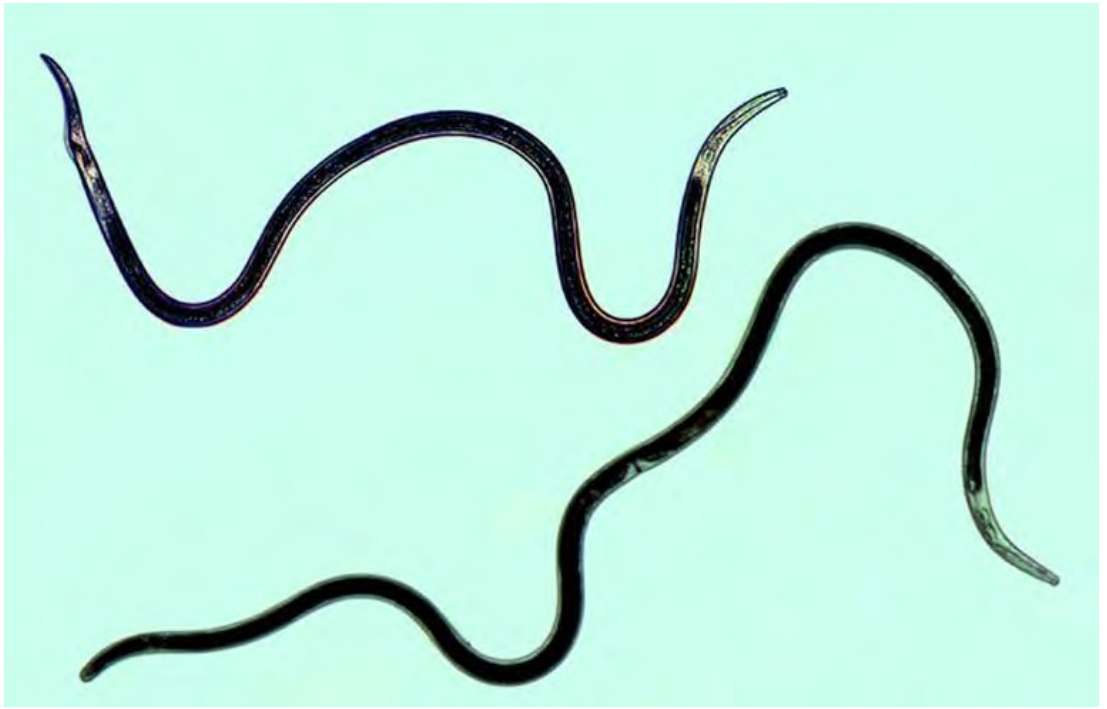
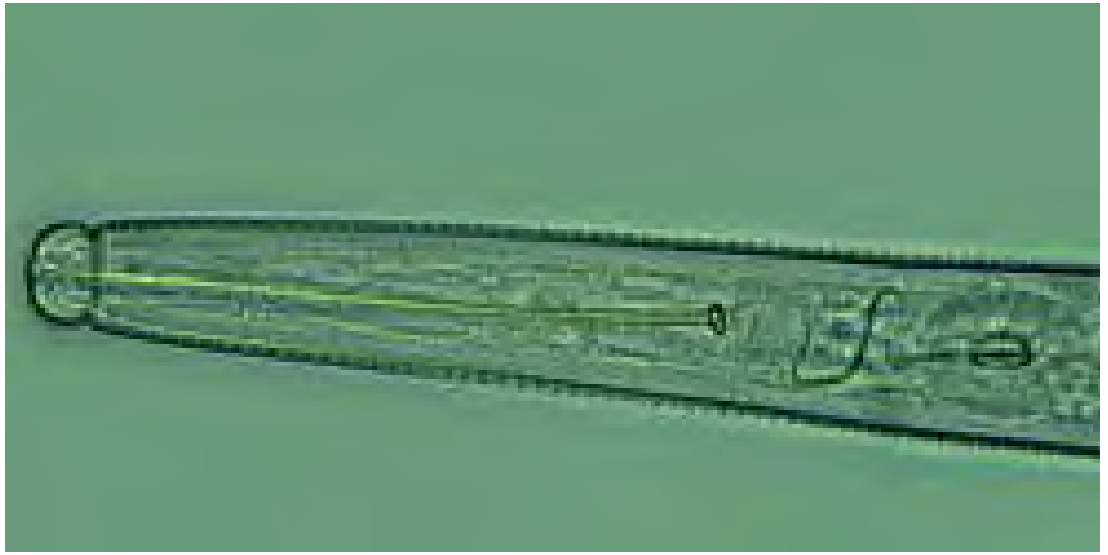
Sting Nematode

Impacts and management

Larry Duncan, UF/IFAS CREC





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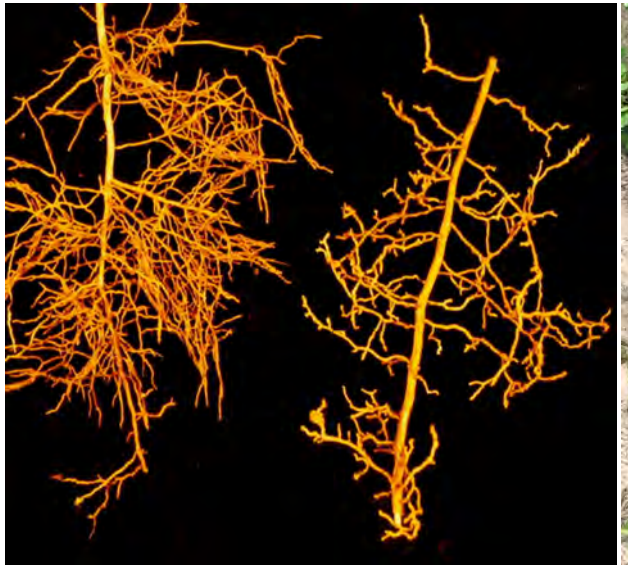
Images courtesy Jon Eisenback, VPI

Sting nematode

- First recognized as widespread pest of young trees when replanting following the freezes of 1980s. Now replanting is in response to HLB.
- Large nematode, adapted to coarse, sandy soil.
- Feeds at root tip, causes stubby root symptoms.
- Moves downward when soil dries.
- Very wide host range, including many weed species.



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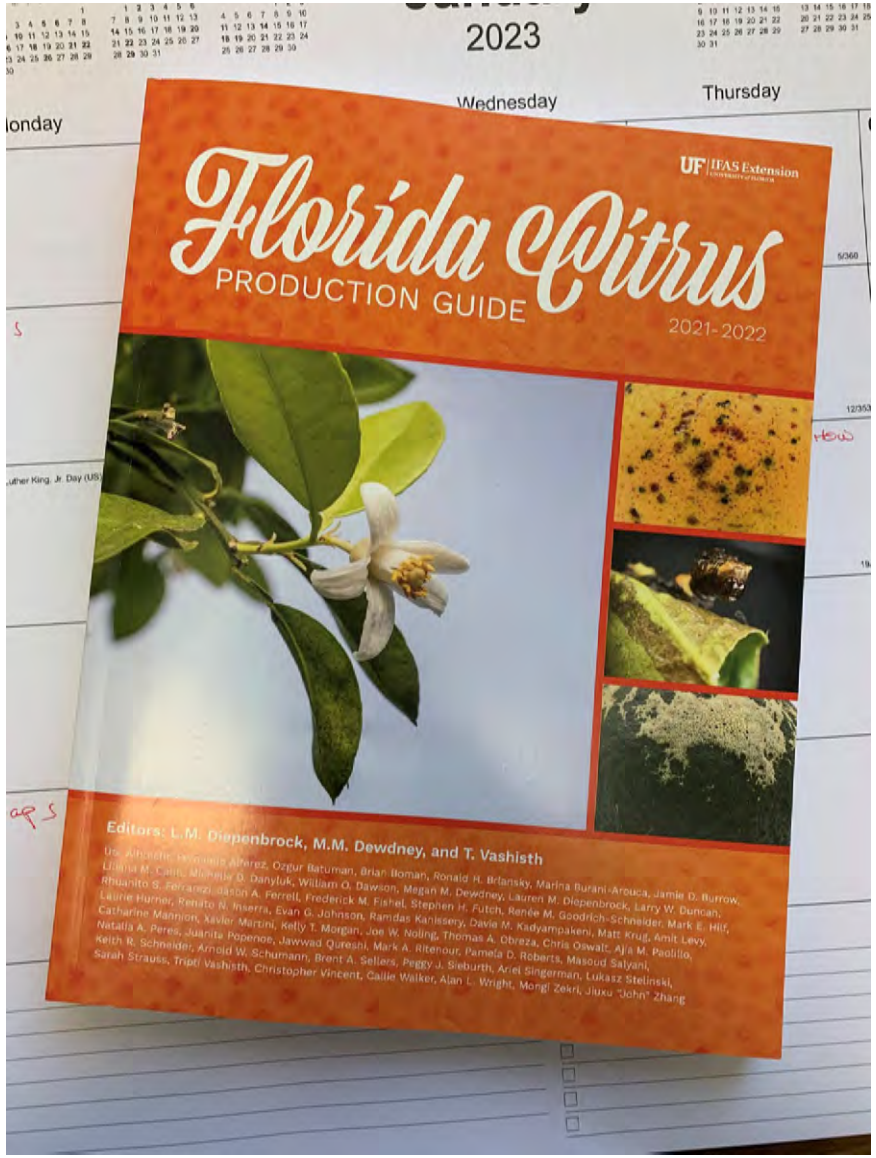
Sting nematode IPM

- Sanitation
- Resistance/tolerance
- Cultural
- Chemical/Biological



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Sting nematode IPM

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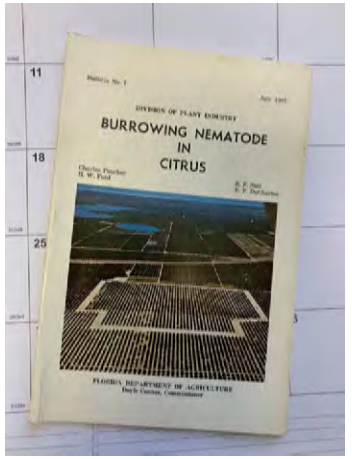
Nematode Rootstock Certification Program

- Citrus nematode
- Burrowing nematode
- Coffee lesion nematode



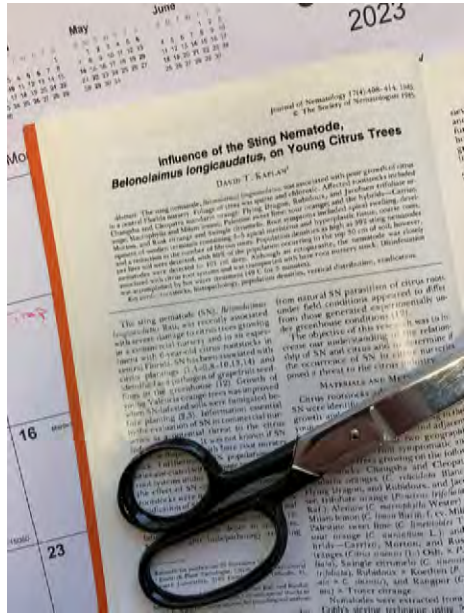
- *Not* Sting nematode because it is too widespread, unlike the others.
- Became a moot point when nurseries were all require to grow containerize trees

Sting nematode IPM

- Sanitation
- Resistance/tolerance
- Cultural
- Chemical/Biological

In a 1985 survey of common rootstocks, all were heavily infested and damaged by sting nematode.

- Changsha mandarin
- Cleopatra mandarin
- Flying Dragon trifoliate orange
- Roubidoux trifoliate orange
- Jacobson trifoliate orange
- Alemow
- Milam lemon
- Palestine sweet lime
- Sour orange
- Carrizo citrange
- Morton citrange
- Rusk citrange
- Swingle citrumelo
- Rubidoux x Koethen Rangpur x Troyer



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Rootstock tolerance

- None reported in older, conventional lines.
- CRDF trials with newer and experimental UF and USDA rootstocks are ongoing

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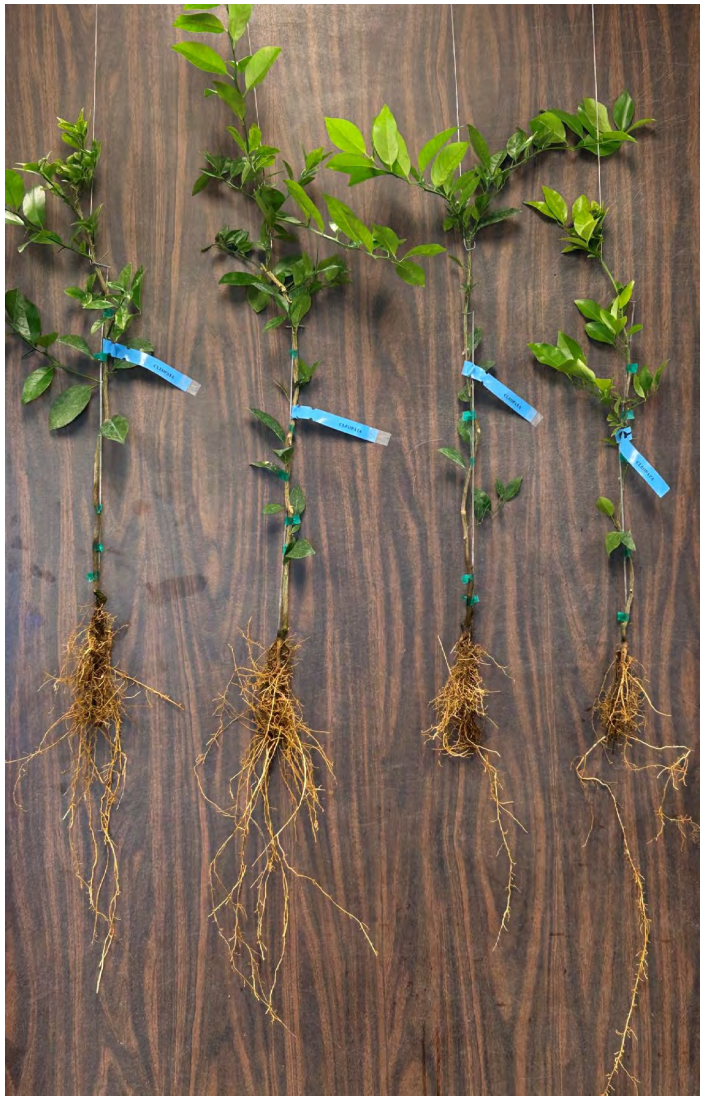
- CRDF trials with newer and experimental UF and USDA rootstocks are ongoing.
- To date some lines appear more tolerant than others. This is Cleopatra mandarin.

- nematode

+ nematode



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Rootstock tolerance

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- CRDF trials with newer and experimental UF and USDA rootstocks are ongoing
- To date some lines appear more tolerant than others. This is UFR-5.

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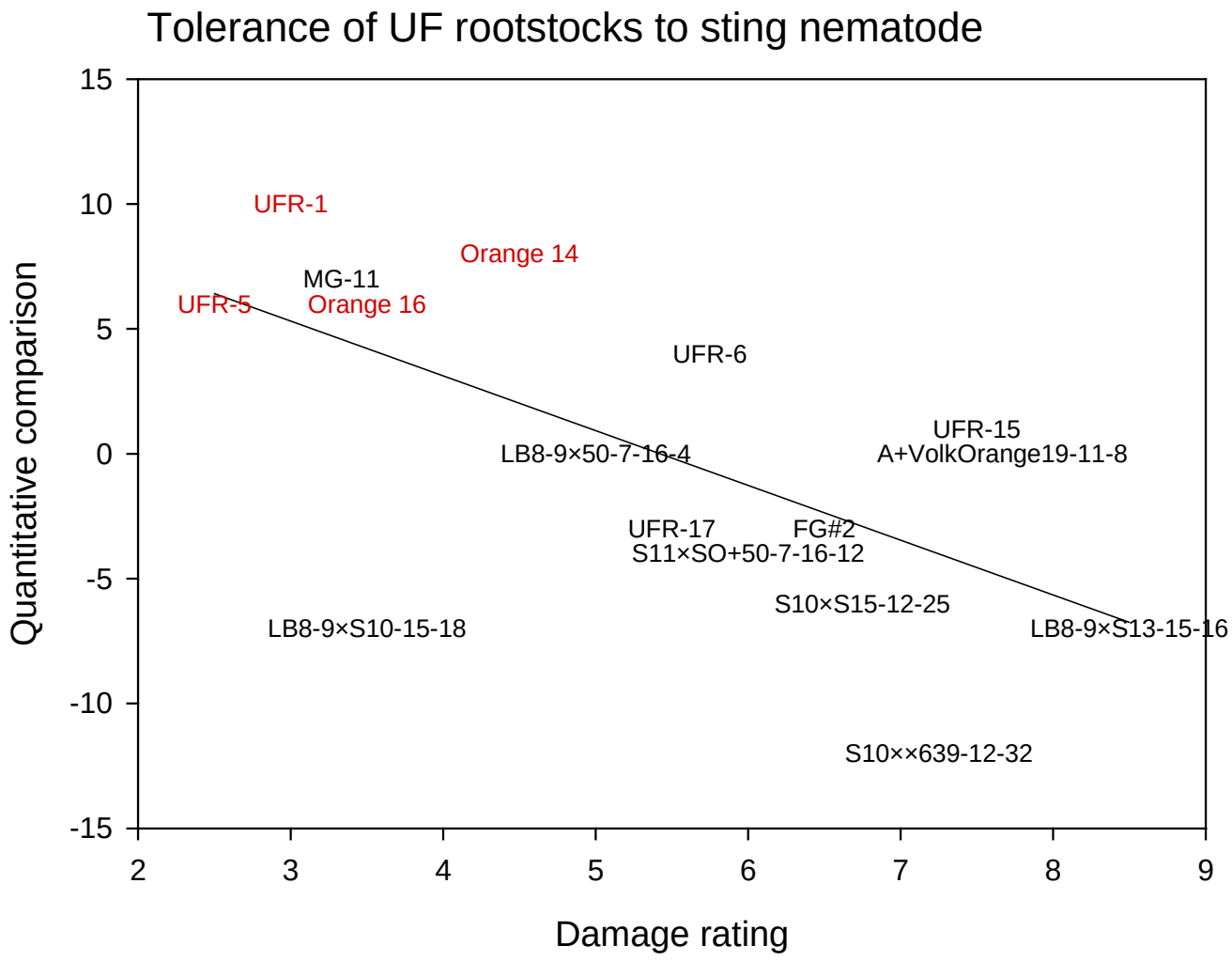
Rootstock tolerance

- None reported in older, conventional lines.
- Trials with newer and experimental UF and USDA rootstocks are ongoing.
- Relative root mass when challenged by nematodes compared to unchallenged root mass. Note that some of the promising rootstocks (red) have identical or near-identical ancestry.
- Will require field trials.



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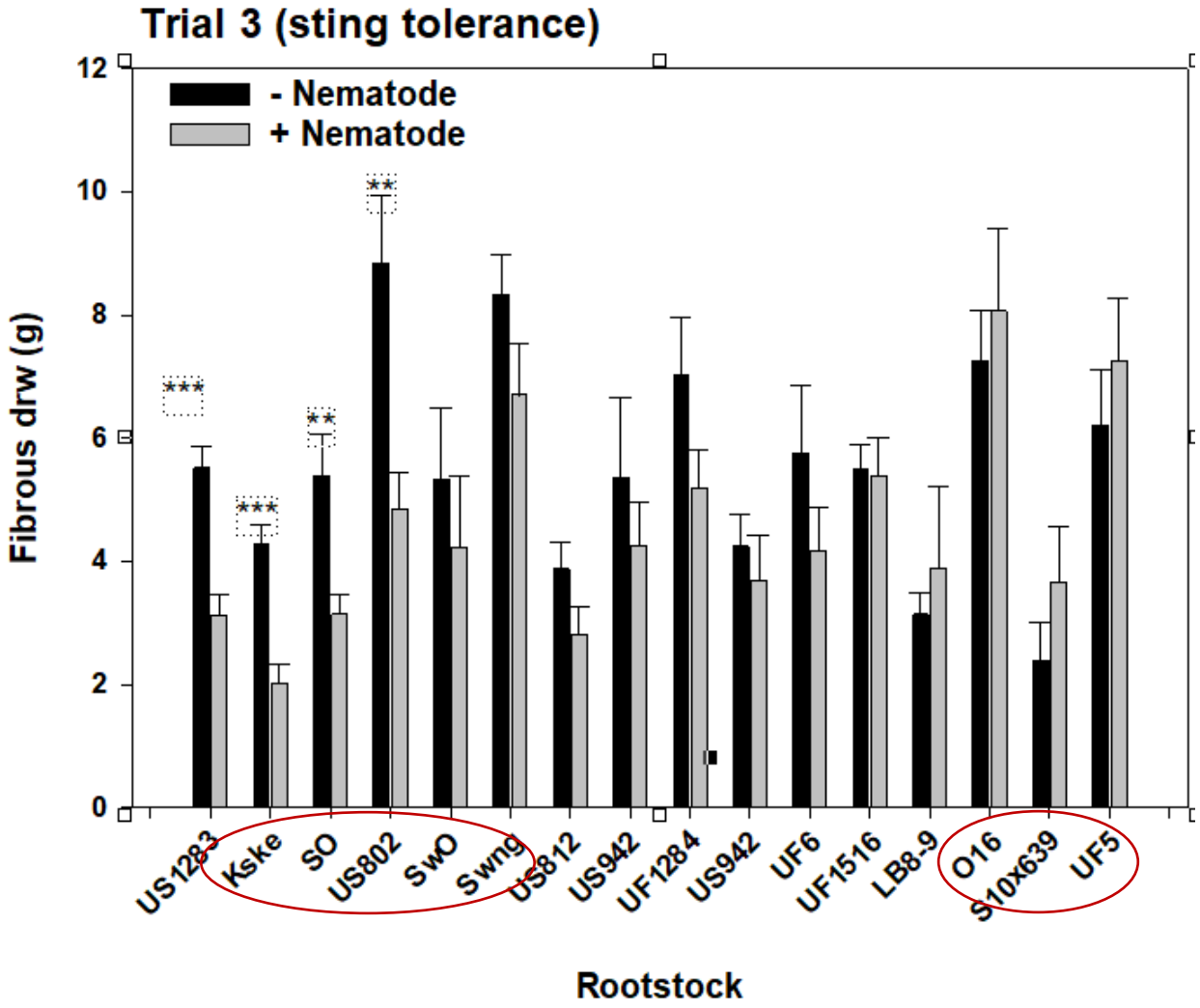
Rootstock tolerance

- Comparison of best UF and US rootstocks from preliminary trials.
- Relative results vary between trials, but several conventional rootstocks consistently intolerant to sting nematode, conventional with trifoliate heritage intermediate, and a few consistently more tolerant than conventional.
- Will require field trials as well as optimization considering other traits.



Sting nematode IPM

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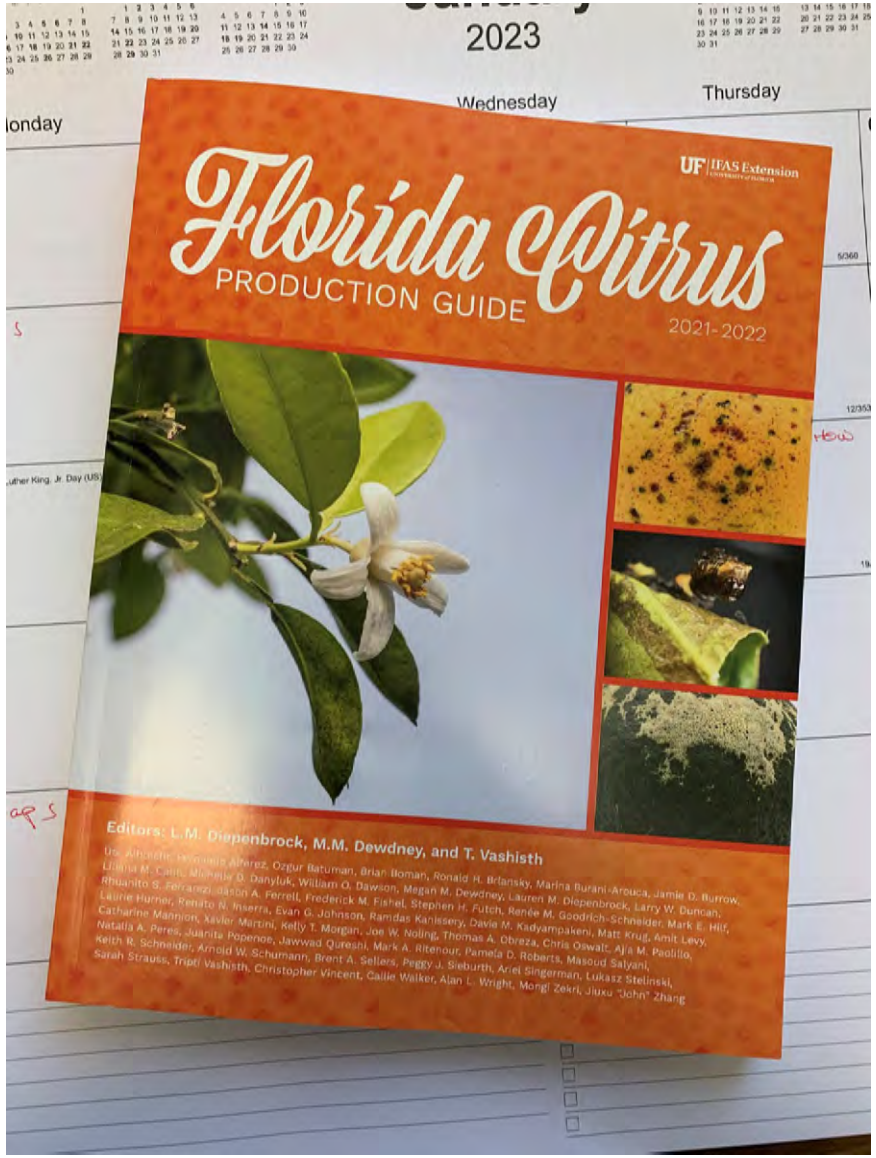

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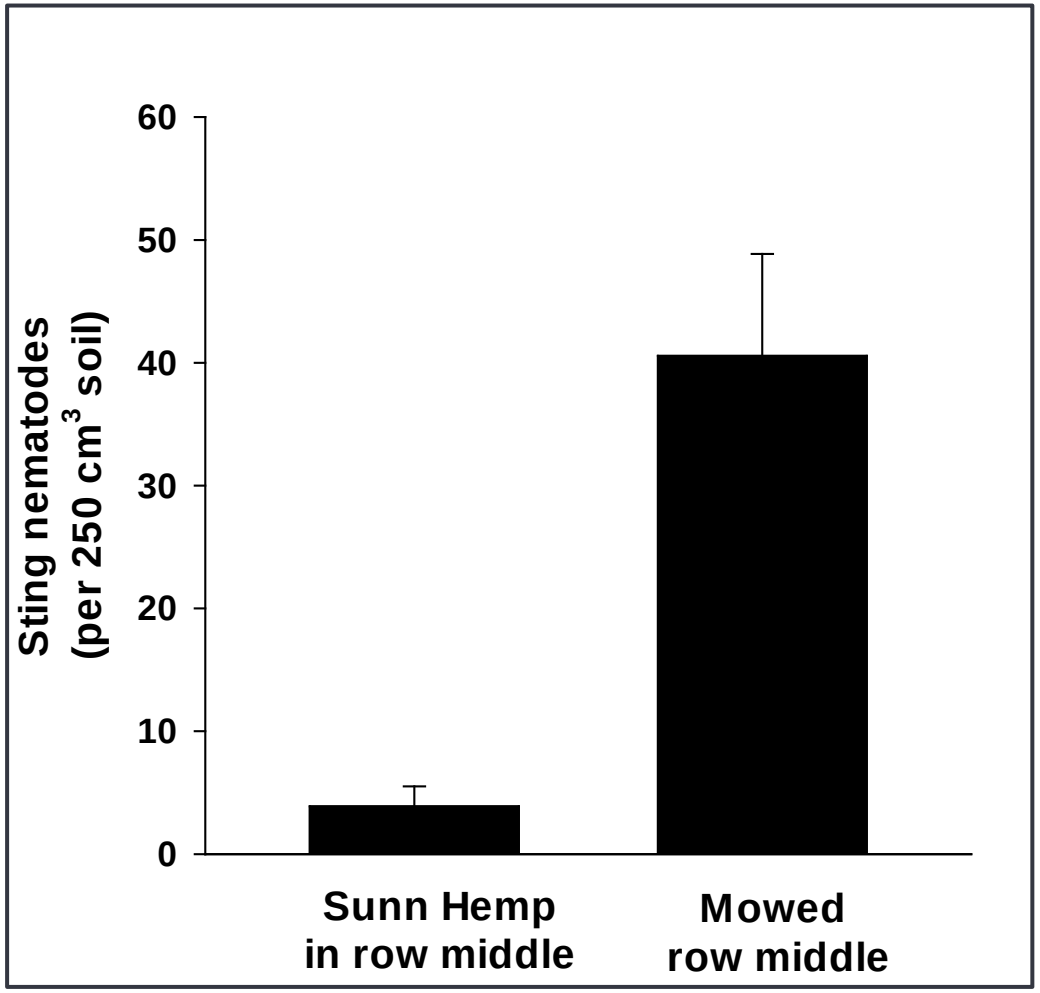
Sting nematode

Non-host cover crops

- Sunn hemp (*Crotalaria juncea*) can suppress sting nematode prior to planting.
- Not practical for row middle management.
- Excellent green manure.



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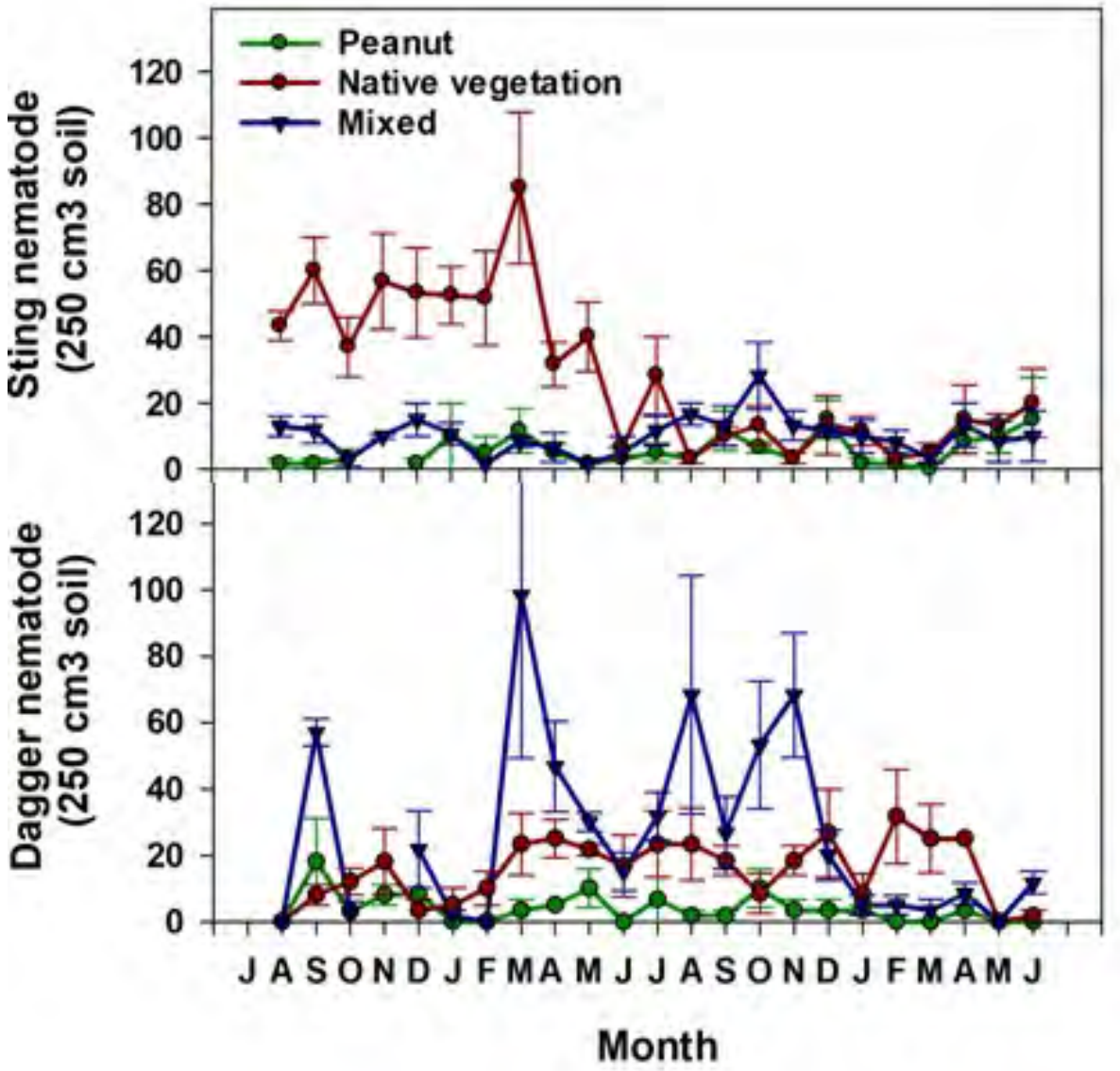
Sting nematode

Non-host cover crops

- Perennial peanut (*Arachis glabrata*) can suppress sting and dagger nematode in row middles.
- Establishes slowly, requires initial irrigation.



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Sting nematode IPM

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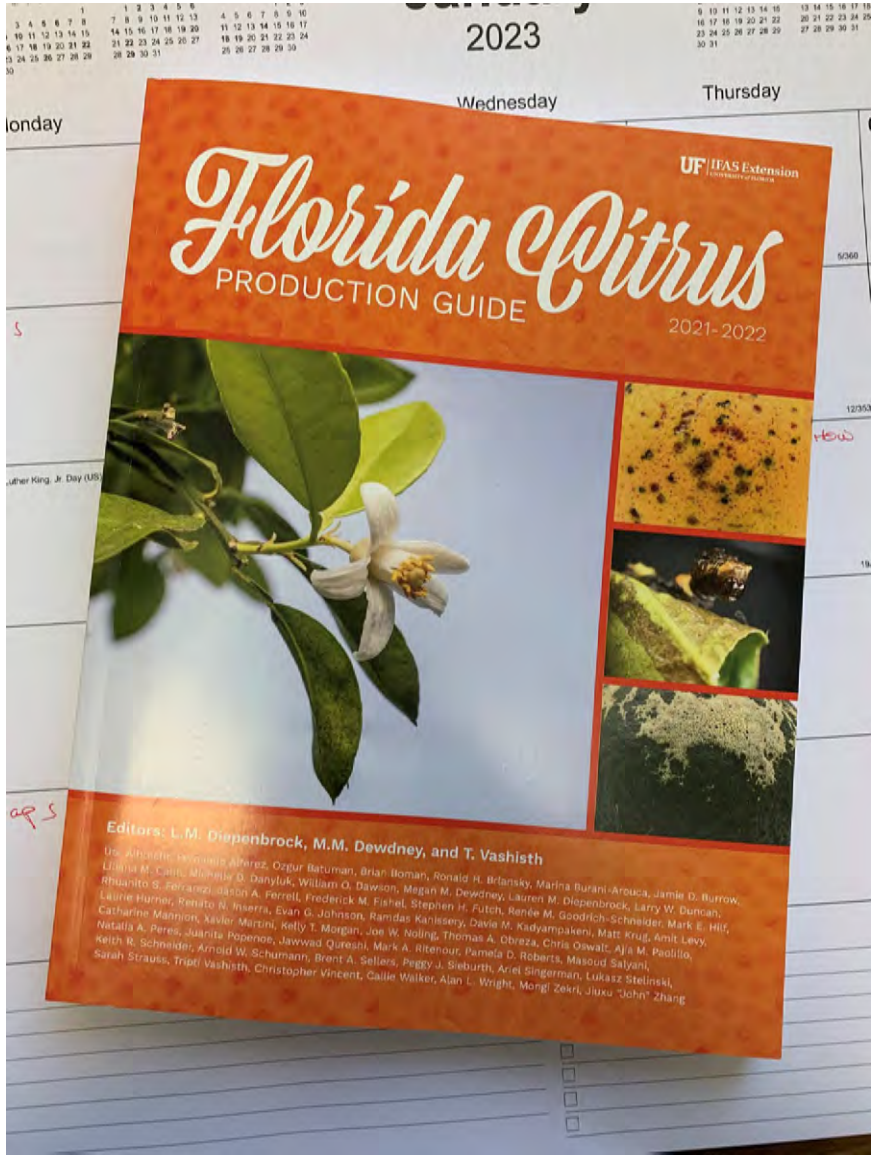

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New nematicide chemistries objectives

1. CRDF trial to estimate profitability of nematode management in young HLB-affected trees

2. Compare nematicides for efficacy
   - Six nematicides
   - Eight, 4-tree plots per treatment
   - All but one nematicide treatment occurs spring and fall

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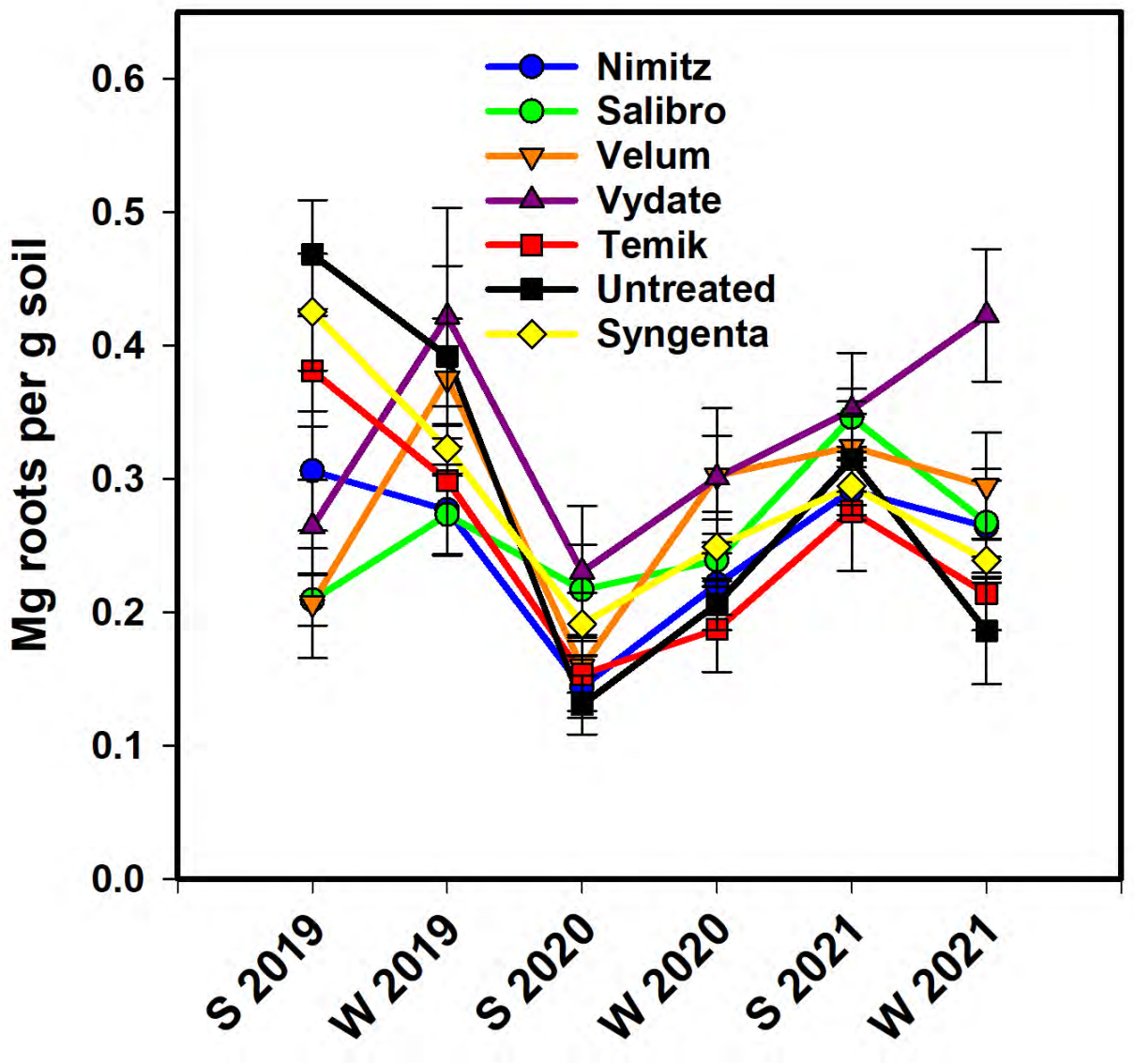
Chemical management

- Untreated trees larger initially (by chance).
- Root mass for untreated trees was initially highest, eventually lowest.
- Oxamyl effect on roots was superior among the nematicides tested.



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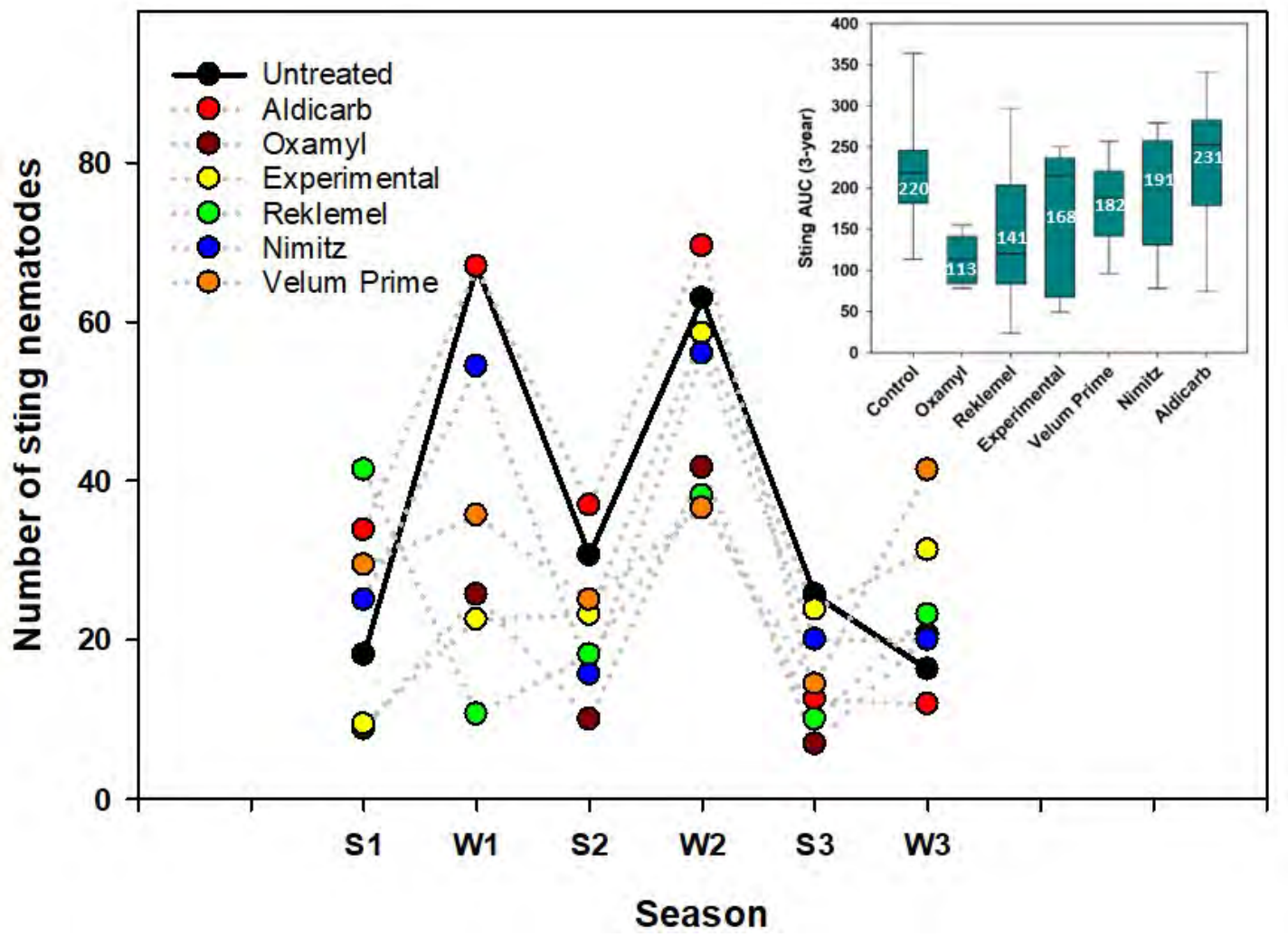
Chemical management

- Nematicide efficacy was variable, but oxamyl consistently reduced nematodes compared to the untreated trees.
- The ‘area under the curve’ or overall average nematode population size was least for oxamyl and greatest for aldicarb.



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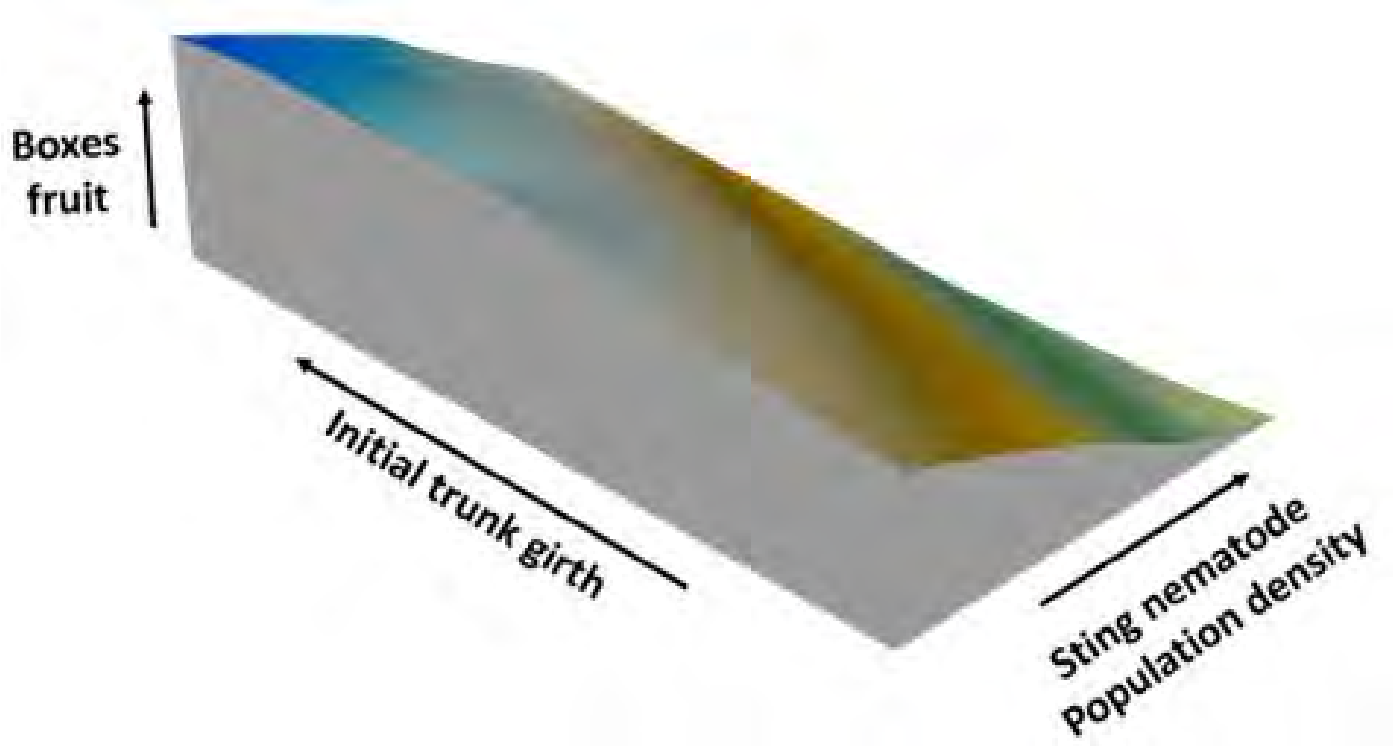
Chemical management

- Fruit weight of 4-year-old trees was significantly related to the size of trees at the beginning of the trial and to the overall abundance of sting nematodes.
- However, the treatments did not increase yield enough to be profitable.



Sting nematode and HLB

- Will trees respond profitably to sting nematode IPM if HLB infection is delayed for several years?

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Sting nematode and HLB

- CRDF trial to measure the interaction between HLB and sting nematode using IPCs and nematicides.

	B 1	B 2	B 3	B 4	B 5	B 6	B 7	B 8	B 9	B 10	B 11	B 12	B 13	B 14	B 15
3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
13	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
18	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
19	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22															

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5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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8	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
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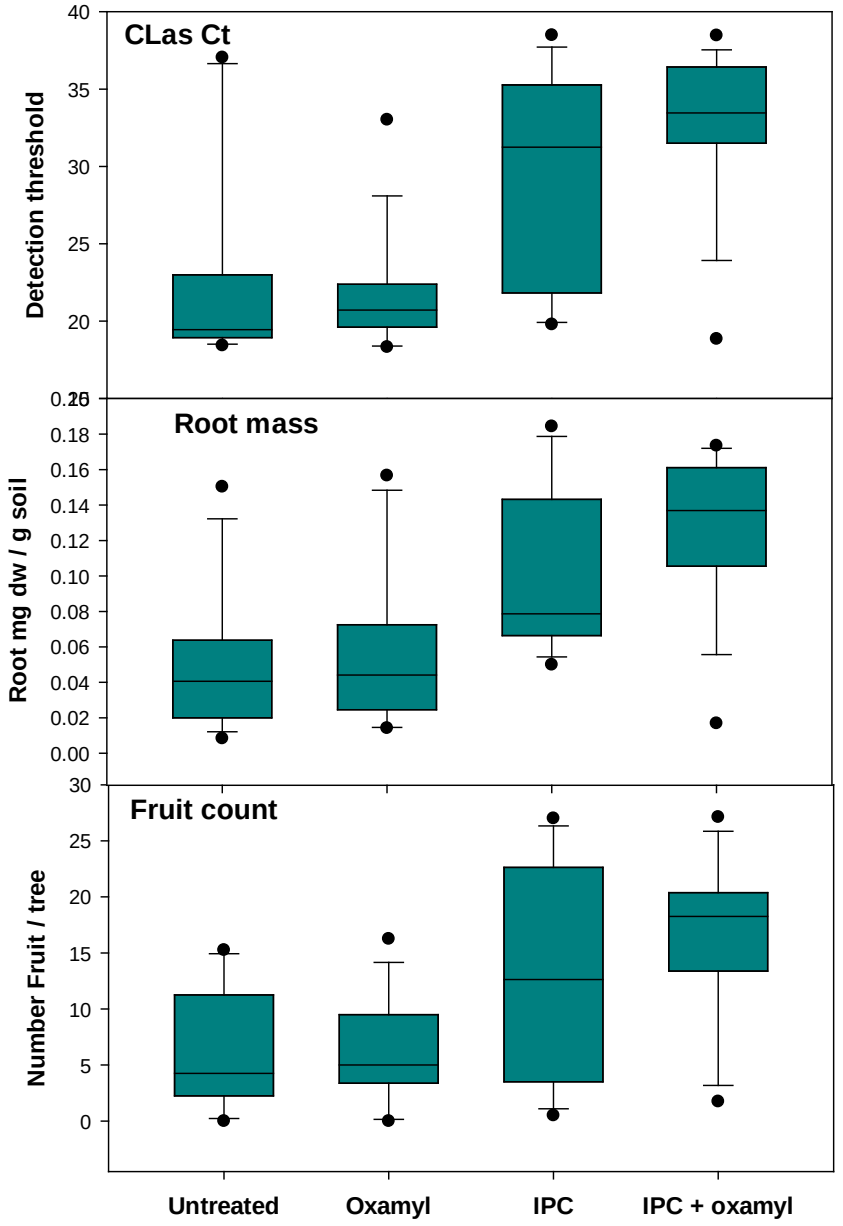
10	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
13	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
14	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
15	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
18	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
19	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22															



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Sting nematode IPM

- Ideally, sting nematode will one day be managed in citrus with a combination of cover cropping with non-host plants, rootstock tolerance/resistance, HLB avoidance, and judicious use of nematicides.

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Thank you!

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Diaprepes Root Weevil

Impacts and management

Larry Duncan, UF/IFAS CREC

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Diaprepes root weevil

- Caribbean pest introduced to Florida in 1960s
- Adults feed and lay eggs in canopy
- Larvae feed on roots, develop in soil
- Adults emerge most of the year with peaks in Spring and sometimes Fall
- Pest-disease complex with *Phytophthora* spp.
- Damage increased by HLB

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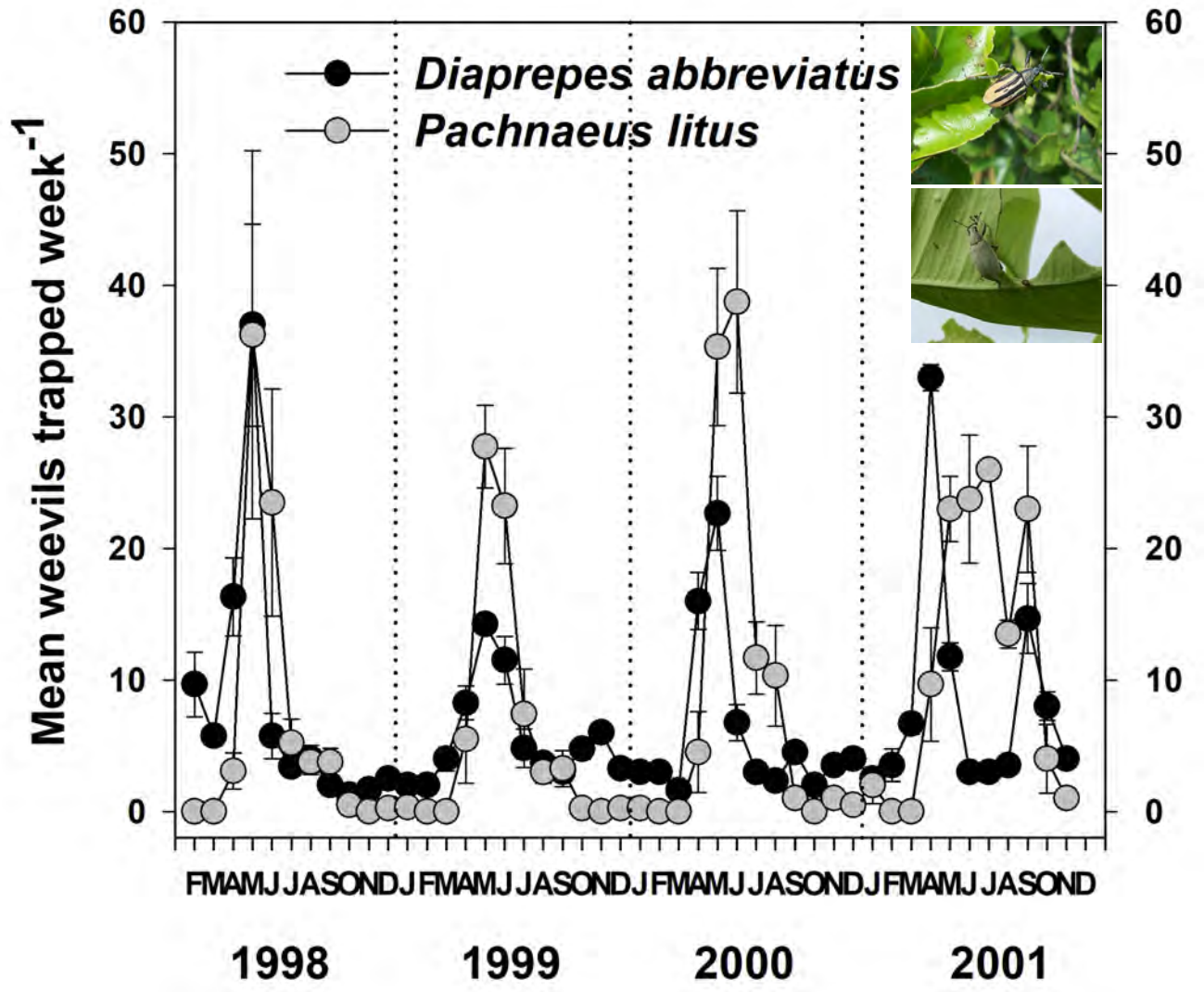
Diaprepes root weevil

- Plant appropriate rootstock depending on *Phytophthora* species
- Improve drainage when necessary
- Monitor adult emergence to time treatment with adulticide and ovicide
- Chemical barriers on soil surface and entomopathogenic nematodes can reduce larvae in soil and adult emergence



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Weevil monitoring *with traps*

- Adult weevils that emerge from soil can be captured in a boll weevil trap attached to a cone-shaped ground trap.
- Tedders traps capture adult weevils that mistake the base for a tree trunk.
- The traps are useful for research, but are inefficient for routine monitoring.

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Weevil monitoring *by scouting*

- Damage to leaves is distinctive, but is easily overlooked if adults are not abundant. When abundant, adults are readily seen in the canopy.

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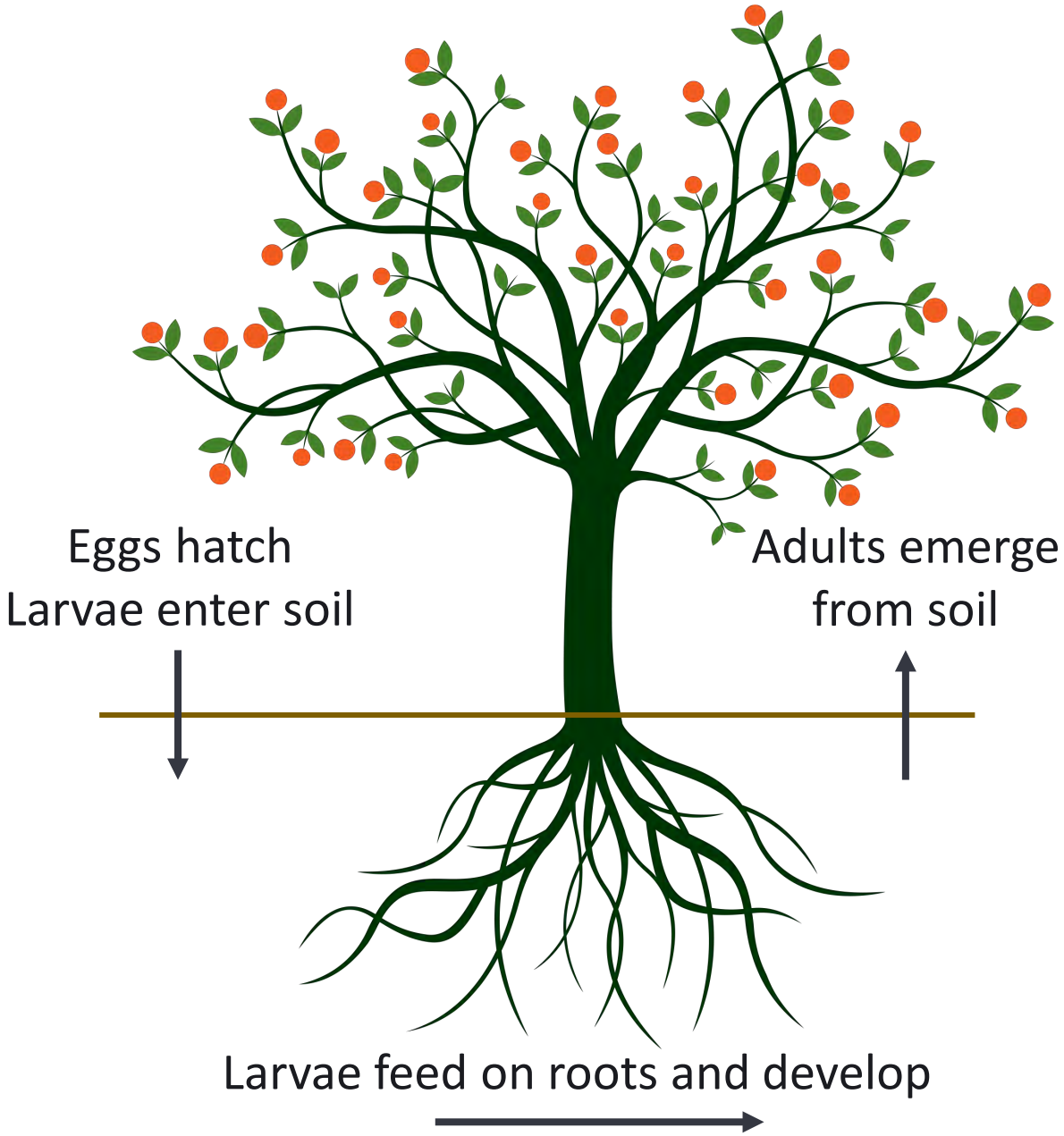
Diaprepes root weevil

- Weevils have multiple generations with continuous development above- and below-ground during all but the coldest months.



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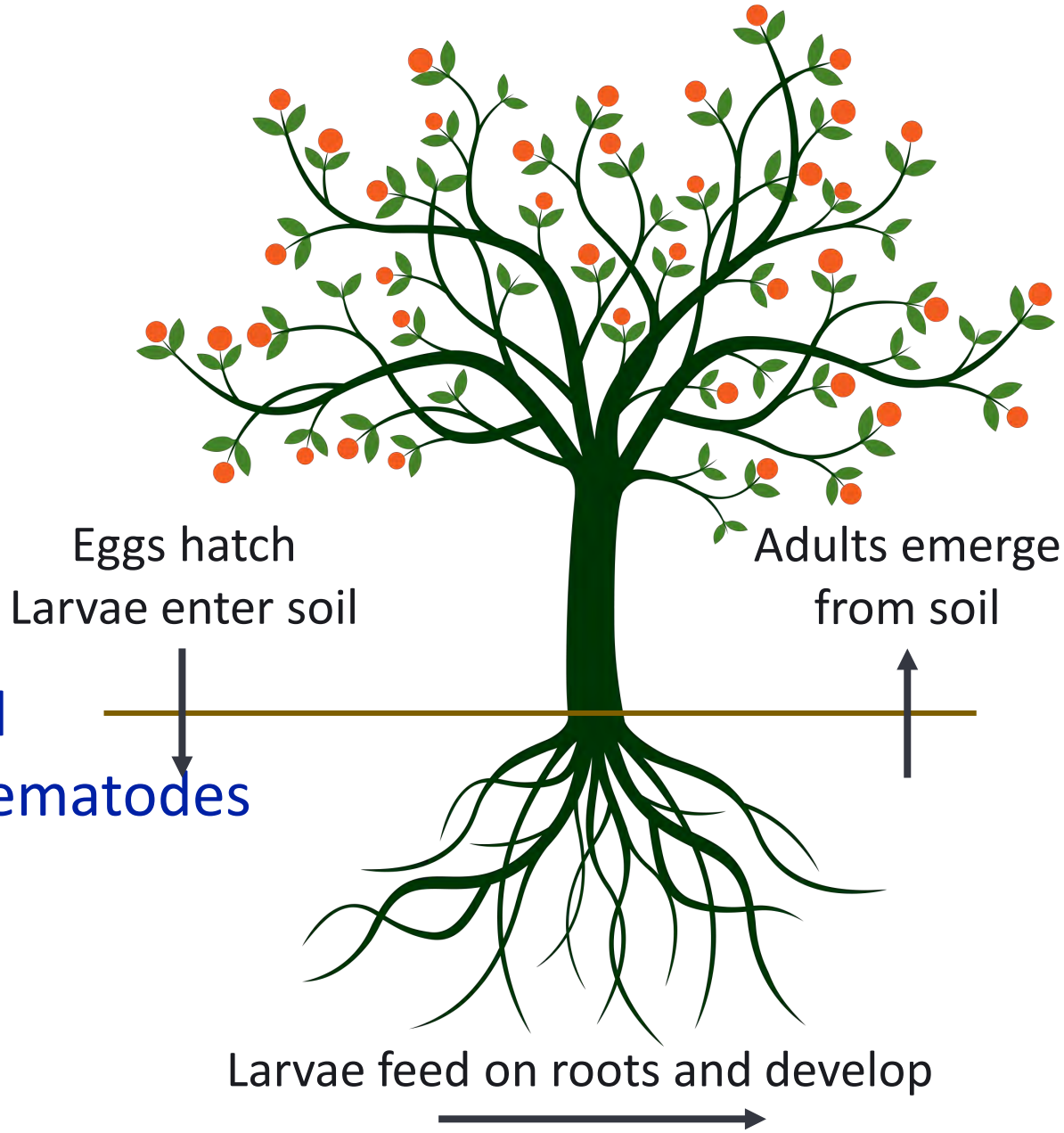
Chemical adulticides and ovicides are non-persistent



Chemical barriers and entomopathogenic nematodes are non-persistent

What is needed to improve weevil IPM?

- Better detection
- Comprehensive evaluation of:
  - New insecticides
  - Physical barriers
  - EPN utility

Weevil monitoring *belowground*

- Examine roots when pulling and resetting trees. If clipping to replant a block, push a few trees to examine roots.

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Fabric Soil Barriers

- Reduced soil entry by neonate larvae by >97% in laboratory
- Reduced adult capture by >99% in field when traps placed on fabric.
- No effect on capture in traps adjacent to fabric (i.e., weevils did not migrate to escape at edge of barriers).

0.12 ± 0.13 adults

2.75 ± 1.0 adults

4.38 ± 1.9 adults

32.1 ± 12.0 adults

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- Flat bed applicators being used in Florida
- Sloped bed applicators used in Texas

Soil accumulation, weed germination and root penetration of fabric can be a problem

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Damage beneath fabric

Source (penetration, edges)?
Frequency?
Fabric profitability?

Requires experimental design to include non-fabric comparison.

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Foliar barriers (IPCs)

Best of both worlds

- No ACP
- No weevil egg laying
- Faster growth, more efficient water and nutrient use.

However, unique IPM tactics required inside covers.

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Not covered

IPC

Foliar barriers (IPCs)

Three months after IPC removal.

- Will the differences between covered and uncovered trees persist as they encounter weevils and HLB while maturing and bearing fruit?
- Will they respond differently to pest management?

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Foliar barriers (IPCs)

Responses to Hurricane Ian

- 17% of uncovered trees were tilted >45° compared to 1.5% of the formerly IPC trees
- Caused by damaged, poorly developed root system.

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Nope….

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Rotovated – Friable soil, no clumps, but uneven lanes.

A blade or a roller needed to level the bed

One pass of roller on the rotovated bed

5.5-feet on each side of trunk, buried 6 inches

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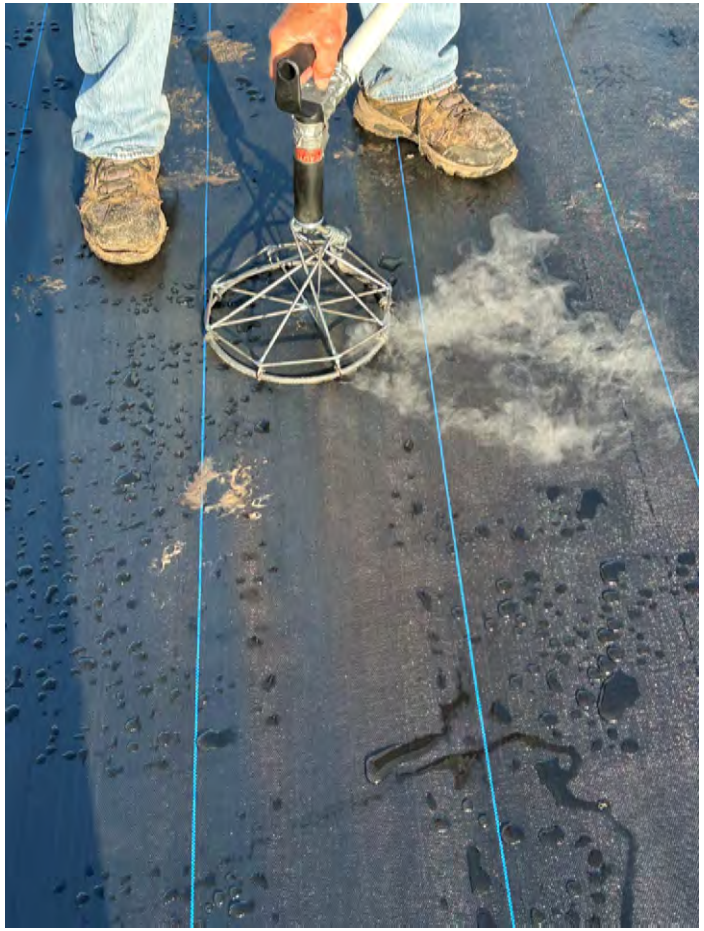

Electric branding iron

Hot knife for stake

Trees in ground next week

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Treatments

- Fabric-Bare soil
- IPC-Bare tree
- *Phytophthora* Tolerant-Susceptible

Measure

- Tree growth
- Fruit yield
- Root channelling
- Water use
- Adult weevil presence

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Cost:

242 trees/acre @ 10-foot spacing = **$1452** for fabric
Tree defenders = **$2117**
Land preparation
Fabric installation
Fabric issues (cleaning, resetting trees, etc.)

Benefit:

Larger trees and greater yield
Less herbicide and insecticide use
Greater water use efficiency

Profitability:

TBD

Issue Date: 5/17/17
Supercedes: 4/15/15

Lumite
PERFORMANCE BY DESIGN SINCE 1946

LUMITE GROUND COVER
BLUE LINE
TYPICAL PHYSICAL FABRIC PROPERTIES

TYPICAL PROPERTIES	TEST METHOD	AVERAGE VALUE
TENSILE STRENGTH	ASTM D4632	185 LBS X 115 LBS
ELONGATION AT BREAK	ASTM D4632	20%
BURST STRENGTH (MULLENS)	ASTM D3786	335 PSI
TRAP TEAR	ASTM D4533	75 LBS X 60 LBS
PUNCTURE	ASTM D4833	70 LBS
A.O.S. STANDARD SIEVE	ASTM D4571	40
MASS PER UNIT AREA	ASTM D5261	3.2 OZ/YD²
FLOW RATE (FALLING HEAD)	ASTM D4491	10 GPM/FT²
PERMEABILITY	ASTM D4491	0.005 cm/sec
U.V. RESISTANCE - STRENGTH RETAINED AFTER 2500 HOURS XENON ARC	ASTM D4355	70%
MARKER YARNS		12" SPACING

Water infiltration must be equivalent to that of Lumite to avoid runoff.

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Thank you!

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