examined several products for the control of *P. aphanidermatum* on geranium. All products were drenched 4 days before disease inoculation. Good control was obtained with V-10161, Aliette, Hymexazol and Heritage + Subdue Maxx (Table 6). Heritage was not as effective, and Mandipropamid, although effective at 8.2 fl oz per 100 gal, caused phytotoxicity as small, chlorotic flecks on leaf margins at both rates.

Hausbeck in 2007 conducted a trial comparing various products on snapdragon (*Antirrhinum majus*). All products were drenched immediately after transplanting on 30 April into infested soilless media and reapplied on 14 May. Subdue Maxx and Terrazole provided excellent control of a high root rot severity, with Adorn and Heritage providing much inferior control, and Hymexazol and Mandipropamid providing no significant control (Table 7). No phytotoxicity was observed from any treatment.



**Table 6. \* Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Geranium (*Pelargonium x hortorum*), Wick, MA, 2007.**

Treatment	Rate Per Liter	Canopy Height (cm) <sup>x</sup>	Canopy Width (cm)	Dry Weight (g)
Aliette 80W (fosetyl Al)	0.78 g	12.1 abc	19.1 ab	2.3 ab
Heritage 50W (azoxystrobin)	0.07 g	10.1 cd	15.3 de	1.8 bc
	0.13 g	10.8 c	14.8 def	1.8 bc
Heritage 50W + Subdue Maxx 2E (mefenoxam)	0.07 g + 0.78 ml	13.6 ab	19.4 ab	2.6 a
Hymexazole 30L	0.47 ml	11.8 bc	17.5 bc	2.0 b
	0.94 ml	11.5 bc	16.7 cd	2.0 b
Mandipropamid 2.08SC	0.156 ml	7.6 e	13.0 f	1.1 d
	0.625 ml	10.9 c	16.8 cd	1.8 b
Subdue Maxx 2E (mefenoxam)	0.078 ml	14.3 a	20.3 a	2.7 a
V-10161 4SC (fluopicolide)	0.8 ml	14.4 a	20.0 a	2.7 a
	1.6 ml	11.7 bc	16.8 cd	2.2 ab
Untreated uninoculated	-	10.9 c	16.2 cd	2.0 b
Untreated inoculated	-	8.0 de	13.3 ef	1.3 cd

\* Not an IR-4 Experiment: PDM Reports Vol 2: OT007.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher's Protected LSD (P=0.05).

**Table 7. \* Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Snapdragon (*Antirrhinum majus*) 'Montego Mix', Hausbeck, MI, 2007.**

Treatment	Rate Per 100 Gal	Plant Height (inch) <sup>x</sup>		Plant Health Rating <sup>y</sup>	
		23 May	6 Jun	23 May	6 Jun
Adorn SC(fluopicolide)	1 fl oz	2.1 c	3.3 cd	3.5 bc	3.2 b
	2 fl oz	1.9 c	2.8 cde	4.0 cd	5.0 c
Heritage 50W (azoxystrobin)	0.9 oz	1.9 c	2.8 cde	3.3 bc	4.3 bc
	1.8 oz	2.2 c	3.5 c	2.5 b	3.0 b
Hymexazol	6 fl oz	1.9 c	2.2 e	3.8 cd	4.9 c
	12 fl oz	1.8 c	2.1 e	4.8 d	5.4 c
Mandipropamid 250SC	2 fl oz	2.0 c	2.5 e	3.2 bc	4.5 bc
	8 fl oz	2.0 c	2.7 de	3.3 bc	4.2 bc
Subdue Maxx 2E (mefenoxam)	1 fl oz	2.8 b	5.2 b	1.2 a	1.1 a
Terrazole 35WP (etridiazole)	8 oz	2.9 b	5.1 b	1.0 a	1.0 a
Untreated uninoculated	-	4.0 a	5.9 a	1.0 a	1.0 a
Untreated inoculated	-	1.9 c	2.9 cde	6.3 e	5.2 c

\* Not an IR-4 Experiment: PDM Reports Vol 3: OT011.

<sup>x</sup> Means followed by same letter do not differ significantly based on Student-Newman-Keuls (P=0.05).

<sup>y</sup> Rating is 1 to 10; 1=healthy, 2=minor chlorosis/minor stunting, 3=severe chlorosis/moderate stunting, 4=severe stunting, 5=minor wilting, 6=moderate wilting, 7=severe wilting, 8=minor necrosis, 9=moderate necrosis, 10=plant death.

In 2010, Reddy conducted a greenhouse trial to determine efficacy of various products for control of Pythium root rot and damping-off caused by *Pythium aphanidermatum* on petunia (*Petunia x violacea*). Products were applied as drench around the plant base at 7 days after transplanting and 4 days before disease inoculation. Root rot and damping-off severity, and plant growth parameters were recorded one month after transplanting. All the tested products (Adorn, Adorn + Subdue Maxx, BW240, CG100, Disarm, Fenstop, Heritage, Pageant and Subdue Maxx) were effective in reducing root rot and damping-off incidence and severity in petunias caused by *Pythium apanidermatum*; all were at least equal to the

uninoculated control (Table 8). Due to significant disease control, plant height, stem girth, root and shoot weights in these treatments were enhanced. No phytotoxicity was observed from any treatment.

**Table 8. Efficacy on Pythium Root Rot and Damping-off Caused by *Pythium aphanidermatum* on *Petunia* (*Petunia x violacea*), ‘Laura Bush’, Reddy, AL, 2010.**

Treatment	Rate Per 100 Gal	Plant Growth Parameters <sup>x</sup>				Disease Severity	
		Height (cm)	Stem Girth (mm)	Root Wt. (g)	Shoot Wt. (g)	Root Rot <sup>y</sup>	Damping-off <sup>z</sup>
Adorn 4SC (fluopicolide)	2 fl oz	45.20a	4.24a	3.18ab	13.60cd	0 c	0 b
Adorn 4SC + Subdue Maxx 2EC	2 + 1 fl oz	45.28a	4.08a	3.22ab	14.53cd	0 c	0 b
BW240 WP	6 oz	41.44abc	4.24a	3.42a	16.75b	0 c	0 b
CG100 (caprylic acid)	1.2 pt	30.96cd	3.20bc	2.61d	13.08d	0.4 c	0.2 b
Disarm 480SC (fluoxastrobin)	0.18 fl oz per 1000 sq ft	35.32abcd	3.58b	2.89bcd	13.67cd	0.2 c	0 b
Fenstop (fenamidone)	10 fl oz	35.30abcd	4.22a	3.44a	22.72a	0.2 c	0 b
Heritage (azoxystrobin)	0.9 oz	38.30abc	3.51bc	2.83cd	13.26cd	0.4 c	0 b
Pageant 38WG (boscalid+pyraclostrobin)	12 oz	42.84ab	4.13a	3.06bc	22.79a	0 c	0 b
Subdue Maxx 2EC (mefenoxam)	1 fl oz	35.32abcd	3.44bc	2.82cd	14.76c	0.4 c	0 b
Untreated uninoculated	-	32.18bcd	3.15c	2.59d	13.54cd	1.4 b	0.2 b
Untreated inoculated	-	24.62d	2.20d	1.04e	9.60e	3.0 a	3.4 a

<sup>x</sup> Means followed by the same letter do not differ significantly based on SAS 9.2 (PROC-ANOVA), P=0.05.

<sup>y</sup> Root rot severity is on a “0 to 4 scale” where 0= normal/healthy, 1= <25% ; 2= 26 to 50% ; 3=51 to 75% ; and 4=>75% of root rotting.

<sup>z</sup> Damping-off severity is on a “0 to 5 scale” where 0= no visible symptoms; 1= plants slightly drooped; 2=prominent drooping of plants with browning of stem tissues at base; 3=50% of the plant wilted due to root rot; 4= >50 of the plant wilted due root rot and 5= death of the plant.

In 2010, Chase conducted a greenhouse trial to determine efficacy of various products for control of Pythium root rot caused by *P. aphanidermatum* on poinsettia (*Euphorbia pulcherrima*). Products were applied as drench around the plant base on 3 August 2010 five days after transplanting and three days before disease inoculation. Applications for several treatments were repeated on 17 and 31 August, 13 and 27 September. Plant height and top grade, phytotoxicity, root growth and root rot incidence were recorded at various times during the experiment (Table 9). No treatment, including uninoculated control, significantly reduced a low root rot incidence although plants treated with Heritage showed no root rotting; similarly, root growth was not significantly affected. No significant differences were observed for plant height and top grade except for plants treated with Adorn and Adorn + Subdue that were taller and had lower top grade because of leaf curling and tip damage due to Adorn phytotoxicity. No other treatment caused phytotoxicity.

In 2010-2011, Benson conducted three trials to determine efficacy of various products for control of Pythium root rot (*Pythium aphanidermatum*) on poinsettia (*Euphorbia pulcherrima*). In 2010, all products were applied as drench except Vital applied as spray (Table 10). Products were applied on the day of disease inoculation except BW240 and Vital which were applied 3 days before, and repeated on a 2-week schedule. In 2011, all products were applied as drench 2 days before disease inoculation and repeated on a 2-week schedule (Table 11). In 2012 treatments were applied as drench, spray or sprench and repeated at various intervals as shown in Table 12. Plant height was recorded at various times, and top weight and

root rot severity, at harvest (41-55 days after inoculation). The standards Terrazole and Subdue Maxx provided very good control of a severe Pythium root rot pressure in all trials. In 2010, Adorn, Fenstop and Pageant provided good control, with average plant heights, top weights and root rot ratings statistically the same as the uninoculated control. Disarm and Heritage provided significant but unsatisfactory control, with plants treated with Disarm judged not salable. BW240, CG100, Vital and the BW240/Vital rotation all failed to control Pythium root rot. In 2011, Fenstop, A13839B, Adorn, Subdue MAXX and the Adorn/Subdue MAXX tank mix provided good control of Pythium root rot with average root rot ratings statistically the same as the uninoculated controls. Demonstrating slight, but unsatisfactory control of Pythium root rot were Disarm and Pageant; plants treated with these fungicides were not salable. CG100, BSEF-11, BW240, Heritage, Vital, and the BW240/Vital rotation all failed to control Pythium root. In 2012, Pageant applied as sprench and Heritage applied as drench provided excellent control while Actigard drench, BW240 drench and Actigard + Heritage spray were ineffective. No phytotoxicity was observed from any treatment in these trials.

**Table 9. Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Poinsettia (*Euphorbia pulcherrima*), Chase, CA, 2010.**

Treatment	Rate Per 100 Gal	Height (cm) <sup>x</sup> 20 Aug	Top Grade <sup>y</sup> 20 Aug	Height (cm) 3 Sep	Top Grade 3 Sep	Height (cm) 20 Sep	Top Grade 20 Sep	Phyto- toxicity 1 Oct	Height (cm) 11 Oct	Top Grade 11 Oct	% Roots 12 Oct	% Rotted Roots 12 Oct
Adorn 4SC (fluopicolide)	2 fl oz	9.2 a	3.5 a	10.3 a	3.4 a	13.2 a	3.4	2.6 b	18.0 ab	2.7 a	51.0 a	3.0 a
Adorn 4SC + Subdue Maxx 2EC	2 + 1 fl oz	10.0 a	3.8 a	10.5 a	3.7 a	14.3 a	3.7 a	3.1 c	19.8 b	2.6 a	57.0 a	5.0 a
Aliette 80WDG (fosetyl Al)	12.8 oz	9.4 a	3.7 a	10.7 a	3.6 a	13.6 a	3.8 a	1.0 a	18.2 ab	4.1 b	63.0 a	2.0 a
BW240 WP	6 oz (once only)	9.1 a	3.7 a	10.4 a	3.6 a	12.9 a	3.6 a	1.0 a	17.4 a	4.0 b	61.0 a	12.0 a
BW240 then Aliette	6 oz (once only) then 12.8 oz	9.2 a	-	10.7 a	3.6 a	13.4 a	3.7 a	1.0 a	17.8 ab	4.2 b	61.0 a	2.0 a
CG100 (caprylic acid)	0.6 pt (once only)	9.6 a	3.7 a	10.3 a	3.5 a	12.9 a	3.4 a	1.0 a	17.0 a	3.9 b	62.0 a	1.0 a
Disarm 480SC (fluoxastrobin)	0.6 fl oz	9.2 a	3.6 a	10.3 a	3.6 a	13.0 a	3.6 a	1.0 a	17.2 a	3.9 b	57.0 a	2.0 a
Fenstop (fenamidone)	14 fl oz (once only)	9.5 a	3.6 a	10.2 a	3.6 a	13.0 a	3.5 a	1.0 a	17.8 ab	3.8 b	56.0 a	6.0 a
Heritage (azoxystrobin)	0.9 oz (once only)	10.2 a	3.6 a	10.2 a	3.7 a	14.1 a	3.6 a	1.0 a	18.1 ab	3.9 b	61.0 a	0.0 a
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	9.8 a	3.6 a	10.9 a	3.6 a	13.4 a	3.6 a	1.0 a	18.2 ab	4.0 b	58.0 a	7.0 a
Segway (cyazofamid)	1.5 fl oz	9.9 a	3.7 a	10.9 a	3.7 a	13.6 a	3.6 a	1.0 a	18.1 ab	4.0 b	56.0 a	7.0 a
Untreated uninoculated	-	9.7 a	3.7 a	10.5 a	3.6 a	13.1 a	3.7 a	1.0 a	16.9 a	4.0 b	57.0 a	3.0 a
Untreated inoculated	-	9.1 a	3.5 a	10.0 a	3.4 a	12.7 a	3.5 a	1.0 a	16.5 a	3.8 b	49.0 a	6.0 a

<sup>x</sup> Means followed by the same letter do not differ significantly at P=0.05.

<sup>y</sup> Top grade was recorded using the following scale: 1 - plant dead, unsalable, 2 - poor, unsalable, 3 - moderate, salable, 4 - good, salable to 5 - excellent, salable.

<sup>z</sup> Phytotoxicity severity (leaf curl) was recorded using the following scale: 1 – no phytotoxicity, 2 – slight, 3 – moderate, 4 – severe to 5 – plant dead.

**Table 10. Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Poinsettia (*Euphorbia pulcherrima*), 'Angelica White', Benson, NC, 2010.**

Treatment	Rate Per 100 Gal	Plant Height (cm) <sup>x</sup>			Top Wt (g)	Root Rot (1-5) <sup>y</sup>
		Day 12	Day 32	Day 46	Day 55	Day 55
Adorn 4SC (fluopicolide)	2 fl oz	13.6 b	15.8 bc	19.3 cd	54.6 c	1.3 de
BW240* WP	6 oz	8.9 d	9.4 de	10.1 f	9.4 e	3.9 a
BW240* drench then Vital spray	6 oz drench then 64 fl oz spray	8.9 d	9.6 de	10.1 f	8.4 e	3.8 a
CG100 (caprylic acid)	0.8 pt	8.1 d	8.5 e	8.9 f	7.4 e	3.8 a
Disarm 480SC (fluoxastrobin)	0.6 fl oz	10.3 cd	12.4 cd	15.9 de	33.4 d	2.5 b
Fenstop (fenamidone)	14 fl oz	17.5 a	23.9 a	30.5 a	76.4 ab	1.4 de
Heritage (azoxystrobin)	0.9 oz	12.2 bc	17.8 b	20.5 cd	46.5 cd	2.0 bc
Heritage	1.8 oz	13.1 b	17.6 b	21.1 bc	45.1 cd	1.6 cd
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	13.3 b	15.1 bc	18.1 cd	59.1 bc	1.3 de
Terrazole L (etridiazole)	7 fl oz	14.3 b	17.8 b	25.8 ab	85.8 a	1.0 e
Vital* then Vital (potassium phosphite)	64 fl oz	10.2 cd	11.3 de	12.0 ef	8.8 e	4.1 a
Untreated uninoculated	-	14.1 b	16.6 b	21.3 bc	62.0 bc	1.0 e
Untreated inoculated	-	8.3 d	9.3 de	10.1 f	8.4 e	3.8 a

<sup>x</sup> Means followed by the same letter do not differ significantly based on the Waller-Duncan k ratio, t-test, k=100,  $P=0.05$ .

<sup>y</sup> Root rot rating: 1= healthy, 2= 25% or less roots necrotic, 3= 26 - 50% roots necrotic, 4= more than 50% necrotic, and 5= crown rot, plant dead.

\*Pre-treated three days prior to start of test and then repeated or rotated on subsequent treatment days.

**Table 11. Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Poinsettia (*Euphorbia pulcherrima*), 'Angelica White', Benson, NC, 2011.**

Treatment	Rate Per100 Gal	Plant Height (cm) <sup>x</sup>				Top Wt (g)	Root Rot (1-5) <sup>y</sup>
		Day 0	Day 21	Day 28	Day 40	Day 41	Day 41
A13839B	1.3 fl oz	7.7 a	17.4 ab	19.8 abc	22.8 ab	27.4 ab	1.3 d
Adorn 4SC (fluopicolide)	2 fl oz	7.1 a	13.8 bcd	15.1 cde	17.9 bc	14.4 cde	1.9 cd
Adorn 4SC + Subdue Maxx	2 fl oz + 1 fl oz	7.2 a	15.8 abc	18.0 abc	21.6 ab	22.6 bcd	1.5 d
BSEF-11	25.6 fl oz	7.5 a	10.1 de	10.3 ef	10.4 d	3.6 ef	4.1 ab
BW240 WP	6 oz	7.9 a	8.8 e	8.9 f	8.0 d	1.4 f	4.9 a
BW240 then rotated w/ Vital	6 oz drench then 20 fl oz spray	6.9 a	9.4 e	9.0 f	9.3 d	1.8 ef	4.9 a
CG100 (caprylic acid)	0.8 pt	6.4 a	9.5 e	9.9 f	10.3 d	4.5 ef	4.5 ab
Disarm 480SC (fluoxastrobin)	0.6 fl oz	7.4 a	12.3 cde	12.3 def	13.8 cd	10.3 def	3.1 bc
Fenstop (fenamidone)	14 fl oz	7.1 a	18.3 a	21.3 ab	28.3 a	29.1 ab	1.1 d
Heritage (azoxystrobin)	1.8 oz	7.3 a	16.1 abc	18.3 abc	21.0 abc	23.8 bc	3.6 ab
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	7.8 a	15.1 abc	16.3 bcd	19.4 bc	21.6 bcd	3.1 bc
Subdue Maxx 2EC (mefenoxam)	1 fl oz	7.6 a	16.4 ab	18.3 abc	23.0 ab	28.6 ab	1.4 d
Terrazole L (etridiazole)	7 fl oz	7.0 a	15.4 abc	18.5 abc	23.9 ab	32.1 ab	1.1 d
Vital (potassium phosphite)	20 fl oz	7.4 a	10.4 de	9.9 f	10.0 d	2.8 ef	4.5 ab
Untreated uninoculated	-	6.9 a	19.0 a	23.0 a	28.3 a	38.1 a	1.0 d
Untreated inoculated	-	6.8 a	9.8 e	9.9 f	9.9 d	2.8 ef	4.9 a

<sup>x</sup> Means followed by the same letter do not differ significantly based on the Waller-Duncan k ratio, t-test, k=100,  $P=0.05$ .

<sup>y</sup> Root rot rating: 1= healthy, 2= 25% or less roots necrotic, 3= 26 - 50% roots necrotic, 4= more than 50% necrotic, and 5= crown rot, plant dead.

**Table 12. Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Poinsettia (*Euphorbia pulcherrima*), 'Angelica White', Benson, NC, 2012.**

Treatment	Rate Per 100 Gal	Applic. Method – Intervals	Plant Height (cm) <sup>x</sup>		Top Wt (g)	Root Rot (1-5) <sup>y</sup>
			Day 41	Day 55	Day 55	Day 55
Actigard (acibenzolar)	0.125 oz	Drench – 28	19.1 cd	22.4 d-g	21.8 d	2.5 ab
	0.25 oz	Drench – 28	20.1 bcd	22.1 efg	18.8 d	3.3 a
Actigard + Heritage (acibenzolar + azoxystrobin)	0.25 oz + 0.9 oz	Spray – 14	20.9 bcd	24.6 c-g	27.6 cd	2.0 bc
	0.50 oz + 1.8 oz	Spray – 14	22.6 a-d	26.4 c-g	28.7 cd	2.5 ab
Rootshield Plus (BW240) *	6 oz then 3 oz	Drench once then 21 days	14.5 d	19.0 g	11.7d	3.5 a
Heritage (azoxystrobin)	0.9 oz	Drench - 28	29.6 a	35.6 a	74.6 a	1.3 bc
	1.8 oz	Drench - 28	25.3 abc	28.9 a-f	48.3 bc	1.9 bc
Pageant (boscalid + pyraclostrobin)	12 oz	Sprench - 14	27.9 ab	32.8 abc	66.2 ab	1.3 bc
	16 oz	Sprench - 14	25.8 abc	30.8 a-e	60.0 ab	1.5 bc
Subdue Maxx (mefenoxam)	1 fl oz	Drench - 28	26.1 abc	31.1 a-d	55.6 ab	1.0 c
Terrazole L (etridiazole)	7 fl oz	Drench - 28	24.8 abc	29.9 a-f	65.4 ab	1.8 bc
Untreated uninoculated	-	-	27.9 ab	33.5 ab	54.2 ab	1.0 c
Untreated inoculated	-	-	19.5 bcd	21.5 fg	20.7 d	3.5 a

<sup>x</sup> Means followed by the same letter do not differ significantly based on the Waller-Duncan k ratio, t-test, k=100, P=0.05.

<sup>y</sup> Root rot rating: 1= healthy, 2= 25% or less roots necrotic, 3= 26 - 50% roots necrotic, 4= more than 50% necrotic, and 5= crown rot, plant dead.

\*Material sourced in 2009.

In 2011-2012, Benson conducted two trials to determine efficacy of various products for control of Pythium root rot (*Pythium aphanidermatum*) on snapdragon (*Antirrhinum majus*). In 2011, all products were applied as drench on 4 May 2 days before disease inoculation on 6 May, except A13839B and BSEF-11, which were applied on 10 May and before inoculation on 12 May. In 2012 treatments were applied as drench, spray or sprench and repeated at various intervals as shown in Table 14. Plant height, top weight and root rot severity were observed at harvest (27 and 57 days after inoculation). In 2011, Terrazole as a standard provided good control of severe Pythium root rot pressure, slightly better than the other standard Subdue MAXX (Table 13). Overall, A13839B, Adorn + Subdue MAXX, Pageant, and Fenstop gave good control while Disarm and Heritage were intermediate. BW240, CG100, Vital, and the BW240/Vital rotation looked ineffective. In 2012, disease symptoms were too low to show significant differences between treatments (Table 14). Data indicated that Actigard and Pageant (high rate) applied as drenches were ineffective, with average root rot ratings statistically higher than the uninoculated control. No phytotoxicity was observed from any treatment in these trials.

**Table 13. Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Snapdragon (*Antirrhinum majus*), 'Snapshot Red', Benson, NC, 2011.**

Treatment	Rate Per 100 Gal	Harvest (Day 27)			
		Plant Ht. (cm) <sup>x</sup>	Plant Rating	Top Wt (g)	Root Rot (1-5) <sup>y</sup>
A13839B <sup>w</sup>	1 fl oz	32.0 ab	1.0 a	25.4 a-d	1.5 c-f
Adorn 4SC (fluopicolide)	2 fl oz	25.5 cde	1.6 a	20.4 def	2.0 b-e
Adorn 4SC + Subdue Maxx	2 fl oz + 1 fl oz	30.0 abc	1.0 a	21.7 c-f	1.8 c-f
BSEF-11 <sup>w</sup>	25.6 fl oz	28.6 bcd	1.3 a	20.1 def	2.4 abc
BW240 WP	6 oz	24.5 de	2.1 a	13.6 g	3.3 a
BW240 then rotated w/ Vital	6 oz drench then 20 fl oz spray	26.9 cde	1.7 a	18.7 efg	2.4 abc
CG100 (caprylic acid)	0.8 pt	25.4 cde	2.1 a	13.8 g	2.9 ab
Disarm 480SC (fluoxastrobin)	0.6 fl oz	29.5 a-d	1.0 a	23.4 b-e	1.6 c-f
Fenstop (fenamidone)	14 fl oz	32.5 ab	2.3 a	26.6 abc	1.4 def
Heritage (azoxystrobin)	1.8 oz	32.4 ab	1.0 a	22.6 c-f	1.4 def
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	32.0 ab	1.0 a	29.0 ab	1.4 def
Subdue Maxx 2EC (mefenoxam)	1 fl oz	29.3 a-d	1.3 a	19.1 efg	2.0 b-e
Terrazole L (etridiazole)	7 fl oz	30.3 abc	1.0 a	24.1 b-e	1.3 ef
Vital (potassium phosphite)	20 fl oz	29.5 a-d	1.4 a	19.7 d-g	2.3 bcd
Untreated uninoculated	-	33.9 a	1.0 a	31.1 a	1.0 f
Untreated inoculated	-	23.4 e	2.0 a	16.9 fg	3.3 a

<sup>x</sup> Means followed by the same letter do not differ significantly based on the Waller-Duncan k ratio, t-test, k=100,  $P=0.05$ .

<sup>y</sup> Root rot rating: 1= healthy, 2= 25% or less roots necrotic, 3= 26 - 50% roots necrotic, 4= more than 50% necrotic, and 5= crown rot, plant dead.

<sup>w</sup> First treated on 10 May and inoculated on 12 May.



**Table 14. Efficacy on Pythium Root Rot (*Pythium aphanidermatum*) on Snapdragon (*Antirrhinum majus*), ‘Rocket Red’, Benson, NC, 2012.**

Treatment	Rate Per 100 Gal	Applic. Method – Intervals	Harvest (Day 57)	
			Top Wt (g)	Root Rot (1-5) <sup>y</sup>
Actigard (acibenzolar)	0.125 oz	Drench – 28	7.1 a	2.4 a
Actigard	0.25 oz	Drench – 28	8.4 a	2.4 a
Actigard + Heritage	0.25 oz + 0.9 oz	Spray – 14	8.0 a	2.3 ab
Actigard + Heritage	0.50 oz + 1.8 oz	Spray – 14	7.4 a	2.3 ab
BW240 *	6 oz then 3 oz	Drench once then 21 days	8.1 a	2.1 ab
Heritage (azoxystrobin)	0.9 oz	Drench - 28	9.1 a	1.9 ab
Heritage	1.8 oz	Drench - 28	8.8 a	2.0 ab
Pageant (boscalid + pyraclostrobin)	12 oz	Sprenc - 14	8.3 a	2.0 ab
Pageant	16 oz	Sprenc - 14	8.3 a	2.5 a
Subdue Maxx (mefenoxam)	1 fl oz	Drench - 28	8.4 a	1.9 ab
Terrazole L (etridiazole)	7 fl oz	Drench - 28	8.2 a	1.9 ab
Untreated uninoculated	-	-	8.4 a	1.3 b
Untreated inoculated	-	-	7.5 a	2.1 ab

<sup>x</sup> Means followed by the same letter do not differ significantly based on the Waller-Duncan k ratio, t-test, k=100, P=0.05.

<sup>y</sup> Root rot rating: 1= healthy, 2= 25% or less roots necrotic, 3= 26 - 50% roots necrotic, 4= more than 50% necrotic, and 5= crown rot, plant dead.

\*Material sourced in 2009.

In 2012, Klett conducted a trial to determine efficacy of various products for control of Pythium root rot (*Pythium aphanidermatum*) on African daisy (*Osteospermum* spp.). Actigard was applied as drench or foliar spray while Adorn, BW240, Heritage, Pageant and Subdue Maxx were applied as drenches. Unfortunately several weeks after inoculation many of the inoculated plants failed to display wilting and other symptoms associated with root-infecting pathogens, hence the results are inconclusive and researcher suggested repeating this study in 2013 (Data not shown; refer to researcher report). No phytotoxicity was observed from any treatment.

In 2002 and 2003, Damicone conducted 2 experiments to examine various products applied as directed sprays for the control of cottony leak caused by *Pythium aphanidermatum* on snap bean (*Phaseolus vulgaris*). Treatments were applied at 7–day intervals from 1<sup>st</sup> pod development to 7 days before harvest. Ranman, Reason, Ridomil Copper and Phostrol reduced disease incidence while Acrobat, Cabrio, Quadris and Tanos did not (Table 15 and Table 16). No phytotoxicity was observed from any treatment.

**Table 15. \* Efficacy on Cottony Leak (*Pythium aphanidermatum*.) on snap bean (*Phaseolus vulgaris*), ‘Contender’, Damicone, OK, 2002.**

Treatment <sup>y</sup>	Rate Per Acre	Row length w/ pod rot (%)	Yield (cwt/A)
Acrobat 50W (dimethomorph)	6.4 oz	6.2 ab	85.78 a
Kocide 2000 DF (copper hydroxide)	2 lb	2.0 cd	87.20 a
Phostrol 6.7S (phosphorus acid salts)	4 pt	4.2 cd	79.42 a
Quadris 2.08F (azoxystrobin)	12.3 fl oz	9.0 ab	90.97 a
Ranman 400F (cyazofamid)	2.75 fl oz	2.2 cd	79.06 a
Reason 4.17F (fenamidone)	8.5 fl oz	0.5 d	95.11 a
Ridomil Copper 70W (metalaxyl + copper hydroxide)	2.5 lb	0.7 d	86.70 a
Tanos 50DF (famoxadone+cymoxanil)	6 oz	12.5 a	85.16 a
Untreated	-	9.0 ab	78.84 a

\* Not an IR-4 Experiment: F&N Tests Vol 59: V098. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher’s LSD (P=0.05).

<sup>y</sup> Treatments applied 31 May, 7 June and 15 June.

**Table 16. \* Efficacy on Cottony Leak (*Pythium aphanidermatum*.) on Snap Bean (*Phaseolus vulgaris*), ‘Contender’, Damicone, OK, 2003.**

Treatment <sup>y</sup>	Rate Per Acre	Row length w/ pod rot (%)	Yield (cwt/A)
Acrobat 50W (dimethomorph) + Kocide 2000 DF (copper hydroxide)	6.4 oz + 2 lb	6.7 ab	127.9 a
Cabrio 20WG (pyraclostrobin)	1 lb	6.2 abc	136.3 a
Kocide 2000 DF (copper hydroxide)	2 lb	9.0 a	132.1 a
Quadris 2.08F (azoxystrobin)	12.3 fl oz	6.5 abc	113.1 a
Ranman 400F (cyazofamid) + Silwet	2.75 fl oz	0.7 d	139.4 a
Reason 4.17F (fenamidone)	8.5 fl oz	0.7 d	135.6 a
Ridomil Copper 70W (metalaxyl + copper hydroxide)	2.5 lb	0.7 d	138.1 a
Tanos 50DF (famoxadone+cymoxanil)	8 oz	6.5 abc	142.1 a
Untreated	-	5.0 abcd	117.5 a

\* Not an IR-4 Experiment: F&N Tests Vol 59: V099. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher’s LSD (P=0.05).

<sup>y</sup> Treatments applied 29 May, 5 June and 13 June.

In 2009, Rideout examined various products sprayed over the row for the control of cottony leak caused by *Pythium aphanidermatum* on snap bean. The first treatment application occurred at full bloom 2 days before disease inoculation followed by a second application 2 weeks later. Treatments containing Phostrol, K-Phite, Prophyt, Ranman, Quadris and Headline offered best cottony leak control and had higher yields (Table 17). Reason, and Ridomil Gold/Copper also provided significant control but not to the level of the previously mentioned fungicides. No phytotoxicity was observed from any treatment.

**Table 17. \* Efficacy on Pythium Cottony Leak (*P. aphanidermatum*) on Snap Bean (*Phaseolus vulgaris*), ‘Festina’ Rideout VA, 2009.**

Treatment	Rate/A	% Infected Feet Row			Yield (lb/A)
		29 Jul	3 Aug	7 Aug	
Headline 2.09 EC(pyraclostrobin)	9 fl oz	0 e	20.0 d-g	16.0 def	3903 a-d
Kocide 3000 (copper hydroxide)	1.25 lb	15.2 a-d	52.0 abc	49.6 abc	3380 cde
K-Phite 7L (phosphorus acid salts)	3 qt	8.8 b-e	10.4 fg	8.0 ef	4071 abc
Phostrol 6.7F (phosphorus acid salts)	5 pt	4.0 de	16.8 efg	8.8 ef	3990 abc
Presidio 4SC (fluopicolide)	4 fl oz	20.8 ab	40.8 abc	50.4 abc	3456 b-e
Previcur Flex 6F (propamocarb hydrochloride)	1.2 pt	20.8 ab	45.6 abc	42.4 abc	3920 abc
Quadris 2.08SC (azoxystrobin)	15 fl oz	0 e	19.2	17.6	5053
Quadris + Prophyt 6.7F (azoxystrobin + potassium phosphite)	10 fl oz + 4 pt	0.8 e	4.8 g	2.4 f	4594 ab
Ranman 400SC (cyazofamid) + Silwet	2.75 fl oz	7.2 b-e	20.0 d-g	16.8 def	4071 abc
Ranman + Phostrol	2.75 fl oz + 4 pt	0 e	0.8 g	0.8 f	4170 abc
Reason 4.13F (fenamidone)	8.2 fl oz	8.0 b-e	30.4 b-f	36.0 bcd	3752 b-e
Revus 250SC (mandipropamid) + Induce	8 fl oz	18.4 abc	44.8 abc	47.2 abc	3462 b-e
Ridomil Gold/Copper 65WP (mefenoxam/copper hydroxide)	2.5	11.2 a-e	32.8 b-f	28.0 cde	3758 b-e
Untreated uninoculated	-	6.4 cde	28.8 c-f	35.2 bcd	3990 abc
Untreated inoculated	-	24.8 a	67.2 a	63.2 a	2573 e

\* Not an IR-4 Experiment: PDM Reports Vol 4: V030. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

In 2007, Matheron conducted a greenhouse study on tomato (*Lycopersicon esculentum*) and watermelon (*Citrullus lanatus*) to determine efficacy of Ranman and V-10161 on damping-off (*Pythium aphanidermatum*). Fungicides were applied as drench treatments when sowing seeds to inoculated potting mix. Both products significantly increased number of live plants compared to the inoculated control (Table 18). No phytotoxicity was observed from any treatment.

**Table 18. \* Efficacy on Damping-off (*Pythium aphanidermatum*.) on Tomato (*Lycopersicon esculentum*), ‘Graziella’, and Watermelon (*Citrullus lanatus*) ‘Royal Sweet’, Matheron, AZ, 2007.**

Treatment <sup>y</sup>	Rate Per Liter	Number of Live Plants <sup>x</sup>	
		Tomato	Watermelon
<i>Experiment 1 conducted from 18 Jun to 16 Jul</i>			
Ranman 400SC (cyazofamid)	0.12 ml	17 bc	90 b
	0.25 ml	30 b	94 ab
Untreated uninoculated	-	65 a	99 a
Untreated inoculated	-	9 c	63 c
<i>Experiment 2 conducted from 18 Jul to 9 Aug</i>			
V-10161 (fluopicolide)	0.6 ml	102 a	100 b
	0.8 ml	100 a	106 ab
Untreated uninoculated	-	104 a	107 a
Untreated inoculated	-	6 b	8 c

\* Not an IR-4 Experiment: PDM Reports Vol 2: V082.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

### **Comparative Efficacy on *Pythium dissotocum***

In 2010 and 2013, Grunwald conducted two greenhouse trials to test the efficacy of several fungicides applied as drench for control of root rot caused by *P. dissotocum* (isolate 41-08) on Douglas fir (*Pseudotsuga menziesii*). In the first trial, products were applied on the day of disease inoculation (6 July) except BW240 and BW240 + Aliette which were applied 3 days before (3 July). Plants were seeded on 8 July. Treatments were applied once or twice on 2- or 3-week schedule for various products. Seedling germination and stand counts were taken at 2, 3, 4 and 5 weeks after planting. Alude, Heritage and the standards Aliette and Subdue Maxx provided some control of *P. dissotocum* resulting in significant stand improvement over the nontreated control although not as good as the uninoculated control (Table 19). Adorn, BW240, BW240 + Aliette, Cg100, Disarm, Fenstop and Pageant were ineffective. In the second trial, products, except Rootshield Plus, were applied on Nov 18, 3 day after disease inoculation (11/15), and 2 days before seeding on Nov 20. The treatment of Rootshield Plus was applied as a soil mix with potting medium 2 days before disease inoculation. Treatments were applied once or twice on 2- or 3-week schedule for various products. Seedling survival counts were taken at 2, 3, and 4 weeks after planting. Only data from the last count are shown (Dec 18). All products provided some control of *P. dissotocum* resulting in significant stand improvement over the untreated control; the standard Subdue Maxx was much better than the other products (Table 20). No phytotoxicity was observed from any treatment.

**Table 19. Efficacy on Pythium Root Rot (*Pythium dissotocum*) on Douglas Fir (*Pseudotsuga menziesii*), Grunwald, OR, 2010a.**

Treatment	Rate Per 100 Gal	No. / Interval of Applications	Plant Emergence at Weeks After Planting <sup>x</sup>			
			2	3	4	5
Adorn 4FL (fluopicolide)	2 fl oz	2/14 days	0.88 d-g	0.88 fg	0.88 ef	0.88 ef
Aliette 80WP (fosetyl Al)	9.6 oz	1	2.5 b	2.63 bcd	2.25 cd	2.25 cd
Alude (phosphorus acid salts)	12.7 fl oz	1	4.38 a	3.75 b	3.75 b	3.75 b
BW240 WP	6 oz	1	1.88 b-e	1.25 f	1.13 def	1.13 def
BW240 + Aliette	6 oz + 9.6 oz	1	2 bcd	1.38 ef	1.38 de	1.38 de
CG100 (caprylic acid)	0.6 pt	1	1.5 b-f	1.5 def	1.5 cde	1.5 cde
Disarm 480SC (fluoxastrobin)	0.4 fl oz	2/14 days	1 c-g	1.13 fg	1.25 de	1.25 de
Fenstop (fenamidone)	10 fl oz	1	0 g	0 g	0 f	0 f
Heritage (azoxystrobin)	0.9 oz	2/21 days	2.75b	2.5 cde	2.63 bc	2.63 bc
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	2/14 days	0.5 efg	0.5 fg	0.5 ef	0.5 ef
Subdue Maxx (mefenoxam)	1 fl oz	2/21 days	2.38 bc	2.75 bc	2.63 bc	2.63 bc
Untreated uninoculated	-	-	4.88 a	5.25 a	5.38 a	5.38 a
Untreated inoculated	-	-	0.25 g	0.38 fg	0.38 ef	0.38 ef

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

**Table 20. Efficacy on Pythium Root Rot (*Pythium dissotocum*) on Douglas Fir (*Pseudotsuga menziesii*), Grunwald, OR, 2013a.**

Treatment	Rate Per 100 Gal	No. / Applic. Interval	Plant Emergence at 4 Weeks After Planting <sup>x</sup>
Adorn 4FL (fluopicolide)	2 fl oz	2/14 days	39.79 b
BW240 WP ( <i>Trichoderma harzianum</i> and <i>T. virens</i> )	6 oz	1	44.03 b
Heritage (azoxystrobin)	0.9 fl oz	1	33.15 b
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	2/14 days	38.39 b
SP2770	2.7 lb	1	35.81 b
SP2771	3 fl oz	1	40.34 b
Subdue Maxx (mefenoxam)	1 fl oz	2/21 days	70.53 a
Untreated inoculated	-	-	9.47 c

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

### Comparative Efficacy on *Pythium irregulare*

In 2001, Wick conducted two trials to test the efficacy of several fungicides applied as drench for control of damping-off caused by *P. irregulare* on New Guinea impatiens (*Impatiens* hybrids). In a trial where plants were inoculated 48 hours after the first fungicide application on 5 Sep, Aliette, Heritage and BAS 500 at the higher rate significantly reduced a moderate disease severity, similar to uninoculated control (Table 21). A second trial was conducted to test fungicides as “rescue treatments”. Treatments were applied as drench on 7 Sep, 48 hours after inoculation, and again on 5 Oct. Heritage was the only treatment that significantly reduced a moderate disease severity, similar to uninoculated control; Aliette, BAS 500, Banol and Truban were ineffective (Table 22). No phytotoxicity was observed from any treatment.

In 2013, Wick conducted a trial to test the efficacy of several fungicides applied as drench 3 days before disease inoculation for control of root rot caused by a mefenoxam-insensitive *P. irregulare* isolate on geranium (*Pelargonium* sp.). Although the Aliette treatment resulted in noticeably more robust plants, results were inconclusive because there were no significant differences between treatments based on plant size and weight (Table 23 **Error! Reference source not found.**). Root rot was not severe in this trial but very evident in many of the treatments (data not included in report). Chlorosis was observed from plants treated with A14658C + Heritage and Pageant.

**Table 21. \* Efficacy on Pythium Root Rot (*Pythium irregulare*) on New Guinea Impatiens (*Impatiens* hybrids) ‘Paradise Pearl White’, Wick, MA, 2001.**

Treatment	Rate Per Liter	Disease Rating 5 Nov	Top Dry Weight (g) 7 Nov
Aliette 80WDG (fosetyl-Al)	0.732 g	1.4 bc	4.6abc
BAS 500 20WDG (pyraclostrobin)	0.6 g	2.4ab	3.8 cd
	1.2g	1.2 c	4.2 bcd
Heritage 50WG (azoxystrobin)	0.07 g	1.7 bc	4.7ab
Untreated uninoculated	-	1.1 c	5.2a
Untreated inoculated	-	3.0 a	3.6 d

\* Not an IR-4 Experiment: F&N Tests Vol 58: OT024.

<sup>x</sup> Means followed by same letter do not differ significantly based on LSD (P=0.05).

<sup>y</sup> Disease rating: 1 = healthy, 2 = slight wilting, 3 = moderate wilt, stunting evident, 4 = severe wilt and stunting, 5 = dead

**Table 22. \* Efficacy on Pythium Root Rot (*Pythium irregulare*.) on New Guinea Impatiens (*Impatiens* hybrids) ‘Paradise Pearl White’, Wick, MA, 2001.**

Treatment	Rate Per Liter	Disease Rating 7 Nov	Top Dry Weight (g) 9 Nov
Aliette 80WDG (fosetyl-Al)	0.732 g	2.1 bc	5.0a
BAS 500 20WDG (pyraclostrobin)	1.2g	2.3 abc	4.3abc
Banol 66.5EC (propamocarb hydrochloride)	3.05 ml	2.3 abc	4.6abc
Heritage 50WG (azoxystrobin)	0.07 g	1.4 d	4.1 bc
Truban 25EC (etridiazole)	0.305 ml	3.0 a	3.9 c
Untreated uninoculated	-	1.7 cd	4.3abc
Untreated inoculated	-	2.8 ab	4.8ab

\* Not an IR-4 Experiment: F&N Tests Vol 58: OT025.

<sup>x</sup> Means followed by same letter do not differ significantly based on LSD (P=0.05).

<sup>y</sup> Disease rating: 1 = healthy, 2 = slight wilting, 3 = moderate wilt, stunting evident, 4 = severe wilt and stunting, 5 = dead

**Table 23. Efficacy on Pythium Root Rot (*Pythium irregulare*) on Geranium (*Pelargonium* sp.), ‘Scarlet Orbit’, Wick, CT 2013.**

Treatment	Rate Per 100 Gal	Applic. Intervals (Days)	Width <sup>x</sup>		Height		Final Dry Weight
			Initial*	Final	Initial	Final	
A14658C	20	-	7.37 a	21.50 a	4.07 a	15.88 ab	8.75 a
A14658C	10	-	7.37 a	20.99 ab	4.10 a	15.58 ab	8.47 ab
A14658C + Heritage	10 + 0.5	-	7.40 a	18.72 ab	4.22 a	14.07 ab	6.78 ab
Acibenzolar	0.125	28	6.88 a	19.99 ab	4.22 a	14.60 ab	7.48 ab
Acibenzolar	0.25	28	7.09 a	19.93 ab	3.90 a	14.08 ab	7.12 ab
Acibenzolar +Heritage	0.9 + 0.25	14	7.15 a	18.53 ab	4.37 a	15.25 ab	6.46 ab
Acibenzolar + Heritage	0.45 + 0.125	14	7.35 a	19.81 ab	4.47 a	14.83 ab	7.17 ab
Aliette	10 oz	30	8.13 a	20.83 ab	4.52 a	16.72 a	8.96 a
Heritage	0.9	28	6.84 a	18.86 ab	3.83 a	13.92 ab	6.80 ab
Heritage	1.8	28	7.19 a	19.09 ab	4.60 a	13.98 ab	6.67 ab
Pageant 38 WG	12	14	7.37 a	20.08 ab	4.18 a	13.67 ab	7.23 ab
Pageant 38 WG	16	14	7.71 a	17.88 ab	4.88 a	12.73 a	5.76 b
Root Shield	6	3 oz/ 10 weeks	7.93 a	18.48 ab	4.38 a	14.02 ab	6.42 ab
Subdue	1 oz	21	7.16 a	18.73 ab	3.82 a	13.42 ab	6.61 ab
Untreated uninoculated	-	-	7.43 a	20.08 ab	4.00 a	16.08 ab	8.23 ab
Untreated inoculated	-	-	6.72 a	19.23 ab	3.80 a	13.72 ab	6.29 ab

Initial plant measurements taken 3/1/13, final measurements on 4/23/13.

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





In 2010, Chase conducted a greenhouse trial to determine efficacy of various products for control of damping-off caused by *Pythium irregulare* on cockscomb (*Celosia* sp.). Products were applied as sprench at 10 ml per 3.5 inch pot on 8 October one day after seeding (7 October) and four days before disease inoculation (12 October). Several treatments were applied a second time on 22 October. Seedling emergence was recorded on 20 and 27 October. BW240, BW240 + Aliette and Heritage were the only treatments that provided some control of severe damping-off on 20 October, with plant emergence comparable to the uninoculated control (Table 24). All other treatments did not increase emergence over the inoculated control. However, no treatment was effective by 27 October.

**Table 24. Efficacy on Damping-off (*Pythium irregulare*) on Cockscomb (*Celosia* sp.), Chase, CA, 2010.**

Treatment	Rate Per 100 Gal	No. Seedlings Per Pot <sup>x</sup>	
		20 Oct	27 Oct
Adorn 4SC (fluopicolide)	2 fl oz	6.6 a-d	0.8 a
Adorn 4SC + Subdue Maxx 2EC	2 + 1 fl oz	5.0 ab	3.6 a
Aliette 80WDG (fosetyl Al)	12.8 oz	9.0 a-d	5.8 a
BW240 WP	6 oz (once only)	12.5 b-e	2.4 a
BW240 then Aliette	6 oz (once only) then 12.8 oz	13.3 cde	5.9 a
CG100 (caprylic acid)	0.6 pt (once only)	9.2 a-d	1.6 a
Disarm 480SC (fluoxastrobin)	0.6 fl oz	6.1 abc	5.8 a
Fenstop (fenamidone)	14 fl oz (once only)	1.6 a	7.9 a
Heritage (azoxystrobin)	0.9 oz (once only)	14.1 de	8.8 a
Pageant 38WG (boscalid+pyraclostrobin)	12 oz	7.9 a-d	5.7 a
Segway (cyazofamid)	1.5 fl oz	8.0 a-d	8.4 a
Untreated uninoculated	-	16.8 e	26.9 b
Untreated inoculated	-	9.2 a-d	0.4 a

<sup>x</sup> Means followed by the same letter do not differ significantly at P=0.05.

In 2012, Williams-Woodward conducted a greenhouse trial to determine efficacy of various products for control of root rot caused by *Pythium irregulare* on rose periwinkle (*Catharanthus roseum*). All products were applied as drench, except Pageant, which was applied as a sprench. First application for all products occurred 4 days before disease inoculation (July 6), and a second application occurred on Jul 30. All products tested, except Cg100 and the standard Terrazole L, effectively reduced root rot disease severity (Table 25). Disease severity symptoms were more pronounced with Cg100 compared to the untreated inoculated control. Heritage at 0.9 oz/100 gal and A14558C at 10 oz/100 gal resulted in significantly larger roots.

**Table 25. Efficacy on Pythium Root Rot (*P. irregulare*) on Rose Periwinkle (*Catharanthus roseum*) ‘Victory Bright Eye’, Williams-Woodward, 2012.**

Treatment	Rate Per 100 Gal	Foliage Wt. (g) 8/26	Root Wt. (g) 8/26	Change in Plant Ht (cm) 8/20	Disease Severity <sup>y</sup> 8/20
A14658C SC	10 fl oz	5.3 a	1.0 a	5.5 a	1.0 a
	20 fl oz	4.4 a	0.9 ab	5.2 a	1.3 a
A14658C + Heritage	10 fl oz + 0.5 oz	5.5 a	0.7 ab	4.7 ab	1.3 a
Acibenzolar	0.125 oz	4.5 a	0.6 ab	5.0 ab	1.3 a
	0.25 oz	5.5 a	0.9 ab	5.4 a	1.3 a
Acibenzolar + Heritage	0.125 oz + 0.45 oz	4.4 a	0.5 ab	4.5 ab	1.3 a
	0.25 oz + 0.9 oz	4.9 a	0.6 ab	5.1 ab	1.5 ab
BW 240 WP ( <i>Trichoderma virens</i> strain G-41)	6 oz	5.0 a	0.6 ab	4.5 ab	1.5 ab
CG100 (caprylic acid)	38.4 fl oz	3.7 a	0.6 ab	2.2 b	3.5 c
Heritage (azoxystrobin)	0.9 oz	5.5 a	1.1 a	5.0 ab	1.0 a
	1.8 oz	4.3 a	0.8 ab	3.4 ab	1.5 ab
Pageant 38WG (boscalid+pyraclostrobin)	12 oz	4.7 a	0.5 ab	4.4 ab	1.0 a
	16 oz	4.6 a	0.2 b	4.0 ab	1.3 a
Plentrix	1.3 oz	5.3 a	0.6 ab	5.0 ab	1.3 a
Subdue Maxx (mefenoxam)	1 fl oz	4.8 a	0.8 ab	4.8 ab	1.3 a
Terrazole L (etridiazole)	7 fl oz	3.1 a	0.4 ab	3.3 ab	2.3 abc
Untreated uninoculated	-	4.6 a	0.7 ab	4.7 ab	1.0 a
Untreated inoculated	-	4.4 a	0.2 b	2.6 b	2.8 bc

<sup>x</sup> Numbers followed by the same letter are not significantly different from each other using Tukey’s HSD means separation test at  $P = 0.05$ .

<sup>y</sup> Disease severity rating based upon a 0-8 scale where 0 = no symptoms or phytotoxicity; 1 = plants slightly off-color; 2 = plant chlorosis evident; 3 = lower leaves chlorotic and wilting; 4 = slight wilting to whole plant; 5 = whole plant wilting with some chlorosis; 6 = whole plant wilting with severe chlorosis; 7 = plant collapse; and 8 = dead plant.

In 2010 and 2013, Grunwald conducted 2 greenhouse trials to test the efficacy of several fungicides applied as drench for control of root rot caused by *P. irregulare* (isolate 45-08) on Douglas fir (*Pseudotsuga menziesii*). Products were applied on the day of disease inoculation (6 July) except BW240 and BW240 + Aliette which were applied 3 days before (3 July). Plants were seeded on 8 July. Treatments were applied once or twice on 2- or 3-week schedule for various products. Seedling germination and stand counts were taken at 2, 3, 4 and 5 weeks after planting. Alude, BW240, and the standards Aliette and Subdue Maxx provided some control of *P. irregulare* resulting in significant stand improvement over the nontreated control although not as good as the uninoculated control (Table 26). Adorn, BW240 + Aliette, Cg100, Disarm, Fenstop, Heritage and Pageant were ineffective. In the second trial, products, except Rootshield Plus, were applied on Nov 18, 3 day after disease inoculation (11/15), and 2 days before seeding on Nov 20. The treatment of Rootshield Plus was applied as a soil mix with potting medium 2 days before disease inoculation. Treatments were applied once or twice on 2- or 3-week schedule for various products. Seedling survival counts were taken at 2, 3, and 4 weeks after planting. Only data from the last count are shown (Dec 18). The standard Subdue Maxx provided the best control of *P. irregulare*, resulting in significant stand improvement over the untreated control, followed by Pageant, Heritage and Adorn (Table 27). SP2770 and SP2771 were not significantly different from the untreated control. No phytotoxicity was observed from any treatment.

**Table 26. Efficacy on Pythium Root Rot (*Pythium irregulare*) on Douglas Fir (*Pseudotsuga menziesii*), Grunwald, OR, 2010b.**

Treatment	Rate Per 100 Gal	No. / Interval of Applications	Plant Emergence at Weeks After Planting <sup>x</sup>			
			2	3	4	5
Adorn 4FL (fluopicolide)	2 fl oz	2/14 days	0.75 e	1 cd	1.13 cd	1.13 cd
Aliette 80WP (fosetyl Al)	9.6 oz	1	3.25 bc	3.25 b	3.38 b	3.38 b
Alude (phosphorus acid salts)	12.7 fl oz	1	3.75 ab	2.63 b	3.00 b	3.00 b
BW240 WP	6 oz	1	3.63 ab	3.13 b	3.25 b	3.25 b
BW240 + Aliette	6 oz + 9.6 oz	1	0.63 e	0.63 d	0.63 d	0.63 d
CG100 (caprylic acid)	0.6 pt	1	0.63 e	0.5 d	0.5 d	0.5 d
Disarm 480SC (fluoxastrobin)	0.4 fl oz	2/14 days	0.25 e	0.5 d	0.5 d	0.5 d
Fenstop (fenamidone)	10 fl oz	1	0.13 e	0 d	0.13 d	0.13 d
Heritage (azoxystrobin)	0.9 oz	2/21 days	1 de	1.13 cd	1.13 cd	1.13 cd
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	2/14 days	0 e	0.13 d	0.13 d	0.13 d
Subdue Maxx (mefenoxam)	1 fl oz	2/21 days	2.25 cd	2.25 bc	2.38 bc	2.38 bc
Untreated uninoculated	-	-	4.88 a	5.25 a	5.38 a	5.38 a
Untreated inoculated	-	-	0 e	0 d	0 d	0 d

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

**Table 27. Efficacy on Pythium Root Rot (*Pythium irregulare*) on Douglas Fir (*Pseudotsuga menziesii*), Grunwald, OR, 2013b.**

Treatment	Rate Per 100 Gal	No. / Applic. Interval	Plant Emergence at 4 Weeks After Planting <sup>x</sup>
Adorn 4FL (fluopicolide)	2 fl oz	2/14 days	33.82 b
BW240 WP ( <i>Trichoderma harzianum</i> and <i>T. virens</i> )	6 oz	1	49.01 ab
Heritage (azoxystrobin)	0.9 fl oz	1	35.64 bc
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	2/14 days	42.88 bc
SP2770	2.7 lb	1	27.77 cd
SP2771	3 fl oz	1	29.23 cd
Subdue Maxx (mefenoxam)	1 fl oz	2/21 days	71.85 a
Untreated inoculated	-	-	9.68 d

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

In 2013, Becker conducted a greenhouse trial to test the efficacy of several fungicides applied as drench for control of root rot caused by *P. irregulare* on geranium (*Pelargonium x domesticum*). Cultures of *P. irregulare* were inoculated into each pot at planting on Jan 17. Products were applied as drenches starting on Feb 17, then reapplied 2 times every 2 weeks, except Adorn and BW240. Evaluations were made on foliar symptoms during the trial, and subsequent root weight, shoot weight, and visual estimate of internal necrosis within the stem tissue observed at harvest. Low disease infection resulted in virtually no statistical differences between treatments including inoculated and non-inoculated checks (Table 28). Leaf necrosis symptoms on Feb 27 were not significantly different from the inoculated or non inoculated plants and were not likely to be due to the treatments. Similarly, yield components on Mar 14 indicated that the inoculation of *Pythium* reduced the root and shoot weights numerically, but not significantly. No phytotoxicity was observed from any treatment.

**Table 28. Efficacy on Pythium Root Rot (*Pythium irregulare*) on Geranium (*Pelargonium x domesticum*), 'Bright Red' Becker, 2013.**

Treatment	Rate Per 100 Gal	% Leaf Chlorosis 2/22	No. of Leaves 2/27	% Leaf Necrosis 2/27	Leaf Chlorosis 2/27	No. of Flowers 2/27	Root Wt. (g) 3/14	Shoot Wt. (g) 3/14	Visual Discoloration <sup>y</sup> 3/14
Adorn4SC (fluopicolide)	2 fl oz once only	3.78 a	10.89 ab	8.67 a	2.44 def	0.56 ab	9.22 bc	33.30 ab	2.44 ab
Adorn, then Alude	2 fl oz once, 12 fl oz twice	2.11 a	10.22 ab	4.56 a	4.33 a-d	0.89 ab	10.00 bc	38.75 ab	3.33 ab
Alliete (fosetyl-Al)	12.8 oz	8.56 a	9.33 ab	4.67 a	5.22 ab	0.11 b	8.95 bc	35.21 ab	2.56 ab
Alude (mono- and di-potassium salts of phosphorus acid)	12 fl oz	11.67 a	10.22 ab	12.89 a	4.67 abc	0.78 ab	11.30 bc	37.88 ab	4.22 ab
BW240 WP ( <i>Trichoderma harzianum</i> and <i>T. virens</i> )	6 oz once only	11.00 a	11.33 ab	10.78 a	1.89 f	0.78 ab	9.23 bc	37.88 ab	2.44 ab
BW240 + Alude	6 oz + 12 fl oz once	12.00 a	10.22 ab	5.67 a	4.11 a-e	0.78 ab	8.69 bc	34.18 ab	4.00 ab
CG100 (caprylic acid)	0.6 pt	9.89 a	9.44	12.89 a	2.11 ef	1.00 ab	9.31 bc	35.53 ab	2.89 ab
Disarm (fluoxastrobin)	0.15 fl oz	6.11 a	12.11 ab	13.11 a	2.11 ef	1.33 a	9.12 bc	38.40 ab	2.11 b
	0.6 fl oz	4.11 a	9.78 ab	4.33 a	3.44 b-f	0.78 ab	9.80 bc	40.58 a	3.78 ab
FenStop (fenamidone)	14 fl oz	13.00 a	9.22 ab	2.78 a	2.22 def	0.78 ab	8.82 bc	39.06 ab	5.11 a
Heritage (azoxystrobin)	0.9 oz	10.00 a	9.00 b	4.00 a	3.22 b-f	0.67 ab	9.57 bc	32.99 ab	4.00 ab
Insignia (pyraclostrobin)	6 oz	10.78 a	10.44 ab	8.33 a	4.33 a-d	0.56 ab	11.93 b	35.05 ab	4.33 ab
Magellan (mono- and dibasic sodium,potassium and ammonium phosphite)	12 fl oz	8.11 a	10.11 ab	8.22 a	5.56 a	0.78 ab	11.25 bc	40.37 a	4.89 a
Pageant (boscalid + pyraclostrobin)	12 oz	8.11 a	12.00 ab	6.56 a	3.33 b-f	0.44 ab	9.95 bc	36.69 ab	4.44 ab
	16 oz	9.33 a	9.11 ab	8.67 a	2.78 c-f	0.67 ab	7.47 c	29.04 b	3.44 ab
Segway (cyazofamid)	2.8 fl oz	4.44	11.44 ab	3.11 a	3.56 b-f	0.78 ab	15.62 a	41.22 a	4.11 ab
SubdueMaxx (mefenoxam)	1 fl oz	6.44 a	10.33 ab	3.11 a	2.56 def	0.22 b	8.88 bc	37.50 ab	3.56 ab
TerrazoleL (etridiazole)	7 fl oz	5.89 a	10.89 ab	7.00 a	3.11 c-f	0.67 ab	12.37 b	38.08 ab	3.56 ab
Untreated uninoculated	-	2.44 a	13.22 a	4.44 a	1.89 f	0.44 ab	12.15 b	40.64 a	3.11 ab
Untreated inoculated	-	5.44 a	10.11 ab	9.00 a	1.89 f	0.67 ab	9.85 bc	35.64 ab	4.78 ab

<sup>x</sup> Means followed by the same letter do not differ significantly based on Student-Newman-Keuls, (P=0.05).

<sup>y</sup> Visual estimate of any necrosis within the stem was rated using a 0-10 scale, where 10 was most severe.

### Comparative Efficacy on *Pythium mamillatum*

In 2010, Chastagner conducted a greenhouse trial to test the efficacy of several fungicides applied as drench for control of damping off and root rot caused by *P. mamillatum* (isolates PD 266A & PP 158A) on Douglas fir (*Pseudotsuga menziesii*). Products were applied Dec 20, 5 days after disease inoculation of potting mix (Dec 15), except Remedier and BW240 which were applied on Dec 7 and Dec 12, respectively. Plants were seeded on Dec 22. Treatments were applied one to three times on 1 to 4-week intervals for various products. Data on symptom development was collected once per week for 4 weeks beginning 14 days after seeding. Notes on symptoms were taken and the number of “healthy” seedlings was recorded. Symptoms included damping off, which occurred shortly after emergence of the cotyledon, to root rot which killed the seedlings during the experiment. Terrazole L, Subdue MAXX, Segway, and Disarm provided good control of *P. mamillatum*, resulting in higher numbers of healthy seedlings per pot compared to the inoculated control (Table 29). No phytotoxicity was observed from any treatment.

**Table 29. Efficacy on Pythium Root Rot (*Pythium mamillatum*) on Douglas Fir (*Pseudotsuga menziesii*), Chastagner WA, 2010a.**

Treatment	Rate Per 100 Gal	Application Dates <sup>z</sup>	Application Interval	No. of Healthy Seedlings <sup>x,y</sup>
Adorn 4FL (fluopicolide)	2 fl oz	3, 7	21 Days	2 cde
Aliette 80WP (fosetyl Al)	9.6 oz	3, 8	28 Days	1.8 cde
BW240 WP ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz	2	1 application	0.8 de
BW240 / Magellan rotation	6 oz + 12 fl oz	2, 4	Magellan @ 14 days	1.2 de
CG100 (caprylic acid)	9.6 fl oz	3, 8	28 Days	1.8 cde
Disarm 480SC (fluoxastrobin)	0.4 fl oz	3, 6, 8	14 Days	5.4 abc
Fenstop (fenamidone)	10 fl oz	3, 8	28 Days	3.8 bcd
Heritage (azoxystrobin)	0.9 oz	3, 7	21 Days	2.8 cde
Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	12 fl oz	3, 8	28 Days	0.6 de
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	3, 6, 8	14 Days	3.6 b-e
Remedier ( <i>Trichoderma asperellum</i> and <i>T. gamsii</i> )	2.5 oz	1, 5, 8	14-21 Days	0 e
Remedier	7.5 oz	1, 5, 8	14-21 Days	0 e
Segway (cyazofamid)	3 fl oz	3, 8	28 Days	7.2 ab
Subdue Maxx (mefenoxam)	2 fl oz	3, 7	21 Days	8.0 a
Terrazole L (etridiazole)	7 fl oz	3, 8	28 Days	8.6 a
Untreated uninoculated	-	-	-	3.0 bcd
Untreated inoculated	-	-	-	0.6 de

<sup>x</sup> Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.001).

<sup>y</sup> Data collected 35 days after seeding (January 26, 2011).

<sup>z</sup> Dates: 1 = 12/7/10, 2 = 12/12/10, 3 = 12/20/10, 4 = 12/26/10, 5 = 12/29/11, 6 = 1/3/11, 7 = 1/10/11, and 8 = 1/18/11.

### Comparative Efficacy on *Pythium myriotylum*

In 2001, McGovern examined several fungicides applied as drench for the control of *P. myriotylum* on caladium (*Caladium x hortulanum*). PlantShield was initially applied 3 wk before inoculation and reapplied 24 hr before inoculation and 1 month later. Other products were applied 24 hr before inoculation and were reapplied 1 month later. Subdue Maxx, Hurricane and Heritage significantly reduced moderate incidence and severity of root rot while PlantShield did not (Table 30). No phytotoxicity was observed from any treatment.

**Table 30. \* Efficacy on Pythium Root Rot (*Pythium myriotylum*) on Caladium (*Caladium x hortulanum*) ‘Rosebud’, McGovern, FL, 2001.**

Treatment	Rate Per 100 Gal	Disease Incidence (%) <sup>x</sup>	Plant Mortality (%)	Root Rot (%)	Fresh Wt. Foliage (oz)	Fresh Wt. Roots (oz)
Heritage 50WG (azoxystrobin)	0.9 oz	5.5 c	0.0 a	24.6 c	1.16 b	1.08 ab
	1.8 oz	13.8 c	5.5 a	27.5 c	1.06 b	0.96 ab
Hurricane 48WP (mefenoxam + fludioxonil)	1.5 oz	13.8 c	0.0 a	33.5 bc	1.13 b	0.88 bc
PlantShield 1.15WP ( <i>Trichoderma harzianum</i> T-22)	9.0 oz	69.4 a	11.1 a	57.2 a	0.43 d	0.31 d
Subdue Maxx 2MEC (mefenoxam)	0.5 fl oz	5.6 c	0.0 a	26.2 c	0.96 bc	0.75 bc
Untreated uninoculated	-	5.5 c	0.0 a	22.2 c	1.67 a	1.18 a
Untreated inoculated	-	44.4 a	2.8 a	51.8 a	0.53 d	0.38 d

\* Not an IR-4 Experiment: F&N Tests Vol 57: OT06. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

### Comparative Efficacy on *Pythium* spp.

In 2007, Farrar examined the efficacy of various fungicides, sprayed over the row after seeding and irrigated into the root zone with 0.25 inch of water, for control of cavity spot caused by *Pythium* spp. (*P. violae*, *P. sulcatum* and *P. ultimum*) on carrot (*Daucus carota*). Ranman, Reason and Ridomil Gold significantly reduced a low incidence of cavity spot (Table 31). No phytotoxicity was observed from any treatment.

**Table 31. \* Efficacy on Pythium Root Rot (*Pythium* spp.) on Carrot (*Daucus carota*) ‘Apache’, Farrar, CA, 2007.**

Treatment	Rate Per Acre	Application Dates <sup>y</sup>	Disease Incidence <sup>x</sup>
Ranman (cyazofamid)	6 fl oz	1, 2, 3, 4, 6	5.5 b
Reason (fenamidone)	8.2 fl oz	1, 2, 3, 5	4.6 b
Ridomil Gold <sup>z</sup> (mefenoxam)	4 and 8 fl oz	1, 2, 3, 5	4.8 b
Untreated	-	-	14.4 a

\* Not an IR-4 Experiment: IR-4 Food Crops Website (online).

<sup>x</sup> Means followed by same letter do not differ significantly based on LSD (P=0.05).

<sup>y</sup> Application dates: 1=12 Sep, 2=9 Oct, 3=11 Nov, 4=25 Nov, 5=3 Dec, 6=8 Dec.

<sup>z</sup> Rates of 8 fl oz on Applic 1, 4 fl oz on Applic 2, 3 and 5.

In 2008, Hausbeck conducted two experiments examining various products applied as drench for the control of mefenoxam-resistant *Pythium* root rot (*Pythium* spp.) on celery (*Apium graveolens*). In the first study, fungicides were applied as a drench to the cells immediately after transplanting into infested medium on 4 Jan, and reapplied on 11 and 18 Jan. Treatments of Aliette, Banrot, Phostrol and Presidio + Previcur Flex provided significant control of *Pythium* spp. and were similar in health to the untreated uninoculated control (Table 32). All fungicide treatments completely prevented plant death. Phytotoxicity symptoms, including minor plant stunting and leaf cupping, were observed only in the Banrot treatment. In the second study, fungicides were applied as a drench to the cells immediately after transplanting into infested soil on 14 Oct, and reapplied on and 28 Oct. Treatments of Aliette, Phostrol and Presidio + Previcur Flex provided control against a moderate *Pythium* spp. pressure and were among the healthiest and tallest of all plants (Table 33). Phytotoxicity symptoms were observed only on the Kocide treatment, consisting of leaf yellowing.

**Table 32. \* Efficacy on Pythium Root Rot (*Pythium* spp.) on Celery (*Apium graveolens*) ‘Dutchess’, Trial 1, Hausbeck, MI, 2008.**

Treatment	Rate Per 100 Gal	Plant Health (1-5) <sup>x,y</sup>			Plant Death (%)	
		9 Jan	16 Jan	23 Jan	16 Jan	23 Jan
Aliette 80WDG (fosetyl-Al)	4 lb	1.0 a	1.1 ab	1.4 ab	0.0 a	0.0 a
Banrot 40WP (etrifiazole + thiophanate-methyl)	12 oz	1.0 a	1.0 a	1.5 abc	0.0 a	0.0 a
Kocide 2000 DF (copper hydroxide)	1.5 lb	1.0 a	1.0 a	2.0 bcd	0.0 a	0.0 a
Phostrol (phosphorus acid salts)	2.5 pt	1.0 a	1.0 a	1.4 ab	0.0 a	0.0 a
Presidio 4SC (fluopicolide)	4 fl oz	1.0 a	1.3 ab	1.8 bcd	0.0 a	0.0 a
Presidio 4SC + Previcur Flex (fluopicolide + propamocarb hydrochloride)	4 fl oz + 1.2 pt	1.0 a	1.0 a	1.4 ab	0.0 a	0.0 a
Quadris SC (azoxystrobin)	9 fl oz	1.3 ab	2.0 cd	3.0 f	0.0 a	0.0 a
Ranman 400F (cyazofamid)	2.75 fl oz	1.0 a	1.4 abc	2.1 cd	0.0 a	0.0 a
Reason 500SC (fenamidone)	8.2 fl oz	1.4 ab	1.6 abc	2.1 cd	0.0 a	0.0 a
Revus 250SC (mandipropamid)	8.2 fl oz	1.5 ab	1.8 bcd	2.3 de	0.0 a	0.0 a
Subdue Maxx 2EC (mefenoxam)	1 fl oz	1.4 ab	1.8 bcd	2.9 ef	0.0 a	0.0 a
Untreated uninoculated	-	1.0 a	1.0 a	1.0 a	0.0 a	0.0 a
Untreated inoculated	-	1.8 b	2.4 d	3.1 f	25.0 b	25.0 b

\* Not an IR-4 Experiment: PDM Reports Vol 3: V049.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.



**Table 33. \* Efficacy on Pythium Root Rot (*Pythium* spp.) on Celery (*Apium graveolens*) ‘Dutchess’, Trial 2, Hausbeck, MI, 2008.**

Treatment	Rate Per 100 Gal	Plant Health (1-5) <sup>x,y</sup>				Plant Height 11 Nov
		21 Oct	28 Oct	4 Nov	11 Nov	
Aliette 80WDG (fosetyl-Al)	4 lb	1.8 abcd	1.7 ab	1.2 ab	1.8 ab	2.5 abc
Banol EC (propamocarb hydrochloride)	3 fl oz	2.3 bcd	4.2 de	5.2 d	5.0 de	1.6 e
Banrot 40WP (etridiazole + thiophanate-methyl)	12 oz	2.3 bcd	3.0 bcde	5.5 d	5.3 e	1.9 bcde
Kocide 2000 DF (copper hydroxide)	1.5 lb	2.0 abcd	3.2 bcde	5.5 d	5.7 e	1.5 e
Phostrol (phosphorus acid salts)	2.5 pt	2.0 abcd	2.0 abc	2.3 abc	2.3 abcd	2.4 abcd
Presidio 4SC (fluopicolide)	4 fl oz	1.7 abc	3.5 cde	3.8 bcd	4.2 bcde	1.8 cde
Presidio 4SC + Previcur Flex (fluopicolide + propamocarb hydrochloride)	4 fl oz +1.2 pt	1.5 ab	2.2 abc	2.2 abc	2.2 abc	2.7 a
Quadris SC (azoxystrobin)	9 fl oz	2.3 bcd	2.8 bcd	3.8 bcd	4.5 bcde	1.7 cde
Ranman 400F (cyazofamid)	2.75 fl oz	1.5 ab	3.2 bcde	4.8 cd	4.5 bcde	1.8 cde
Reason 500SC (fenamidone)	8.2 fl oz	1.2 ab	2.8 bcd	4.5 cd	4.8 cde	1.9 abcde
Revus 250SC (mandipropamid)	8.2 fl oz	2.2 abcd	3.7 cde	6.0 d	6.0 e	1.4 e
Subdue Maxx 2EC (mefenoxam)	1 fl oz	2.2 abcd	3.3 bcde	6.2 d	6.5 e	1.7 de
ZeroTol (hydrogen dioxide)	100 fl oz	3.0 d	4.0 de	5.2 d	5.2 e	1.6 e
Untreated uninoculated	-	1.0 a	1.0 a	1.0 a	1.0 a	2.6 a
Untreated inoculated	-	2.8 cd	4.7 e	5.3 d	5.5 e	1.3 e

\* Not an IR-4 Experiment: PDM Reports Vol 3: V047.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.

### **Comparative Efficacy on *Pythium ultimum***

Hausbeck conducted four experiments examining various products applied as drench for the control of *Pythium* root rot (*P. ultimum*) on geranium (*Pelargonium x hortorum*). In a 1999 research, products were drenched to plants in the plug tray 6 days before transplanting into infested medium. Stunting and plant death from a severe disease pressure was prevented by Heritage, Subdue Maxx, Banol and Terrazole (Table 34). In another trial in 2008, the initial fungicide application was applied the day of transplanting into mefenoxam-resistant infested medium on 23 May. An additional drench was made 6 Jun to all treatments, with the exception of Terrazole, Adorn + Terrazole, FenStop and Subdue MAXX in which a second fungicide application was not applied due to label recommendations. Terrazole or Adorn (applied alone or as a tank mix with Heritage, Alude or Terrazole), completely prevented plant death from a severe disease pressure causing 100 % mortality of untreated inoculated plants (Table 35). Plants that were similar in health to the untreated uninoculated plants included Terrazole and Adorn + Terrazole. Treatments of Heritage (both rates), Subdue, Mandipropamid, FenStop, and Alude resulted in ≥50% plant death. In a third trial in 2010, the initial fungicide application was applied the day of transplanting into mefenoxam-resistant infested medium on 5 Aug and reapplied on 18 Aug for all treatments. Disease pressure in this trial was severe with all untreated inoculated plants dead by the first rating (Table 36). By

the fourth rating, the Cg100, Disarm, Pageant, and Subdue MAXX treatments all had 100% plant death. Applications of Adorn SC and Terrazole 35WP completely prevented plant death and were similar in plant vigor and height in comparison to the untreated uninoculated. Alude, Fenstop and V-10208 were also effective in preventing plant death in comparison to the untreated inoculated. No phytotoxicity was observed from any treatment. In a fourth trial in 2013, the initial fungicide application was applied the day of transplanting into mefenoxam-resistant infested medium starting on 10 Jul and reapplied in accordance to the schedule in Table 37. Disease pressure was light in this trial with no significant differences in plant health between the untreated inoculated and uninoculated plants. Alude L, Vital, and Heritage WG (low rate) were the only treatments that resulted in health ratings of 1.0. Phytotoxicity was observed on the Adorn treated plants in the form of contorted leaves. Applications of Acibenzolar, spray or drench, resulted in health ratings worse than the untreated inoculated control.

**Table 34. \* Efficacy on Pythium Root Rot (*Pythium ultimum*.) on Geranium (*Pelargonium x hortorum*) ‘White Orbit’, Hausbeck, MI, 1999.**

Treatment	Rate Per 2 Liters	Plant Height (cm) <sup>x</sup>		Plant Death (%)		
		19 Apr	3 May	16 Apr	26 Apr	3 May
Banol (propamocarb hydrochloride)	4.7 ml	2.2 a	5.4 bcd	0.0 a	0.0 a	6.3 ab
Heritage 50W (azoxystrobin)	0.06 g	2.3 a	6.2 abc	0.0 a	0.0	0.0 a
RootShield ( <i>Trichoderma harzianum</i> T-22)	1.8 g	2.4 a	5.2 cd	25.0 c	37.5 b	56.3 cd
Subdue Maxx 2E (mefenoxam)	0.08 ml	2.5 a	6.6 ab	0.0 a	0.0 a	6.3 ab
	0.16 ml	2.3 a	5.9 abc	0.0 a	0.0 a	0.0 a
Terrazole 35WP (etridiazole)	1.5 g	2.3 a	5.8 abc	0.0 a	0.0 a	0.0 a
Untreated inoculated	-	2.2 a	4.1 e	31.3 c	37.5 b	56.3 cd

\* Not an IR-4 Experiment: F&N Tests Vol 55: 542. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Student-Newman-Keuls (P=0.05).

**Table 35. \* Efficacy on Pythium Root Rot (*Pythium ultimum*) on Geranium (*Pelargonium x hortorum*) ‘Orbit White’, Hausbeck, MI, 2008.**

Treatment	Rate Per 100 Gal	Plant Health (1-5) <sup>x,y</sup>			Plant Death (%)		
		30 May	6 Jun	13 Jun	30 May	6 Jun	13 Jun
Adorn 4SC (fluopicolide)	2 fl oz	1.9 b	2.0 bc	2.3 bc	0 a	0 a	0 a
Adorn + Alude (fluopicolide + phosphorus acid salts)	2 + 12.75 fl oz	1.8 b	2.3 bc	2.4 c	0 a	0 a	0 a
Adorn + Heritage (fluopicolide + acibenzolar)	2 fl oz + 0.9 oz	2.0 b	2.5 bc	2.9 c	0 a	0 a	0 a
Adorn + Terrazole (fluopicolide + etridiazole)	2 fl oz + 10 oz	1.9 b	1.6 ab	1.6 ab	0 a	0 a	0 a
Alude L (phosphorus acid salts)	12.75 fl oz	3.1 c	3.9 d	4.1 de	12.5 ab	50 b	50 b
Fenstop 500SC (fenamidone)	14 fl oz	3.0 c	3.2 d	3.9 d	0 a	37.5 b	50 b
Heritage 50WDG (azoxystrobin)	0.9 oz	4.1 d	4.9 e	5.0 f	12.5 ab	87.5 c	100 c
	1.8 oz	4.1 d	4.8 e	4.8 ef	37.5 bc	87.5 c	87.5 c
Mandipropamid 250SC (mandipropamid)	8.2 fl oz	4.3 d	4.8 e	4.9 f	37.5 bc	87.5 c	87.5 c
Subdue Maxx 2EC (mefenoxam)	1 fl oz	4.4 d	4.9 e	5.0 f	37.5 bc	87.5 c	100 c
Terrazole 35WP (etridiazole)	10 oz	1.4 ab	1.3 a	1.4 a	0 a	0 a	0 a
Untreated uninoculated	-	1.0 a	1.0 a	1.1 a	0 a	0 a	0 a
Untreated inoculated	-	4.5 d	4.9 e	5.0 f	62.5 c	87.5 c	100 c

\* Not an IR-4 Experiment: PDM Reports Vol 3: OT003.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.

**Table 36. Efficacy on Pythium Root Rot (*Pythium ultimum*.) on Geranium (*Pelargonium x hortorum*) ‘Orbit White’, Hausbeck, MI, 2010.**

Treatment	Rate Per 100 Gal	VigorRating <sup>x, y</sup>					Height (cm)			Plant Death (%)				
		9 Aug	12 Aug	16 Aug	19 Aug	23 Aug	16 Aug	19 Aug	23 Aug	9 Aug	12 Aug	16 Aug	19 Aug	23 Aug
Adorn 4SC (fluopicolide)	4 fl oz	1.1 c	1.4 d	1.4 e	1.4 d	1.5 d	3.38 a	3.8 a	5.1 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Alude L (phosphorus acid salts)	64 fl oz	1.5 c	2.4 c	3.5 c	3.9 b	4.1 b	1.84 b	1.6 b	1.3 b	12.5 ab	12.5 a	12.5 a	37.5 b	50.0 c
CG100 (caprylic acid)	0.6 pt	4.8 a	4.9 a	4.9 a	5.0 a	5.0 a	0.04 d	0.0 c	0.0 c	75.0 c	87.5 c	87.5 b	100.0 c	100.0 d
Disarm 480SC (fluoxastrobin)	2.4 fl oz	3.5 b	4.5 ab	4.8 a	5.0 a	5.0 a	0.11 d	0.0 c	0.0 c	37.5 b	50.0 b	75.0 b	100.0 c	100.0 d
Fenstop 500SC (fenamidone)	14 fl oz	1.6 c	2.5 c	3.1 c	3.5 b	3.8 b	2.19 b	1.8 b	1.7 b	0.0 a	0.0 a	0.0 a	25.0 b	37.5 bc
Heritage 50WDG (azoxystrobin)	0.9 oz	3.1 b	4.0 b	4.1 b	4.8 a	4.9 a	0.80 c	0.4 c	0.2 c	12.5 ab	25.0 ab	25.0 a	87.5 c	87.5 d
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	4.6 a	4.9 a	4.9 a	5.0 a	5.0	0.06 d	0.0 c	0.0 c	87.5 c	87.5 c	87.5 b	100.0 c	100.0 d
Subdue Maxx 2EC (mefenoxam)	1 fl oz	4.8 a	4.9 a	4.9 a	5.0 a	5.0 a	0.00 d	0.0 c	0.0 c	75.0 c	87.5 c	87.5 b	100.0 c	100.0 d
Terrazole 35WP (etridiazole)	10 oz	1.0 c	1.0 d	1.1 e	1.3 d	1.3 d	3.74 a	4.5 a	5.4 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
V-10208 SC	8 fl oz	1.0 c	1.3 d	2.0 d	2.5 c	3.1 c	2.26 b	2.2 b	1.7 b	0.0 a	0.0 a	0.0 a	0.0 a	12.5 ab
Untreated uninoculated	-	1.0 c	1.0 d	1.0 e	1.0 d	1.0 d	3.76 a	4.7 a	5.7 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Untreated inoculated	-	5.0 a	5.0 a	5.0 a	5.0 a	5.0 a	0.00 d	0.0 c	0.0 c	100.0 c	100.0 c	100.0 b	100.0 c	100.0 d

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s LSD (P=0.05).

<sup>y</sup> Rated on a scale of 1 to 5, where 1=healthy; 2=chlorosis/stunting; 3=minor to moderate wilting; 4=severe wilting; 5=plant death.

**Table 37. Efficacy on Pythium Root Rot (*Pythium ultimum*) on Geranium (*Pelargonium x hortorum*) ‘Orbit White’, Hausbeck, MI, 2013.**

Treatment	Rate Per 100 Gal	Application Interval/Method	Plant Health (1-5) <sup>x, y</sup>		
			7/17	8/1	8/14
Acibenzolar 50WDG	0.25 oz	14-day spray	1.5 abc	1.8 b	1.5 ab
	0.50 oz	14-day spray	1.8 cd	2.7 c	3.0 e
Acibenzolar 50WDG	0.125 oz	drench, one app	1.0 a	1.8 b	2.2 bcd
	0.25 oz	drench, one app	1.7 cde	2.8 c	2.5 cde
Acibenzolar 50WDG + Heritage WG	0.125 oz + 0.45 oz	21-day, drench	2.0 cd	2.7 c	2.8 de
	0.25oz + 0.9 oz	21-day, drench	2.2 d	3.0 c	3.0 e
Adorn SC (fluopicolide)	2 fl oz	14-day, drench	1.2 ab	1.5 a	2.0 bc
Alude L (phosphorus acid salts)	12.75 fl oz	drench, one app	1.2 ab	1.0 a	1.0 a
Heritage WG (azoxystrobin)	0.9 oz	Drench. app	1.0 a	1.0 a	1.0 a
	1.8 oz	Drench. app	1.0 a	1.0 a	1.2 a
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	14-day, drench	1.0 a	1.2 a	1.5 ab
	16 oz	14-day, drench	1.0 a	1.0 a	1.2 a
Terrazole L (etridiazole)	7 fl oz	drench, one app	1.2 ab	1.0 a	1.2 a
Vital (potassium phosphite)	1.25 pt	drench, one app	1.2 ab	1.0 a	1.0 a
Untreated uninoculated	-	-	1.0 a	1.0 a	1.0 a
Untreated inoculated	-	-	1.5 abc	1.5 ab	1.7 ab

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.

In 2006, Hausbeck conducted a study on poinsettia (*Euphorbia pulcherrima*). Fungicides were applied as drench immediately after transplanting and at 30-day intervals on 13 Jan and 14 Feb. Subdue Maxx, Truban and Heritage at the high rate (0.9 oz per 100 gal) provided the best control of a severe disease pressure, with plant health and height similar to or better than the untreated uninoculated control (Table 38). Heritage at 0.45 oz per acre was less effective. No phytotoxicity was observed from any treatment.

In 2011, Hausbeck conducted another study to determine efficacy of various products for control of Pythium root rot on poinsettia. All fungicides were applied as a drench immediately after transplanting except BW240 which was applied 3 days before inoculation and transplanting. Fungicides were applied at various intervals starting on 26 Jul (Table 39). Disease pressure was moderate in this trial with 25% of the untreated inoculated plants dead by the final rating date (Table 41). Stunting was severe in the untreated control. Adorn SC (both rates), Disarm SC, FenStop SC, Heritage (both rates), Pageant WG (16 oz), and Terrazole WP were the only treatments that resulted in plants statistically taller than the untreated control (Table 40). Adorn SC (1 fl oz), FenStop SC, and Terrazole WP were the only treatments that resulted in plant heights statistically similar to the untreated uninoculated plants. No phytotoxicity was observed except on plants treated with Adorn SC in the form of severe leaf curl. This symptom was especially noticeable on the newer growth and was severe enough that the plants would be classified as unsalable.

**Table 38. \* Efficacy on Pythium Root Rot (*Pythium ultimum*) on Poinsettia (*Euphorbia pulcherrima*) ‘Freedom Red’, Hausbeck, MI, 2006.**

Treatment	Rate Per 100 Gal	Plant Health (1-5) <sup>x, y</sup>			Plant Height (in.)
		27 Jan	24 Feb	17 Mar	17 Mar
Heritage 50WDG (azoxystrobin)	0.45 oz	1.8 b	1.8 b	1.8 b	4.8 d
	0.9 oz	1.2 a	1.5 ab	1.5 ab	6.1 bc
Heritage + Subdue Maxx (azoxystrobin + mefenoxam)	0.45 oz + 0.5 fl oz	1.0 a	1.0 a	1.0 a	7.3 a
	0.9 oz + 1 fl oz	1.0 a	1.0 a	1.0 a	7.5 a
Subdue Maxx 2EC (mefenoxam)	0.5 fl oz	1.0 a	1.0 a	1.3 ab	7.4 a
	1 fl oz	1.0 a	1.0 a	1.0 a	7.1 ab
Truban 30WP (etr Diazole)	10 oz	1.2 a	1.0 a	1.2 a	6.9 abc
Untreated uninoculated	-	1.0 a	1.0 a	1.0 a	6.0 c
Untreated inoculated	-	2.5 c	3.2 c	3.5 c	4.1 d

\* Not an IR-4 Experiment: PDM Reports Vol 1: OT013.

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.

**Table 39. Efficacy on Pythium Root Rot (*Pythium ultimum*) on Poinsettia (*Euphorbia pulcherrima*), ‘Freedom Red’ – Plant Health, Hausbeck, MI, 2011.**

Treatment	Rate Per 100 Gal	Applic. Intervals	Plant Health <sup>x,y</sup>				
			8/9	8/17	8/23	9/1	9/23
Adorn SC (fluopicolide)	1 floz	14-day	1.1 ab	1.1 ab	1.4 a-c	1.5 a-c	1.9 ab
Adorn SC	2 fl oz	14-day	1.1 ab	1.1 ab	1.5 a-d	1.5 a-c	1.6 ab
Aliette (fosetyl Al)	12.8 oz	28-day	1.9 bc	2.0 bc	2.4 d	2.8 e	3.1 d
Alude (Mono- and Di-potassium salts of Phosphorus Acid)	12.75 fl oz	21-day	1.8 a-c	1.9 a-c	2.1 b-d	2.5 de	3.1 d
BW240 WP ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz	3 dbi	1.3 ab	1.3 a-c	1.4 a-c	2.0 b-e	2.4 b-d
BW240 / Alude	6 oz / 12.75 fl oz	14-day	1.0 a	1.0 a	1.4 a-c	1.8 a-d	1.6 ab
Cg100 (caprylic acid)	0.8 pt	doi	1.5 a-c	1.5 a-c	1.6 a-d	1.9 a-e	2.4 b-d
Disarm SC (fluoxastrobin)	6 fl oz	14-day	1.6 a-c	1.6 a-c	1.6 a-d	1.8 a-d	2.1 bc
FenStop SC (fenamidone)	14 floz	28-day	1.0 a	1.0 a	1.5 a-d	1.6 a-d	1.9 ab
Heritage WDG (azoxystrobin)	0.9 fl oz	21-day	1.0 a	1.0 a	1.0 a	1.1 ab	1.8 ab
Heritage WDG	1.8 fl oz	21-day	1.3 ab	1.3 a-c	1.4 a-c	1.5 a-c	1.9 ab
Pageant WG (boscalid+pyraclostrobin)	12 oz	14-day	1.6 a-c	1.8 a-c	1.9 a-d	1.9 a-e	2.3 b-d
Pageant WG	16 oz	14-day	1.0 a	1.0 a	1.4 a-c	1.6 a-d	1.9 ab
Terrazole WP (etr Diazole)	10 oz	28-day	1.1 ab	1.1 ab	1.3 ab	1.4 a-c	1.6 ab
Untreated uninoculated	-	-	1.0a	1.0 a	1.0 a	1.0 a	1.0 a
Untreated inoculated	-	-	2.1 c	2.1 c	2.3 cd	2.3 c-e	2.9 cd

\* dbi=days before inoculation; doi=day of inoculation

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.

**Table 40. Efficacy on Pythium Root Rot (*Pythium ultimum*) on Poinsettia (*Euphorbia pulcherrima*), ‘Freedom Red’ – Plant Height, Hausbeck, MI, 2011.**

Treatment	Rate Per 100 Gal	Applic. Intervals	Plant Height (cm) <sup>x,y</sup>			
			8/17	8/23	9/1	9/23
Adorn SC (fluopicolide)	1 floz	14-day	12.2 a	13.1 a	14.5 a	16.9 ab
	2 fl oz	14-day	11.1 a-d	12.2 a-c	13.5 ab	14.7 b-d
Aliette (fosetyl Al)	12.8 oz	28-day	8.5 e	9.0 e	9.1 f	9.9 f
Alude (Mono- and Di-potassium salts of Phosphorus Acid)	12.75 fl oz	21-day	9.9 b-e	9.9 de	10.2 ef	11.1 ef
BW240 WP ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz	3 dbi	9.8 c-e	10.7 b-e	11.5 b-f	12.7 d-f
BW240 / Alude	6 oz / 12.75 fl oz	14-day	9.3 de	10.0 de	9.9 f	11.4 ef
Cg100 (caprylic acid)	0.8 pt	doi	9.4 de	9.9 de	10.3 d-f	11.7 ef
Disarm SC (fluoxastrobin)	6 fl oz	14-day	10.2 b-e	10.9 b-e	12.3 a-e	15.0 b-d
FenStop SC (fenamidone)	14 floz	28-day	10.7 a-d	11.4 a-d	13.3 a-c	17.4 ab
Heritage WDG (azoxystrobin)	0.9 fl oz	21-day	9.5 c-e	10.4 c-e	11.5 b-f	14.8 b-d
	1.8 fl oz	21-day	10.8 a-d	11.5 a-d	12.7 a-d	15.4 b-d
Pageant WG (boscalid+pyraclostrobin)	12 oz	14-day	9.6 c-e	9.9 de	10.9 c-f	13.4 c-e
	16 oz	14-day	11.1 a-d	11.8 a-d	13.2 a-c	16.2 bc
Terrazole WP (etridiazole)	6 oz alt. 12.75 fl oz	14-day	11.8 ab	12.6 ab	14.7 a	17.4 ab
Untreated uninoculated	10 oz	28-day	11.3 a-c <sup>z</sup>	12.7 ab	14.7 a	19.7 a
Untreated inoculated	-	-	9.5 c-e	10.4 c-e	10.5 d-f	11.7 ef

\* dbi=days before inoculation; doi=day of inoculation

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.



**Table 41. Efficacy on Pythium Root Rot (*Pythium ultimum*) on Poinsettia (*Euphorbia pulcherrima*), ‘Freedom Red’ – Plant Death, Hausbeck, MI, 2011.**

Treatment	Rate Per 100 Gal	Applic. Intervals	Plant Death (%) <sup>x,y</sup>				
			8/9	8/17	8/23	9/1	9/23
Adorn SC (fluopicolide)	1 floz	14-day	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
	2 fl oz	14-day	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Aliette (fosetyl Al)	12.8 oz	28-day	0.0 a	0.0 a	0.0 a	0.0 a	12.5 a
Alude (Mono- and Di-potassium salts of Phosphorus Acid)	12.75 fl oz	21-day	12.5 ab	12.5 ab	12.5 ab	25.0 b	25.0 a
BW240 WP ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz	3 dbi	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
BW240 / Alude	6 oz / 12.75 fl oz	14-day	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Cg100 (caprylic acid)	0.8 pt	doi	12.5 ab	12.5 ab	12.5 ab	12.5 ab	12.5 a
Disarm SC (fluoxastrobin)	6 fl oz	14-day	12.5 ab	12.5 ab	12.5 ab	12.5 ab	12.5 a
FenStop SC (fenamidone)	14 floz	28-day	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Heritage WDG (azoxystrobin)	0.9 fl oz	21-day	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
	1.8 fl oz	21-day	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Pageant WG (boscalid+pyraclostrobin)	12 oz	14-day	0.0 a	12.5 ab	12.5 ab	12.5 ab	12.5 a
	16 oz	14-day	0.0 a	0.0 a	0.0 a	0.0 a	12.5 a
Terrazole WP (etridiazole)	10 oz	28-day	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	-	-	25.0 b	25.0 b	25.0 b	25.0 b	25.0 a

\* dbi=days before inoculation; doi=day of inoculation

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher’s LSD (P=0.05).

<sup>y</sup> Plant health rating based on 1 to 5 scale where 1=healthy, 2=minor wilting or chlorosis, 3=moderate wilting or chlorosis, 4=severe wilting or chlorosis, and 5=plant death.

In 2010, Chase conducted a greenhouse trial to determine efficacy of various products for control of damping-off caused by *Pythium ultimum* on cockscomb (*Celosia* sp.). Products were applied as sprinch at 20 ml per 3.5 inch pot on 11 October three days after seeding (8 October) and one day before disease inoculation (12 October). Several treatments were applied a second time on 25 October. Seedling emergence was recorded on 20 October and 2 November. Adorn + Subdue Maxx was the only treatment that provided significant control of severe damping-off on 20 October, with plant emergence comparable to the uninoculated control (Table 42); Adorn by itself was ineffective. All other treatments did not significantly increase emergence over the inoculated control. By 2 November, Adorn + Subdue Maxx and Fenstop had higher emergence than the inoculated control, though not as high as the uninoculated control.

**Table 42. Efficacy on Damping-off (*Pythium ultimum*) on Cockscomb (*Celosia* sp.), Chase, CA, 2010.**

Treatment	Rate Per 100 Gal	No. Seedlings Per Pot <sup>x</sup>	
		20 Oct	2 Nov
Adorn 4SC (fluopicolide)	2 fl oz	1.7 a	0.1 a
Adorn 4SC + Subdue Maxx 2EC	2 + 1 fl oz	15.3 b	14.5 c
Aliette 80WDG (fosetyl Al)	12.8 oz	1.8 a	0.3 a
BW240 WP( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz (once only)	2.9 a	0.3 a
BW240 / Aliette	6 oz (once only) / 12.8 oz	2.8 a	0.4 a
CG100 (organic acid)	0.6 pt (once only)	4.0 a	0.0 a
Disarm 480SC (fluoxastrobin)	0.6 fl oz	4.6 a	1.4 a
Fenstop (fenamidone)	14 fl oz (once only)	8.6 a	10.9 b
Heritage (azoxystrobin)	0.9 oz (once only)	3.8 a	1.9 a
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	5.2 a	1.4 a
Segway (cyazofamid)	1.5 fl oz	7.5 a	2.4 a
Untreated uninoculated	-	18.3 b	18.8 d
Untreated inoculated	-	1.8 a	0.2 a

<sup>x</sup> Means followed by the same letter do not differ significantly at P=0.05.

In 2010, Chastagner conducted a greenhouse trial to test the efficacy of several fungicides applied as drench for control of damping off and root rot caused by *P. ultimum* (isolates 193 and PP249B) on Douglas fir (*Pseudotsuga menziesii*). Products were applied 20 Dec, 5 days after disease inoculation of potting mix (15 Dec), except Remedier and BW240 which were applied on 7 Dec and 12 Dec, respectively. Plants were seeded on 22 Dec. Treatments were applied one to three times on 1 to 4-week intervals for various products. Data on symptom development was collected once per week for 4 weeks beginning 14 days after seeding. Notes on symptoms were taken and the number of “healthy” seedlings was recorded. Symptoms included damping off, which occurred shortly after emergence of the cotyledon, to root rot which killed the seedlings during the experiment. Subdue MAXX, Fenstop, Adorn and Segway provided good control of *P. ultimum* resulting in higher numbers of healthy seedlings per pot compared to the inoculated control (Table 43). No phytotoxicity was observed from any treatment.

**Table 43. Efficacy on Pythium Root Rot (*Pythium ultimum*) on Douglas Fir (*Pseudotsuga menziesii*), Chastagner WA, 2010b.**

Treatment	Rate Per 100 Gal	Application Dates <sup>z</sup>	Application Interval	No. of Healthy Seedlings <sup>x,y</sup>
Adorn 4FL (fluopicolide)	2 fl oz	3, 7	21 Days	7.4 ab
Aliette 80WP (fosetyl Al)	9.6 oz	3, 8	28 Days	5.2 a-e
BW240 WP ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz	2	1 application	2.6 b-e
BW240 / Magellan rotation	6 oz + 12 fl oz	2, 4	Magellan @ 14 days	0.8 de
CG100 (organic acid)	9.6 fl oz	3, 8	28 Days	4.0 a-e
Disarm 480SC (fluoxastrobin)	0.4 fl oz	3, 6, 8	14 Days	6.6 abc
Fenstop (fenamidone)	10 fl oz	3, 8	28 Days	8.2 a
Heritage (azoxystrobin)	0.9 oz	3, 7	21 Days	4.2 a-e
Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	12 fl oz	3, 8	28 Days	4.6 a-e
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	3, 6, 8	14 Days	6.0 a-d
Remedier ( <i>Trichoderma asperellum</i> and <i>T. gamsii</i> )	2.5 oz	1, 5, 8	14-21 Days	0.2 e
Remedier	7.5 oz	1, 5, 8	14-21 Days	0.2 e
Segway (cyazofamid)	3 fl oz	3, 8	28 Days	7.0 ab
Subdue Maxx (mefenoxam)	2 fl oz	3, 7	21 Days	8.8 a
Terrazole L (etridiazole)	7 fl oz	3, 8	28 Days	6.2 a-d
Untreated uninoculated	-	-	-	7.6 ab
Untreated inoculated	-	-	-	1.3 cde

<sup>x</sup> Means followed by the same letter do not differ significantly based on Tukey's HSD Test, (P=0.001).

<sup>y</sup> Data collected 35 days after seeding (January 26, 2011).

<sup>z</sup> Dates: 1 = 12/7/10, 2 = 12/12/10, 3 = 12/20/10, 4 = 12/26/10, 5 = 12/29/11, 6 = 1/3/11, 7 = 1/10/11, and 8 = 1/18/11.

In 2010, Kirk conducted a greenhouse trial to test the efficacy of several fungicides for control of root rot caused by *P. ultimum* on larkspur (*Delphinium sp.*). Initial treatments were applied as drench 4 days after transplanting, except BW240 which was applied to plant roots as an immersion in solution for 30 seconds prior to transplanting. Plants were inoculated with a liquid suspension of *Pythium ultimum* that had been grown in liquid PDA culture for 14 days. Pythium root rot developed in the trial and about 140 days after transplanting, the inoculated control plants developed some leaf chlorosis and root necrosis. No treatments significantly reduced Pythium leaf chlorosis or root necrosis in comparison to the untreated control (Table 44). No treatment affected the number of leaves per plant. Pageant and Terrazole significantly increased the height of the plants in comparison to the untreated control plants. Several treatments caused transient leaf phytotoxicity; these included the treatments of Adorn, BW240, Disarm, Fenstop and Terrazole.

In 2012 and 2013, Santamaria conducted two greenhouse studies on geranium to test the efficacy of several fungicides for control of root rot caused by *P. ultimum*. In the first study, fungicides were applied as drench to 10-week old plants on Sept 9, 3 days before disease inoculation. All treatments were reapplied 28 days later except Pageant which was reapplied 14 days later; BW240 was applied only once because trial was concluded before a second application scheduled for 10-12 weeks after first application.

Data on plant size and plant health, as well as root rot rating and root dry weight, were recorded at various times up to 60 days after initial application of fungicides. The results suggest that all treatments except Acibenzolar and Acibenzolar + Heritage work efficiently to prevent the infection of *Pythium ultimum* (Table 45). No phytotoxicity was observed from any treatment. In the second study, fungicides were applied as drench to 8-week old plants on Sept 14, 3 days before disease inoculation. All treatments were reapplied 28 days later, except Pageant which was reapplied 14 days later; Rootshield Plus, SP2770 and SP2771 were applied only once. In order to more clearly distinguish between phytotoxic effects from chemical treatments and effects from the pathogen, each treatment was inoculated or not inoculated (Table 46). All treatments significantly reduced disease severity, with Terrazole better than the other treatments; however all were inferior to uninoculated treatments. Data from the uninoculated treatments indicate that Terrazole may have slight phytotoxic effect on geranium.

**Table 44. Efficacy on Pythium Root Rot (*Pythium ultimum*) on Larkspur (*Delphinium sp.*), Kirk, MI, 2010.**

Treatment	Rate Per 100 Gal	Application Dates <sup>u</sup>	Phytotoxicity <sup>x, w</sup> 79 DAP <sup>v</sup>	No. Leaves Per Plant 137 DAP	Plant Height (cm) 137 DAP	Leaf Necrosis <sup>y</sup> 137 DAP	Root Necrosis <sup>z</sup> 137 DAP
Adorn 4SC (fluopicolide)	4 fl oz	B, C	0.9 b	8.9 a	45.9 abc	5.4 ab	4.5 bcd
AgriFos 45.8SC (mono- and di-potassium salts of phosphorus acid) then BW 240	67 fl oz, 6 oz	B, C	0.2 c	10.0 a	38.2 bcd	4.6 ab	4.6 bcd
BW 240 WP( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	3 oz	A, E	0.9 b	9.4 a	33.6 cd	6.1 a	4.9 bcd
CG100 20SC (organic acid)	0.8 pt	B	0.5 bc	9.8 a	41.6 a-d	4.8 ab	4.7 bcd
Disarm 480SC (fluoxastrobin)	0.6 fl oz	B, D	1.0 ab	9.6 a	37.0 bcd	5.7 ab	6.1 ab
Fenstop 480SC (fenamidone)	14 fl oz	B, D	1.6 a	11.2 a	31.3 d	5.4 ab	6.7 a
Heritage 50WDG (azoxystrobin)	1.8 oz	B, D	0.5 bc	8.2 a	36.9 bcd	5.8 ab	5.9 abc
Magellan 23SC (mono- and dibasic sodium, potassium and ammonium phosphites)	8 fl oz	B	0.5 bc	9.2 a	30.7 b	4.7 ab	4.4 bcd
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	B, C	0.0 c	9.2 a	48.0 ab	4.9ab	4.6 bcd
Subdue Maxx 2EC (mefenoxam)	1 fl oz	B	0.4 bc	10.0 a	34.9 bcd	4.4 bc	4.2 cde
Terrazole 35WP (etridiazole)	10 oz	B	1.0 b	9.5 a	54.8 a	4.5 abc	3.4 de
Untreated uninoculated	-	-	0.0 c	7.7 a	34.2 cd	2.9 c	2.7 e
Untreated inoculated	-	-	0.0 c	7.2 a	34.1 cd	5.8 ab	5.1 a-d

<sup>x</sup> Means followed by the same letter do not differ significantly based on Fisher's LSD (P=0.05).

<sup>w</sup> Phytotoxicity scale from 0 – 5; 0= no phytotoxicity; 1= ≈1mm of entire leaf margin yellow of at least one leaf; 2= 1-5% of entire leaf margin yellow of at least one leaf; 3= 1-5% of entire leaf margin yellow of all leaves; 4= 5-10% of entire leaf margin yellow of all leaves; 5= >10% of entire leaf margin yellow of all leaves.

<sup>y</sup> Leaf necrosis scale from 0 – 10; 0= no yellowing; 1= bottom two leaves pale green; 2= bottom two leaves pale yellow; 3= bottom two leaves yellow; 4= 5-10% all leaves yellow; 5= 10-20% of all leaves yellow; 6= 20-50% of all leaves yellow; 7= 50-75% of all leaves yellow; 8= 75-100% of all leaves yellow; 9= 0 - 50% of leaves necrotic; 10= 100% of leaves necrotic.

<sup>z</sup> Root necrosis scale from 0 – 10; 0= no necrosis; 1= 0-5%; 2= 6-10%; 3= 11-15%; 4= 16-20%; 5= 20-30%; 6= 30-40%; 7= 40-50%; 8= 50-60%; 9= 60-75%; 10= 75-100% of root mass necrotic.

<sup>u</sup> Application dates: A= 12 Sep; B= 16 Sep; C= 5 Oct; D= 19 Oct; E= 8 Dec.

<sup>v</sup> Days after transplanting (on 9/12/10).

**Table 45. Efficacy on Pythium Root Rot (*Pythium ultimum*.) on Geranium (*Pelargonium x hortorum*), ‘Orbit White’, Santamaria, OR, 2012.**

Treatment	Rate Per 100 Gal	Plant Height (cm) <sup>x</sup>		Plant Width (cm)		Root Rating <sup>y</sup> 60 DAT	Root Dry Wt (g) 60 DAT	Plant Health <sup>z</sup>		
		0 DAT	60 DAT	0 DAT	60 DAT			7 DAT	14 DAT	28 DAT
Acibenzolar	0.125 oz	18.32 cd	23.87 e	20.07 cd	17.54 g	2.90 a	0.87 e	1.60 b	2.70 a	3.00 a
Acibenzolar	0.25 oz	19.31 a-d	22.86 e	20.07 cd	16.77 g	3.00 a	0.85 e	1.90 a	2.70 a	3.00 a
Acibenzolar + Heritage (azoxystrobin)	0.125 oz + 0.45 oz	20.34 ab	27.30 d	21.85 abc	24.14 ef	3.00 a	1.92 d	1.50 b	2.70 a	2.80 ab
Acibenzolar + Heritage	0.25 oz + 0.9 oz	20.59	27.96d	22.74ab	23.87 f	3.10 a	1.99 d	1.10 c	2.40 ab	3.00 a
BW240 ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz then 3 oz	18.94 bcd	32.02ab	20.84bcd	27.82 b-e	1.00 b	3.99 a	1.10 c	1.80 c	1.80 de
Heritage	0.9 oz	19.83abc	29.47bc	20.34cd	25.92 def	1.30 b	4.06 a	1.10 c	1.80 c	2.20 cd
Heritage	1.8 oz	19.20a-d	30.36bcd	21.61a-d	28.94 bcd	1.20 b	3.28 abc	1.00 c	1.70 c	2.00 cde
Pageant (boscalid + pyraclostrobin)	12 oz	19.06a-d	28.57cd	21.61a-d	26.41c-f	1.50 b	2.72 bc	1.10 c	2.00 bc	2.20 cd
Pageant	16 oz	20.20ab	31.38bc	22.61ab	29.98 bc	1.10 b	3.07 bc	1.20 c	2.10 bc	2.10 cd
Subdue Maxx 2EC (mefenoxam)	1 fl oz	20.32ab	30.34bcd	23.50a	30.35 b	1.00 b	2.55bcd	1.10 c	2.10 bc	2.40 bc
Terrazole L (etridiazole)	7 fl oz	19.45a-d	32.78ab	21.61a-d	34.04 a	1.40 b	2.99 bc	1.10 c	1.10 d	1.60 e
Untreated uninoculated	-	20.46ab	34.81a	20.59cd	34.31 a	1.00 b	3.43 ab	1.00 c	1.00 d	1.00 f
Untreated inoculated	-	18.03 d	30.63 bcd	19.70 d	29.20 bcd	1.40 b	2.42 cd	1.10 c	1.70 c	2.00 cde

<sup>x</sup> Means within a column followed by the same letter do not differ significantly based on the Waller-Duncan k ratio, t-test, k=100, P=0.05.

<sup>y</sup> Root rot rating: 1= healthy, 2= 25% or less roots necrotic, 3= 26 - 50% roots necrotic, 4= more than 50% necrotic, and 5= crown rot, plant dead.

<sup>z</sup> Rated on a 1-5 scale: 1= healthy; 2=minor wilting or chlorosis; 3=moderate wilting or chlorosis; 4=severe wilting or chlorosis; 5= plant death

**Table 46. Efficacy on Pythium Root Rot (*Pythium ultimum*.) on Geranium (*Pelargonium x hortorum*), ‘Orbit White’, Santamaria, OR, 2013.**

Treatment	Rate Per 100 Gal	Inoculate	Final Evaluation <sup>x</sup> (11/13/13)		
			Severity <sup>y</sup>	Growth Index <sup>z</sup>	Root Dry Wt (g)
Heritage (azoxystrobin)	0.9 oz	-	1.3 a	17.5 b	93.2 d
	0.9 oz	+	2.6 f	8.7 d	63.6 i
Pageant (boscalid + pyraclostrobin)	12 oz	-	1.1 a	18.3 b	99.7 c
	12 oz	+	3.0 f	8.1 d	47.2 j
	16 oz	-	1.6 c	18.5 b	96.0 c
	16 oz	+	3.0 f	6.7 d	37.4 l
Rootshield Plus ( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz	-	1.5 b	16.1 b	88.1 e
	6 oz	+	2.6 f	8.7 d	48.2 j
SP2770	2.66 lb	-	1.0 a	18.2 b	117.2 b
	2.66 lb	+	2.9 f	7.7 d	42.3 k
SP2771	3 fl oz	-	1.6 c	18.5 b	100.5 c
	3 fl oz	+	3.0 f	6.8 d	55.3 j
Subdue Maxx 2EC (mefenoxam)	1 fl oz	-	1.8 c	15.2 b	103.6 c
	1 fl oz	+	3.0 f	7.7 d	52.5 j
Terrazole L (etridiazole)	7 fl oz	-	2.3 d	15.1 c	70.4 g
	7 fl oz	+	2.4 e	10.7 d	65.5 h
Untreated	-	-	1.6 c	19.4 a	137.0 a
	-	+	3.1 g	7.6 d	85.8 f

<sup>x</sup> Means within a column followed by the same letter do not differ significantly based on the Waller-Duncan k ratio, P=0.05.

<sup>y</sup> Root rot rating: 0= Healthy, 1=Minor Wilting or Chlorosis, 2=Moderate Wilting or Chlorosis, 3=Severe Wilting or Chlorosis, 4= Severe Wilting or Chlorosis and Dieback, 5=Complete Plant Death.

<sup>z</sup> Growth index = (Final Height - Initial Height) + ( Final Width - Initial Width)] ÷ 2.

In 2003, Dillard conducted a greenhouse experiment to examine biological fungicides for the control of damping-off caused by *P. ultimum* on cucumber (*Cucumis sativus*). All treatments were applied as drench on the day of inoculation (7 Aug) except SoilGard which was incorporated in the potting mix 3 days before inoculation. None of the biological fungicides (Companion, PlantShield and SoilGard) significantly increased stand count (Table 47). No phytotoxicity was observed from any treatment.

**Table 47. \* Efficacy on Damping-off (*Pythium ultimum*.) on Cucumber (*Cucumis sativus*)‘Diva Hybrid’, Dillard, NY, 2003.**

Treatment	Rate	Stand Count <sup>x</sup> 9 Sep
Companion ( <i>Bacillus subtilis</i> GB03)	1.5ml/L	0.0 c
Oximate SC (hydrogen dioxide)	1:100	4.0 b
Plantshield ( <i>Trichoderma harzianum</i> T-22)	4g/L	0.3 c
SoilGard 12G ( <i>Gliocladium virens</i> )	5.5 g/5000 cc	1.3 c
Untreated uninoculated	-	9.5 a
Untreated inoculated	-	0.0 c

\* Not an IR-4 Experiment: F&N Tests Vol 60: V101. Not all products tested included in table.

<sup>x</sup> Means followed by same letter do not differ significantly based on Fisher’s Protected LSD (P=0.05).

## Comparative Efficacy on *Pythium vipa*

In 2010 and 2013, Grunwald conducted two greenhouse trials to test the efficacy of several fungicides applied as drench for control of root rot caused by *P. vipa* (isolate 09) on Douglas fir (*Pseudotsuga menziesii*). In the first trial, products were applied on the day of disease inoculation (6 July) except BW240 and BW240 + Aliette which were applied 3 days before (3 July). Plants were seeded on 8 July. Treatments were applied once or twice on 2- or 3-week schedule for various products. Seedling germination and stand counts were taken at 2, 3, 4 and 5 weeks after planting. Alude provided the best control of *P. vipa* resulting in significant stand improvement comparable to the uninoculated control (Table 48). Adorn, Heritage and the standards Aliette and Subdue Maxx provided some control resulting in significant stand improvement over the nontreated control although not as good as the uninoculated control. BW240, BW240 + Aliette, Cg100, Disarm, Fenstop and Pageant were ineffective. In the second trial, products, except Rootshield Plus, were applied on Nov 18, 3 day after disease inoculation (11/15), and 2 days before seeding on Nov 20. The treatment of Rootshield Plus was applied as a soil mix with potting medium 2 days before disease inoculation. Treatments were applied once or twice on 2- or 3-week schedule for various products. Seedling survival counts were taken at 2, 3, and 4 weeks after planting. Only data from the last count are shown (Dec 18). The standard Subdue Maxx and Adorn provided the best control of *P. vipa* resulting in significant stand improvement over the untreated control, followed by BW240 and Pageant and SP2771 (Table 49). Heritage and SP2770 were not significantly different from the untreated control. No phytotoxicity was observed from any treatment.

**Table 48. . Efficacy on Pythium Root Rot Caused by *Pythium vipa* on Douglas Fir (*Pseudotsuga menziesii*), Grunwald, OR, 2010c.**

Treatment	Rate Per 100 Gal	No. / Interval of Applications	Plant Emergence at Weeks After Planting <sup>x</sup>			
			2	3	4	5
Adorn 4FL (fluopicolide)	2 fl oz	2/14 days	3.38 bcd	2.38 bc	2.38 cd	2.38 cd
Aliette 80WP (fosetyl Al)	9.6 oz	1	3.13 cde	2.75 b	2.5 cd	2.5 cd
Alude (phosphorus acid salts)	12.7 fl oz	1	4.75 ab	4.38 a	4.38 ab	4.38 ab
BW240 WP( <i>Trichoderma harzianum</i> & <i>T. virens</i> )	6 oz	1	1.75 edf	1.63 bcd	1.63 cde	1.63 cde
BW240 + Aliette	6 oz + 9.6 oz	1	0.375 gh	0.5 ed	0.5 ef	0.5 ef
CG100 (caprylic acid)	0.6 pt	1	1.25 fgh	1.13 cde	1.13 def	1.13 def
Disarm 480SC (fluoxastrobin)	0.4 fl oz	2/14 days	0.75 fgh	0.63 de	0.63 ef	0.63 ef
Fenstop (fenamidone)	10 fl oz	1	0 h	0.25 de	0.25 ef	0.25 ef
Heritage (azoxystrobin)	0.9 oz	2/21 days	2.13 def	1.63 bcd	1.63 cde	1.63 cde
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	2/14 days	0.13 h	0.38 de	0.38 ef	0.38 ef
Subdue Maxx (mefenoxam)	1 fl oz	2/21 days	3.75 abc	2.63 b	3 bc	3 bc
Untreated uninoculated	-	-	4.88 a	5.25 a	5.38 a	5.38 a
Untreated inoculated	-	-	0 h	0 e	0 f	0 f

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



**Table 49. Efficacy on Pythium Root Rot (*Pythium vipa*) on Douglas Fir (*Pseudotsuga menziesii*), Grunwald, OR, 2013c.**

<b>Treatment</b>	<b>Rate Per 100 Gal</b>	<b>No. / Applic. Interval</b>	<b>Plant Emergence at 4 Weeks After Planting<sup>x</sup></b>
Adorn 4FL (fluopicolide)	2 fl oz	2/14 days	60.96 ab
BW240 WP ( <i>Trichoderma harzianum</i> and <i>T. virens</i> )	6 oz	1	49.01 bc
Heritage (azoxystrobin)	0.9 fl oz	1	23.97 cd
Pageant 38WG (boscalid + pyraclostrobin)	12 oz	2/14 days	40.79 bc
SP2770	2.7 lb	1	26.83 cd
SP2771	3 fl oz	1	31.31 c
Subdue Maxx (mefenoxam)	1 fl oz	2/21 days	69.66 ab
Untreated inoculated	-	-	7.62 d

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

## ***Efficacy Summary by Active Ingredient***

A brief efficacy summary for select products is given below, with a reminder that there are very limited published data available to draw definitive conclusions for each product/pest species. Products were selected based on interest in these products for testing in 2010-2013 Pythium efficacy project.

**Acibenzolar.** Acibenzolar applied as drench and Acibenzolar + Heritage applied foliar or drench provided good control of root rot (*P. irregulare*) in a rose periwinkle trial, generally poor control of *P. aphanidermatum* in single trials on poinsettia and snapdragon, and no control of *P. ultimum* in a geranium trial; results of another trial on geranium were inconclusive.

**Azoxystrobin.** Heritage applied as drench provided generally good control of root rot (*P. aphanidermatum*) on petunia, less effective control on geranium and snapdragon, and poor to good control on poinsettia. It provided excellent control of root rot and damping-off in one petunia trial. Trials on geranium and poinsettia showed Heritage generally providing good control of *P. ultimum*. It provided good control of root rot (*P. irregulare*) in a rose periwinkle trial. On New Guinea impatiens, good control of damping-off (*P. irregulare*) was obtained when applied 48 hours before disease inoculation. Also it was the only treatment that controlled damping-off when applied 48 hours after inoculation. However, it provided no control of *P. irregulare* in a cockscomb trial; results of a trial on geranium were inconclusive. In two Douglas fir trials, poor control of *P. dissotocum*, *P. irregulare* and *P. vicia* was obtained. Another Douglas fir trial showed poor control of *P. mamillatum* and *P. ultimum*. A trial on *P. myriotylum* on caladium showed Heritage providing good control when applied as drench but not when applied as a spray. It was ineffective on *P. ultimum* in cockscomb, geranium and larkspur trials. On snap bean, Heritage provided good control of cottony leak (*P. aphanidermatum*) in one trial but was ineffective in two other trials. In 2 greenhouse celery trials, Quadris was ineffective on mefenoxam-resistant Pythium root rot (*Pythium* spp.).

**Bacillus subtilis.** QRD 713 provided no significant control of *P. aphanidermatum* on geranium, and Companion was ineffective in a gerbera test.

**Boscalid+Pyraclostrobin.** Pageant provided excellent control of Pythium root rot and damping-off caused by *Pythium aphanidermatum* in a petunia trial, good control of root rot in a snapdragon trial, but variable (poor and good) control in two poinsettia trials. It provided good control of root rot (*P. irregulare*) in a rose periwinkle trial; results of a trial on geranium were inconclusive. No and fair control of *P. dissotocum* and *P. irregulare* and *P. vicia* was obtained in two Douglas fir trials; another Douglas fir trial showed mediocre control of *P. mamillatum* and *P. ultimum*. It was ineffective on *P. ultimum* in cockscomb, geranium, larkspur and poinsettia trials.

**Caprylic Acid.** CG100 provided excellent control of *Pythium* root rot and damping-off caused by *Pythium aphanidermatum* in one petunia trial, but no control of root rot in poinsettia and snapdragon trials. It provided no control of *P. dissotocum*, *P. irregulare*, and *P. vicia* in one Douglas fir trial; in another trial, poor control of both *P. ultimum* and *P. mamillatum* was obtained. It provided no control of *P. irregulare* in one cockscomb trial and a rose periwinkle trial. Also it was ineffective on *P. ultimum* in cockscomb, geranium, larkspur and poinsettia trials.

**Cyazofamid.** Segway provided no control of *P. aphanidermatum* in one poinsettia trial. It provided no control of *P. irregulare* and *Pythium ultimum* in cockscomb trials. However, excellent control of *P. mamillatum* and *P. ultimum* was obtained in a Douglas fir trial. Ranman provided good control of *P. aphanidermatum* on snap bean, tomato and watermelon. It also significantly reduced cavity spot caused by *Pythium* spp. (*P. violae*, *P. sulcatum* and *P. ultimum*) on carrot. However, 2 greenhouse trials on celery showed no to poor control of mefenoxam-resistant Pythium root rot (*Pythium* spp.).

**Etridiazole.** Terrazole or Truban provided excellent control of root rot (*P. aphanidermatum*) in geranium, poinsettia and snapdragon trials. Similarly, they provided excellent control of root rot (*P.*

*ultimum*) in two poinsettia and five geranium trials. On New Guinea impatiens, Truban did not reduce disease severity from *P. irregulare*. Terrazole provided excellent control of *P. mamillatum*, but mediocre control of *P. ultimum* in a Douglas fir trial. Fair control of *P. irregulare* was obtained in a rose periwinkle trial. It provided poor control of *P. ultimum* in geranium and larkspur trials.

**Fenamidone.** Fenstop provided excellent control of *Pythium* root rot and damping-off caused by *Pythium aphanidermatum* in a petunia trial. Good control of *P. aphanidermatum* was obtained in poinsettia and snapdragon trials. It provided excellent control of *P. ultimum* in a poinsettia trial but poor control in two geranium trials, and no control in cockscomb and larkspur trials. No control of *P. dissotocum*, *P. irregulare* and *P. ultimum* was obtained in one Douglas fir trial; in another trial, no control of *P. mamillatum* and *P. ultimum* was obtained. Similarly, it provided no control of *P. irregulare* in one cockscomb trial; results of a trial on geranium were inconclusive. Reason provided good control of cottony leak (*P. aphanidermatum*) in 3 snap bean trials. It also significantly reduced cavity spot caused by *Pythium* spp. (*P. violae*, *P. sulcatum* and *P. ultimum*) on carrot. However, 2 greenhouse trials on celery showed no to poor control of mefenoxam-resistant *Pythium* root rot (*Pythium* spp.).

**Fluopicolide.** Adorn or V-10161 provided excellent control of *Pythium* root rot and damping-off caused by *Pythium aphanidermatum* in a petunia trial, good control of root rot in one geranium and two poinsettia trials but was less effective than labeled products in two snapdragon trials. It provided no and fair control of *P. dissotocum* and *P. irregulare*, and poor and excellent control of *P. vipa*, in two Douglas fir trials; in another trial, excellent control of *P. ultimum* but poor control of *P. mamillatum* was obtained. It provided no control of *P. irregulare* in one cockscomb trial; results of a trial on geranium were inconclusive. It provided good to excellent control of *P. ultimum* in a poinsettia and two geranium trials, but no control in a cockscomb and a larkspur trial; results of another geranium trial were inconclusive. Good control of damping-off (*P. aphanidermatum*) was obtained with V-10161 in tomato and watermelon; however Presidio provided poor control of cottony leak (*P. aphanidermatum*) on snap bean. In 2 greenhouse trials on celery, Presidio showed no to poor control of mefenoxam-resistant *Pythium* root rot (*Pythium* spp.); tank-mix with Previcur Flex improved efficacy.

**Fluoxastrobin.** Disarm provided excellent control of *Pythium* root rot and damping-off caused by *Pythium aphanidermatum* in a petunia trial, good control of root rot in a snapdragon trial, but poor control in two poinsettia trials. It provided no control of *P. dissotocum*, *P. irregulare* and *P. vipa*, in one Douglas fir trial; in another trial, good control of both *P. ultimum* and *P. mamillatum* was obtained. No control of *P. irregulare* was obtained in one cockscomb trial; results of a trial on geranium were inconclusive. Also it was ineffective on *P. ultimum* in cockscomb, geranium, larkspur and poinsettia trials.

**Fosetyl-Al.** Aliette provided good control of *P. aphanidermatum* in one geranium trial but no significant control in another. It provided poor control of *P. dissotocum* and *P. vipa*, and mediocre control of *P. irregulare*, in one Douglas fir trial; in another trial, poor control of both *P. ultimum* and *P. mamillatum* was obtained. Against *P. irregulare* on New Guinea impatiens, it provided good control when applied 48 hours before inoculation but not when applied 48 hours after inoculation. No control of *P. irregulare* was obtained in one cockscomb trial; results of a trial on geranium were inconclusive. It was ineffective on *P. ultimum* in a cockscomb and a poinsettia trial. In 2 greenhouse trials on celery, Aliette provided excellent control of mefenoxam-resistant *Pythium* root rot (*Pythium* spp.).

**Gliocladium virens.** SoilGard provided no significant control of root rot (*P. aphanidermatum*) in one gerbera and one poinsettia trial. It did not control damping-off caused by *Pythium ultimum* on cucumber.

**Hymexazol.** Hymexazol demonstrated good control of *P. aphanidermatum* on geranium but not on snapdragon.

**Mandipropamid.** Mandipropamid provided good control of *P. aphanidermatum* in a geranium trial; however, some phytotoxicity was observed. It provided no significant control of *P. aphanidermatum* in a snapdragon trial. A trial on geranium against *P. ultimum* showed no significant reduction of a severe root

rot pressure. Revus provided marginal control of cottony leak (*P. aphanidermatum*) in a snap bean trial. In 2 greenhouse trials on celery, it showed no to poor control of mefenoxam-resistant Pythium root rot (*Pythium* spp.).

**Mefenoxam.** Subdue MAXX provided good to excellent control of *P. aphanidermatum* on geranium, petunia, poinsettia and snapdragon. It provided poor and excellent control of *P. dissotocum* and *P. irregulare*, and mediocre and excellent control of *P. vipa*, in two Douglas fir trials; in another trial, excellent control of both *P. ultimum* and *P. mamillatum* was obtained. It provided excellent control of root rot (*P. irregulare*) in a rose periwinkle trial. No control of *P. irregulare* was obtained in one cockscomb trial; results of a trial on geranium were inconclusive. It provided excellent control of *P. ultimum* on poinsettia, good control on cockscomb, but poor control on larkspur. On geranium, poor and excellent control of *P. ultimum* was obtained. Subdue Maxx provided good control of *P. myriotylum* on caladium. On snap bean, Ridomil Gold provided excellent control of cottony leak (*P. aphanidermatum*). It provided good control of cavity spot caused by *Pythium* spp. (*P. violae*, *P. sulcatum* and *P. ultimum*) on carrot.

### **Phosphorus Acids/Phosphorus Acid Generators**

**Alude.** Alude provided poor control of *P. ultimum* in a poinsettia and two geranium trials, results of another trial on geranium were inconclusive. Poor control of *P. dissotocum*, mediocre control of *P. irregulare*, and excellent control of *P. vipa* was obtained in one Douglas fir trial. Results of a *P. irregulare* trial on geranium were inconclusive.

**Agri-Fos.** Agri-Fos provided no control of *P. ultimum* in a larkspur trial.

**K-Phite.** K-Phite provided good control of cottony leak (*P. aphanidermatum*) in a snap bean trial.

**Magellan.** Magellan provided poor control of both *P. mamillatum* and *P. ultimum* in one Douglas fir trial. No control of *P. ultimum* was obtained in a larkspur trial. Results of a *P. irregulare* trial on geranium were inconclusive.

**Phostrol.** Phostrol provided good control of cottony leak (*P. aphanidermatum*) in two snap bean trials, and good to excellent control of mefenoxam-resistant Pythium root rot (*Pythium* spp.) in 2 greenhouse trials on celery.

**Vital.** Vital provided no control of *P. aphanidermatum* in two poinsettia trials, and poor control in a snapdragon trial. Results of a *P. ultimum* trial on geranium were inconclusive.

**Pyraclostrobin.** BAS 500 provided good control of damping-off (*P. irregulare*) on New Guinea impatiens when applied 48 hours before disease inoculation but not when applied 48 hours after inoculation. Results of a *P. irregulare* trial on geranium were inconclusive. On snap bean, Headline provided good control of cottony leak (*P. aphanidermatum*) in one trial but Cabrio did not in another trial.

**SP2770.** SP2770 provided fair control of *P. dissotocum*, but poor control of *P. irregulare* and *P. vipa*, in a Douglas fir trial. Poor control of *P. ultimum* was obtained in a geranium trial.

**SP2771.** SP2771 provided fair control of *P. dissotocum* and *P. vipa*, but poor control of *P. irregulare* and in a Douglas fir trial. Poor control of *P. ultimum* was obtained in a geranium trial.

**Trichoderma asperellum & T. gamsii.** Remedier provided no control of both *P. mamillatum* and *P. ultimum* in one Douglas fir trial.

**Trichoderma harzianum T-22.** PlantShield or RootShield provided no control of *P. aphanidermatum* in one geranium trial, *P. ultimum* in another geranium trial, and *P. myriotylum* on caladium. Also, it provided no control of damping-off (*P. ultimum*) on cucumber.

**Trichoderma harzianum & T. virens.** BW240 and Rootshield Plus provided excellent control of *Pythium* root rot and damping-off caused by *Pythium aphanidermatum* in a petunia trial, but no control of root rot in poinsettia and snapdragon trials. It provided mediocre and good control of *P. irregulare*, and no and mediocre control of *P. dissotocum* and *P. vipa*, in two Douglas fir trials; in another Douglas fir trial, no control of *P. mamillatum* and *P. ultimum* was obtained. It provided good control of root rot (*P. irregulare*) in a rose periwinkle trial. It provided no control of *P. irregulare* in a cockscomb trial; results of a trial on geranium were inconclusive. No control of *P. ultimum* was obtained in cockscomb, larkspur and poinsettia trials. Two trials on geranium showed poor and mediocre control of *P. ultimum*.

**V-10208.** This product provided promising control of *P. ultimum* in a geranium trial.

### ***Phytotoxicity***

No phytotoxicity was observed in any crop with the exception of larkspur where several treatments caused very minor and transient leaf phytotoxicity; these included Adorn, BW240, Disarm, Fenstop and Terrazole. Also, Adorn caused slight to moderate phytotoxicity in a geranium and 2 poinsettia trials, chlorosis was observed from plants treated with A14658C + Heritage and Pageant, and growth inhibition by Terrazole in a geranium trial.

**Table 50. 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 8/31/2015 are included in the table below.

PR#	Product (Active Ingredients)s	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30423	A13836B (A13836B)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Good control with 1 fl oz per 100 gal; comparable to uninoculated control.
30424	A13836B (A13836B)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Great control with 1.3 fl oz per 100 gal; comparable to uninoculated control.
32369	A13836B (A13836B)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2012	Drench	Significantly reduced plant death from a severe disease pressure with 1 fl oz per 100 gal.
32131	A14658C (A14658C)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Significantly reduced disease severity and increased root with 10 and 20 oz per 100 gal; comparable to the untreated uninoculated check.
31624	A14658C (A14658C)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
26523	Actinovate Soluble (Streptomyces lydicus WYEC 108)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments.
26731	Actinovate Soluble (Streptomyces lydicus WYEC 108)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Fair efficacy at 10 oz per 100 gal
26527	Actinovate Soluble (Streptomyces lydicus WYEC 108)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy
27774	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Montego Mix'	Greenhouse	Hausbeck	MI	2007	Drench	Severe disease pressure; virtually no efficacy at 1 and 2 fl oz per 100 gal

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
27774	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Slight control with 2 fl oz per 100 gal; inferior to uninoculated control.
25495	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence between inoculated and non-inoculated Checks, and Adorn at 2 fl oz per 100 gal; unacceptable phytotoxicity (leaf curl and tip damage).
25495	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 30 ml per 100 gal; inferior at 60 ml
25495	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; good control at 2 fl oz per 100 gal; comparable to uninoculated control but plants smaller.
25495	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Great control with 2 fl oz per 100 gal; comparable to uninoculated control.
25495	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Good control of a moderate disease pressure with 1 and 2 fl oz per 100 gal; almost comparable to uninoculated check; unacceptable injury (severe leaf curl).
31336	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	African Daisy (Osteospermum sp.) 'O. jucundum x O. barberiae 'Avalanche'	Field Container	Klett	CO	2012	Drench	Data inconclusive because of low disease incidence; no injury or effect on plant growth with 2 fl oz per 100 gal.
26397	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) P. x hortorum 'Red Pinto'	Greenhouse	Wick	MA	2007	Drench	Excellent efficacy at 30 and 60 ml per 100 gal; plant size and weight higher than non-inoculated Check
26397	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Did not significantly increase plant volume and top dry weight with 2 fl oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29954	Adorn 4F (Fluopicolide)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 2 fl oz per 100 gal.
30158	Adorn 4F (Fluopicolide)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 2 fl oz per 100 gal.
30158	Adorn 4F (Fluopicolide)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 2 fl oz per 100 gal applied twice.
29705	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 2 fl oz per 100 gal
25532	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Virtually no efficacy at 30 and 60 ml per 100 gal; may be phytotoxic
25532	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Virtually no efficacy at 30 and 60 ml per 100 gal; may be phytotoxic
26401	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26401	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x hortorum 'Pinto White'	Greenhouse	Chase	CA	2007	Drench	Poor to good control with 60 and 120 ml per 100 gal.
26401	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
26511	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 2 fl oz per 100 gal.
26511	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 2 fl oz per 100 gal applied twice.
26511	Adorn 4F (Fluopicolide)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments



PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
26768	Adorn 4F (Fluopicolide)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and good efficacy at 30 and 60 ml per 100 gal
29695	Adorn 4F (Fluopicolide)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprenc	No control at 2 fl oz per 100 gal.
30427	Adorn 4F (Fluopicolide)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 2 fl oz per 100 gal applied twice; slight, transient leaf injury.
26007	Adorn 4F (Fluopicolide)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	Completely prevented plant death from severe disease pressure at 4 fl oz per 100 gal; similar to non-inoculated check in plant vigor and height.
26007	Adorn 4F (Fluopicolide)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy
26007	Adorn 4F (Fluopicolide)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Drench	Very low disease pressure. Plant health rating with fl oz per 100 gal not significantly different from uninoculated and inoculated Check; some injury (contorted leaves) observed.
29880	Adorn 4F (Fluopicolide)	Pythium ultimum (Pythium ultimum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Excellent control of P. ultimum, poor on P. mamillatum, with 2 fl oz per 100 gal.
30169	Adorn 4F (Fluopicolide)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement at 2 fl oz per 100 gal; comparable to Aliette and Subdue Maxx.
30169	Adorn 4F (Fluopicolide)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Mediocre efficacy with 2 fl oz per 100 gal applied twice.
25497	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Foliar	Low disease pressure; root rating higher and plant growth lower than inoculated and uninoculated Checks at 64 fl oz per 100 gal
29952	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Did not significantly increase plant volume and top dry weight with 9 fl oz per 100 gal.
26517	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
26732	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and good efficacy at 1 and 2 gal per 100 gal
26529	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy applied as a drench.
26529	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Foliar	No efficacy with foliar application.
26693	Aliette WDG (Fosetyl AI)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and Aliette at 12.8 oz per 100 gal; no phytotoxicity.
26693	Aliette WDG (Fosetyl AI)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Foliar	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 5 lb per 100 gal
26693	Aliette WDG (Fosetyl AI)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Poor control of a moderate disease pressure with 12.8 oz per 100 gal.
27546	Aliette WDG (Fosetyl AI)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) P. x hortorum 'Red Pinto'	Greenhouse	Wick	MA	2007	Drench	Good efficacy at 10 oz per 100 gal; plant size and weight equal to non-inoculated Check
30159	Aliette WDG (Fosetyl AI)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 9.6 oz per 100 gal.
29712	Aliette WDG (Fosetyl AI)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control with Aliette at 12.8 oz per 100 gal
27543	Aliette WDG (Fosetyl AI)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Good efficacy at 12 oz per 100 gal
27543	Aliette WDG (Fosetyl AI)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Good efficacy at 12 oz per 100 gal

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31623	Aliette WDG (Fosetyl Al)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
31623	Aliette WDG (Fosetyl Al)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
26512	Aliette WDG (Fosetyl Al)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 9.6 oz per 100 gal.
26512	Aliette WDG (Fosetyl Al)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments
29888	Aliette WDG (Fosetyl Al)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Poor control of both P. ultimum and P. mamillatum with 9.6 oz per 100 gal.
29702	Aliette WDG (Fosetyl Al)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Spreng	No significant control with Aliette at 12.8 oz per 100 gal.
26528	Aliette WDG (Fosetyl Al)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy
30170	Aliette WDG (Fosetyl Al)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 9.6 oz per 100 gal.
25496	Alude (Potassium phosphite)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Foliar	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 12.7 fl oz per 100 gal
25496	Alude (Potassium phosphite)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Poor control of a moderate disease pressure with 12.75 fl oz per 100 gal.
30160	Alude (Potassium phosphite)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 12.7 fl oz per 100 gal.
27540	Alude (Potassium phosphite)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 12.7 fl oz per 100 gal

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27540	Alude (Potassium phosphite)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 12.7 fl oz per 100 gal
32119	Alude (Potassium phosphite)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26516	Alude (Potassium phosphite)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 12.7 fl oz per 100 gal.
26516	Alude (Potassium phosphite)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments
26008	Alude (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	Significantly reduced plant death from severe disease pressure at 0.5 gal per 100 gal.
26008	Alude (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy applied drench.
26008	Alude (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Foliar	No efficacy with foliar application.
26008	Alude (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2012	Drench	Significantly reduced a severe disease pressure and plant death with 12.75 fl oz per 100 gal.
26008	Alude (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Drench	Very low disease pressure. Plant health rating with 12.75 fl oz per 100 gal not significantly different from uninoculated and inoculated Check.
30171	Alude (Potassium phosphite)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement at 12.7 fl oz per 100 gal; only product comparable to non-inoculated check.
30422	BSEF-11 (Unknown)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 25.6 fl oz per 100 gal.

PR#	Product (Active Ingredients)s	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
26886	BSEF-11 (Unknown)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 25.6 fl oz per 100 gal.
26695	Calirus (PMA300) (Phosphorus acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Foliar	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 64 fl oz per 100 gal
27541	Captan (Captan)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Fair efficacy at 16 oz per 100 gal
27541	Captan (Captan)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Fair efficacy at 16 oz per 100 gal
26513	Captan (Captan)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments
26526	Captan (Captan)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy
29819	CG100 (Caprylic acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 0.8 pt per 100 gal.
29813	CG100 (Caprylic acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and CG100 at 0.6 pt per 100 gal; no phytotoxicity.
29813	CG100 (Caprylic acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; no control at 0.8 pt per 100 gal.
29813	CG100 (Caprylic acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 0.8 pt per 100 gal.

PR#	Product (Active Ingredients)s	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29813	CG100 (Caprylic acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Poor control of a moderate disease pressure with 0.8 pt per 100 gal.
29947	CG100 (Caprylic acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Severe injury (leaf burn, plant death) with 0.3 % v/v.
29956	CG100 (Caprylic acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 1.2 pint per 100 gal.
30163	CG100 (Caprylic acid)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 9.6 fl oz per 100 gal.
32136	CG100 (Caprylic acid)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Did not reduce disease severity with 38.4 fl oz per 100 gal.
29707	CG100 (Caprylic acid)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 0.6 pt per 100 gal
32116	CG100 (Caprylic acid)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
29616	CG100 (Caprylic acid)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 9.6 fl oz per 100 gal.
29882	CG100 (Caprylic acid)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Poor control of both P. ultimum and P. mamillatum with 9.6 fl oz per 100 gal.
29697	CG100 (Caprylic acid)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 0.6 pt per 100 gal.
30429	CG100 (Caprylic acid)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 0.8 pt per 100 gal applied once.
30315	CG100 (Caprylic acid)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	No significant control of severe disease pressure at 0.6 pt per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30174	CG100 (Caprylic acid)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 9.6 fl oz per 100 gal.
29824	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Good control with 0.6 fl oz per 100 gal; comparable to non-inoculated control but plants smaller.
26696	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and Disarm at 0.6 fl oz per 100 gal; no phytotoxicity.
26696	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating equal to and plant growth lower than inoculated Check at 3 fl oz per 100 gal
26696	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; poor control at 0.6 fl oz per 100 gal.
26696	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Slight, but unsatisfactory, control with 0.6 fl oz per 100 gal.
26696	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Mediocre control of a moderate disease pressure with 0.6 fl oz per 100 gal; inferior to uninoculated check.
29948	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Did not significantly increase plant volume and top dry weight with 0.6 fl oz per 100 gal.
29957	Disarm 480SC (Fluoxastrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 0.18 fl oz per 1000 sq ft.
30164	Disarm 480SC (Fluoxastrobin)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 0.4 fl oz per 100 gal.
29708	Disarm 480SC (Fluoxastrobin)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 0.6 fl oz per 100 gal.

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25829	Disarm 480SC (Fluoxastrobin)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 3 fl oz per 100 gal.
25829	Disarm 480SC (Fluoxastrobin)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 3 fl oz per 100 gal.
32117	Disarm 480SC (Fluoxastrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26521	Disarm 480SC (Fluoxastrobin)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 0.4 fl oz per 100 gal.
26521	Disarm 480SC (Fluoxastrobin)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments.
26767	Disarm 480SC (Fluoxastrobin)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Good efficacy at 3 oz per 100 gal
29883	Disarm 480SC (Fluoxastrobin)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Good control of both P. ultimum and P. mamillatum with 0.4 fl oz per 100 gal.
29698	Disarm 480SC (Fluoxastrobin)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Spreng	No significant control at 0.6 fl oz per 100 gal.
30430	Disarm 480SC (Fluoxastrobin)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 6 fl oz per 100 gal applied twice; slight, transient leaf injury.
26011	Disarm 480SC (Fluoxastrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	No significant control of severe disease pressure at 2.4 fl oz per 100 gal.
26011	Disarm 480SC (Fluoxastrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	Significant reduction of disease severity
26011	Disarm 480SC (Fluoxastrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2012	Drench	Significantly reduced a severe disease pressure and plant death with 0.6 fl oz per 100 gal.



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30175	Disarm 480SC (Fluoxastrobin)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 0.4 fl oz per 100 gal.
29825	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Good control with 14 fl oz per 100 gal; comparable to untreated non-inoculated control.
25493	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and Fenstop at 14 fl oz per 100 gal; no phytotoxicity.
25493	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 7 and 14 fl oz per 100 gal
25493	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; good control at 14 fl oz per 100 gal; comparable to uninoculated control.
25493	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Excellent control with 14 fl oz per 100 gal; comparable to uninoculated control.
25493	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Good control of a moderate disease pressure with 14 fl oz per 100 gal; almost comparable to uninoculated check.
29949	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Significantly increased plant volume and top dry weight with 14 fl oz per 100 gal; only treatment comparable to non-inoculated check.
29958	Fenstop (Fenamidone)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 10 fl oz per 100 gal.
30165	Fenstop (Fenamidone)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 10 fl oz per 100 gal.
29709	Fenstop (Fenamidone)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 14 oz per 100 gal

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32118	Fenstop (Fenamidone)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26509	Fenstop (Fenamidone)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 10 fl oz per 100 gal.
26509	Fenstop (Fenamidone)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments
26763	Fenstop (Fenamidone)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and good efficacy at 7 and 14 oz per 100 gal
29884	Fenstop (Fenamidone)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Excellent control of P. ultimum, may be less effective on P. mamillatum, with 10 fl oz per 100 gal.
29699	Fenstop (Fenamidone)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Spreng	Significant control, though inferior to non-inoculated check, at 14 oz per 100 gal.
30431	Fenstop (Fenamidone)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 14 fl oz per 100 gal applied twice; slight, transient leaf injury.
26004	Fenstop (Fenamidone)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	Significantly reduced plant death from severe disease pressure at 14 fl oz per 100 gal.
26004	Fenstop (Fenamidone)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elita White'	Greenhouse	Chastagner	WA	2006	Drench	Significant reduction of disease severity
26004	Fenstop (Fenamidone)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2012	Drench	Completely prevented plant death from severe disease pressure with 14 fl oz per 100 gal; comparable to non-inoculated Check.
30176	Fenstop (Fenamidone)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 10 fl oz per 100 gal.
27775	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Montego Mix'	Greenhouse	Hausbeck	MI	2007	Drench	Severe disease pressure; virtually no efficacy at 0.9, poor at 1.8 oz per 100 gal

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
27775	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Good control with 1.8 oz per 100 gal; comparable to uninoculated control but plants smaller.
27775	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2012	Drench	Poor control with 0.9 and 1.8 oz per 100 gal applied twice.
26887	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and Heritage at 0.9 oz per 100 gal; no phytotoxicity.
26887	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; poor control at 0.9 and 1.8 oz per 100 gal.
26887	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 1.8 oz per 100 gal.
26887	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2012	Drench	Excellent control with 0.9 and 1.8 oz per 100 gal applied twice.
26887	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Good control of a moderate disease pressure with 0.9 and 1.8 oz per 100 gal; inferior to uninoculated check.
31334	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	African Daisy (Osteospermum sp.) O. ecklonis 'Lavender Mist'	Field Container	Klett	CO	2012	Drench	Data inconclusive because of low disease incidence; no injury or effect on plant growth with 0.9 and 1.8 oz per 100 gal.
26394	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) P. x hortorum 'Red Pinto'	Greenhouse	Wick	MA	2007	Drench	Good efficacy at 0.9 and 1.8 oz per 100 gal; plant size and weight equal to non-inoculated Check
26394	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Did not significantly increase plant volume and top dry weight with 0.9 oz per 100 gal.

PR#	Product (Active Ingredients)s	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29959	Heritage (Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 0.9 oz per 100 gal.
30166	Heritage (Azoxystrobin)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 0.9 fl oz per 100 gal.
30166	Heritage (Azoxystrobin)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 0.9 oz per 100 gal applied once.
32137	Heritage (Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Significantly reduced disease severity and increased root weight with 0.9 and 1.8 oz per 100 gal; comparable to the untreated uninoculated check.
29710	Heritage (Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Spreng	No significant control at 0.9 oz per 100 gal.
26398	Heritage (Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. hortorum 'Pinto White'	Greenhouse	Chase	CA	2007	Drench	At rates of 0.9 and 1.8 oz per 100 gal, excellent control equivalent to untreated uninoculated.
26398	Heritage (Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26398	Heritage (Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
26518	Heritage (Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 0.9 fl oz per 100 gal.
26518	Heritage (Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 0.9 oz per 100 gal applied once.
29885	Heritage (Azoxystrobin)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Poor control of both P. ultimum and P. mamillatum with 0.9 oz per 100 gal.
29700	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Spreng	No significant control at 0.9 oz per 100 gal.
30432	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 1.8 oz per 100 gal applied twice.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
26531	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	Poor to no significant reduction of plant death from severe disease pressure at 0.9 oz per 100 gal.
26531	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy
26531	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2012	Drench	Significantly reduced a severe disease pressure and plant death with 0.9 oz per 100 gal.
26531	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Drench	Very low disease pressure. Plant health rating with 0.9 and 1.8 oz per 100 gal not significantly different from uninoculated and inoculated Check.
26531	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	CA	2012	Drench	Results suggest efficient prevention of disease infection with 0.9 and 1.8 oz per 100 gal applied twice at 28-day interval.
26531	Heritage (Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2013	Drench	Significantly reduced disease severity with 0.9 fl oz per 100 gal; inferior to non-inoculated check.
30177	Heritage (Azoxystrobin)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant, but poor, stand improvement at 0.9 fl oz per 100 gal.
30177	Heritage (Azoxystrobin)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 0.9 oz per 100 gal applied once.
27778	Hymexazol 30L (Hymexazol)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Montego Mix'	Greenhouse	Hausbeck	MI	2007	Drench	Severe disease pressure; no efficacy at 6 and 12 fl oz per 100 gal
26395	Hymexazol 30L (Hymexazol)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) P. x hortorum 'Red Pinto'	Greenhouse	Wick	MA	2007	Drench	Good efficacy at 6 and 12 fl oz per 100 gal; plant size and weight equal to non-inoculated Check

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
27539	Hymexazol 30L (Hymexazol)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 500 ppm
27539	Hymexazol 30L (Hymexazol)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 500 ppm
26399	Hymexazol 30L (Hymexazol)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. hortorum 'Pinto White'	Greenhouse	Chase	CA	2007	Drench	Good control with 6 oz per 100 gal and poor control with 12 oz per 100 gal.
26764	Hymexazol 30L (Hymexazol)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and good efficacy at 6 and 12 oz per 100 gal
26009	Hymexazol 30L (Hymexazol)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy at both rates
25501	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 16 and 40 oz per 100 gal
25830	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Fair efficacy at 8 oz per 100 gal
25830	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Fair efficacy at 8 oz per 100 gal
32122	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26519	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006		High variability precluded determination of statistical significance between treatments

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
26010	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy
31448	Insimmo (Acibenzolar- S-methyl)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2012	Drench	No control with 0.125 and 0.25 oz per 100 gal applied twice.
31446	Insimmo (Acibenzolar- S-methyl)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2012	Drench	No control with 0.125 and 0.25 oz per 100 gal applied twice.
31332	Insimmo (Acibenzolar- S-methyl)	Pythium aphanidermatum (Pythium aphanidermatum)	African Daisy (Osteospermum sp.) O. jucundum x O. barberiae 'Avalanche'	Field Container	Klett	CO	2012	Drench	Data inconclusive because of low disease incidence; no injury with 0.125 and 0.25 oz per 100 gal; slight growth enhancement.
31332	Insimmo (Acibenzolar- S-methyl)	Pythium aphanidermatum (Pythium aphanidermatum)	African Daisy (Osteospermum sp.) O. jucundum x O. barberiae 'Avalanche'	Field Container	Klett	CO	2012	Foliar	Data inconclusive because of low disease incidence; no injury with 0.25 and 0.5 oz per 100 gal; slight growth enhancement.
32133	Insimmo (Acibenzolar- S-methyl)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams- Woodward	GA	2012	Drench	Significantly reduced disease severity and increased root weight with 0.125 and 0.25 oz per 100 gal; comparable to the untreated uninoculated check.
31620	Insimmo (Acibenzolar- S-methyl)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
29848	Insimmo (Acibenzolar- S-methyl)	Pythium sp. (Pythium sp.)	Geranium (Pelargonium sp.)	Greenhouse	Hausbeck	MI	2002	Foliar	No efficacy at 0.5, 1, and 2 oz per 100 gal.
31300	Insimmo (Acibenzolar- S-methyl)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2012	Drench	Significantly reduced a severe disease pressure and plant death with 0.45 oz per 100 gal, 0.9 oz less effective.
31300	Insimmo (Acibenzolar- S-methyl)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Drench	Very low disease pressure. Plant health rating with 0.125 and 0.25 oz per 100 gal significantly worse than inoculated Check.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31300	Insimmo (Acibenzolar-S-methyl)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Foliar	Very low disease pressure. Plant health rating with 0.25 and 0.5 oz per 100 gal significantly worse than inoculated Check.
31300	Insimmo (Acibenzolar-S-methyl)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	CA	2012	Drench	Plant health and root rot rating inferior to untreated checks with 0.125 and 0.25 oz per 100 gal applied twice at 28-day interval.
25499	K-Phite (Phosphorus acid salts)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Foliar	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 48 fl oz per 100 gal
25502	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Foliar	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 12 fl oz per 100 gal
27544	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 12 fl oz per 100 gal
27544	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 12 fl oz per 100 gal
32121	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26520	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006		High variability precluded determination of statistical significance between treatments
29887	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Poor control of both P. ultimum and P. mamillatum with 12 fl oz per 100 gal.



PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30434	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 8 fl oz per 100 gal applied twice.
27779	Micora (NOA 446510) (Mandipropamid)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Montego Mix'	Greenhouse	Hausbeck	MI	2007	Drench	Severe disease pressure; virtually no efficacy at 2 and 8 fl oz per 100 gal
25986	Micora (NOA 446510) (Mandipropamid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 4 and 8 fl oz per 100 gal
26396	Micora (NOA 446510) (Mandipropamid)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) P. x hortorum 'Red Pinto'	Greenhouse	Wick	MA	2007	Drench	Good efficacy at 8 fl oz per 100 gal, none at 2 fl oz; both rates caused phytotoxicity
26400	Micora (NOA 446510) (Mandipropamid)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x hortorum 'Pinto White'	Greenhouse	Chase	CA	2007	Drench	Poor to good control with 4 and 8 oz per 100 gal.
26765	Micora (NOA 446510) (Mandipropamid)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and good efficacy at 2 and 8 oz per 100 gal
25494	MultiGuard (Furfural)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 500 ppm; inferior at 1000 ppm
25530	MultiGuard (Furfural)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	No efficacy at 500 and 1000 ppm; may be phytotoxic
25530	MultiGuard (Furfural)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	No efficacy at 500 and 1000 ppm; may be phytotoxic
26510	MultiGuard (Furfural)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006		High variability precluded determination of statistical significance between treatments; severe injury.
26766	MultiGuard (Furfural)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and good efficacy at 250 and 500 ppm

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
26005	MultiGuard (Furfural)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy at both rates
25503	Muscodor albus (Muscodor albus)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Soil Incorporation	Low disease pressure; root rating higher and plant growth lower than inoculated and uninoculated Checks at 1.8 and 3.8 g/L
29820	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Good control with 12 oz per 100 gal; comparable to uninoculated control.
29820	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2012	Spreng	Poor control with 12 and 16 oz per 100 gal applied 4 times .
29814	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and Pageant at 12 oz per 100 gal; no phytotoxicity.
29814	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; good control at 12 oz per 100 gal; comparable to uninoculated control.
29814	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Slight, but unsatisfactory, control with 12 oz per 100 gal.
29814	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2012	Spreng	Excellent control with 12 and 16 oz per 100 gal applied 4 times .
29814	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Good control of a moderate disease pressure with 12 and 16 oz per 100 gal; inferior to uninoculated check; some positive rate response.
31335	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	African Daisy (Osteospermum sp.) O. ecklonis 'Lavender Mist'	Field Container	Klett	CO	2012	Drench	Data inconclusive because of low disease incidence; no injury or effect on plant growth with 12 and 16 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29951	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Did not increase plant volume and top dry weight with 12 oz per 100 gal.
29960	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 12 oz per 100 gal.
30167	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 12 oz per 100 gal.
30167	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 12 and 16 oz per 100 gal applied twice.
32138	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Sprench	Significantly reduced disease severity with 12 and 16 oz per 100 gal; comparable to the untreated uninoculated check.
29711	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 12 oz per 100 gal
31622	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
31622	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight; chlorosis observed.
29617	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 12 oz per 100 gal.
29617	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 12 and 16 oz per 100 gal applied twice.
29891	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Mediocre control of P. ultimum, questionable on P. mamillatum, with 12 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29701	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 12 oz per 100 gal.
30433	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 12 oz per 100 gal.
30317	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	No significant control of severe disease pressure at 12 oz per 100 gal.
30317	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Sprench	Very low disease pressure. Plant health rating with 12 and 16 oz per 100 gal not significantly different from uninoculated and inoculated Check.
30317	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	CA	2012	Sprench	Results suggest efficient prevention of disease infection with 12 and 16 oz per 100 gal applied twice at 28-day interval.
30317	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2013	Drench	Significantly reduced disease severity with 12 and 16 oz per 100 gal; inferior to non-inoculated check.
30178	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 12 oz per 100 gal.
30178	Pageant Intrinsic (Boscalid + Pyraclostrobin)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 12 and 16 oz per 100 gal applied twice.
29892	Remedier (Trichoderma asperellum + Trichoderma gamsii)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. No control of both P. ultimum and P. mamillatum with 2.5 and 7.5 oz per 100 gal.
29818	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 6 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29818	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2012	Drench	Poor control with 6 oz, then 3 oz oz per 100 gal applied after 21 days. NOTE: Product used in this experiment had expired and was no longer viable.
29812	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Dipped in solution	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and BW240 at 6 oz per 100 gal; no phytotoxicity.
29812	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; no control at 6 oz per 100 gal.
29812	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 6 oz per 100 gal.
29812	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2012	Drench	No control with 6 oz, then 3 oz oz per 100 gal applied every 21 days. NOTE: Product used in this experiment had expired and was no longer viable.
29812	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Poor control of a moderate disease pressure with 6 oz oz per 100 gal.
31333	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	African Daisy (Osteospermum sp.) O. jucundum x O. barberiae 'Avalanche'	Field Container	Klett	CO	2012	Drench	Data inconclusive because of low disease incidence; no injury with 6 oz per 100 gal.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29946	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Did not significantly increase plant volume and top dry weight with 6 oz per 100 gal.
29955	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 6 oz per 100 gal.
30161	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 6 oz per 100 gal.
30161	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 6 oz per 100 gal applied once.
32135	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Reduced disease severity and increased root weight with 6 oz per 100 gal; inferior to the untreated uninoculated check.
29706	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 6 oz per 100 gal.
31621	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31621	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
29615	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement at 6 oz per 100 gal; comparable to Aliette and Subdue Maxx.
29615	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 6 oz per 100 gal applied once.
29881	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. No control of both P. ultimum and P. mamillatum with 6 oz per 100 gal.
29696	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Spreng	No significant control at 6 oz per 100 gal.
30428	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Root dip	No significant control at 3 oz per 100 gal applied twice; slight, transient leaf injury.
31301	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	CA	2012	Drench	Results suggest efficient prevention of disease infection with 6 oz per 100 gal applied once.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31301	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2013	Drench	Significantly reduced disease severity with 6 oz per 100 gal; inferior to non-inoculated check.
30172	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant, but poor, stand improvement at 6 oz per 100 gal.
30172	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 6 oz per 100 gal applied once.
29906	Rotation: BW240 / Aliette (BW240 / Aluminum tris-phosphate)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and BW240/Aliette rotation at 6 and 12.8 oz per 100 gal; no phytotoxicity.
29713	Rotation: BW240 / Aliette (BW240 / Aluminum tris-phosphate)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control with BW240 at 6 oz, then Aliette at 12.8 oz per 100 gal
29703	Rotation: BW240 / Aliette (BW240 / Aluminum tris-phosphate)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control with BW240 at 6 oz, then Aliette at 12.8 oz per 100 gal.
29822	Rotation: BW240 / Phosphorus Acid (BW240 / Phosphorus Acid)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with 6 oz, then Vital at 20 fl oz per 100 gal.
25492	Segway (Cyazofamid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence, plant height and top grade between inoculated and non-inoculated Checks, and Segway at 1.5 fl oz per 100 gal; no phytotoxicity.



PR#	Product (Active Ingredients)s	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
25492	Segway (Cyazofamid)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 3 and 6 fl oz per 100 gal
30527	Segway (Cyazofamid)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2010	Drench	Did not significantly increase plant volume and top dry weight with 0.9 oz per 100 gal.
25528	Segway (Cyazofamid)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Good efficacy at 1.5 and 3 fl oz per 100 gal
25528	Segway (Cyazofamid)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Good efficacy at 1.5 and 3 fl oz per 100 gal
32120	Segway (Cyazofamid)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26508	Segway (Cyazofamid)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006		High variability precluded determination of statistical significance between treatments
26762	Segway (Cyazofamid)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and good efficacy at 1.5 and 3 oz per 100 gal
29889	Segway (Cyazofamid)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Excellent control of both P. ultimum and P. mamillatum with 3 fl oz per 100 gal.
30276	Segway (Cyazofamid)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 1.5 fl oz per 100 gal.
26003	Segway (Cyazofamid)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	Significant reduction of disease severity at both rates
32228	SP2770 10WP (SP2770)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 2.66 lb per 100 gal applied once.
32229	SP2770 10WP (SP2770)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 2.66 lb per 100 gal applied once.

PR#	Product (Active Ingredients)s	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31574	SP2770 10WP (SP2770)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2013	Drench	Significantly reduced disease severity with 2.66 lb per 100 gal; inferior to non-inoculated check.
32230	SP2770 10WP (SP2770)	Pythium vicia (Pythium vicia)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 2.66 lb per 100 gal applied once.
32231	SP2771 (SP2771)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 3 fl oz per 100 gal applied once.
32232	SP2771 (SP2771)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Poor efficacy with 3 fl oz per 100 gal applied once.
31575	SP2771 (SP2771)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2013	Drench	Significantly reduced disease severity with 3 fl oz per 100 gal; inferior to non-inoculated check.
27776	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Montego Mix'	Greenhouse	Hausbeck	MI	2007	Drench	Severe disease pressure; excellent efficacy at 1 fl oz per 100 gal
27776	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Slight control with 1 fl oz per 100 gal; inferior to uninoculated control.
27776	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2012	Drench	Poor control with 1 fl oz per 100 gal applied twice.
26694	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Drench	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 1 oz per 100 gal
26694	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Great control with 1 fl oz per 100 gal; comparable to uninoculated control.
26694	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2012	Drench	Excellent control with 1 fl oz per 100 gal applied twice.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31337	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	African Daisy (Osteospermum sp.) O. jucundum x O. barberiae 'Avalanche'	Field Container	Klett	CO	2012	Drench	Data inconclusive because of low disease incidence; no injury with 1 oz per 100 gal; slight plant growth suppression.
27545	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) P. x hortorum 'Red Pinto'	Greenhouse	Wick	MA	2007	Drench	Excellent efficacy at 1 oz per 100 gal; plant size and weight higher than non-inoculated Check
29962	Subdue MAXX (Mefenoxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 1 fl oz per 100 gal.
30168	Subdue MAXX (Mefenoxam)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 1 fl oz per 100 gal.
30168	Subdue MAXX (Mefenoxam)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Mediocre efficacy with 1 fl oz per 100 gal applied twice; best treatment.
32140	Subdue MAXX (Mefenoxam)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Significantly reduced disease severity and increased root weight with 1 oz per 100 gal; comparable to the untreated uninoculated check.
26460	Subdue MAXX (Mefenoxam)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x domesticum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26460	Subdue MAXX (Mefenoxam)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x hortorum 'Pinto White'	Greenhouse	Chase	CA	2007	Drench	At 2.0 oz per 100 gal, excellent control equivalent to untreated uninoculated.
26460	Subdue MAXX (Mefenoxam)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
26514	Subdue MAXX (Mefenoxam)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 1 fl oz per 100 gal.
26514	Subdue MAXX (Mefenoxam)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Mediocre efficacy with 1 fl oz per 100 gal applied twice; best treatment.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
26514	Subdue MAXX (Mefenoxam)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006		High variability precluded determination of statistical significance between treatments
29890	Subdue MAXX (Mefenoxam)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Excellent control of both P. ultimum and P. mamillatum with 2 fl oz per 100 gal; best treatment.
30436	Subdue MAXX (Mefenoxam)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 1 fl oz per 100 gal applied once.
26532	Subdue MAXX (Mefenoxam)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	No significant control of severe disease pressure at 1 fl oz per 100 gal.
26532	Subdue MAXX (Mefenoxam)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	Excellent efficacy
26532	Subdue MAXX (Mefenoxam)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2012	Drench	Results suggest efficient prevention of disease infection with 1 fl oz per 100 gal applied twice at 28-day interval.
26532	Subdue MAXX (Mefenoxam)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2013	Drench	Significantly reduced disease severity with 1 oz per 100 gal; inferior to non-inoculated check.
30179	Subdue MAXX (Mefenoxam)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant stand improvement, though less than non-inoculated check, at 1 fl oz per 100 gal.
30179	Subdue MAXX (Mefenoxam)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2013	Drench	Mediocre efficacy with 1 fl oz per 100 gal applied twice; best treatment.
32132	Tank Mix: A14658C + Heritage (A14658C + azoxystrobin)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Significantly reduced disease severity and increased root weight with 10 oz + 0.5 oz per 100 gal; comparable to the untreated uninoculated check.
31625	Tank Mix: A14658C + Heritage (A14658C + azoxystrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight; chlorosis observed.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
31449	Tank Mix: Acibenzolar + Heritage (Acibenzolar + Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2012	Spray	Poor control with 0.25 + 0.9 and 0.5 + 1.8 oz per 100 gal applied 4 times.
31447	Tank Mix: Acibenzolar + Heritage (Acibenzolar + Azoxystrobin)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2012	Spray	Poor control with 0.25 + 0.9 and 0.5 and 1.8 oz per 100 gal applied 4 times.
32134	Tank Mix: Acibenzolar + Heritage (Acibenzolar + Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Significantly reduced disease severity and increased root weight with 0.125 + 0.45 and 0.25 + 0.9 oz per 100 gal; comparable to the untreated uninoculated check.
31619	Tank Mix: Acibenzolar + Heritage (Acibenzolar + Azoxystrobin)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) 'Scarlet Orbit'	Greenhouse	Wick	MA	2013	Drench	Results inconclusive because there were no differences between treatments based on final plant size and weight.
31422	Tank Mix: Acibenzolar + Heritage (Acibenzolar + Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2012	Drench	Poor to no significant reduction of plant death from severe disease pressure with 0.125 + 0.45 and 0.25 + 0.9 oz per 100 gal.
31422	Tank Mix: Acibenzolar + Heritage (Acibenzolar + Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Drench	Very low disease pressure. Plant health rating with 0.125 + 0.45 and 0.25 + 0.9 oz per 100 gal significantly worse than inoculated Check.
31422	Tank Mix: Acibenzolar + Heritage (Acibenzolar + Azoxystrobin)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	CA	2012	Drench	Plant health and root rot rating inferior to untreated checks with 0.125 + 0.45 and 0.25 + 0.9 oz per 100 gal applied twice at 28-day interval.
30425	Tank Mix: Adorn + Subdue MAXX (Fluopicolide + mefonaxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Good control with 2 fl oz + 1 fl oz Subdue Maxx per 100 gal; comparable to uninoculated control, but smaller plants.
30075	Tank Mix: Adorn + Subdue MAXX (Fluopicolide + mefonaxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima)	Greenhouse	Chase	CA	2010	Drench	No significant differences in disease incidence between inoculated and non-inoculated Checks, and Adorn + Subdue MAXX at 2 + 1 fl oz per 100 gal; unacceptable phytotoxicity (leaf curl and tip damage).

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
30075	Tank Mix: Adorn + Subdue MAXX (Fluopicolide + mefonaxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Great control with 2 fl oz + 1 fl oz Subdue Maxx per 100 gal; comparable to uninoculated control but plants smaller.
29961	Tank Mix: Adorn + Subdue MAXX (Fluopicolide + mefonaxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Petunia (Petunia sp.) P. x violacea 'Laura Bush'	Greenhouse	Reddy	AL	2010	Drench	Excellent control of root rot and damping-off at 2 + 1 fl oz per 100 gal.
29714	Tank Mix: Adorn + Subdue MAXX (Fluopicolide + mefonaxam)	Pythium irregulare (Pythium irregulare)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	No significant control at 2 fl oz + Subdue Maxx at 1 fl oz per 100 gal.
29704	Tank Mix: Adorn + Subdue MAXX (Fluopicolide + mefonaxam)	Pythium ultimum (Pythium ultimum)	Cockscomb, Wool Flower (Celosia sp.)	Greenhouse	Chase	CA	2010	Sprench	Significant control, though inferior to non-inoculated check, at 2 fl oz + Subdue Maxx at 1 fl oz per 100 gal; best product.
30162	Tank Mix: BW420 + Alude (BW420 + Potassium phosphite)	Pythium dissotocum (Pythium dissotocum)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 6 oz + 12.7 fl oz per 100 gal.
30180	Tank Mix: BW420 + Alude (BW420 + Potassium phosphite)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	No significant stand improvement at 6 oz + 12.7 fl oz per 100 gal.
30173	Tank Mix: BW420 + Alude (BW420 + Potassium phosphite)	Pythium vipa (Pythium vipa)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Grunwald	OR	2010	Drench	Significant, but very poor, stand improvement at 6 oz + 12.7 fl oz per 100 gal.
26885	Tank Mix: Heritage + Subdue MAXX (Azoxystrobin + mefonaxam)	Pythium aphanidermatum (Pythium aphanidermatum)	Geranium (Pelargonium sp.) P. x hortorum 'Red Pinto'	Greenhouse	Wick	MA	2007	Drench	Excellent efficacy but no better than Subdue Maxx alone
26894	Tank Mix: Heritage + Subdue MAXX (Azoxystrobin + mefonaxam)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x hortorum 'Pinto White'	Greenhouse	Chase	CA	2007	Drench	Excellent control with Heritage 0.9 oz + Subdue MAXX 1.0 oz per 100 gal, equivalent to untreated uninoculated.
27777	Terrazole 35% WP (Etridiazole)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Montego Mix'	Greenhouse	Hausbeck	MI	2007	Drench	Severe disease pressure; excellent efficacy at 8 fl oz per 100 gal
27542	Terrazole 35% WP (Etridiazole)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic Red'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 8 oz per 100 gal

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
27542	Terrazole 35% WP (Etridiazole)	Pythium irregulare (Pythium irregulare)	New Guinea Impatiens (Impatiens hawkeri) 'Sonic White'	Greenhouse	Becker	NY	2006	Drench	Poor efficacy at 8 oz per 100 gal
26461	Terrazole 35% WP (Etridiazole)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x hortorum 'Bright Red'	Greenhouse	Becker	NY	2011	Drench	Inconclusive results due to low disease infection. Virtually no statistical differences between treatments including inoculated and non-inoculated checks.
26461	Terrazole 35% WP (Etridiazole)	Pythium irregulare (Pythium irregulare)	Geranium (Pelargonium sp.) P. x hortorum 'Pinto White'	Greenhouse	Chase	CA	2007	Drench	Excellent control with 8 oz per 100 gal, equivalent to untreated uninoculated.
26515	Terrazole 35% WP (Etridiazole)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006	Drench	High variability precluded determination of statistical significance between treatments
30437	Terrazole 35% WP (Etridiazole)	Pythium ultimum (Pythium ultimum)	Larkspur (Delphinium sp.)	Greenhouse	Kirk	MI	2010	Drench	No significant control at 10 oz per 100 gal applied once; slight, transient leaf injury.
26533	Terrazole 35% WP (Etridiazole)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	Completely prevented plant death from severe disease pressure at 10 oz per 100 gal; similar to non-inoculated check in plant vigor and height.
26533	Terrazole 35% WP (Etridiazole)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	Excellent efficacy
29823	Terrazole EC (Etridiazole)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2012	Drench	Poor control with 7 fl oz per 100 gal applied twice.
29817	Terrazole EC (Etridiazole)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Drench	High disease pressure; excellent control at 7 fl oz per 100 gal; comparable to uninoculated control.
29817	Terrazole EC (Etridiazole)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2012	Drench	Excellent control with 7 fl oz per 100 gal applied twice.

PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29817	Terrazole EC (Etridiazole)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Freedom Red'	Greenhouse	Hausbeck	MI	2011	Drench	Good control of a moderate disease pressure with 10 oz per 100 gal; almost comparable to uninoculated check.
32141	Terrazole EC (Etridiazole)	Pythium irregulare (Pythium irregulare)	Rose Periwinkle (Catharanthus roseus) 'Victory Bright Eye'	Greenhouse	Williams-Woodward	GA	2012	Drench	Did not significantly reduced disease severity with 7 fl oz per 100 gal.
30069	Terrazole EC (Etridiazole)	Pythium sp. (Pythium sp.)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Chastagner	WA	2010	Drench	High disease pressure. Excellent control of P. mamillatum, less effective on P. ultimum, with 7 fl oz per 100 gal.
31302	Terrazole EC (Etridiazole)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Drench	Very low disease pressure. Plant health rating with 7 fl oz per 100 gal not significantly different from uninoculated and inoculated Check.
31302	Terrazole EC (Etridiazole)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2012	Drench	Results suggest efficient prevention of disease infection with 7 fl oz per 100 gal applied twice at 28-day interval.
31302	Terrazole EC (Etridiazole)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Santamaria	OR	2013	Drench	Significantly reduced disease severity with 7 fl oz per 100 gal; best product tested but inferior to non-inoculated check.
30316	V-10208 SC (V-10208)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2010	Drench	Significantly reduced plant death from severe disease pressure at 8 fl oz per 100 gal.
29821	Vital 4L (Potassium phosphite)	Pythium aphanidermatum (Pythium aphanidermatum)	Snapdragon (Antirrhinum majus) 'Snapshot Red'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. Poor control with Vital at 20 fl oz per 100 gal; much inferior to uninoculated control.
25498	Vital 4L (Potassium phosphite)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2006	Foliar	Low disease pressure; root rating and plant size equal to uninoculated and inoculated Checks at 64 fl oz per 100 gal
25498	Vital 4L (Potassium phosphite)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2010	Foliar	High disease pressure; no control with Vital at 64 fl oz per 100 gal.



PR#	Product (Active Ingredients)	Target	Crop	Production Site	Researcher	State	Year	Application Type	Results
29815	Vital 4L (Potassium phosphite)	Pythium aphanidermatum (Pythium aphanidermatum)	Poinsettia (Euphorbia pulcherrima) 'Angelica White'	Greenhouse	Benson	NC	2011	Drench	High disease pressure. No control with Vital at 20 fl oz per 100 gal.
26522	Vital 4L (Potassium phosphite)	Pythium irregulare (Pythium irregulare)	Fir, Douglas (Pseudotsuga menziesii)	Greenhouse	Linderman	OR	2006		High variability precluded determination of statistical significance between treatments
26769	Vital 4L (Potassium phosphite)	Pythium sp. (Pythium sp.)	Geranium (Geranium sp.)	Greenhouse	Reddy	AL	2006	Drench	Poor and excellent efficacy at 2 and 4 pt per 100 gal
26530	Vital 4L (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Drench	No efficacy
26530	Vital 4L (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Elite White'	Greenhouse	Chastagner	WA	2006	Foliar	No efficacy
26530	Vital 4L (Potassium phosphite)	Pythium ultimum (Pythium ultimum)	Geranium (Pelargonium sp.) P. x hortorum 'Orbit White'	Greenhouse	Hausbeck	MI	2013	Drench	Very low disease pressure. Plant health rating with 1.25 pt per 100 gal not significantly different from uninoculated and inoculated Check.

## Appendix 1: Contributing Researchers

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