

Project Name: Nematode Efficacy

New	Ongoing	X	Completed	Duration if ongoing or completed:	2016-2020
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Project Description:

Nematodes have routinely surfaced in the biennial survey of grower needs. Recently, fluopyram has been registered for nematode management in turf. However, no new nematicides have been commercialized for ornamentals in the past 20 years and growers continue to have challenges managing nematodes with limited old products that are currently available.

Research Project Abstract (if available):

Abstract from 2017 Nematode Efficacy Summary & Literature Review

Foliar nematodes cause huge damage not only in food crops but also on popular ornamental horticulture plants. This summary includes research from nematode efficacy experiments on environmental horticulture crops during 1999 to 2020. The 36 products tested either as soil or foliar treatments were from different mode-of-action groups and included 26 chemicals, 9 plant oils, and 1 bacterial biopesticide. Products with good efficacy included: abamectin, acephate, clothianidin, dimethoate, insecticidal soap, isofenphos, methiocarb, neem oil, oregano oil, oxamyl and lambda-cyhalothrin. Active ingredients with excellent efficacy included: ammonia hydroxide, *Burkholderia cepacia*, chlofenapyr, cinnamon + clove + thyme oils (32% + 8% + 15%), diazinon, ethoprophos, grapefruit seed extract, imidacloprid, peroxyacetic acid, potassium permanganate, sodium dichloroisocyanurate, sodium hypochlorite, and trichlofon.

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

Aphelenchoides fragarie
Meloidogyne hapla
Meloidogyne incognita

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

Autumn Sage (*Salvia greggii*)
 Daylily (*Hemerocallis sp.*)
 Chinese hibiscus (*Hibiscus rosa-sinensis*)
 Hay-scented Fern (*Microlepia strigosa*)

Target Product(s)(list tested products or numbered compounds if ongoing or completed project)

Indemnify	MBI 306
MBI 203 SC2	NMG-787
MBI 304	RootShield Plus WP
MBI 305	

Product Registration and Research Status

	Fully Screened (also includes standards)	Partially Screened through IR-4 ¹	Need Data Across Species ?
Labeled Generally & Commercialized	Basamid Chloropicrin K-Pam HL Methyl Bromide Mocap Pylon Telone Vapam, Busan, Nemasol Vorlex		



Environmental Horticulture Program Research Project Sheet

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

Labeled Generally But NOT Commercialized			
Labeled for Specific Diseases & Commercialized			
Labeled for Specific Diseases but NOT Commercialized		Indemnify Majestene (MBI-305)	
Not yet registered or Labeled		MBI-304 MBI 306 NMG-787	
No longer available for development			

* IR-4 Data contributed to registration decision – either adding pest to label or not pursuing further research
1 At least one species screened fully

Area	Characteristic	Pro	Con
Availability & effectiveness of alternative management tools	New biological and chemical ingredients are available for screening	x	
	Several different genera cause nematode diseases and performance may not be similar	x	
	Loss of methyl bromide – need alternatives	x	
Damage potential of target	Can be major pest for growers	x	
Performance and crop safety of proposed products (from other systems)			
Compatibility with IPM, resistance management programs			
Economics			
Geographic distribution			
Manufacturer interest in labeling products	Uncertain interest for ornamentals		x
Other			

IR-4 Efficacy Trials to Date

Average rating on a scale of 1 – 5 with 1 = 0 to about 50% efficacy (not effective) and 5 = 95 to 100 efficacy (very effective); minimum to maximum rating; number of trials (See table on next page). For product/insect combinations that are blank, IR-4 has not screened this combination.

'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.

MOA	Product (Active Ingredients)	Foliar Nematode, (<i>Aphelenchoides fragariae</i>)	Nematode, Northern Root Knot (<i>Meloidogyne hapla</i>)	Nematode, Southern Root Knot (<i>Meloidogyne incognita</i>)
FRAC 7	Indemnify (Fluopyram)	1.0 (1 - 1) n1	3.0 (3 - 3) n1	5.0 (5 - 5) n1
FRAC BM02	RootShield Plus WP (aka BW240) (Trichoderma)			1.0 (1 - 1) n1



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	harzianum T-22 + Trichoderma virens G-41)			
FRAC NC & IRAC UNB	MBI 305 (Burkholderia rinojensis strain A396)	2.0 (2 - 2) n1	3.0 (3 - 3) n1	
unknown	MBI 203 SC2 (MBI 203)			1.0 (1 - 1) n1
unknown	MBI 304 (Chromobacterium subtsugae)	2.0 (2 - 2) n1	3.0 (3 - 3) n1	
unknown	MBI 306 (MBI 306)			1.0 (1 - 1) n1
unknown	NMG-787 (NMG-787)			1.0 (1 - 1) n1

FRAC Class	Fungicides (active ingredients)	Registered Use Site(s)	REI	Efficacy on Nematodes			
				<i>Meloidogyne</i> spp.	<i>Pratylenchus</i> spp.	<i>Aphelenchoides</i> spp.	<i>Paratylenchus</i> spp.
Registered Products							
7	Indemnify (fluopyram)	SF	12 h	P-E	G	P	G ^a
NC	MeloCon; <i>Purpureocillium lilacinum</i> (syn. <i>Paecilomyces lilacinus</i>) strain 251)	I, N	4 h	P	-	-	-
Experimental Products							
1A	Vydate (oxamyl)	TBD	48 h	P-F	G-E	-	-
44	Aveo EZ (<i>Bacillus amyloliquefaciens</i> strain PTA-4838)	TBD	4 h	P	-	-	-
BM 02	Actinovate (<i>Streptomyces lydicus</i> WYEC 108)	G, I, L, N, S	1 h	P	-	-	-
BM 02	Majestene, MBI 305 (<i>Burkholderia</i> spp. strain A396)	TBD	4 h	P-G	-	-	P ^a
BM 02	MBI 304 (<i>Chromobacterium subtsugae</i>)	TBD	4 h	G	-	F	P ^a
NC	Nemakill (cinnamon, clove and thyme oils)	TBD	-	P	-	-	-
BM 01	NemaQ (<i>Quillaja saponaria</i> extract)	TBD	-	F	-	-	-
BM 02	Nortica 5% WP (<i>Bacillus firmus</i> strain I-1582)	TBD	4 h	P	-	-	-
NC	Sesamin EC (sesame oil)	TBD	-	P	-	-	-
IRAC UNE	Ecozin Plus (azadirachtin)	TBD	4 h	P	-	-	-
-	ADA 36230 (soletanol)	TBD	-	-	G	-	-
-	BW240 (BW240)	TBD	-	P	-	-	-
-	Dazitol (blend of pepper and mustard extracts)	TBD	-	P	-	-	-
-	MBI 203 (MBI 203)	TBD	-	P	-	-	-
-	MBI 306 (MBI 306)	TBD	-	P	-	-	-
-	Nimitz, MCW-2 (fluensulfone)	TBD	-	P-E	G	-	-
-	NMG 787 (NMG 787)	TBD	-	G	-	-	-
-	Salibro 500 SC, Q8U80 (fluazaindolizine)	TBD	-	E	G	-	-

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

^a Drench application

Efficacy: E = clearly statistically different than untreated, best treatment; G = statistically different from untreated, inferior to best treatment; F = statistically different than untreated, much inferior to best treatment; P = statistically equivalent to untreated; OR

Efficacy: E = clearly statistically better than untreated and greater than 95% control; G = statistically better than untreated and between 85 and 95% control; F- statistically better than untreated with control between 70 and 85%; P = statistically equivalent to untreated and/or efficacy less than 70%, OR

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).

Efficacy ratings taken from 3 IR-4, 12 2012-16 PDMR, 3 2016-17 Univ of Florida and 1 2014 Univ of California efficacy reports.

Updated 9/10/2021