

Project Name: Phytophthora Efficacy

New	Ongoing	Completed	X	Duration if ongoing or completed:	2003 – 2010, 2014 – 2017
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Project Description:

In 2002 the concept of ‘Super A’ studies was initiated to group together research areas needing higher attention. This concept morphed into ‘High Priority Projects’ by 2005. Screening biological and chemical tools for efficacy on Phytophthora diseases fell under the initial concept and continued through 2010. The impetus was to determine whether newer products were efficacious and to scope out the range of efficacy among the different *Phytophthora* species.

Research Project Abstract (if available):

Abstract from 2016 Phytophthora Efficacy Summary

From 2003 to 2015, 66 products representing 59 active ingredients were tested through the IR-4 Program as drench or foliar applications against nine *Phytophthora* species causing root rots and stem/leaf blights. *Phytophthora* species tested included: *P. cactorum*, *P. cinnamomi*, *P. citricola*, *P. cryptogea*, *P. dreschleri*, *P. nicotianae/parasitica*, *P. palmivora*, *P. plurivora*, *P. ramorum*, *P. syringae*, and *P. tropicalis*. Control of *Phytophthora cinnamomi* root rot was achieved primarily with drench applications onto azaleas. When this pathogen was tested on rhododendrons, the data were either inconclusive or the products did not perform as well as on azaleas with the exception of Magellan and Fenamidone. For *Phytophthora dreschleri* root rot, the good to excellent efficacy was achieved with several products including BioPhos, Segway, Stature DM, and Terrazole. For *Phytophthora nicotianae*, consistent efficacy across crops was difficult to achieve, but the best performers included Adorn, Aliette, Alude, Biophos, Fenamidone, Insignia, Micora Segway, Stature DM, Subdue MAXX, and Vital. The best control of *Phytophthora citricola* blight was achieved with foliar applications of the phosphorus acid generators Aliette, Biophos and Magellan. For *Phytophthora ramorum* blights, Subdue MAXX provided the most consistent control. Adorn, Fenamidone, Insignia, Segway, and Stature also provided good control. For *Phytophthora tropicalis*, the best control was achieved with Adorn and Stature. Micora and Segovis provided effective control of *Phytophthora plurivora* in two rhododendron experiments.

Target Species (Phytotoxicity, or common and Latin name of arthropod, pathogen, weed):

<i>Phytophthora cactorum</i>	<i>Phytophthora dreschleri</i>	<i>Phytophthora plurivora</i>
<i>Phytophthora cinnamomi</i>	<i>Phytophthora nicotianae/</i>	<i>Phytophthora ramorum</i>
<i>Phytophthora citricola</i>	<i>Phytophthora parasitica</i>	<i>Phytophthora syringae</i>
<i>Phytophthora cryptogea</i>	<i>Phytophthora palmivora</i>	<i>Phytophthora tropicalis</i>

Target Crops (list tested crops if ongoing or completed project)

African Violet (<i>Saintpaulia sp.</i>)	Garden Snapdragon (<i>Antirrhinum majus</i>)
Alder (<i>Alnus sp.</i>)	Lilyturf (<i>Liriope muscari</i>)
Arrowwood (<i>Viburnum sp.</i>)	Madagascar Periwinkle (<i>Catharanthus roseus</i>)
Azalea & Rhododendron (<i>Rhododendron sp.</i>)	Marigold (<i>Tagetes sp.</i>)
Bamboo Palm (<i>Chamaedorea seifrizii</i>)	Mexican Cliff Rose (<i>Purshia mexicana</i>)
Camellia (<i>Camellia japonica</i>)	Pansy (<i>Viola X wittrockiana</i>)
Centipede Tongavine (<i>Pothos sp.</i>)	Periwinkle (<i>Vinca sp.</i>)
Common Sage (<i>Salvia officinalis</i>)	Poinsettia (<i>Euphorbia pulcherrima</i>)
Crabapple (<i>Malus sp.</i>)	Seifriz’s Chamaedorea (<i>Chamaedorea seifrizii</i>)
English Ivy (<i>Hedera helix</i>)	Spathe Flower (<i>Spathiphyllum sp.</i>)
Fir (<i>Abies sp.</i>)	Transvaal Daisy (<i>Gerbera sp.</i>)



Environmental Horticulture Program Research Project Sheet

<https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-extension-resources/>

Target Product(s)(list tested products or numbered compounds if ongoing or completed project)		
Actinovate Soluble	Heritage	Remedier
Adorn 4F	Hymexazol 30L	RootShield Plus WP (aka BW240)
Agrifos	Insignia 20WDG Intrinsic Brand	SA 11210
Aliette WDG	Fungicide	Segovis (A21008A SC, SYN546539)
Alude	K-Phite	Segway
Banol	Magellan	Sernade Prime (aka Rhapsody ASO)
Calirus 150	Maneb 75DF	SP2770 10WP
Captan	MBI 110	Stature DM
Cease	Medallion	Stature MZ
Celero 16WSG	Micora (NOA 446510)	Stature SC
CG100	MultiGuard	Subdue MAXX
Champ Formula 2F	Muscodor albus	Taegro
Daconil 54EC	Orkestra Intrinsic (BAS703 06F/BAS703 01F)	Tanos
Daconil Ultrex	Orvego (BAS 651F)	Terramec SP
Daconil Weather Stik (2787 Flowable Fungicide)	Pageant Intrinsic	Terrazole 35%WP
Disarm 480SC	Polyram	TM-459
Dithane 75DF Rainshield	Prestop	Truban 25EC
Fenstop	Promax	Truban 30WP
Fluazinam	Proud 3	Vital 4L
Fore 80WP	Regalia O5 (MOI-10605)	ZeroTol
Gavel DF	Regalia SC (MOI 106)	

Products/Crops Registered through IR-4Research:				
	Fully Screened (also includes standards)	Partially Screened through IR-4 ¹		Need Data Across Species ?
Labeled Generally & Commercialized	Aliette Captan Stature * Subdue Maxx * Terrazole	Actinovate Champ Banol Banrot Cease Companion Daconil DisArm Empress * Heritage Insignia * Micora *	Mycostop Orvego * Pageant * PlantShield, RootShield Phosphorus Acid Salts ¹ RootShield Plus * Segway * Soilguard Taegro *	Hurricane
Labeled Generally But NOT Commercialized				
Labeled for Specific Phytophthora & Commercialized	Adorn *		FenStop	Compass
Labeled for Specific Phytophthora but NOT Commercialized				
Not yet registered or labeled for Phytophthora			Bio-Tam Heritage + Subdue	<i>Bacillus pumilus</i> BAS703 06F

No longer available for development for Phytophthora	Gavel DF ² Maneb ² Polyram ²	CG100 MOI-106 MOI-107 Multiguard	<i>Muscodor albus</i> SP2015 SP2770
* IR-4 Data contributed to registration decision – either adding pest to label or not pursuing further research ¹ Agri-Fos, Alude Magellan, Vital etc. ² Not for development for ornamental horticulture crops			

Other:
 This project also tested tank mix and rotations to foster IPM strategies for managing resistance.

Area	Characteristic	Pro	Con
Availability & effectiveness of alternative management tools	Individual Phytophthora species vary in response	x	x
	General labels could be refined by listing species – however, growers many not know which species they might have without detailed diagnostics	x	
	Best management practices water quality	x	
	Biofiltration with microbes	x	
	Biofiltration with microbes	x	
	Multiple years of data with successful registrations of products of different classes		x
	Many labels already list “Phytophthora diseases” on the label so further refinement of labels is not needed		x
	Growers may not know which species they might have without detailed diagnostics		x
Damage potential of target			
Performance and crop safety of proposed products (from other systems)			
Compatibility with IPM programs	Rotations for resistance management	x	
Economics			
Geographic distribution			
Manufacturer interest in labeling products			
Other	More important in future with water recycling	x	

IR-4 Efficacy Trials to Date
 Average rating on a scale of 1 – 5 with 1 = 0 to about 60% efficacy and 5 = 100 efficacy or equivalent to non-inoculated control; minimum to maximum rating; number of trials (See table on next page).
 ‘Labeled’ indicates that this disease species or genera is listed on the label. A rating of 2 or lower is considered unacceptable efficacy (*red text*). A rating of 3 or higher is considered commercially acceptable (black text). Non-labeled, completed product/disease combinations (3 or more trials) with an average rating of 3 or higher are highlighted with *green text*. For disease/product combinations that are blank, IR-4 has not screened this combination.

Table 1 of 2.

MOA	Product (Active Ingredients)	<i>Phytophthora cinnamomi</i>	<i>Phytophthora citricola</i>	<i>Phytophthora cryptogea</i>	<i>Phytophthora drechsleri</i>	<i>Phytophthora nicotianae</i>	<i>Phytophthora palmivora</i>
FRAC 11	Disarm 480SC (Fluoxastrobin)	3.0 (1 - 5) n4 Labeled	1.0 (1 - 1) n1 Labeled	1.8 (1 - 5) n5 Labeled	1.0 (1 - 1) n1 Labeled	5.0 (5 - 5) n1 Labeled	3.0 (3 - 3) n1 Labeled
FRAC 11	Fenstop (Fenamidone)	3.3 (1 - 5) n7 Labeled	1.5 (1 - 2) n2 Labeled	5.0 (5 - 5) n5 Labeled	4.0 (3 - 5) n2 Labeled	4.2 (2 - 5) n6 Labeled	3.0 (3 - 3) n2 Labeled
FRAC 4	Subdue MAXX (Mefenoxam)	2.1 (1 - 5) n7 Labeled	1.0 (1 - 1) n1 Labeled	4.2 (1 - 5) n5 Labeled	3.0 (1 - 5) n2 Labeled	4.8 (4 - 5) n4 Labeled	4.0 (3 - 5) n4 Labeled
FRAC 7 + FRAC 11	Pageant Intrinsic (Boscalid + pyraclostrobin)				1.0 (1 - 1) n1 Labeled		
FRAC 11	Heritage (Azoxystrobin)	1.5 (1 - 2) n2 Labeled	1.0 (1 - 1) n1 Labeled	3.0 (1 - 5) n4 Labeled	1.0 (1 - 1) n1 Labeled	5.0 (5 - 5) n1 Labeled	2.5 (2 - 3) n4 Labeled
FRAC 11	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)	2.7 (1 - 5) n6 Labeled	1.5 (1 - 2) n2 Labeled	2.2 (1 - 5) n5 Labeled	1.0 (1 - 1) n2 Labeled	3.6 (1 - 5) n5 Labeled	2.5 (2 - 3) n4 Labeled
FRAC 11 + FRAC 27	Tanos (Famoxadone + Cymoxanil)		1.0 (1 - 1) n1	1.0 (1 - 1) n2	1.0 (1 - 1) n1		3.0 (3 - 3) n1
FRAC 11 + FRAC 4	Tank Mix: Heritage + Subdue MAXX (Azoxystrobin + mefenoxam)		1.0 (1 - 1) n1			5.0 (5 - 5) n1	4.5 (4 - 5) n2
FRAC 12	Medallion (Fludioxonil)	1.0 (1 - 1) n1		1.0 (1 - 1) n1		1.0 (1 - 1) n2	
FRAC 14	Terrazole 35%WP (Etridiazole)	2.0 (1 - 3) n3 Labeled			4.5 (4 - 5) n2 Labeled	1.0 (1 - 1) n3 Labeled	3.0 (3 - 3) n1 Labeled
FRAC 14	Truban 25EC (Etridiazole)	1.0 (1 - 1) n2 Labeled					
FRAC 14	Truban 30WP (Etridiazole)					1.0 (1 - 1) n1 Labeled	
FRAC 21	Segway (Cyazofamid)	3.5 (3 - 5) n8 Labeled	1.0 (1 - 1) n3 Labeled	3.0 (1 - 5) n5 Labeled	4.3 (4 - 5) n3 Labeled	4.0 (1 - 5) n10 Labeled	3.0 (2 - 5) n6 Labeled
FRAC 21 / FRAC P07	Tank Mix: Cyazofamid + Alude (Cyazofamid + potassium phosphite)	3.0 (3 - 3) n1					
FRAC 28 + FRAC 43	V-10162 5.73FL (Fluopicolide + propamacarb hydrochloride)					5.0 (5 - 5) n1 Labeled	
FRAC 29	Fluazinam (Fluazinam)	3.0 (3 - 3) n1					
FRAC 32	Hymexazol 30L (Hymexazol)	1.0 (1 - 1) n1					
FRAC 40	Micora (Mandipropamid)	4.0 (1 - 5) n4 Labeled	1.0 (1 - 1) n1 Labeled	3.0 (1 - 5) n2 Labeled		5.0 (5 - 5) n3 Labeled	3.0 (1 - 5) n2 Labeled
FRAC 40	Stature DM (Dimethomorph)	3.4 (1 - 5) n8 Labeled	1.3 (1 - 2) n3 Labeled	4.0 (3 - 5) n2 Labeled	4.0 (4 - 4) n2 Labeled	2.9 (1 - 5) n9 Labeled	3.0 (3 - 3) n1 Labeled
FRAC 40	Stature SC (Dimethomorph)			5.0 (5 - 5) n2 Labeled	1.0 (1 - 1) n1 Labeled		2.3 (2 - 3) n3 Labeled

MOA	Product (Active Ingredients)	<i>Phytophthora cinnamomi</i>	<i>Phytophthora citricola</i>	<i>Phytophthora cryptogea</i>	<i>Phytophthora drechsleri</i>	<i>Phytophthora nicotianae</i>	<i>Phytophthora palmivora</i>
FRAC 40 + FRAC M3	Stature MZ (Dimethomorph + Mancozeb)	1.0 (1 - 1) n1					
FRAC 43	Adorn 4F (Fluopicolide)	2.6 (1 - 5) n5 Labeled	3.0 (1 - 5) n2 Labeled	3.8 (1 - 5) n5 Labeled	5.0 (5 - 5) n2 Labeled	5.0 (5 - 5) n4 Labeled	3.0 (2 - 5) n5 Labeled
FRAC 45 + FRAC 40	Orvego (BAS 651F) (Ametoctradin + dimethomorph (BAS 651))			5.0 (5 - 5) n1 Labeled	5.0 (5 - 5) n1 Labeled		
FRAC BM02	Actinovate Soluble (Streptomyces lydicus WYEC 108)	1.0 (1 - 1) n1 Labeled					
FRAC BM02	Remedier (Trichoderma asperellum + Trichoderma gamsii)			1.0 (1 - 1) n2 Labeled	1.0 (1 - 1) n1 Labeled	1.0 (1 - 1) n1 Labeled	
FRAC BM02	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)			1.0 (1 - 1) n1 Labeled	1.0 (1 - 1) n1 Labeled		
FRAC BM02	Taegro (Bacillus subtilis var amyloliquefaciens strain FZB24)			1.0 (1 - 1) n2 Labeled	1.0 (1 - 1) n1 Labeled		3.0 (3 - 3) n1 Labeled
FRAC M3	Fore 80WP (Manganese + Zinc + Ethylene bis-dithiocarbamate Ion)		1.0 (1 - 1) n1				
FRAC M4	Captan (Captan)	1.7 (1 - 3) n3 Labeled				4.0 (4 - 4) n1 Labeled	3.0 (3 - 3) n1 Labeled
FRAC M5	Daconil Weather Stik (2787 Flowable Fungicide) (Chlorothalonil)					1.0 (1 - 1) n1 Labeled	
FRAC P07	Aliette WDG (Fosetyl Al)	3.7 (2 - 5) n7 Labeled	4.3 (3 - 5) n3 Labeled	1.0 (1 - 1) n5 Labeled	1.5 (1 - 2) n2 Labeled	3.5 (1 - 5) n6 Labeled	2.0 (2 - 2) n1 Labeled
FRAC P07	Alude (Potassium phosphite)	2.9 (1 - 5) n7 Labeled	4.0 (4 - 4) n1 Labeled	1.0 (1 - 1) n3 Labeled	2.0 (1 - 3) n3 Labeled	3.0 (1 - 5) n4 Labeled	2.0 (2 - 2) n1 Labeled
FRAC P07	Calirus 150 (Mono- and di- potassium salts of phosphorus acid + copper sulfate pentahydrate)	5.0 (5 - 5) n1					
FRAC P07	K-Phite (Phosphorus acid salts)	5.0 (5 - 5) n1 Labeled				5.0 (5 - 5) n1 Labeled	
FRAC P07	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)	2.7 (1 - 5) n6 Labeled	4.0 (3 - 5) n3 Labeled	1.0 (1 - 1) n5 Labeled	1.0 (1 - 1) n1 Labeled	4.0 (3 - 5) n2 Labeled	3.0 (3 - 3) n1 Labeled
FRAC P07	Vital 4L (Potassium phosphite)	3.4 (1 - 5) n7 Labeled		1.0 (1 - 1) n3 Labeled	1.0 (1 - 1) n1 Labeled	4.3 (3 - 5) n3 Labeled	1.0 (1 - 1) n2 Labeled
IRAC 4A	Celero 16WSG (Clothianidin)						1.0 (1 - 1) n1
FRAC NC	Muscodor albus (Muscodor albus)	1.0 (1 - 1) n3		1.0 (1 - 1) n1		1.0 (1 - 1) n1	
FRAC NC	ZeroTol (Hydrogen dioxide)				1.0 (1 - 1) n1 Labeled		

MOA	Product (Active Ingredients)	<i>Phytophthora cinnamomi</i>	<i>Phytophthora citricola</i>	<i>Phytophthora cryptogea</i>	<i>Phytophthora drechsleri</i>	<i>Phytophthora nicotianae</i>	<i>Phytophthora palmivora</i>
FRAC P07	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)	3.3 (1 - 5) n8 Labeled	3.0 (3 - 3) n2 Labeled	1.0 (1 - 1) n2 Labeled	2.5 (1 - 4) n2 Labeled	3.5 (1 - 5) n4 Labeled	1.0 (1 - 1) n2 Labeled
unknown	MultiGuard (Furfural)	1.0 (1 - 1) n3 Labeled	1.0 (1 - 1) n1 Labeled	1.0 (1 - 1) n1 Labeled		1.7 (1 - 3) n3 Labeled	
unknown	TM-459 (TM-459)		1.0 (1 - 1) n1				

*Replaced in the marketplace with Empress Intrinsic; the WDG formulation is no longer available

** Disarm 480SC is now known as Fame SC

Table 2 of 2.

MOA	Product (Active Ingredients)	<i>Phytophthora plurivora</i>	<i>Phytophthora ramorum</i>	<i>Phytophthora sp</i>	<i>Phytophthora syringae e)</i>	<i>Phytophthora tropicalis</i>
FRAC 11	Disarm 480SC (Fluoxastrobin)		2.2 (1 - 5) n9 Labeled	4.0 (4 - 4) n1 Labeled	1.0 (1 - 1) n2 Labeled	5.0 (5 - 5) n2 Labeled
FRAC 11	Fenstop (Fenamidone)		2.7 (2 - 5) n6 Labeled	5.0 (5 - 5) n1 Labeled	1.0 (1 - 1) n1 Labeled	5.0 (5 - 5) n2 Labeled
FRAC 4	Subdue MAXX (Mefenoxam)	5.0 (5 - 5) n1 Labeled	3.8 (1 - 5) n11 Labeled		1.0 (1 - 1) n2 Labeled	5.0 (5 - 5) n1 Labeled
FRAC 7 + FRAC 11	Orkestra Intrinsic (Fluxapyroxad + pyraclostrobin)	4.0 (4 - 4) n1 Labeled				
FRAC 11	Heritage (Azoxystrobin)		1.5 (1 - 3) n4 Labeled		1.0 (1 - 1) n1 Labeled	5.0 (5 - 5) n2 Labeled
FRAC 11	Insignia 20WDG Intrinsic Brand Fungicide (Pyraclostrobin)		1.9 (1 - 5) n7 Labeled		1.0 (1 - 1) n1 Labeled	2.0 (2 - 2) n1 Labeled
FRAC 11 + FRAC 27	Tanos (Famoxadone + Cymoxanil)		5.0 (5 - 5) n1		1.0 (1 - 1) n1	
FRAC 11 + FRAC 4	Tank Mix: Heritage + Subdue MAXX (Azoxystrobin + mefenoxam)		2.0 (2 - 2) n1		1.0 (1 - 1) n1	
FRAC 14	Terrazole 35%WP (Etridiazole)		1.0 (1 - 1) n2 Labeled			
FRAC 21	Segway (Cyazofamid)		3.1 (2 - 5) n8 Labeled	4.0 (4 - 4) n1 Labeled	1.0 (1 - 1) n3 Labeled	5.0 (5 - 5) n3 Labeled
FRAC 40	Micora (Mandipropamid)	4.0 (3 - 5) n2 Labeled	3.3 (1 - 5) n7 Labeled	4.0 (4 - 4) n1 Labeled	1.0 (1 - 1) n2 Labeled	5.0 (5 - 5) n1 Labeled
FRAC 40	Stature DM (Dimethomorph)		2.6 (1 - 5) n10 Labeled		1.0 (1 - 1) n3 Labeled	
FRAC 40	Stature SC (Dimethomorph)		3.0 (3 - 3) n1 Labeled			5.0 (5 - 5) n1 Labeled

MOA	Product (Active Ingredients)	<i>Phytophthora plurivora</i>	<i>Phytophthora ramorum</i>	<i>Phytophthora sp</i>	<i>Phytophthora syringae e</i>	<i>Phytophthora tropicalis</i>
FRAC 43	Adorn 4F (Fluopicolide)		2.3 (1 - 5) n11 <i>Labeled</i>	4.0 (4 - 4) n1 Labeled	1.0 (1 - 1) n3 <i>Labeled</i>	5.0 (5 - 5) n4 Labeled
FRAC 45 + FRAC 40	Orvego (BAS 651F) (Ametoctradin + dimethomorph (BAS 651))		4.0 (3 - 5) n3 Labeled			
FRAC 49	Segovis (Oxathiapiprolin)	5.0 (5 - 5) n2 Labeled				
FRAC BM01	Promax (Thyme Oil (3%))	1.0 (1 - 1) n1				
FRAC BM01	Proud 3 (Thyme oil (5.6%))	5.0 (5 - 5) n1				
FRAC BM01	Regalia O5 (MOI-10605) (Extract of Reynoutria sachalinensis)		5.0 (5 - 5) n1 Labeled			
FRAC BM01	Regalia SC (MOI 106) (Extract of Reynoutria sachalinensis)		2.0 (2 - 2) n1			
FRAC BM02	Actinovate Soluble (Streptomyces lydicus WYEC 108)		1.0 (1 - 1) n2 <i>Labeled</i>	2.0 (2 - 2) n1 <i>Labeled</i>		
FRAC BM02	Cease (Bacillus subtilis strain QST 713)		1.0 (1 - 1) n1 <i>Labeled</i>			
FRAC BM02	Prestop (Gliocladium catenulatum Strain J1446)	1.0 (1 - 1) n1 <i>Labeled</i>				
FRAC BM02	RootShield Plus WP (aka BW240) (Trichoderma harzianum T-22 + Trichoderma virens G-41)		1.0 (1 - 1) n1 <i>Labeled</i>			
FRAC BM02	Seranade Prime (aka Rhapsody ASO) (Bacillus subtilis strain QST 713)	1.0 (1 - 1) n1				
FRAC BM02	Taegro (Bacillus subtilis var amyloliquefaciens strain FZB24)					1.0 (1 - 1) n1 <i>Labeled</i>
FRAC M1	Champ Formula 2F (Copper hydroxide)		1.0 (1 - 1) n1			
FRAC M3	Dithane 75DF Rainshield (Mancozeb)		3.4 (1 - 5) n5 Labeled			
FRAC M3	Maneb 75DF (Maneb)		5.0 (5 - 5) n4			
FRAC M3	Polyram (EBDC)		4.5 (3 - 5) n4			
FRAC M3 + FRAC 22	Gavel DF (Mancozeb + Zoxamide)		4.5 (3 - 5) n4			
FRAC M4	Captan (Captan)		2.0 (1 - 5) n7 <i>Labeled</i>		1.0 (1 - 1) n1 <i>Labeled</i>	
FRAC M5	Daconil Ultrex (Chlorothalonil)		2.0 (2 - 2) n1 <i>Labeled</i>			
FRAC P07	Aliette WDG (Fosetyl Al)		1.1 (1 - 2) n7 <i>Labeled</i>		2.3 (1 - 3) n3 <i>Labeled</i>	2.0 (1 - 3) n2 <i>Labeled</i>

MOA	Product (Active Ingredients)	<i>Phytophthora plurivora</i>	<i>Phytophthora ramorum</i>	<i>Phytophthora sp</i>	<i>Phytophthora syringae e</i>	<i>Phytophthora tropicalis</i>
FRAC P07	Alude (Potassium phosphite)		1.0 (1 - 1) n3 <i>Labeled</i>		3.0 (3 - 3) n1 Labeled	
FRAC P07	Magellan (Mono- and Dibasic Sodium, Potassium and Ammonium Phosphites)		1.0 (1 - 1) n6 <i>Labeled</i>		3.0 (3 - 3) n2 Labeled	
FRAC P07	Vital 4L (Potassium phosphite)		1.0 (1 - 1) n4 <i>Labeled</i>	5.0 (5 - 5) n1 Labeled		
IRAC UNF & FRAC BM02	Stargus (Bacillus nakamurai strain F727)	5.0 (5 - 5) n1 Labeled				
FRAC NC	CG100 (Caprylic acid)		3.0 (1 - 5) n2			
FRAC P07	Agrifos (Dipotassium phosphonate + Dipotassium phosphate)		1.3 (1 - 2) n4 <i>Labeled</i>	4.0 (4 - 4) n1 Labeled		
unknown	MultiGuard (Furfural)		1.0 (1 - 1) n2 <i>Labeled</i>	3.0 (3 - 3) n1 Labeled		1.0 (1 - 1) n1 <i>Labeled</i>
unknown	SA 11210 (SA 11210)		1.0 (1 - 1) n1			
unknown	SP2770 10WP (SP2770)	3.5 (2 - 5) n2				

*Replaced in the marketplace with Empress Intrinsic; the WDG formulation is no longer available

** Disarm 480SC is now known as Fame SC

FRAC Class	Fungicide (active ingredients)	Registered Use Site(s)	REI	Application Method	Phytophthora Root Rot						Phytophthora Foliar/Stem Blight						
					<i>P. cactorum</i>	<i>P. cinnamomi</i>	<i>P. cryptogea</i>	<i>P. drechsleri</i>	<i>P. nicotianae/parasitica</i>	<i>P. palmivora</i>	<i>P. plurivora</i>	<i>Phytophthora sp.</i>	<i>P. tropicalis</i>	<i>P. citricola</i>	<i>P. nicotianae/parasitica</i>	<i>P. ramorum</i>	<i>P. syringae</i>
Registered Products																	
4	Subdue MAXX, Fenox (mefenoxam)	G, L, N, S	0 h or 48 h	D	F	P-E	G-E	E	F-E	E	E	-	G-E	-	P-E	P-E	-
				S	-	-	-	-	-	-	-	-	-	-	P	-	P-E
7 + 11	Broadform (fluopyram + trifloxystrobin)	G, I, L, N, S	12 h	D	-	-	-	P	-	-	-	-	-	-	-	-	-
				S	-	-	-	P	-	-	-	-	-	-	-	-	-
	Orkestra Intrinsic, BAS 703 (fluxapyroxad + pyraclostrobin)	G, L, N, S	12 h	D	-	G	-	-	-	-	-	-	-	-	G	-	-
				S	-	-	-	-	-	-	E	-	-	-	-	-	-
11	Compass (trifloxystrobin)	G, I, L, N, S	12 h	D, S	-	-	-	-	-	-	-	-	-	-	-	-	-
				D	-	P-E	P-E	P-F	F-E	E	-	-	G-E	-	-	F	-
	Disarm (fluoastrobin)	G, I, N, S	12 h	S	-	-	-	-	-	-	-	-	-	-	-	P-E	P
				D	F	P-E	F	F	G-E	P-G	-	G-E	F-G	-	G	-	-
	Empress Intrinsic, Insignia (pyraclostrobin)*	G, L, N, S	12 h	S	-	-	-	-	-	-	-	-	-	P	P-G	P-G	P
				D	F	P-E	E	P-E	P-E	E	-	E	E	-	-	-	-
	Fenstop (fenamidone)	G	12 h	S	-	-	-	-	F	-	-	-	-	P	E	P-E	-
				D	F	P-E	E	P-E	P-E	E	-	E	E	-	-	-	-
Heritage (azoxystrobin)	G, L, N, S	4h	D	P-F	F	P-E	P-E	P-E	P-E	-	-	G-E	-	P-E	E	-	
			S	-	-	-	-	-	-	-	-	-	-	P	-	P	P
11 + 7	Mural, A18126B (azoxystrobin + benzovindiflupyr)	G, L, N, S	-	D	-	G	E	-	-	-	-	-	-	-	-	-	
				D	-	G	-	P-E	P	-	-	-	E	-	G	-	-
	Pageant Intrinsic (pyraclostrobin + boscalid)	G,I,L,N,S	12 h	S	-	-	-	P-E	P	-	-	-	E	-	-	-	
				D	-	-	-	-	-	-	-	-	-	-	-	-	-
12 + 4	Hurricane (fludioxonil+mefenoxam)	G, I, N, S	48 h	D	-	-	-	-	-	-	-	-	-	-	-	-	
14	Terrazole, Truban (etridiazole)	G, N	12 h	D	F	?	?	P-E	P-E	-	-	-	-	-	-	-	-
				-	-	-	-	-	-	-	-	-	-	-	-	-	-
				S	-	-	-	-	-	-	-	-	-	-	-	-	P
14 + 1	Banrot (etridiazole+thiophanate methyl)	G	12 h	D	-	-	-	-	P	-	-	-	-	-	-	-	
21	Segway (cyazofamid)	G, N	12 h	D	P-F	F-E	P-E	F-E	P-E	P-E	-	E	G-E	P	P	-	P
				S	-	F	-	-	-	-	-	-	-	-	-	P-E	P-E
28	Banol, Proplant (propamocarb)	G, N	24 h	D	-	P	-	-	P-F	-	-	-	-	-	-	-	
40	Micora (mandipropamid)	G, L, N, S	4 h	D	P-F	E	P-G	E	F-E	P-E	G-E	E	F	P	-	-	P
				S	-	-	-	-	-	-	-	-	-	-	-	E	P-E
	Stature SC (dimethomorph)	G, L, N	12 h	D	F	P-E	G-E	P-E	P-E	-	-	-	P-E	P	-	-	P
				S	-	-	-	-	-	F	-	-	-	-	P	P-E	P-E
40 + 45	Orvego, BAS 651 (ametoctradin + dimethomorph)	G, I, L, N, S	12 h	D	-	-	-	-	-	-	-	-	-	-	G	-	-
				S + D	-	G-E	G-E	-	F-E	-	-	-	G-E	E	-	P	G-E

FRAC Class	Fungicide (active ingredients)	Registered Use Site(s)	REI	Application Method	Phytophthora Root Rot						Phytophthora Foliar/Stem Blight						
					<i>P. cactorum</i>	<i>P. cinnamomi</i>	<i>P. cryptogea</i>	<i>P. drechsleri</i>	<i>P. nicotianae/parasitica</i>	<i>P. palmivora</i>	<i>P. plurivora</i>	<i>Phytophthora sp.</i>	<i>P. tropicalis</i>	<i>P. citricola</i>	<i>P. nicotianae/parasitica</i>	<i>P. ramorum</i>	<i>P. syringae</i>
-	Kleengrow (Didecyl dimethyl ammonium chloride)	G	48 h	D	-	-	-	-	-	-	-	-	-	-	-	-	-
Experimental Products																	
11 + 2	Interface (trifloxystrobin + iprodione)	TBD	-	D	-	G	-	-	-	-	-	-	-	-	-	-	-
11 + 3	Tartan (trifloxystrobin + triadimefon)	TBD	-	D	-	G	-	-	-	-	-	-	-	-	-	-	-
BM01	Proud 3 Promax (thyme oil)	TBD	0 h	S	-	-	-	-	-	-	P-G	-	-	-	-	-	-
	Regalia (extract of <i>Reynoutria sachalinensis</i>)	G, I, L, N, S	4 h	D, S	-	-	-	-	-	-	-	-	-	-	-	-	-
BM02	<i>Bacillus pumilus</i>	TBD	4 h	S	-	-	-	-	-	-	-	-	-	-	-	-	-
NC	Bio-Tam (<i>Trichoderma asperellum & gamsii</i>)	G, N	4 h	D	-	-	P	P	P	-	-	-	P	-	-	-	-
NC	<i>Muscodor albus</i>	TBD	-	S	-	P	P	-	P	-	-	-	-	-	-	-	-
-	A21519C	TBD	-	D	-	-	-	-	E	-	-	-	-	-	-	-	-
-	A21916A	TBD	-	D	-	-	-	-	E	-	-	-	-	-	-	-	-
-	BW159	TBD															
-	SP2770 (SP2770)	TBD	-	D	-	-	-	-	-	-	P	-	-	-	-	-	-
				S	-	-	-	-	-	-	P	-	-	-	-	-	-
				D + S	-	-	-	-	-	-	E	-	-	-	-	-	-

Registered Use Sites: G = Greenhouse; L = Lath House; I = Indoors; N = Nursery; S = Shade House; TBD = To Be Determined

Application Method: D = Drench; S = Spray

Efficacy: E = clearly statistically equivalent or better than untreated non-inoculated and/or clearly statistically different than untreated inoculated; G = statistically different from untreated inoculated and untreated non-inoculated; F = statistically equivalent to both untreated inoculated and untreated non-inoculated; P = statistically equivalent to untreated inoculated. For trials without non-inoculated check, efficacy determined on author's conclusions, % control or comparisons to standard product(s).

1 Phytophthora Efficacy taken from the 2016 IR-4 Phytophthora efficacy summary, 11 2016-2020 PDMR reports. If mefenoxam-resistant Phytophthora isolate used in a trial, data were not included for mefenoxam efficacy.

2 Empress Intrinsic has replaced Insignia for use in production ornamentals applied as drench to control soil-borne diseases caused by *Fusarium*, *Phytophthora*, *Pythium* and *Rhizoctonia* spp.

3 PlantShield is only registered in a few states.

* No longer available for development in ornamental horticulture crops