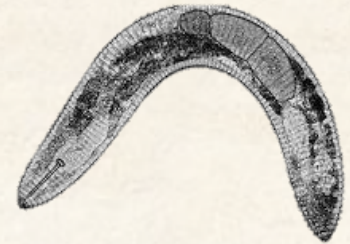


Nematode Management in Soybean, Corn, and Sweetpotato

**Louisiana Agricultural Technology &
Management Conference**

Marksville, LA

(February 10, 2022)



Dr. Tristan Watson

Assistant Professor of Nematology

Plant Pathology and Crop Physiology

LSU AgCenter

Presentation Outline

Topics:

- Nematodes of Concern in Louisiana
- Overview of Nematode Management
- Nematicide Field Trials on Sweetpotato 2021
- Variety Screening on Soybean 2021
- New Nematicide Evaluation on Corn 2021



Nematodes of Concern

Southern Root-Knot Nematode (*Meloidogyne incognita*)

- Wide host range
- Forms galls on roots
- Aboveground:
 - Yellowing
 - Stunted growth
- Reduces yield
- 'Hot spots' in a field

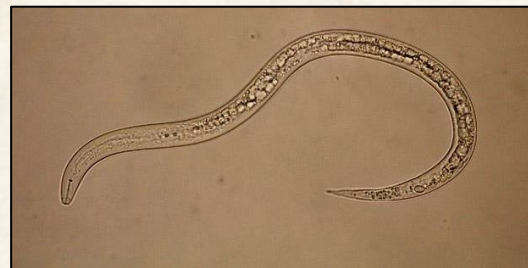


Nematodes of Concern

Guava Root-Knot Nematode

(*Meloidogyne enterolobii*)

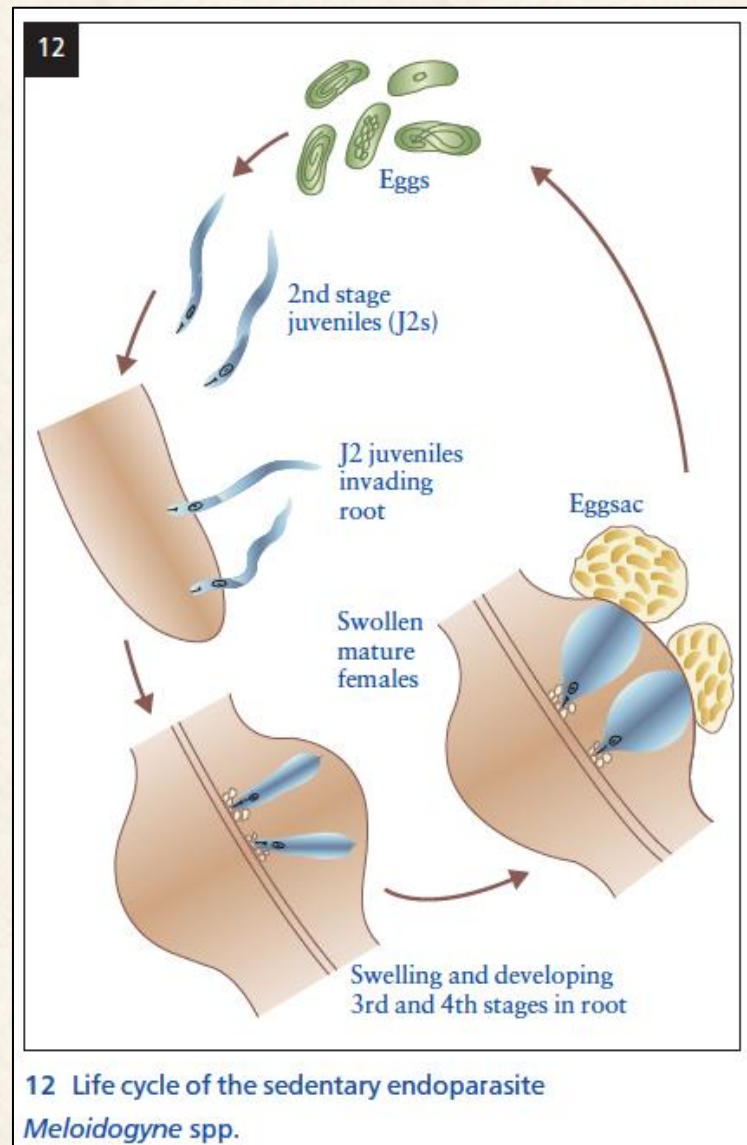
- Highly damaging
- Breaks available host resistance
- Introduced into Louisiana twice:
 - 2018 in Morehouse Parish
 - 2019 in Franklin Parish
- Not found in any LA production field during 2019 to 2021 surveys



Nematodes of Concern

Root-Knot Nematode Life Cycle

1. J2-stage nematode emerges from egg
2. J2 seeks out and penetrates root tip
3. J2 establishes feeding site (giant cell)
4. Nematode ingests cytoplasmic contents
5. J2 increases in width and molts
 - J3-stage, J4-stage, Adult
6. Eggs are deposited in egg mass on roots



Nematodes of Concern

Reniform Nematode

(Rotylenchulus reniformis)

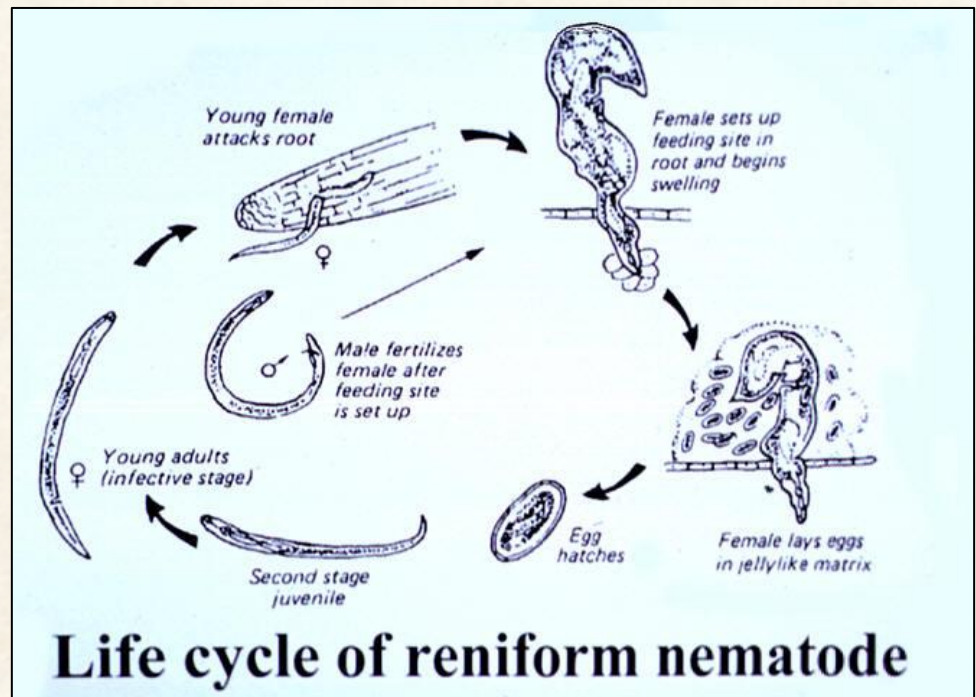
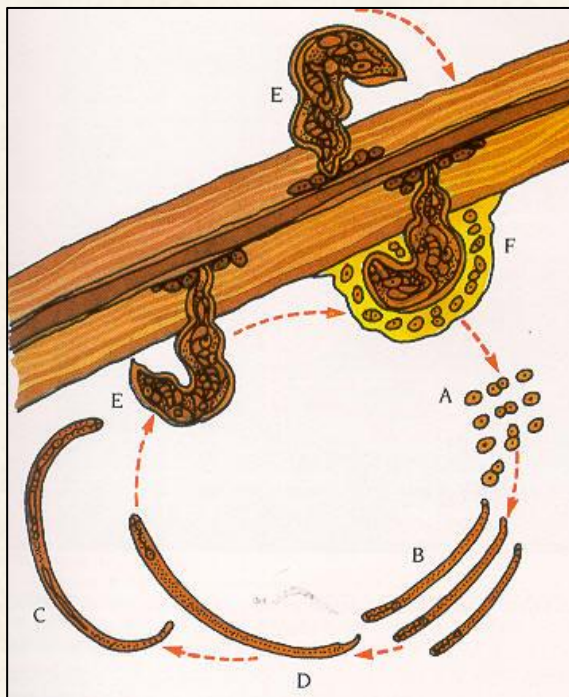
- Moderate host range
 - Corn and Grain Sorghum = non-host
- No obvious root symptoms
- Reduces yield
- Infested fields occasionally show no obvious signs of damage.



Nematodes of Concern

Reniform Nematode

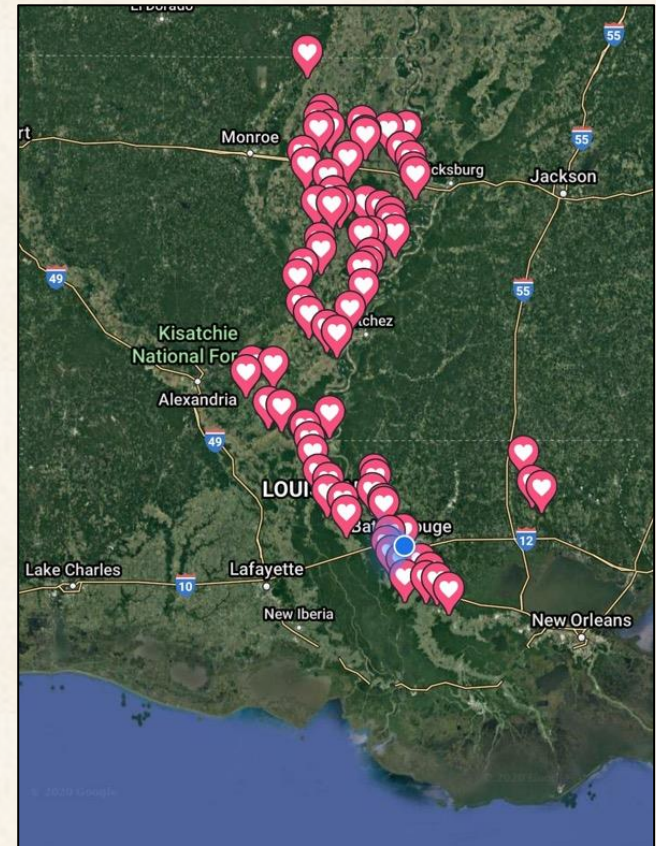
(*Rotylenchulus reniformis*)



Nematodes of Concern

Distribution in Louisiana

- 16 Major Crop Producing Parishes
- Reniform nematode is widespread
- All root-knot nematode species were identified as *M. incognita*
- *M. enterolobii* was not detected



Crop	Fields (n)	Occurrence (%)		
		<i>R. reniformis</i>	<i>M. incognita</i>	<i>M. enterolobii</i>
Sweetpotato	40	97.5	17.5	0
Soybean	118	61.9	19.5	0
Cotton	43	41.9	23.3	0

Nematode Diagnostics

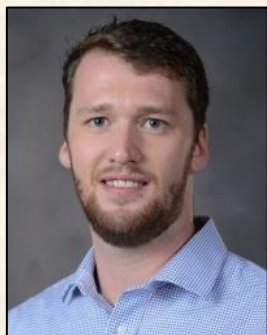
Nematode Advisory Service

Department of Plant Pathology and Crop Physiology
302 Life Science Building
Baton Rouge, LA 70803



Nematode Advisory Service
125 Life Science Annex
Louisiana State University

Provides nematode diagnostics, population monitoring,
and management recommendations to the state of
Louisiana



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Director
Nematode Advisory Service



Dr. Josie Rezende
Research Associate
Nematode Advisory Service



Nematode Advisory Service

Department of Plant Pathology & Crop Physiology
302 Life Sciences Building
110 LSU Union Square
Baton Rouge, LA 70803
Tel: (225) 578-2186



Nematode Assay Form

Grower's name and address:

Name _____

Address _____

City, State, Zip _____

Parish _____

Email _____

Date of sampling _____

Submitted by:

Name _____

Address _____

City, State, Zip _____

County Agent _____

Sample Information

Clinic number (leave blank)	Sample identification	Current crop or past crop	Next crop or alternatives

There is a charge of \$10 per sample. Checks should be made out to "LSU AgCenter NAS".

The LSU AgCenter is a statewide campus of the LSU System and provides equal opportunities in programs and employment.

Nematode Management



Clean Plant Material



Crop Rotation



Cover Crops



Host Resistance



Nematicides

Nematode Management

Clean Equipment

- Nematodes are transferred from field to field via soil on equipment.
- Clean equipment after entering a nematode infested field.



Clean Plant Material

- Nematodes are transferred from field to field via contaminated planting material
- Purchase certified pest-free plants
- Cut sweetpotato slips well above the soil level



Nematode Management

Crop Rotation

- Can rotate to a non-host to starve the nematode
- Difficult when a field has a multiple nematode species
- Common rotation crops in Louisiana:

Rotation Crop	Reniform Nematode	Southern Root-Knot Nematode	Guava Root-Knot Nematode
Soybean	Host	Host*	Host
Sweetpotato	Host	Host*	Host
Cotton	Host*	Host*	Host
Corn	Non-host	Host	Non-host
Grain Sorghum	Non-host	Host	Non-host
Peanut	Non-host	Non-host	?

* = resistant varieties available

Cotton = RKN + RN host



Corn = RKN host



Image

Nematode Management

Winter Cover Crops

- Can grow non-host winter cover crop between growing seasons
- Reduce weeds that may act as a '*green bridge*' between growing seasons
- Common winter cover crops in Louisiana:

Rotation Crop	Reniform Nematode	Southern Root-Knot Nematode	Guava Root-Knot Nematode
Winter Wheat	Poor Host	Moderate Host	Poor Host
Winter Rye	Poor Host	Poor Host	Poor Host
Hairy Vetch	Moderate Host	Host	Host
Austrian Winter Pea	Poor Host	Host	Host
Crimson Clover	Host	Host	Host



Nematode Management

Host Resistance

Sweetpotato:

- Numerous **root-knot nematode** resistant varieties available:
 - Covington
 - Jewel
 - Bellevue
 - Bonita
 - Burgundy
 - Evangeline
 - Murasaki-29
- No **reniform nematode** resistant varieties available.

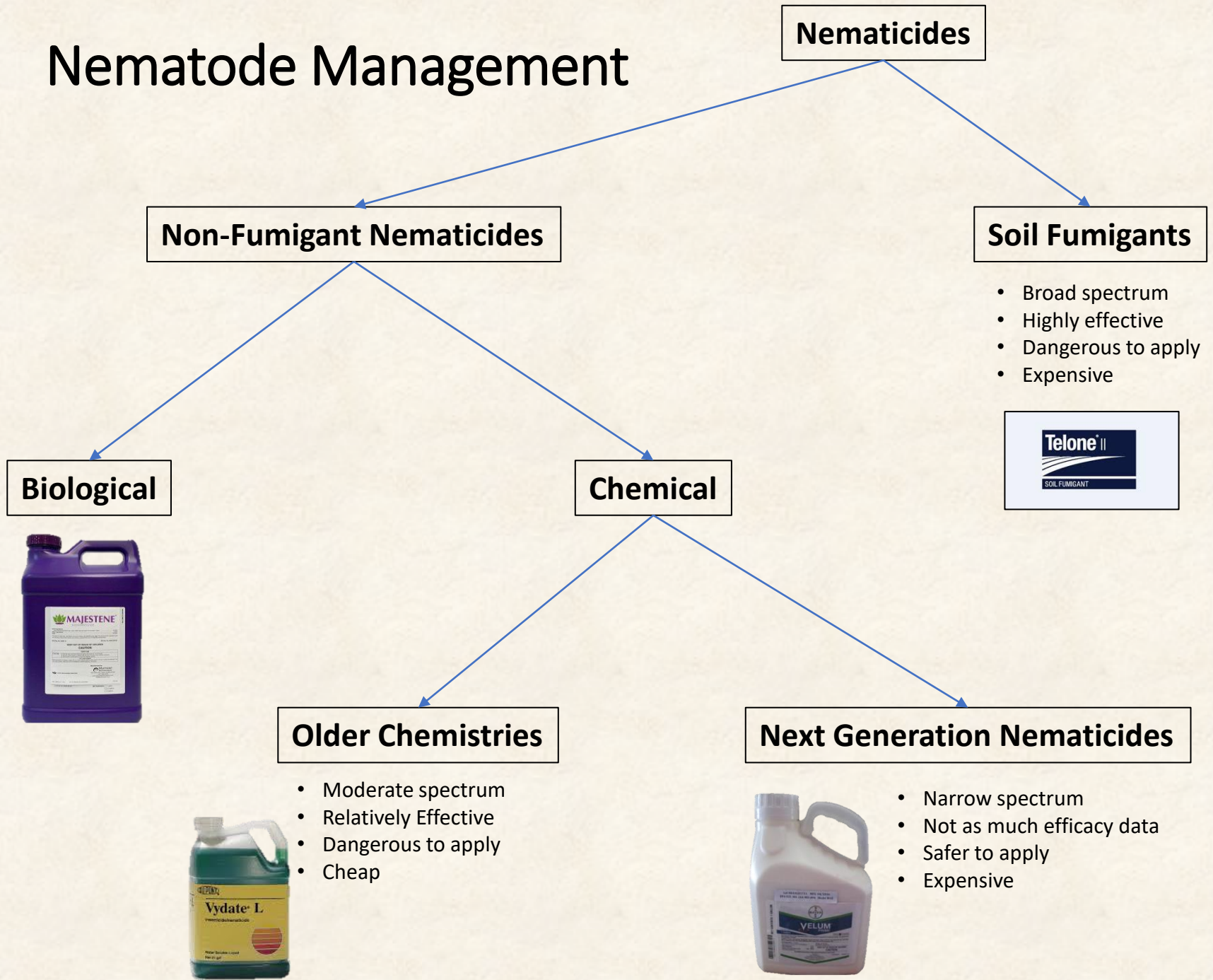
Corn:

- No **root-knot nematode** resistant varieties available.
- Non-host to **reniform nematode**

Soybean:

- Numerous **root-knot nematode** resistant varieties available:
 - Armor 48-D03
 - Armor 55-D33
 - Armor 55-D57
 - Dyna-Gro S48XT40
 - Local Seed Company LS5009XS
 - Progeny P4444RXS
 - Armor 46-D09
 - Armor 48-D05
- Reports of **reniform nematode** resistance.

Nematode Management





Nematicides Registered for Use on Corn

Crop	Product Choices	Rate	Comments	Nematicide Type	a.i.
Corn	Mocap 15G	10-13 lb (40-in rows)	Apply in a 12-15 inch band at planting. Incorporate into top 2-4 inches of soil.	Granular – Organophosphate	Ethoprop
	Counter 15G Lock ‘n Load Counter 20G Lock ‘n Load Counter 20G Smartbox	6-8 oz/1000 ft 4.5-6 oz/1,000 ft	Apply in a 7 inch band. Apply in a 4-5 inch band over open seed furrow in front of press wheel or apply in furrow.	Granular – Organophosphate	Terbufos
	Avicta Complete Corn 250 Avicta Complete Corn 500 Avicta Duo Corn Avicta Duo 250 Corn	Preordered seed treatment	Use in fields with low to moderate nematode levels only.	Seed Coat – Lactone	Abamectin
	Poncho Votivo	Seed application	Use in fields with low to moderate nematode levels only.	Seed Coat – Biological	Bacteria
	Telone II	3-6 gal	Apply fumigant 1 week before planting at a depth of 14 inches beneath the soil surface. Soil should not be excessively wet at the time of application.	Soil Fumigant	1,3-D
	Averland FC	4-6 fl oz	Apply in-furrow. Do not apply more than 6 fl oz per year.	Liquid – Lactone	Abamectin

From 2022 Louisiana Plant Disease Management Guide



Nematicides Registered for Use on Soybean

Crop	Product Choices	Rate	Comments	Nematicide Type	a.i.
Soybean	Poncho Votivo	Seed application	Use in fields with low to moderate nematode levels only.	Seed Coat – Biological	Bacteria
	ILeVO	Seed application	Use in fields with low to moderate nematode levels only.	Seed Coat-3F Nematicide	Fluopyram
	Avicta Complete Beans 500	Seed application	Use in fields with low to moderate nematode levels only.	Seed Coat – Lactone	Abamectin
	Majestene	7.3-19.6 fl oz/1000 row feet	Apply at planting in-furrow or in a T-band.	Liquid – Biological	Bacterial Metabolites
	Telone II	3-6 gal/a	Apply pre-plant under the row. Reserve for heavy nematode pressure.	Soil Fumigant	1,3-D

From 2022 Louisiana Plant Disease Management Guide



Nematicides Registered for Use on Sweetpotato

Crop	Product Choices	Rate	Comments	Nematicide Type	a.i.
Sweetpotato	Mocap 15G	1.6-2.1 lb/1,000	Apply in a 12-15-inch band.	Granular – Organophosphate	Ethoprop
	Mocap EC	5.1-6.9 oz/1,000 row ft			
	Nimitz	3.5-7 pt	Application can be made at planting or pre-plant. Apply in a moist, well-prepared seedbed.	Liquid – 3F Nematicide	Fluensulfone
	AgLogic 15G	10-20 lb	Apply in a 12 band over open furrow or soil surface and cover immediately during bed forming.	Granular – Carbamate	Aldicarb
	Vydate L	2 gal product per 20 gal of water (pre-plant) 1-2 gal (in-furrow)	Apply within a week of planting and incorporate 4-6 inches. Apply in at least 200 gal of transplant water during planting of slips (in-furrow).	Liquid – Carbamate	Oxamyl
	Velum	6.84 fl oz	Apply using overhead chemigation equipment. If high levels of root-knot nematode are present, use other suppressive measures as well.	Liquid – 3F Nematicide	Fluopyram
	Telone II	6-8 gal	Apply pre-plant beneath the row, 7-10 days prior to planting.	Soil Fumigant	1,3-D
	Vapam HL	See manufacturer's label for rates	Must be applied at least 3 weeks prior to planting.	MIT Generator (soil fumigant)	Metam Sodium
	K-Pam HL	See manufacturer's label for rates	Must be applied at least 3 weeks prior to planting.	MIT Generator (soil fumigant)	Metam Potassium

Sweetpotato 2021 On-Farm Nematicide Trial

Location: Evangeline Parish

Crop: Sweetpotato 'Bayou Belle' (RKN resistant)

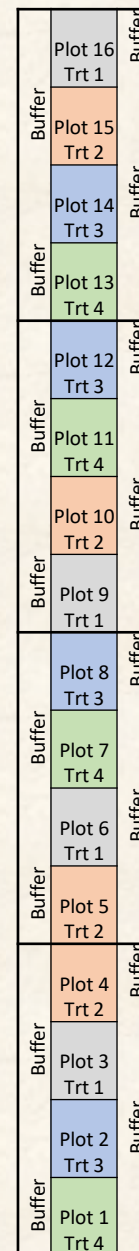
Nematode: Reniform Nematode (*Rotylenchulus reniformis*)

Plot Size: 2 rows wide by 50-ft long

Measurements:

- Nematode population dynamics (at plant, mid-season, at harvest)
- Yield (lb/A)

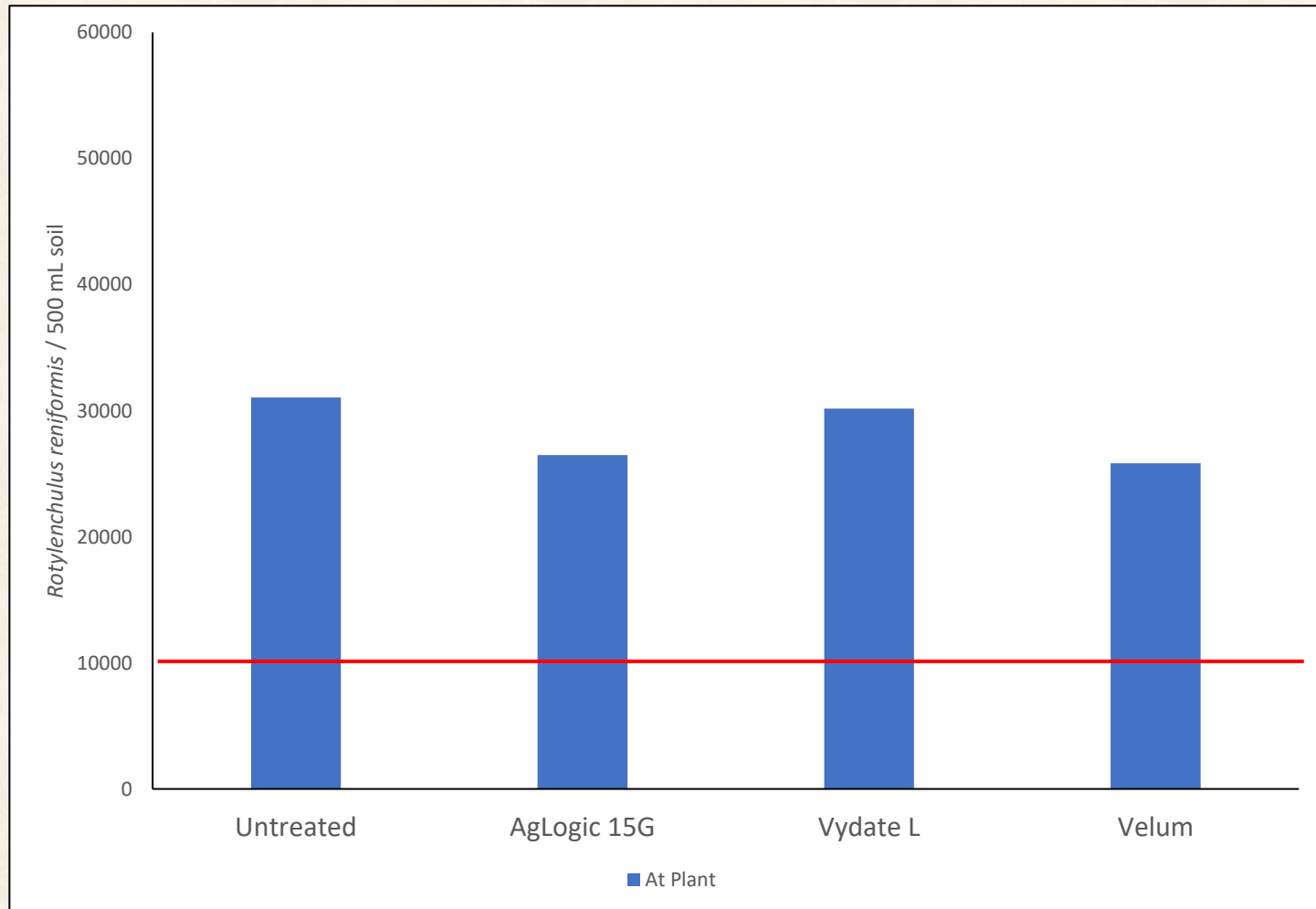
Treatment	Rate	Method	Timing
Control	-	-	-
AgLogic	15 lb/A	In-furrow	at plant
Vydate	2 gal/A	In-furrow	at plant
Velum	6.84 fl oz/A	In-furrow	at plant



Sweetpotato 2021 On-Farm Nematicide Trial



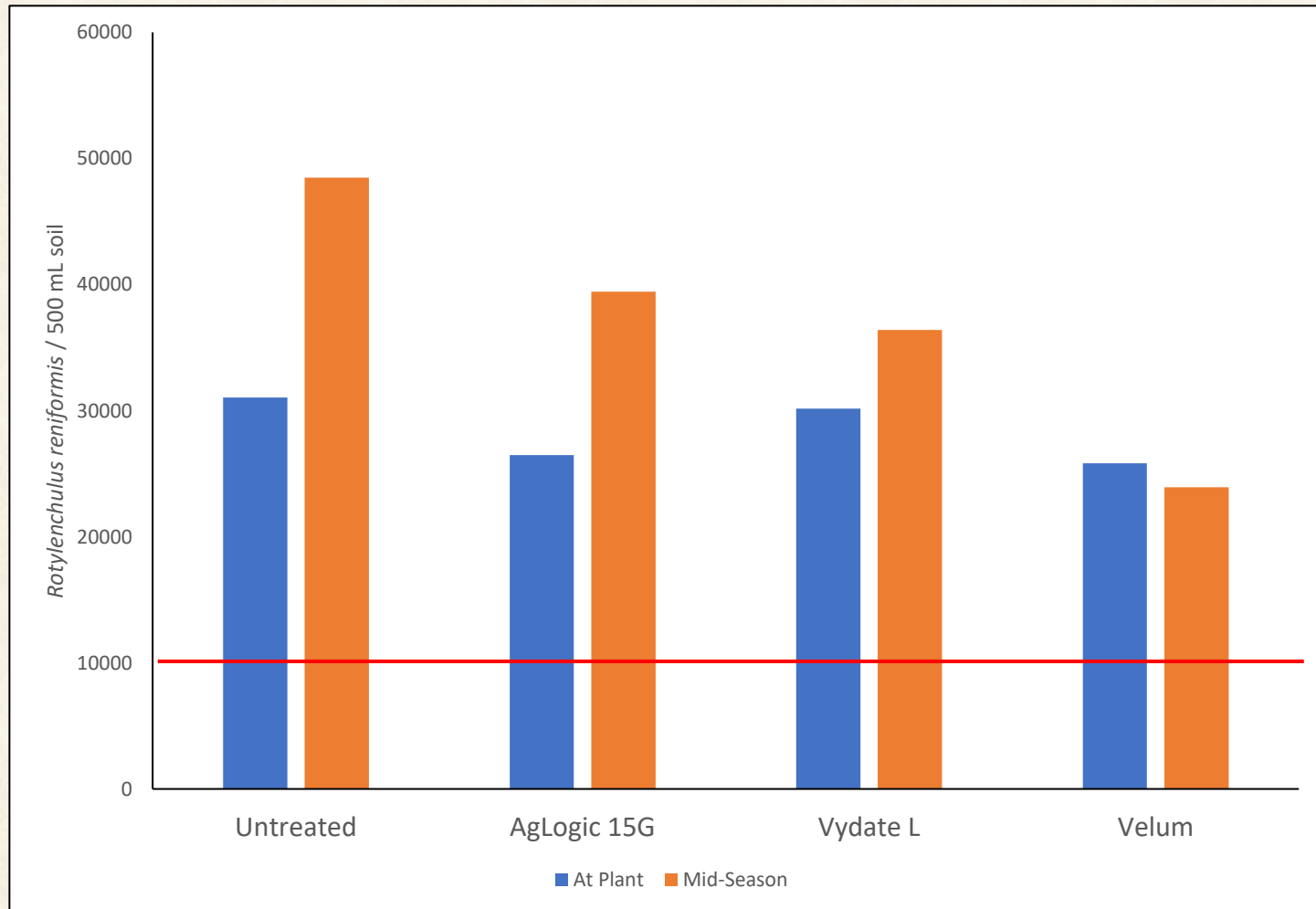
Nematode Population Dynamics



Sweetpotato 2021 On-Farm Nematicide Trial



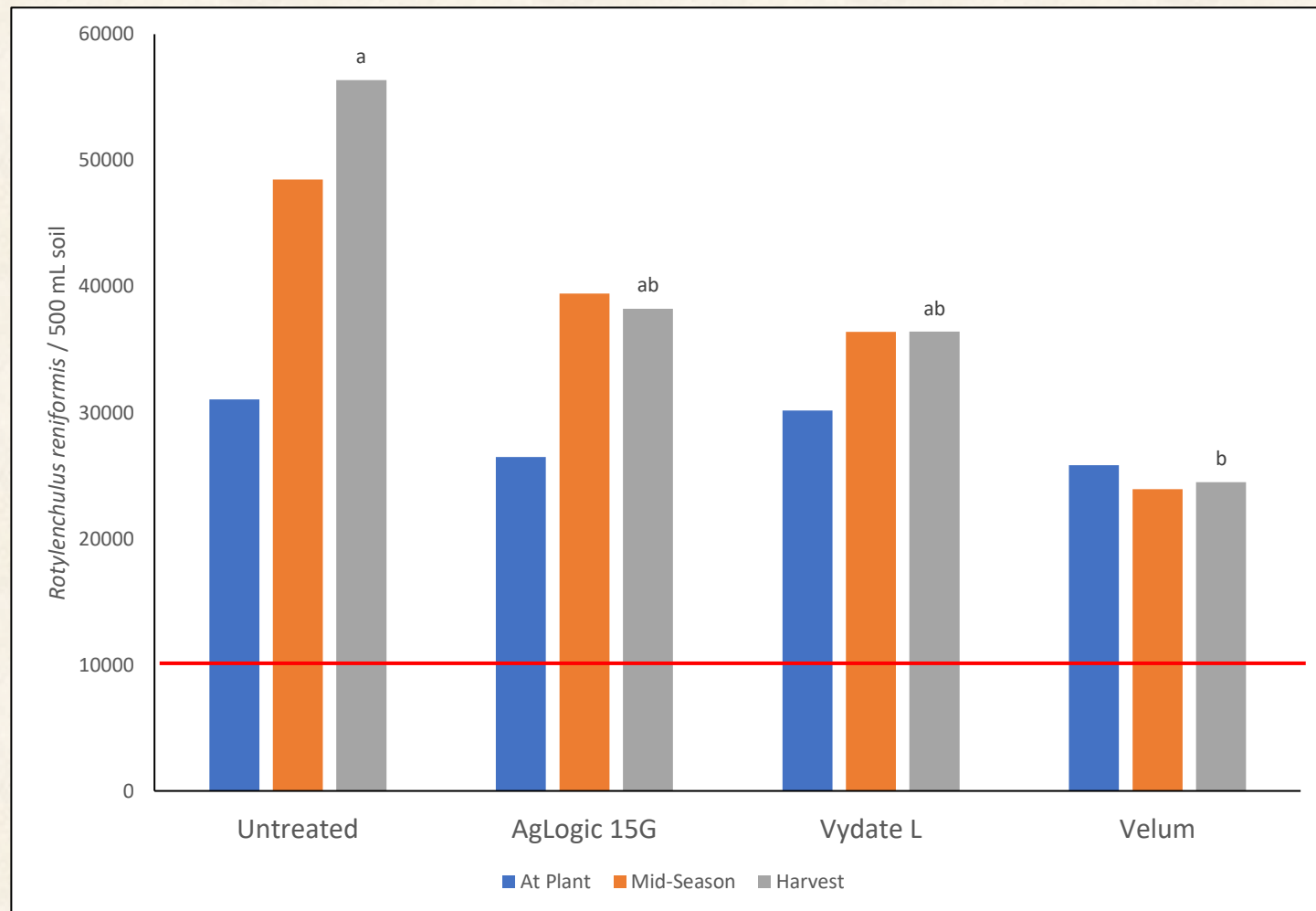
Nematode Population Dynamics



Sweetpotato 2021 On-Farm Nematicide Trial

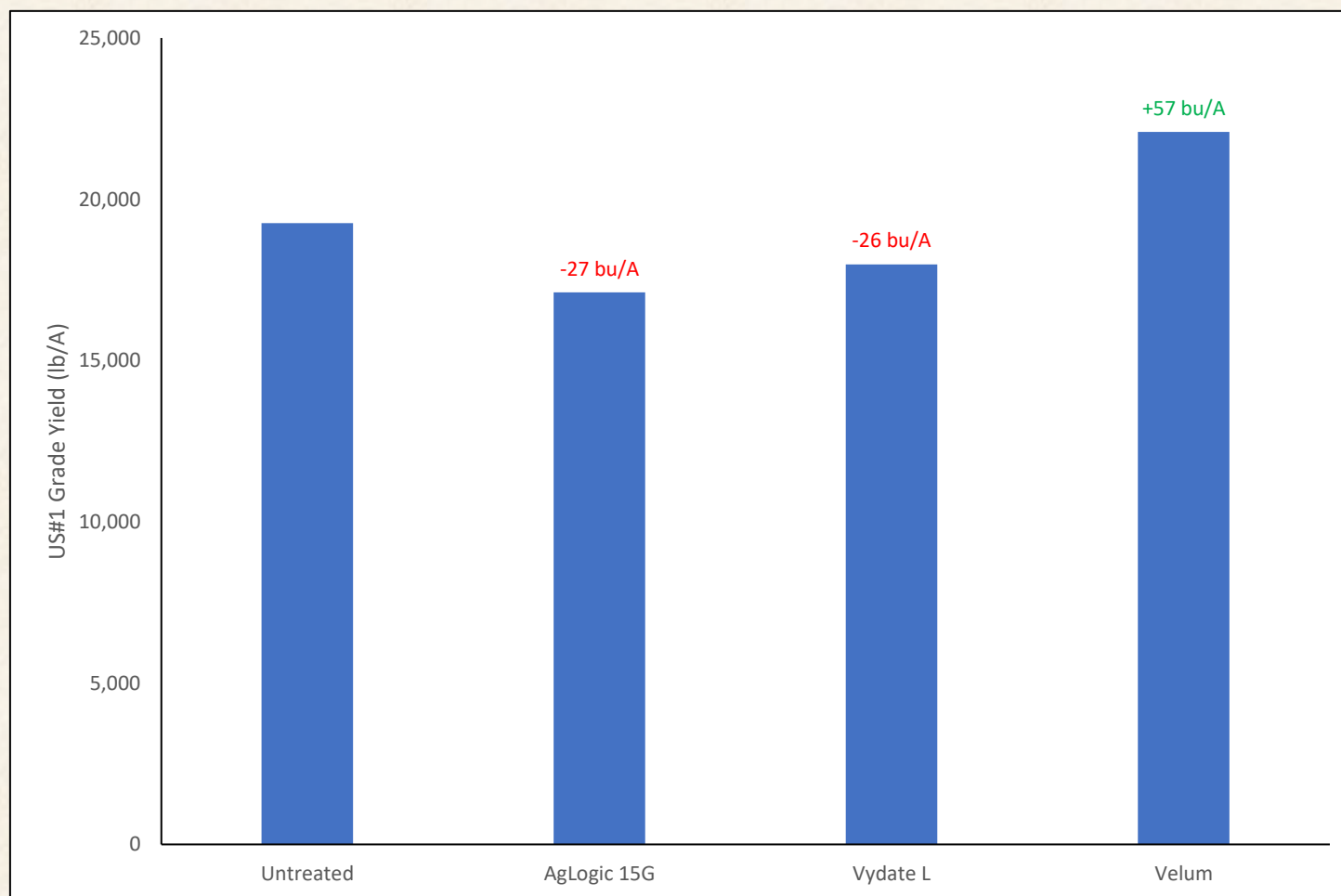


Nematode Population Dynamics



Sweetpotato 2021 On-Farm Nematicide Trial

Yield of US#1 Grade Sweetpotato



Sweetpotato 2021 On-Farm Nematicide Trial

Summary

Velum

- Suppressed reniform nematode populations by 57%.
- Increased yield of US#1 grade sweetpotato by 57 bu/A.



AgLogic 15G

- Intermediate level of reniform nematode suppression (32%).
- No US#1 yield increase



Vydate L

- Intermediate level of reniform nematode suppression (35%).
- No US#1 yield increase
 - (~100 bu/A increase in canner yield relative to control; *data not shown*)



Soybean Variety Screening Reniform Nematode

Field Trials

Locations:

- St. Joseph (Northeast Research Station)
- Winnsboro (Macon Ridge Research Station)

Data Collection:

- Nematode Populations in Soil
 - *At plant, mid-season, harvest*
- Nematode Populations in Roots
- Yield

Greenhouse Trials

Soils:

- St. Joseph
- Winnsboro

Data Collection:

- Nematode Reproductive Factor

22 Top Selling Varieties Evaluated

<u>Company</u>	<u>Variety</u>	<u>Maturity Group</u>
WinField United	Armor 48-D25	4.8
WinField United	Armor 46-D09	4.6
Great Heart Seed	GT-4828X	4.8
Great Heart Seed	GT-4677XS	4.6
Local Seed Company	LS5009XS	5.0
Syngenta - NK	NK39-A1XF	3.9
Bayer	AG48XF0	4.8
Syngenta - NK	S49-F5X	4.9
Dyna-Gro	S48XT40	4.8
WinField United Seed	Armor 48-D03	4.8
University of Missouri	S16-7840C	5.0
Progeny	P 4444RXS	4.4
Progeny	P 4821RX	4.8
Progeny	P 5252RX	5.2
Progeny	P 4970RX	4.9
Pioneer	Pioneer P54A54X	5.4
Pioneer	Pioneer P46A86X	4.6
Bayer	AG53XF2	5.3
Bayer	AG48XF2	4.6
Bayer	AG48X9	4.8



2021 Results – Top 3 Performing Varieties

St. Joseph Field Trial

Nematode Suppression	Yield
Dyna-Gro S48XT40	Syngenta NK39-A1XF
Progeny P4444RXS	Bayer AG53XF2
Bayer AG48X9	WinField United Armor 48-D25

Winnsboro Field Trial

Nematode Suppression	Yield
Bayer AG53XF2	Progeny P4444RXS
Progeny P4970RX	WinField United Armor 48-D25
Progeny P4444RXS	Progeny P4970RX

St. Joseph - Greenhouse Trial

Nematode Suppression
Syngenta NK39-A1XF
Bayer AG53XF2
WinField United Armor 48-D25

Winnsboro Soil Greenhouse Trial

Nematode Suppression
Progeny P4444RXS
WinField United Armor 48-D25
Progeny P4970RX

2021 Results – Top 3 Performing Varieties

St. Joseph Field Trial

Nematode Suppression	Yield
Dyna-Gro S48XT40	Syngenta NK39-A1XF
Progeny P4444RXS	Bayer AG53XF2
Bayer AG48X9	WinField United Armor 48-D25

Winnsboro Field Trial

Nematode Suppression	Yield
Bayer AG53XF2	Progeny P4444RXS
Progeny P4970RX	WinField United Armor 48-D25
Progeny P4444RXS	Progeny P4970RX

St. Joseph - Greenhouse Trial

Nematode Suppression
Syngenta NK39-A1XF
Bayer AG53XF2
WinField United Armor 48-D25

Winnsboro Soil Greenhouse Trial

Nematode Suppression
Progeny P4444RXS
WinField United Armor 48-D25
Progeny P4970RX

2021 Results – Top 3 Performing Varieties

St. Joseph Field Trial

Nematode Suppression	Yield
Dyna-Gro S48XT40	Syngenta NK39-A1XF
Progeny P4444RXS	Bayer AG53XF2
Bayer AG48X9	WinField United Armor 48-D25

Winnsboro Field Trial

Nematode Suppression	Yield
Bayer AG53XF2	Progeny P4444RXS
Progeny P4970RX	WinField United Armor 48-D25
Progeny P4444RXS	Progeny P4970RX

St. Joseph - Greenhouse Trial

Nematode Suppression
Syngenta NK39-A1XF
Bayer AG53XF2
WinField United Armor 48-D25

Winnsboro Soil Greenhouse Trial

Nematode Suppression
Progeny P4444RXS
WinField United Armor 48-D25
Progeny P4970RX

Soybean Variety Screening – Root-Knot Nematode

Background

- Numerous reports of excessive galling on root-knot ‘resistant’ commercial varieties:
 - Dr. Boyd Padgett
 - R.L. Frazier
 - Dr. David Moseley
 - Myself (greenhouse screening)

- Why is soybean host resistance to nematodes failing in Louisiana:
 - Different root-knot nematode species?
 - Different root-knot nematode populations?



Soybean Variety Screening

Greenhouse Trials:

6 Nematode Populations:

M. incognita 'Concordia1'
M. incognita 'West Feliciana'
M. incognita 'Tensas'
M. incognita 'Concordia2'
M. incognita 'Franklin'
M. incognita 'Richland'

9 Root-Knot Resistant Soybean Varieties:

Armor 48-D03
 Armor 55-D33
 Armor 55-D57
 48XT40
 LS5009X5
 P4444RXS
 S16-11651C
 Armor 46-D09
 Armor 48-D05
 Tomato (control)

Protocol

- Inoculate soil with 500 eggs
- Plant soybean seeds (n=4)
- Grow in greenhouse for 6 weeks
- Quantify egg production
- Calculate nematode reproductive factor



Soybean Variety Screening

Nematode Reproductive Factor:

>1 = Susceptible

<1 = Resistant

Nematode Population	Tomato (control)	Armor 48-D03	Armor 55-D33	Armor 55-D57	48XT40	LS5009X5	P4444RXS	S16-11651C	Armor 46-D09	Armor 48-D25
Concordia1	1.5	4.1	2.2	1.4	0.9	0	0	0	0.1	0
West Feliciana	2.7	2.4	1.0	6.3	3.6	17.7	2.4	22.1	15.5	5.1
Tensas	1.0	0.2	0.1	0.2	0.1	0.3	0	1.6	0.8	0.1
Concordia2	1.6	0.1	0	0	0.1	1.3	0.2	2.1	0.9	0.7
Franklin	6.2	1.6	0.4	0.5	0	0.2	0.2	0.3	0.6	1.1
Richland	4.9	0.7	1.8	1.1	0.8	2.3	0.7	16	5.3	2.2

Summary:

Variety:

Resistance:

Tomato (control)	0%
Armor 48-D03	50%
Armor 55-D33	50%
Armor 55-D57	50%
48XT40	83%
LS5009X5	50%
P4444RXS	83%
S16-11651C	33%
Armor 46-D09	67%
Armor 48-D25	50%

Resistant Varieties Do Not Protect Against All Root-Knot Nematode Populations

Resistance Breaking Nematode Populations Exist in LA

Soybean Variety Screening

Trial Conducted by Dr. David Moseley (Dean Lee Research Station)

Concordia Parish

P46A35X

Resistant

520 eggs/plant

P46A86X

Susceptible

2,903 eggs/plant



Corn Nematicide Field Trial 2021

Location: Northeast Research Station

Crop: Corn 'DKC55-99'



Nematode: Southern Root-Knot Nematode (*Meloidogyne incognita*)

Plot Size: 4 rows wide by 35-ft long

Measurements:

- Nematode population dynamics (at plant, mid-season, at harvest)
- Stand Count
- Yield (bu/A)

Treatment	Rate	Method	Timing
Untreated	-	-	-
Averland FC	4 fl oz/A	In-furrow	at plant
Averland FC	6 fl oz/A	In-furrow	at plant

Corn Nematicide Field Trial 2021

Treatment	<u>At Plant</u> <i>M. incognita</i> / 500 ml soil	<u>Mid-Season</u> <i>M. incognita</i> / 500 ml soil	<u>Harvest</u> <i>M. incognita</i> / 500 ml soil
Untreated Control	1,600	1,040	3,280
Averland FC at 4 fl oz/A	1,400	880	4,080
Averland FC at 6 fl oz/A	1,420	640	3,040

Averland FC at 6 fl oz/A
reduced mid-season
Southern root-knot
nematode populations by
39%

Treatment	Stand Count (plants/A)	Yield (bu/A) ^z
Untreated Control	32,719	212
Averland FC at 4 fl oz/A	34,389	219
Averland FC at 6 fl oz/A	25,252	210

Averland FC at 6 fl oz/A
reduced stand count by 23%

Treatment	Cost of Application (\$/A)	Yield Increase (bu/A)	Return (\$/A)
Untreated Control	\$0	\$0	\$0
Averland FC at 4 fl oz/A	\$6.88/A	+7 bu/A	+\$29/A
Averland FC at 6 fl oz/A	\$10.32/A	-2 bu/A	-\$20/A

Averland FC at 4 fl oz/A
increased yield by 7 bu/A

Economic Analysis Assumptions:

- \$5/bu of corn
- \$220/gal Averland FC

Acknowledgements

Watson Lab Team:

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David Bonilla (Intern)
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Warren Ratcliff
Denis Burns
Farm crew members

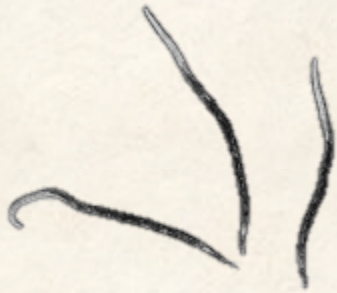


Sweetpotato Research Station:

Dr. Tara Smith
Cole Gregorie
Theresa Arnold
Farm crew members

Macon Ridge Research Station:

Dr. Trey Price
Myra Purvis
Farm crew members



Questions?

