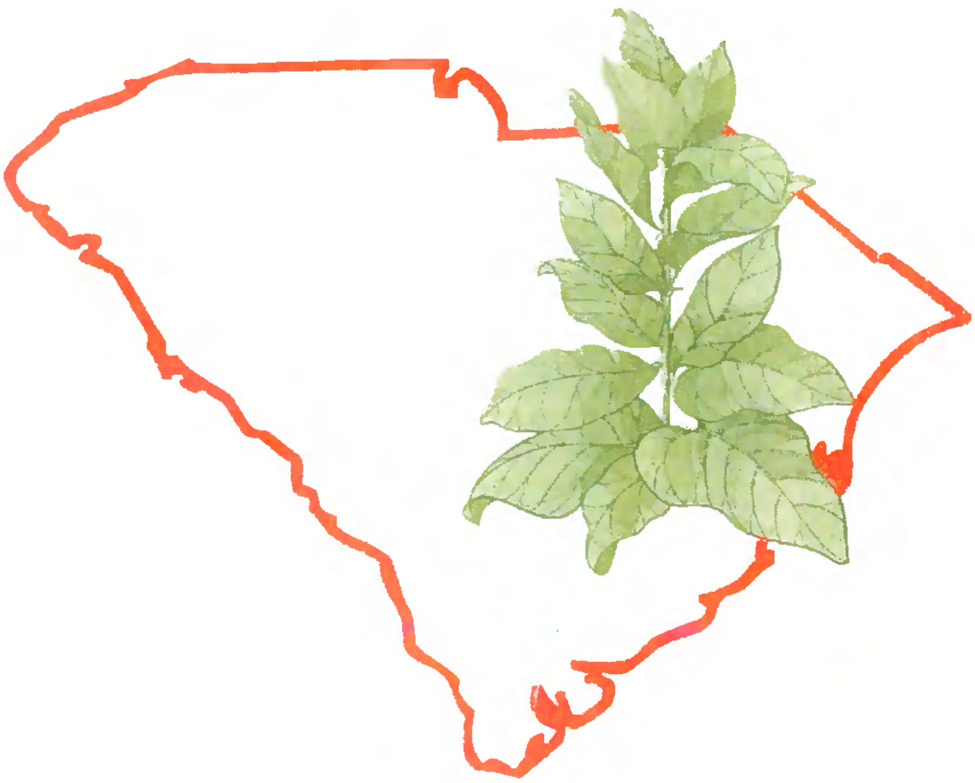
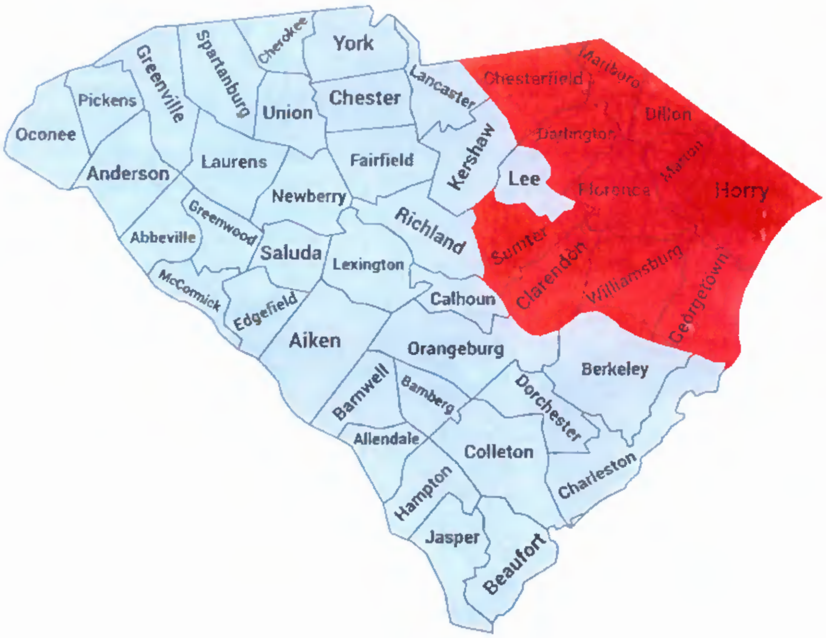
2023 South Carolina Tobacco Tour



COOPERATIVE EXTENSION

College of Agriculture, Forestry and Life Sciences

Tobacco Producing Counties



County	Phone
Chesterfield	(843) 623-2134
Clarendon	(803) 435-8429
Darlington	(843) 393-0484
Dillon	(843) 774-8218
Florence	(843) 661-4800
Georgetown	(843) 546-4481
Horry	(843) 365-6715
Marion	(843) 423-8285
Marlboro	(843) 479-6851
Sumter	(803) 773-5561
Williamsburg	(843) 355-6106

Extension Tobacco Team

William Hardee – Extension Tobacco Specialist, Horry and Marion County Agent
David DeWitt – New and Emerging Crops Coordinator, Lee, Sumter and Kershaw County Agent
Churamani Khanal – Assistant Professor, Plant Nematology
Francis P.F. Reay-Jones – Professor of Entomology and IPM Coordinator
Mike Marshall – Extension Weed Specialist
Hannah Mikell – Clarendon and Williamsburg County Agent
Kyle Smith – Darlington, Marlboro, Florence and Dillon Counties
Pee Dee REC Farm Crew- Brandon Rogers (manager), Ryan Graham, Allen DeWitt, Johnathan Edgeworth, Karen Barefoot, & Chuck Parker

Tour Rules

1. Headlights on.

2. Follow at a close, yet SAFE distance.

3. There are no police escorts. When the tour goes through a busy intersection, we will slow down long enough for everyone to make it through.

4. Fuel up before the tour.

5. Remember those behind you will follow you. Let the tour "leave you" instead of "leaving the tour."

2023 South Carolina Tobacco Tour Schedule

July 11, 2023

3:00 p.m. – until – **Check into Hampton Inn at Georgetown Marina**
420 Marina Drive
Georgetown, SC 29440
https://maps.app.goo.gl/pF88vRUTaY3KZ6NN7

5:30 p.m. – **Hospitality Suite Open (check email or ask front desk for room #)**

6:30 p.m. – **Depart**

7:00 p.m. – **Supper at River Room Restaurant**
801 Front Street
Georgetown, SC 29440
https://maps.app.goo.gl/iLsdHX1YQgHZp42bA

July 12, 2023

8:00 a.m. – **Depart Hampton Inn Georgetown Marina to Squires Farms Test Plot**

8:45 a.m. – **Velum Prime On-farm Test Plot**
1529 Barnhill Road
Hemingway, SC 29554
GPS: 33.712211, -79.380568
http://maps.app.goo.gl/2GjXLwCTTd8g6h9W8

9:15 a.m. – **Depart**

9:30 a.m. – **On-Farm Bacterial Wilt Variety Resistance Demonstration**
1000 Whiteville Drive
Georgetown, SC 29440
GPS: 33.604107, -79.395653
https://goo.gl/maps/4zS4iPfHMBWQ3dpJ6

10:00 a.m. – **Depart**

10:05 a.m. – **Bathroom Break, Barn Modifications, Sprayer Nozzle Configuration, Weather Station Project, and Black Mingo Produce and Fresh Meat**

Baxley Farms Headquarters
4490 Rose Hill Road
Georgetown, SC 29440
GPS: 33.591807, -79.399447
https://maps.app.goo.gl/SeSpF2U6SFT8mhWSA

11:00 a.m. – **Depart**

12:30 p.m. – **Lunch** at Pee Dee Research and Education Center (Pee Dee REC)
John B. Pitner Center
2200 Pocket Road
Darlington, SC 29532
GPS: 34.288445, -79.737940
https://goo.gl/maps/6h7Md9ZYK9TqBTgGA

1:30 p.m. – **Depart John B. Pitner Center to On-Site Field**

1:45 p.m. – **Bacterial Wilt Nursery OVT at Pee Dee REC**
GPS: 34.287774, -79.748795
https://maps.app.goo.gl/4EaRXwgSPerJCooJ7

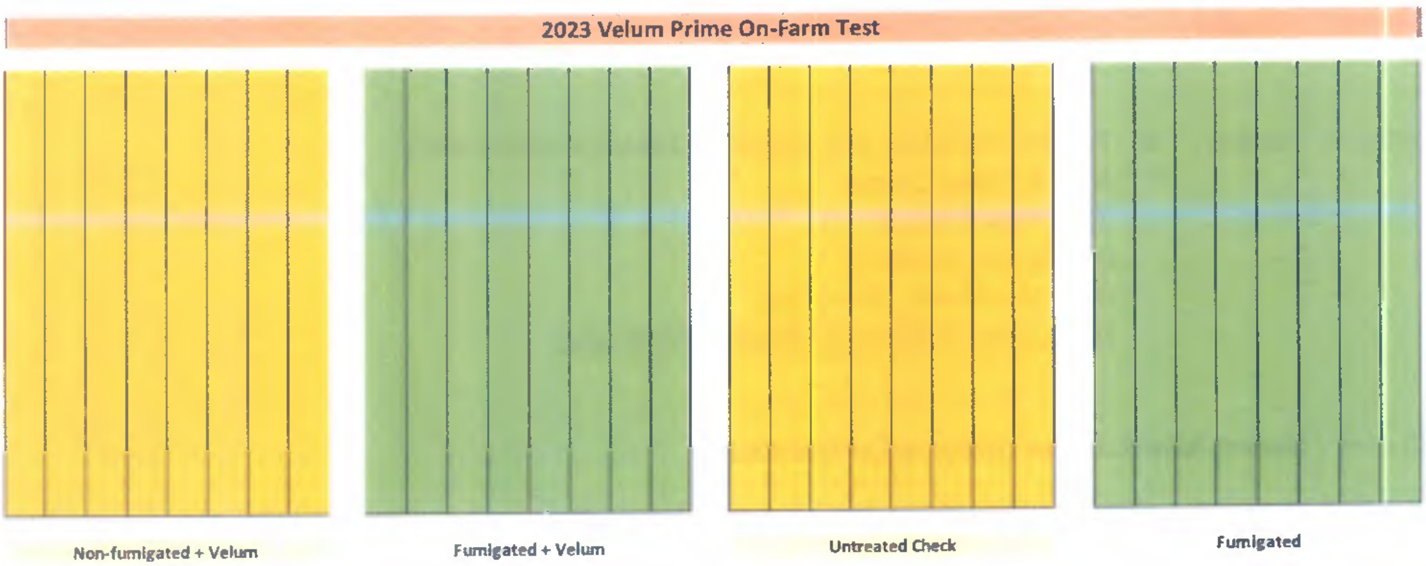
2:15 p.m. – **Depart. End of Tour**

Contact William Hardee (843-222-8701) or David DeWitt (843-229-7994) if you need assistance with directions.

On-Farm Velum Prime Test Plot

Treatments:

1. Velum Prime (6.84 fl oz / Acre)
2. Chloropicrin (4.0 GPA) + Velum Prime (6.84 fl oz / Acre)
3. Untreated Check
4. Chloropicrin (4.0 GPA)



Preseason

Sample #	Field ID	Host/Habitat
N2300149	Field 1 Shallow	Tobacco (general)
N2300150	Field 1 Deep	Tobacco (general)
N2300151	Field 2 Shallow	Tobacco (general)
N2300152	Field 2 Deep	Tobacco (general)
N2300153	Field 3 Shallow	Tobacco (general)
N2300154	Field 3 Deep	Tobacco (general)

Sample #	*List of Nematode/ID(s)*	*Count*	*Risk*
N2300149	Root-knot nematodes (Meloidogyne sp./spp.)	40 juveniles per 100 cc of soil	--
N2300149	Lesion nematodes (Pratylenchus sp./spp.)	10 individuals per 100 cc of soil	--
N2300149	Stubby-root nematodes (Family Trichodoridae)	10 individuals per 100 cc of soil	--
N2300150	Root-knot nematodes (Meloidogyne sp./spp.)	140 juveniles per 100 cc of soil	--
N2300150	Stubby-root nematodes (Family Trichodoridae)	30 individuals per 100 cc of soil	--
N2300150	Stunt nematodes (Tylenchorhynchus sp./spp.)	10 individuals per 100 cc of soil	--
N2300151	Root-knot nematodes (Meloidogyne sp./spp.)	70 juveniles per 100 cc of soil	--
N2300151	Spiral nematodes (Helicotylenchus sp./spp.)	50 individuals per 100 cc of soil	--
N2300151	Stubby-root nematodes (Family Trichodoridae)	90 individuals per 100 cc of soil	--
N2300151	Stunt nematodes (Tylenchorhynchus sp./spp.)	30 individuals per 100 cc of soil	--
N2300152	Root-knot nematodes (Meloidogyne sp./spp.)	50 juveniles per 100 cc of soil	--
N2300152	Stubby-root nematodes (Family Trichodoridae)	30 individuals per 100 cc of soil	--
N2300152	Stunt nematodes (Tylenchorhynchus sp./spp.)	20 individuals per 100 cc of soil	--
N2300153	Ring nematode (Mesocriconema sp./spp.)	110 individuals per 100 cc of soil	--
N2300153	Stubby-root nematodes (Family Trichodoridae)	10 individuals per 100 cc of soil	--
N2300153	Stunt nematodes (Tylenchorhynchus sp./spp.)	10 individuals per 100 cc of soil	--
N2300154	Spiral nematodes (Helicotylenchus sp./spp.)	20 individuals per 100 cc of soil	--
N2300154	Ring nematode (Mesocriconema sp./spp.)	110 individuals per 100 cc of soil	--
N2300154	Lesion nematodes (Pratylenchus sp./spp.)	10 individuals per 100 cc of soil	--
N2300154	Stubby-root nematodes (Family Trichodoridae)	60 individuals per 100 cc of soil	--

Before Transplanting

Sample #	Field ID	Host/Habitat
N2300261	F Shallow	Tobacco (general)
N2300262	F Deep	Tobacco (general)
N2300263	NF Deep	Tobacco (general)
N2300264	NF Shallow	Tobacco (general)
N2300265	FWV Deep	Tobacco (general)
N2300266	FWV Shallow	Tobacco (general)
N2300267	NFWV Shallow	Tobacco (general)
N2300268	NFWV Deep	Tobacco (general)

Above sample(s) have been diagnosed/identified with the following diagnosis/ID(s)

Sample #	*List of Nematode/ID(s)*	*Count*	*Risk*
N2300261	Root knot nematodes (Meloidogyne sp./spp.)	20 juveniles per 100 cc of soil	--
N2300261	Stubby-root nematodes (Family Trichodoridae)	10 individuals per 100 cc of soil	--
N2300262	No nematode found (No Nematode Found)	0 -- per 100 cc of soil	--
N2300263	Root knot nematodes (Meloidogyne sp./spp.)	310 juveniles per 100 cc of soil	--
N2300263	Spiral nematodes (Helicotylenchus sp./spp.)	50 individuals per 100 cc of soil	--
N2300263	Ring nematode (Mesocriconema sp./spp.)	50 individuals per 100 cc of soil	--
N2300263	Lesion nematodes (Pratylenchus sp./spp.)	10 individuals per 100 cc of soil	--
N2300263	Stubby root nematodes (Family Trichodoridae)	10 individuals per 100 cc of soil	--
N2300263	Stunt nematodes (Tylenchorhynchus sp./spp.)	10 individuals per 100 cc of soil	--
N2300264	Root-knot nematodes (Meloidogyne sp./spp.)	130 juveniles per 100 cc of soil	--
N2300264	Spiral nematodes (Helicotylenchus sp./spp.)	70 individuals per 100 cc of soil	--
N2300264	Stubby-root nematodes (Family Trichodoridae)	20 individuals per 100 cc of soil	--
N2300265	Root knot nematodes (Meloidogyne sp./spp.)	10 juveniles per 100 cc of soil	--
N2300265	Spiral nematodes (Helicotylenchus sp./spp.)	10 individuals per 100 cc of soil	--

Nematode Assay Lab 511 Westinghouse Rd Pendleton SC 29670 Telephone 864-646-2133 Fax 864-646-2178	Diagnosed By Charanam Khanal (ckhanal@clemson.edu) Completed Date 4/27/2023

Sample# N2300261 - N2300264

At Topping

Sample #	Field ID	Host/Habitat
N2300472	NFWV	Tobacco (general)
N2300473	FWV	Tobacco (general)
N2300474	NF	Tobacco (general)
N2300475	F	Tobacco (general)

Above sample(s) have been diagnosed/identified with the following diagnosis/ID(s)

Sample #	*List of Nematode/ID(s)*	*Count*	*Risk*
N2300472	Root-knot nematodes (Meloidogyne sp./spp.)	120 juveniles per 100 cc of soil	--
N2300472	Stunt nematodes (Tylenchorhynchus sp./spp.)	20 individuals per 100 cc of soil	--
N2300473	No nematode found (No Nematode Found)	0 -- per 100 cc of soil	--
N2300474	Root knot nematodes (Meloidogyne sp./spp.)	320 juveniles per 100 cc of soil	--
N2300474	Spiral nematodes (Helicotylenchus sp./spp.)	20 individuals per 100 cc of soil	--
N2300474	Ring nematode (Mesocriconema sp./spp.)	10 individuals per 100 cc of soil	--
N2300474	Stunt nematodes (Tylenchorhynchus sp./spp.)	20 individuals per 100 cc of soil	--
N2300475	No nematode found (No Nematode Found)	0 -- per 100 cc of soil	--

Sample# N2300472 - N2300475

Nematode Assay Lab 511 Westinghouse Rd Pendleton SC 29670 Telephone 864-646-2133 Fax 864-646-2178	Diagnosed By Charanam Khanal (ckhanal@clemson.edu) Completed Date 7/3/2023

Research Paper | DOI: 10.2478/jofnem-2022-0045

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Non-fumigant Nematicides are Promising Alternatives to Fumigants for the Management of *Meloidogyne enterolobii* in Tobacco

M. S. Alam[1], C. Khanal[1,*], W. Rutter[2] and J. Roberts[1]

[1]Department of Plant and Environmental Sciences, Clemson University, Clemson, SC 29643

[2]USDA-ARS, U.S. Vegetable Laboratory, Charleston, SC 29643

*E-mail: ckhanal@clemson.edu

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Abstract

Experiments were conducted to evaluate the efficacy of three currently available non-fumigant chemical nematicides (oxamyl, fluopyram, and fluensulfone) and a biological nematicide derived from *Burkholderia* against *Meloidogyne enterolobii* on tobacco in a growth room environment. The non-fumigant chemical nematicides greatly suppressed nematode egg production compared to the untreated control, the suppression being 99.9% for fluensulfone and oxamyl, and 93% for fluopyram. Similarly, oxamyl-, fluensulfone-, and fluopyram-treated pots, respectively, had 99%, 98%, and 94% less J2/100 cm³ of soil than those in the control. The biological nematicide did not have a significant effect on nematode egg production and the soil abundance of J2. The root biomass of tobacco was significantly reduced by the application of fluensulfone, while the effects of oxamyl, fluopyram, and *Burkholderia* metabolites were not significant compared to the untreated control. Results from this study suggest that non-fumigant nematicides have a potential to serve as an alternative to fumigant nematicides.

Keywords

biological, *Burkholderia*, fluensulfone, fluopyram, management, *Meloidogyne enterolobii*, nematicide, non-fumigant, oxamyl, tobacco

The guava root-knot nematode (*Meloidogyne enterolobii* Yang and Eisenback, 1983) is a cosmopolitan, polyphagous, and highly damaging species of root-knot nematode. Tobacco (*Nicotiana tabacum* L.) is a known host of *M. enterolobii*, although the extent of damage (qualitative and quantitative) the nematode can cause to this crop has not been studied well. Being a specialty crop with field production in restricted geography and limited funding opportunities for research could be the reasons behind the scarcity of tobacco-nematode interaction studies. Nevertheless, reports of *M. enterolobii* infestations in tobacco fields in North Carolina (Ye, 2018) and Brazil (Filho et al., 2016) suggest the need for studies on the reproduction, pathogenicity, and management of the nematode in order to save the 15-billion-dollar tobacco industry (FAO, 2019).

As seen with many other agricultural crops, *M. enterolobii* management in tobacco is challenging. A very wide host range and ability to overcome resistance effective for other common species of root-knot nematodes make *M. enterolobii* unmanageable with currently available nematode management practices (Brito et al., 2007; Kiewnick et al., 2009; Rutter et al., 2019; Ye et al., 2021; Khanal and Harshman, 2022). The use of fumigant nematicides is the most common method of nematode management

in commercial agricultural production systems; however, none of the currently available fumigants are able to provide satisfactory management of *M. enterolobii*. Additionally, with the increasing cost of fumigants, their inability to protect crops from nematodes throughout the crop growing season, increased legal restrictions, and adverse effects on human health and the environment render their use less preferred, cumbersome, and unsustainable (Khanal et al., 2018, 2021; Khanal and Dessager, 2020). The undesirable consequences of fumigant nematicides have led to the development of safer non-fumigant nematicides by chemical industries over the past couple of decades. Additionally, some biological nematicides have also been released. While the use of non-fumigant nematicides can be an alternative to fumigants, published studies on their efficacy against *M. enterolobii* in tobacco are not available. Additionally, the efficacy of non-fumigant nematicides can greatly vary depending on the nematode species, host crop, and season (Oka and Saroya, 2019; Khanal and Dessager, 2020; Watson, 2022). The objective of the current study was to evaluate the efficacy of three non-fumigant chemical nematicides (oxamyl, Vydate® L, Corteva Agriscience, Indianapolis, IN; fluopyram, Velum® Prime, Bayer CropScience, Research Triangle Park, NC; and fluensulfone, Nimitz®, ADAMA Agricultural Solutions Ltd., Raleigh, NC) and one biological nematicide derived from *Burkholderia* metabolites (Majestene®, Marrone Bio Innovations, Davis, CA) on reproduction and pathogenicity of *M. enterolobii* in tobacco.

Materials and Methods

Preparation of nematode inoculum

Pure cultures of *M. enterolobii* were maintained in a growth room environment on tomato (*Solanum lycopersicum* L., cv. Rutgers, Seedway, Hall, NY). Nematode eggs were extracted by agitating tomato roots in 0.6% NaOCl for 4 min, as described by Hussey and Barker (1973). The extracted eggs were transferred to a modified Baermann pan in an incubator (VWR, Cornelius, OR) at 25°C. Second-stage juveniles (J2) collected 2 d after incubation served as inoculum for this study.

Establishment of experiments

Experiments were conducted in a growth room because of the quarantine nature of the pathogen that requires a Biosafety Level-2 facility. Experiments were established in 15-cm-top diameter plastic pots containing 1.5 kg sandy loam soil steam sterilized for 5 hr at 135°C prior to use. The experiment was established as a randomized block design with five replications. Treatments included a single application of the currently recommended rate of three non-fumigant chemical nematicides (oxamyl, fluopyram, and fluensulfone) and a biological nematicide (*Burkholderia* metabolites) plus an untreated control (Table 1). Each pot received an 8-wk-old tobacco seedling (cultivar K 346, Gold Leaf Seed Company, Hartsville, SC) with four to six true leaves. Each plant was inoculated with an aqueous suspension of 1,000 freshly hatched J2 of *M. enterolobii* on the day of transplanting. The inoculum was pipetted into three 0.5-cm-diam. × 5-cm deep depressions arranged into a triangular pattern and 2-cm away from the crown region. Nematicides were drench applied 2 d after inoculation, except for the pots receiving fluensulfone, which were planted a week after nematicide application because of possible phytotoxicity. Standard fertilization and insect management practices were conducted. The average daily room temperature during the study period was 30 ± 6°C. The relative humidity of the growth room was 44 ± 4% during the study period. Four metal halide bulbs (1,000 W) hanging approximately 3 m above the table provided a 12-hr photoperiod.

The experiments were terminated 60 d after inoculation. Eggs were extracted from whole root systems in each pot on the day of termination by agitating roots in 0.6% NaOCl for 4 min to dislodge eggs from egg masses (Hussey and Barker, 1973). The eggs were enumerated within 24 hr of extraction using a compound microscope (Martin Microscope Company, Easley, SC) at 40× magnification. The soil

Table 1. Non-fumigant chemical and biological nematicide treatments and their recommended application rates used in the current study.

Treatment	Application rate (L/ha)
Oxamyl	4.68
Fluopyram	0.50
Fluensulfone	4.09
Burkholderia[a]	18.71
Untreated control	–

[a]*Burkholderia rinojensis* strain A396 secondary metabolites.

samples were placed in a walk-in cooler at 4°C until nematode extraction. Nematode J2 were extracted from 100 cm³ subsample of soil from each pot using the centrifugal flotation technique (Jenkins, 1964). Extraction and enumeration of J2 were conducted within 2 wk of termination of the experiments. The J2 and eggs were enumerated using a compound microscope (Martin Microscope Company) at 40x magnification. The aboveground parts (shoot) and belowground parts (root) were dried at 45°C for 2 wk, and dry biomass was recorded for the determination of pathogenicity of the nematode on tobacco. The entire experiment was repeated once.

Data analysis

Data were subject to one-way analysis of variance using the mixed model in JMP PRO 16.0 (SAS Institute, Cary, NC). Nematode reproduction data were subjected to log transformation (log x + 1) before analysis. Nematicide treatment was used as a fixed effect, and replication was used as a random effect. Tukey's HSD or Student's *t*-test ($P \leq 0.05$) was used as *post-hoc* mean comparisons.

Results

Data from two experiments were combined for analysis because of the absence of significant treatment by experiment interactions. The nematicides had a significant effect on nematode reproduction (J2 and eggs) and plant root weight (Figs. 1–3), but not on plant shoot weight ($P = 0.5006$).

The effect of nematicides on nematode reproduction expressed as number of eggs per root system is presented in Figure 1. The nematode reproduction ranged from 6 to 14,576 eggs per root system. All non-fumigant chemical nematicides (oxamyl, fluopyram, and fluensulfone) significantly suppressed the egg production compared to the control, with fluensulfone having the greatest suppression (99.96%), followed by oxamyl (99.91%) and fluopyram (93%). The number of nematode eggs in pots treated with the *Burkholderia* metabolites was statistically similar to that in the control.

The effect of nematicides on nematode reproduction expressed as number of J2 per 100 cm³ soil was similar to the effect on the number of eggs, as presented in Figure 2. The nematode reproduction ranged from 1 to 116 J2/100 cm³ of soil. Nematode reproduction was significantly suppressed by oxamyl, fluopyram, and fluensulfone compared to that in control, the suppression being 99% for oxamyl, 98% for fluensulfone, and 94% for fluopyram. *Burkholderia* metabolites did not have a significant effect on the nematode reproduction compared to the control.

Tobacco root biomass was significantly affected by the application of nematicides, as presented in

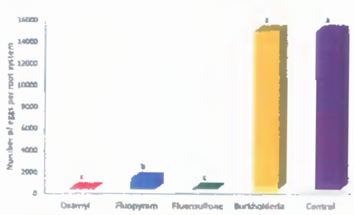

Figure 1: Reproduction of *Meloidogyne enterolobii* expressed as number of eggs per root system of tobacco inoculated with 1,000 freshly hatched second-stage juveniles, treated with non-fumigant nematicides, and harvested at 60 d after inoculation. Data were combined over two experiments and are means of 10 replications. Within columns, means followed by a common letter are not significantly different according to Tukey's HSD test ($P \leq 0.05$). Burkholderia refers to *Burkholderia rinojensis* strain A396 secondary metabolites.

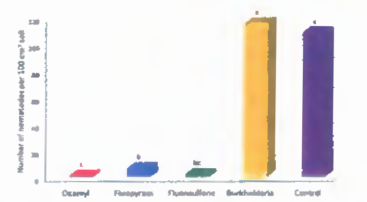

Figure 2: Reproduction of *Meloidogyne enterolobii* expressed as number of second-stage juveniles per 100 cm³ of soil containing tobacco inoculated with 1,000 freshly hatched second-stage juveniles, treated with non-fumigant nematicides, and harvested at 60 d after inoculation. Data were combined over two experiments and are means of 10 replications. Within columns, means followed by a common letter are not significantly different according to Student's *t*-test ($P \leq 0.05$). Burkholderia refers to *Burkholderia rinojensis* strain A396 secondary metabolites.

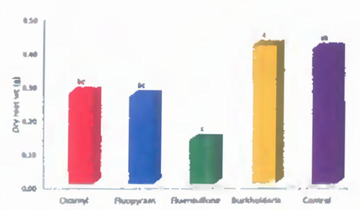

Figure 3. Dry weights of tobacco roots 60 d after inoculation with 1,000 freshly hatched second-stage juveniles of *Meloidogyne enterolobii* and application of non-fumigant nematicides. Data are means of 10 replications. The plant material was dried at 45°C for 2 wk. Bars with common letters are not significantly different according to Tukey's HSD test ($P \leq 0.05$).

Figure 3. Fluensulfone significantly reduced the root dry weight compared to the control, the reduction being 68%. Although not significantly different from the control, tobacco treated with oxamyl and fluopyram had 33% and 35% lower root dry weight, respectively. The root dry weight of tobacco treated with *Burkholderia* metabolites did not differ significantly from that of control.

Discussion

Meloidogyne enterolobii has drawn great attention from nematologists in recent years due to its large host range, aggressiveness, and management challenge. Until recently, 95% of crops lost to root-knot nematodes would be attributed to four species of root-knot nematodes, namely, *M. incognita*, RSR 2347 145 1920 368 4E

On-Farm Bacterial Wilt Variety Resistance Demonstration
Baxley Farms- Lloyd, Connie, Josh and Jesse Baxley
1000 Whiteville Drive, Georgetown, SC 29440

Trt. No	Variety or Line	Generation or year of release	Pedigree	BS	GW	FW	RKN	Sponsor
1	NC 986	2017	N19-502 x N19-503	H	M		R	NC
2	CC 145	2015	CERT	H	H		S	Cross Creek
3	GL 26H	2015	Hybrid	M	M		R	GoldLeaf
4	PVH 1920 (PXH16)	2014	Hybrid	H	M		M. incog/R	Foley
5	GL 386	2020		R	R		R	GoldLeaf
6	NC 196	2002	Hybrid	H	L		R	GoldLeaf
7	K 326	1981	McNair 225 (McNair 30 x NC 95)	L	L		R	GoldLeaf
8	GL 395	2010	Hybrid	H	M		R	GoldLeaf
9	NC 606	1998	NC 729 x NC 82	H	H		R	GoldLeaf
10	GL 365	2017	Hybrid	H	H		R	GoldLeaf
11	CC 143	2012	CERT	H	M		R	Cross Creek
12	CC 1063	2011	CERT	H	M		R	Cross Creek
13	K 346	1988	McNair 926 x 80241	H	M		R	GoldLeaf
14	NC 987	2017	N19-504 x N19-505					NC
15	PVH 1940	2022	Hybrid	0/R; 1/M	H		M. incog/R	Profigen
16	CC 607	2022	Foundation	R	R		R	Cross Creek

Resistance level designated as L= Low, M = Moderate, and H = High, R = Resistance, T = Tolerant, S = Susceptible

Varieties with resistance to root knot nematode = R, susceptible varieties = S.

BS- Black Shank
GW- Granville Wilt (bacterial wilt)
FW- Fusarium Wilt
RKN- Root knot nematode

Seeded 2/09/23; Transplanted 4/07/23.

305	316	307	314	308	310	313	306	315	302	304	311	312	309	301	303
212	208	215	210	207	211	216	201	204	214	213	203	206	205	202	209
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116

Thanks to Altria Client Services LLC and the SC Tobacco Board for their support of this extension project!

M. arenaria, *M. javanica*, and *M. hapla*. However, crop lost to *M. enterolobii* will likely share the greatest portion of total crop losses attributed to root-knot nematodes because of its rapid geographic expansion and the lack of effective management methods (Khanal and Harshman, 2022). Additionally, a high reproduction rate and pathogenicity of *M. enterolobii* may outcompete other root-knot nematode species present in the field, making its management a further challenge.

Most studies on the management of *M. enterolobii* are focused on row and vegetable crops. Being a minor crop, tobacco has received little to no attention for management against *M. enterolobii*; however, due to its economic importance, the effect of this nematode on tobacco should be further studied. It is a common understanding of the growers that application of fumigants helps manage soil-borne pathogens including nematodes; however, none of the currently available fumigant nematicides are effective in managing *M. enterolobii*. Additionally, adverse effects of fumigant nematicides on human health and the environment, increasing cost due to the legal requirement of the fumigant management plan render fumigant nematicides less desirable (Khanal and Dessaeger, 2020). Of the four non-fumigant nematicides evaluated in the present study, three chemical nematicides significantly suppressed *M. enterolobii*, suggesting these nematicides can be a potential alternative to fumigant nematicides. Oxamyl and fluensulfone were the most effective nematicides in suppressing nematode eggs, followed by fluopyram. Similarly, the three chemical non-fumigants greatly suppressed the soil abundance of nematode relative to the control. A similar effect of non-fumigant nematicides was observed in a growth cabinet experiment conducted by Watson (2022) who reported that fluopyram, fluensulfone, and oxamyl significantly suppressed *M. enterolobii* egg production. While the chemical non-fumigants were very effective in suppressing nematode reproduction, the current study did not find any effects of the *Burkholderia* metabolites on nematode reproduction. Although 93% to 99.9% nematode reproduction was suppressed by the non-fumigant chemical nematicides compared to the control, this study suggests that the currently recommended rate of these nematicides is not enough to eradicate *M. enterolobii*. More studies are needed to determine higher efficacy rates.

Reproduction of a nematode in a host crop is an indicator of host susceptibility to the nematode. The reproduction of *M. enterolobii* on the untreated control was 14,576 eggs per root system, which is approximately 13 times lower than that reported by Khanal and Harshman (2022) on tomato, suggesting the possibility of presence of some *M. enterolobii*-suppressive mechanisms in tobacco. A lower reproduction rate of the nematode on tobacco was also reported by Adamo *et al.* (2021) who found the highest amount of 11,612 eggs per fresh gram of tobacco root, although that study employed a different nematode species (*M. arenaria*) and different tobacco cultivars. The tobacco cultivar K 346 is resistant to *M. incognita* races 1 and 3 and many other diseases; however, any resistance to *M. enterolobii* is not known. Studies are needed to determine the nematode suppression mechanism in tobacco.

An idea nematicide, although not available, should keep the nematode population below the damage threshold while exhibiting no adverse effects on the host plant. The current study showed that the non-fumigant chemical nematicides not only greatly suppressed *M. enterolobii* reproduction but also reduced the tobacco root biomass numerically or significantly, suggesting a trade-off between nematode suppression and host plant biomass likely exists. However, the shoot weight of tobacco was not significantly reduced by the application of the chemical nematicides, implying these nematicides can be a good choice for the growers as tobacco is grown for the shoots. Although oxamyl, fluopyram, and fluensulfone have been reported to have low to high systemic activity in plants (Alphey *et al.*, 1975; Oka *et al.*, 2012; Jeschke, 2017), results from the current study suggest they are likely concentrated more in the root system. However, studies are needed to confirm the translocation and variable concentrations of nematicides in different plant parts. Furthermore, while the current study measured quantitative losses, further studies are needed to determine if any qualitative losses are possible from the application of the non-fumigant nematicides on tobacco.

Acknowledgments

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Disclaimer

Mention of trade name is for reporting purpose only, and we do not endorse any nematicides or the companies.

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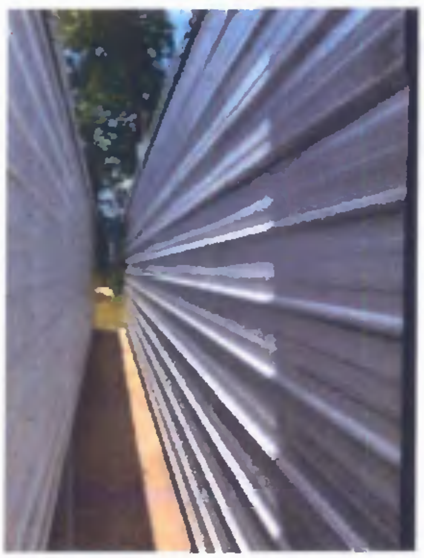
Bathroom Break, Barn Modifications, Nozzle Configuration, Weather Station Project
Baxley Farm Headquarters/Black Mingo Produce
4490 County Rd S-22-6, Georgetown, SC 29440

Barn Modifications



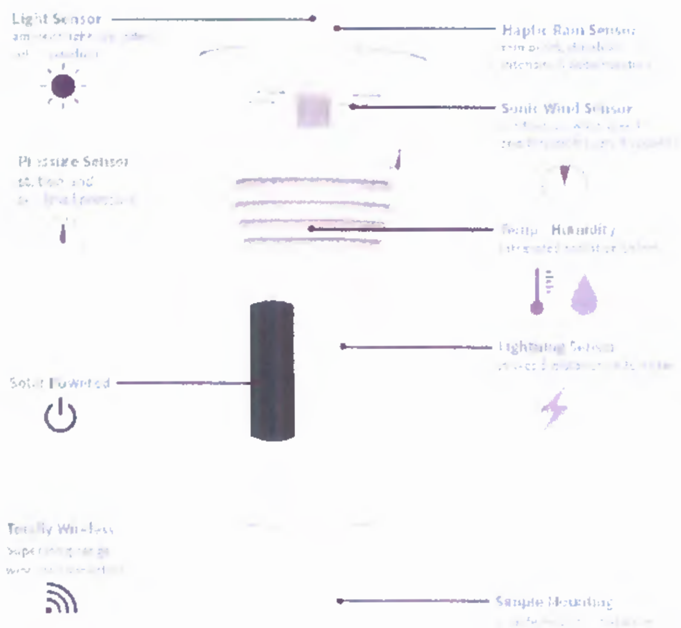




Grant Ellington, NCSU

Homemade Nozzle: Applies 50 – 55 GPA at 4.8 – 5 MPH

Weather Station Project

https://clemson-weather.app.clemson.edu/index.php



Bacterial Wilt OVT
Pee Dee Research and Education Center
2200 Pocket Road, Darlington, SC 29532
Transplants from Baxley Farms, Georgetown County

Trt.	Variety or Line	Gen. or year of release	Pedigree	BS	GW	FW	RKN	Sponsor
1	NC 989	2017	N19-506 x N19-507					NC
2	RJREX 608	2023		M; 0/R	H		R	RJR
3	GL 386	2020		R	R			GoldLeaf
4	PVH 2310	2013	Hybrid	0/R	M	L	R	RJR
5	RJREX 609	2023		M; 0/R	M		R	RJR
6	NC 987	2017	N19-504 x N19-505					NC
7	NC 993 (NCEX 103)	2021	N19-488 x N19-489					NC
8	NC 196	2002	Hybrid	H	M		R	GoldLeaf
9	PVH 1920 (PXH 16)	2014	Hybrid	R	R		M.incog/R	Foley
10	CC 145	2015	CERT	R	R			Cross Creek
11	NC 299	2001	CERT	R	R		R	Cross Creek
12	GF 318	2012	Hybrid	R	R		R	GoldLeaf
13	NC 996	2020	N19-492 x N19-493					NC
14	CC 700	2005	CERT	R	R		R	Cross Creek
15	NC 1226	2016	Hybrid	0/R; 1/H	M		R	Foley
16	NC 606	1998	NC 729 x NC 82	R	R		R	GoldLeaf
17	CC 1063	2011	CERT	R	R		R	Cross Creek
18	NC 960 (NC 1960)	2019	N19-627 x N19-628	H	M		R	Foley
19	NC 994 (NCEX 104)	2022	N19-508 x N19-509	H	M		M. incog/R; M. arenar/R	NC
20	NC 1007 (NCEX 107)	2023	N19-583 x N19-584					NC
21	GL 26H	2015	Hybrid	M	M		R	GoldLeaf
22	NC 991 (NCEX 101)	2021	N19-484 x N19-485	H	M		R	NC
23	PVH 1980 (PXH 94)	2022	Hybrid	0/R; 1/L	L		M. incog/R; M. arenar/R	Profigen
24	GL 395	2010	Hybrid	M	M		R	GoldLeaf
25	K 326	1981	McNair 225 (McNair 30 x NC 95)	L	L		R	GoldLeaf
26	NC 1006 (NCEX 106)	2023	N19-579 x N19-580					NC
27	K 346	1988	McNair 926 x 80241	H	M		R	GoldLeaf
28	CC 143	2012	CERT	R	R			Cross Creek
29	CC 607 (RJREX 607)	2022	Foundation	R	R		R	Cross Creek
30	GL 365	2017	Hybrid	R	R			GoldLeaf
31	PVH 1600 (PXH 13)	2013	Hybrid	0/R; 1/M	H		M. incog/R	Foley
32	CC 603 (RJREX 603)	2021	Foundation	R			R	Cross Creek
33	PVH 2254 (XP254)	2011	Hybrid	0/R; 1/M	H		M. incog/R	Foley
34	PVH 2243 (PXH 23)	2017	Hybrid		M		M. incog/R	Foley
35	NC 986	2017	N19-502 x N19-503					NC
36	PVH 1940 (PXH 54)	2022	Hybrid	0/R; 1/M	H		M. incog/R	Profigen
37	PVH 2233 (PXH 10)	2023	Hybrid	0/R		M	M. incog/R; M. aren/M	Profigen
38	PXH 53	2023	Hybrid	0/R; 1/M	H		M. incog/R	Profigen

Resistance level designated as L= Low, M = Moderate, and H = High, R = Resistance, T = Tolerant, S = Susceptible
Varieties with resistance to root knot nematode = R, susceptible varieties = S.
M. aren. - Meloidgoyne arenaria; M. incog. - Meloidogyne incognita
BS- Black Shank (0 = Race 0, 1 = Race 1)
GW- Granville Wilt (bacterial wilt)
FW- Fusarium Wilt
RKN- Root knot nematode

Field Layout

Rep 1

101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138

Rep 2

225	207	209	228	235	237	203	232	211	221	226	236	223	210	204	213	229	231	206	218	222	220	208	234	217	215	212	205	233	214	219	201	202	224	216	238	230	227

Rep 3

326	316	307	312	331	313	333	321	306	330	310	322	311	338	318	323	327	304	332	301	314	317	305	319	336	328	329	308	303	325	315	334	324	337	302	335	320	309

Rep 4

434	419	416	425	426	402	418	420	430	417	436	403	438	401	435	412	414	410	432	423	405	408	422	413	429	415	424	411	409	431	406	421	437	428	407	427	404	433

Seeded 2/09/23; Transplanted 4/18/23.

Thanks to Altria Client Services LLC and the SC Tobacco Board for their support of this extension project!

Black Shank Resistant Variety Demonstration
Newman Farms (Lee Newman), Sumter
Transplants from Ben Teal, Chesterfield County
2575 US-521, Sumter, SC 29153

Trt.	Variety or Line	Gen. or year of release	Pedigree	BS	GW	FW	RKN	Sponsor
1	NC 986	2017	N19-502 x N19-503	H	M		R	NC
2	CC 145	2015	CERT	H	H		S	Cross Creek
3	GL 26H	2015	Hybrid	M	M		R	GoldLeaf
4	PVH 1920 (PXH16)	2014	Hybrid	H	M		M. incog/R	Foley
5	GL 386 (GF 315)	2020		R	R		R	GoldLeaf
6	NC 196	2002	Hybrid	H	L		R	GoldLeaf
7	K 326	1981	McNair 225 (McNair 30 x NC95)	L	L		R	GoldLeaf
8	GL 395	2010	Hybrid	H	M		R	GoldLeaf
9	NC 606	1998	NC 729 x NC 82	H	H		R	GoldLeaf
10	GL 365	2017	Hybrid	H	H		R	GoldLeaf
11	CC 143	2012	CERT	H	M		R	Cross Creek
12	CC 1063	2011	CERT	H	M		R	Cross Creek
13	NC 1226	2016	Hybrid	H	L		R	NC
14	PVH 2310 (PXH07)	2013	Hybrid	R	M	L	M. incog/R; M. arenar/R	Foley
15	NC 987	2017	N19-504 x N19-505					NC
16	K346	1988	McNair 926 x 80241	H	M	R		GoldLeaf
17	CC 607	2022	Hybrid	R	R		R	Cross Creek
18	NC 960	2019	N19-627 x N19-628					Foley
19	CC 603	2021	Foundation	R			R	Cross Creek
20	PVH 1940	2022	Hybrid	0/R; 1/M	H		M. incog/R	Profigen

Resistance level designated as L= Low, M = Moderate, and H = High, R = Resistance, T = Tolerant, S = Susceptible

Varieties with resistance to root knot nematode = R, susceptible varieties = S.

BS- Black Shank (0 = Race 0, 1 = Race 1)
GW- Granville Wilt (bacterial wilt)
FW- Fusarium Wilt
RKN- Root knot nematode

Seeded 2/20/23; Transplanted 5/8/23

3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
0	1	1	1	1	1	2	0	0	1	1	0	1	0	0	0	1	0	1	0
7	9	0	2	4	7	0	1	8	3	6	3	5	2	4	5	8	9	1	6

2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
0	1	1	2	1	1	1	0	1	1	1	0	1	0	0	0	1	0	0	0
9	8	4	0	2	9	7	4	6	5	0	1	1	6	2	3	3	7	8	5

1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2
1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0

Thanks to Altria Client Services LLC and the SC Tobacco Board for their support of this extension project!

Thanks For Attending the 2023 South Carolina Tobacco Tour!

COOPERATIVE EXTENSION

College of Agriculture, Forestry and Life Sciences

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