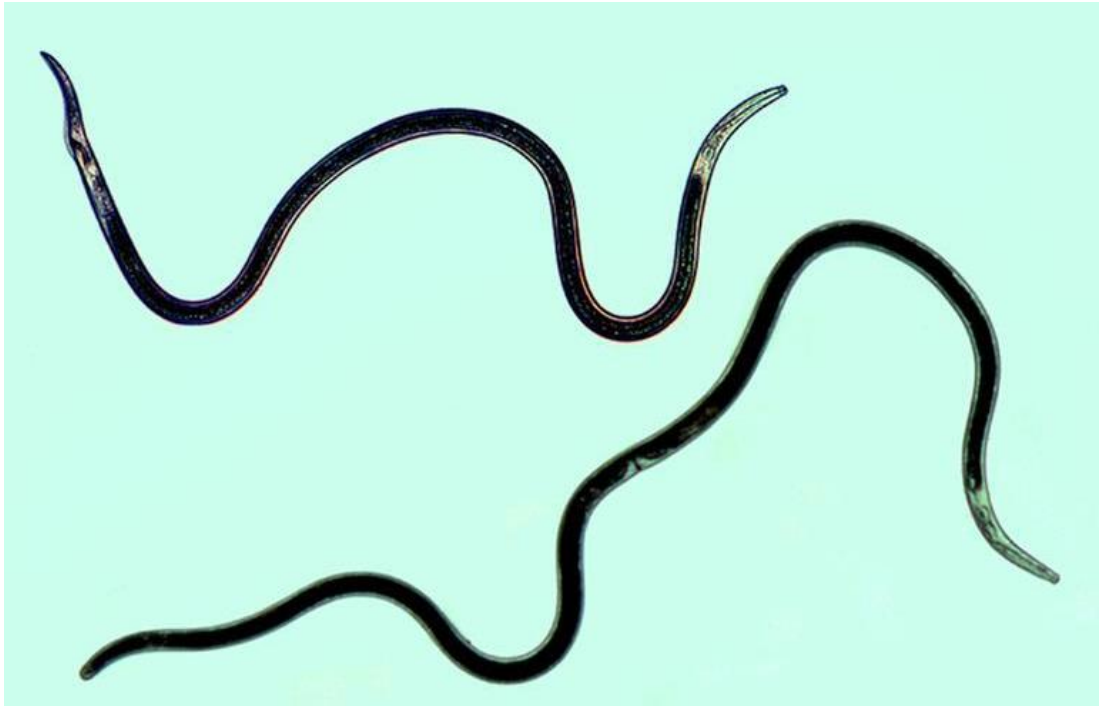
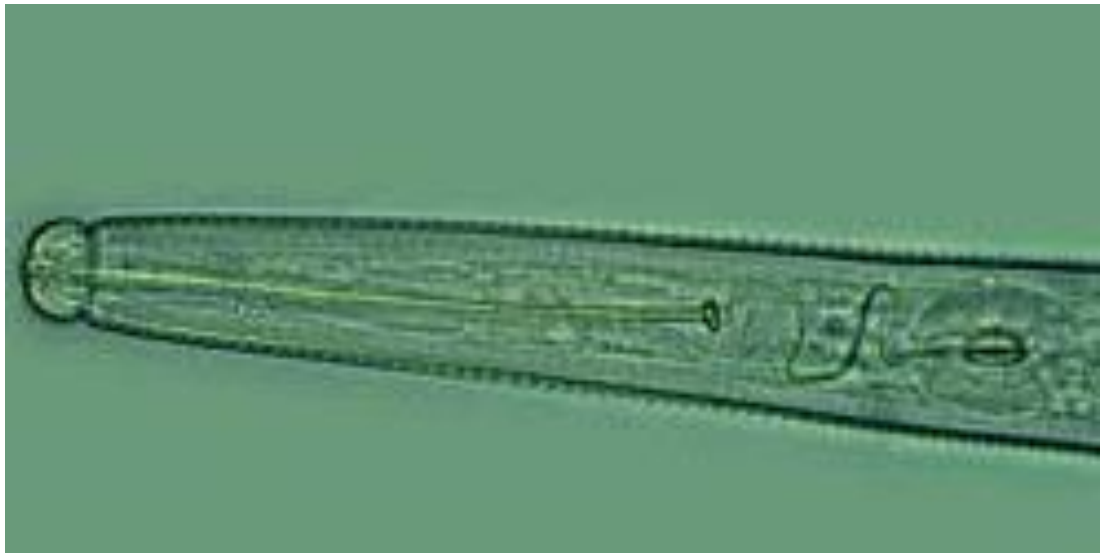
Nematode IPM in young groves

Larry Duncan
UF/IFAS CREC





Nematode IPM in young groves with HLB

Larry Duncan
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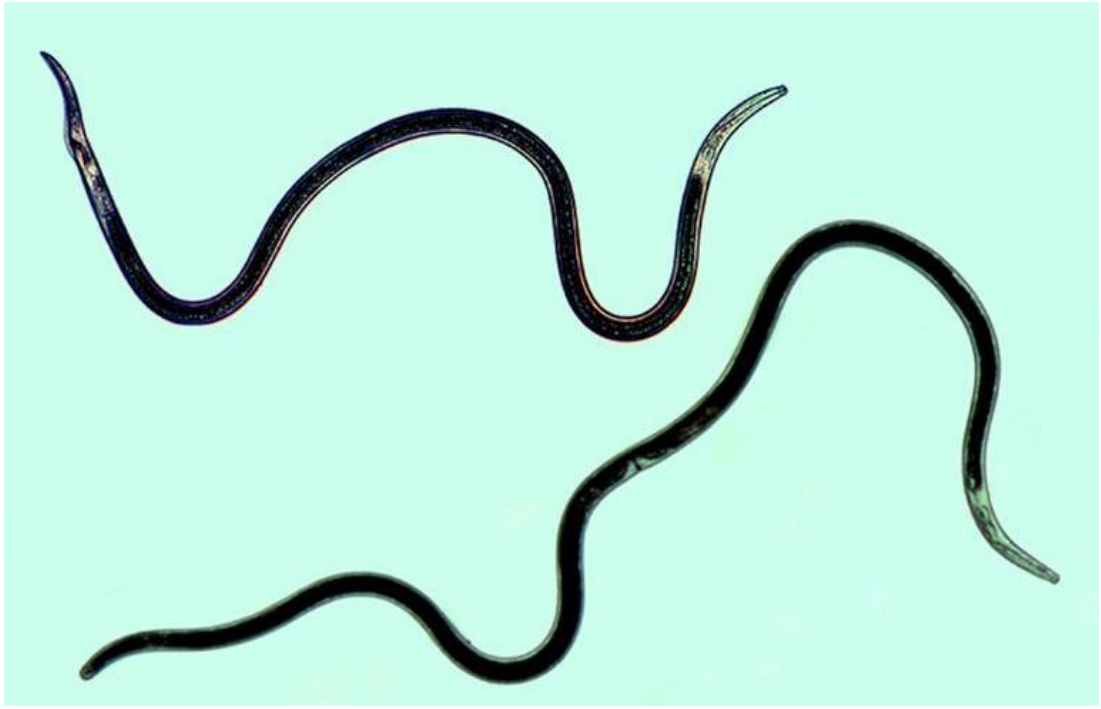
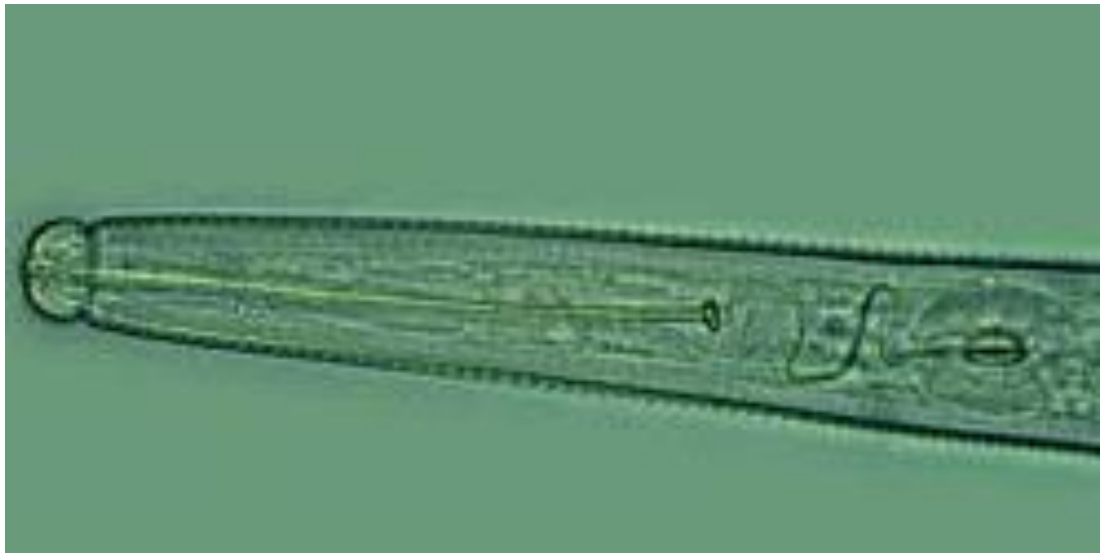




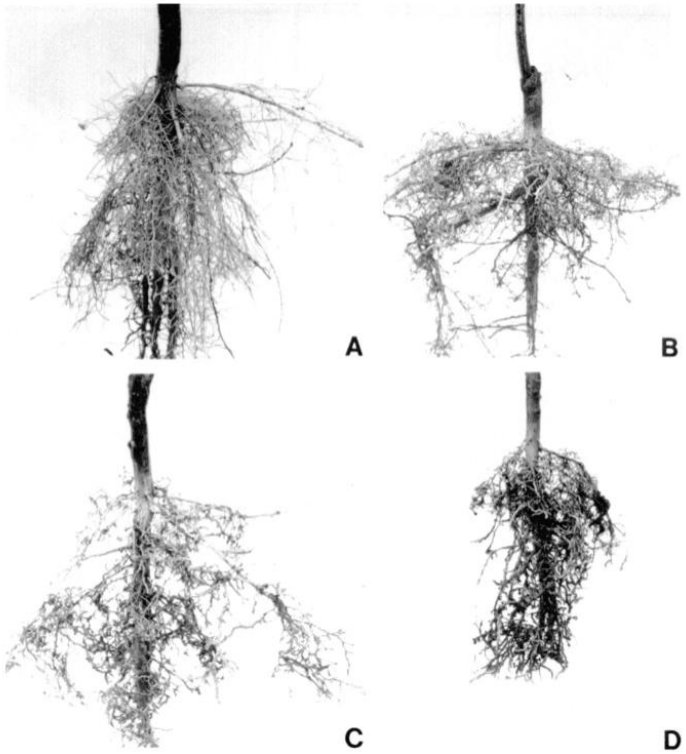
Brief History of Sting nematode in Florida citrus

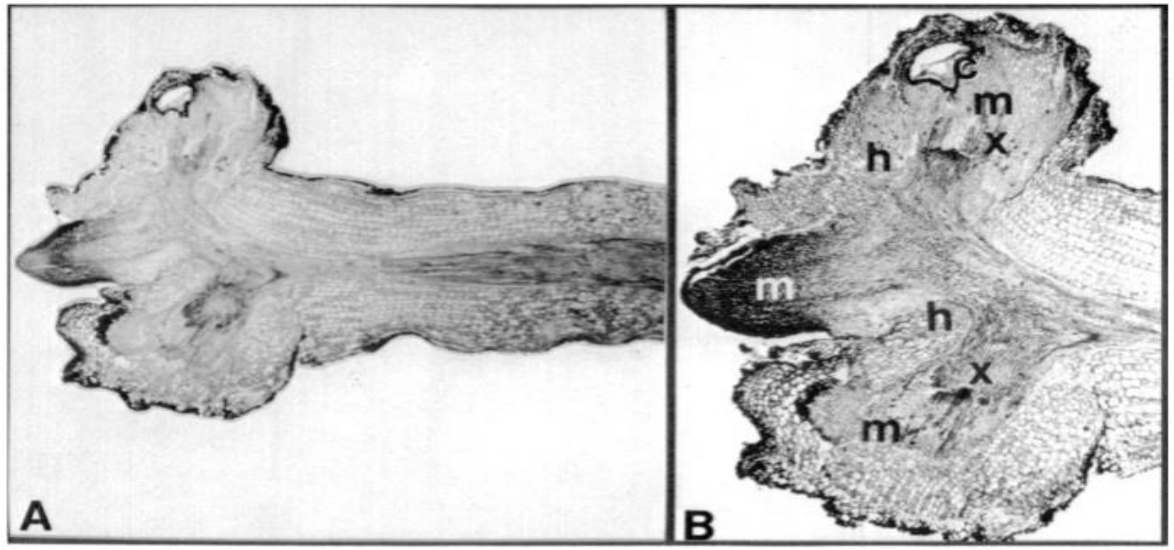
Damage caused and disease progression

Why is it the most serious nematode problem in young groves

Management

Journal of Nematology, Volume 17, No. 4, October 1985





Influence of the Sting Nematode, *Belonolaimus longicaudatus*, on Young Citrus Trees

David T. Kaplan[1]

Prior to the mid-late 1980s Freezes

- Sting nematode ‘recently associated’ with young citrus trees in a nursery and a field experiment.
- Demonstrated root damage associated with nematode density.
- Demonstrated symptoms caused by death of root apical meristem.
- Demonstrated that all commonly grown and experimental rootstocks in both sites were adversely affected.
- Demonstrated value of hot water dips to prevent spread from nurseries.
- Recommended sanitation and nematicides

Stunted trees stung by sting nematode

By Ernie Neff

In the 1990s, thousands of young trees have virtually stopped growing on the high, sandy Ridge of northeast Polk County.

They're not dying; they simply hit a certain height – like maybe three-and-a-half feet – and don't grow anymore.

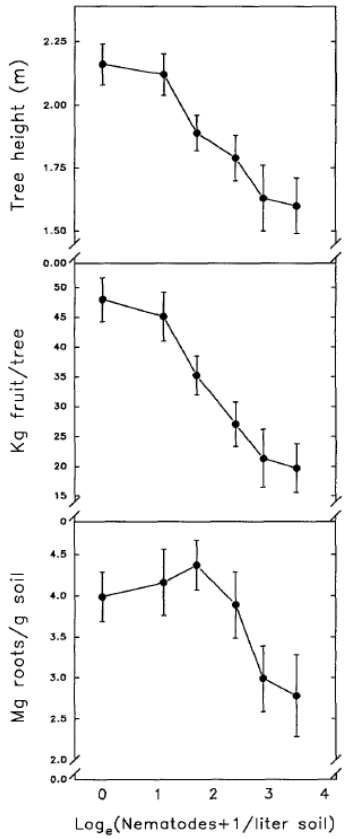
Some growers haven't had the heart to remove those trees. After all, they're still alive. And scientists have now found that many of the stunted trees start growing again after years of standing still.

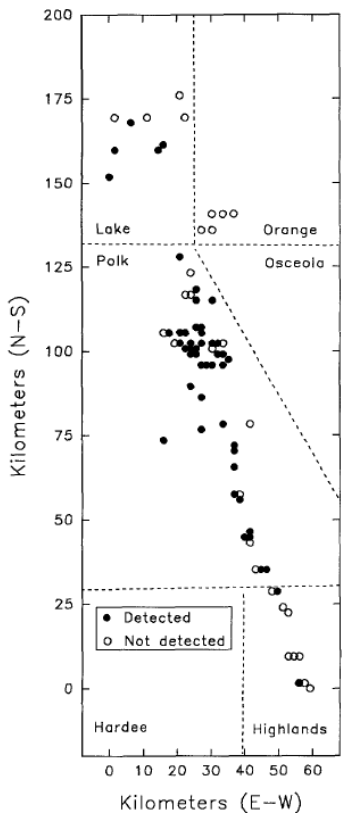
University of Florida Institute of Food and Agricultural Sciences (IFAS) researchers have identified a culprit, the sting nematode, which previously hadn't caused widespread problems in mature groves.

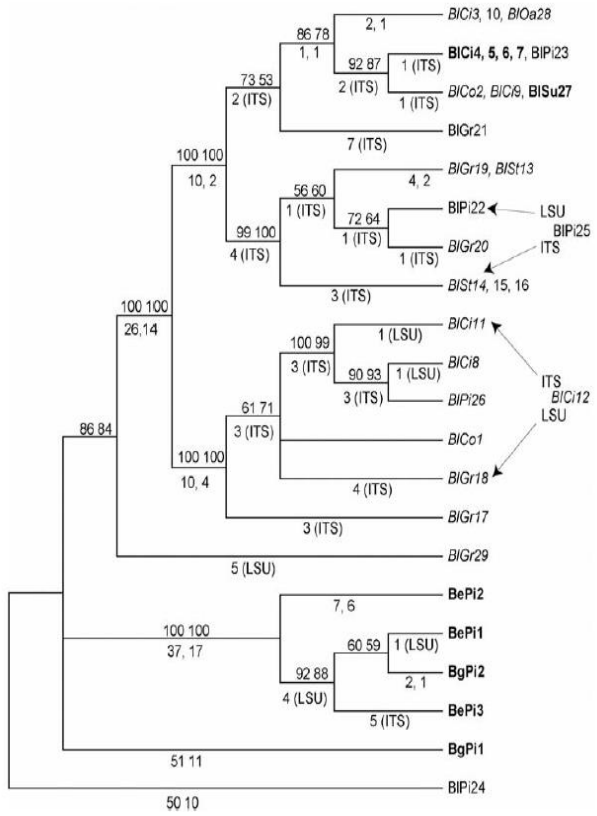
At that time, Duncan recalled, most nematologists said sting nematodes "can be a tremendous problem in a nursery," and cause stunting of young trees if the nursery trees were planted. "But we still thought that in groves, sting nematodes would cause only occasional problems."

SUDDENLY, THEY'RE AFFECTING YOUNG GROVES

The theory that groves were reasonably safe from sting nematodes may have bitten the dust in the last few years. Interestingly enough, sting nematodes may have become a bigger problem in groves as the result of Florida's last major cold spell, the freeze in the winter of 1989-90.







Long before HLB….

- Mowing replaced disking
- There were successive freezes
- Patchy growth of young trees

Research showed

- Sting nematode was widely encountered: **64%** of 200 groves on central ridge and **82%** of Polk County sites.
- Sting nematode is a species complex
- Tree growth and fruit production were markedly reduced on heavily infested trees.
- Trees were otherwise healthy, and groves remained profitable.
- Affected trees often resumed growth with time.

Problem receded when replanting decreased

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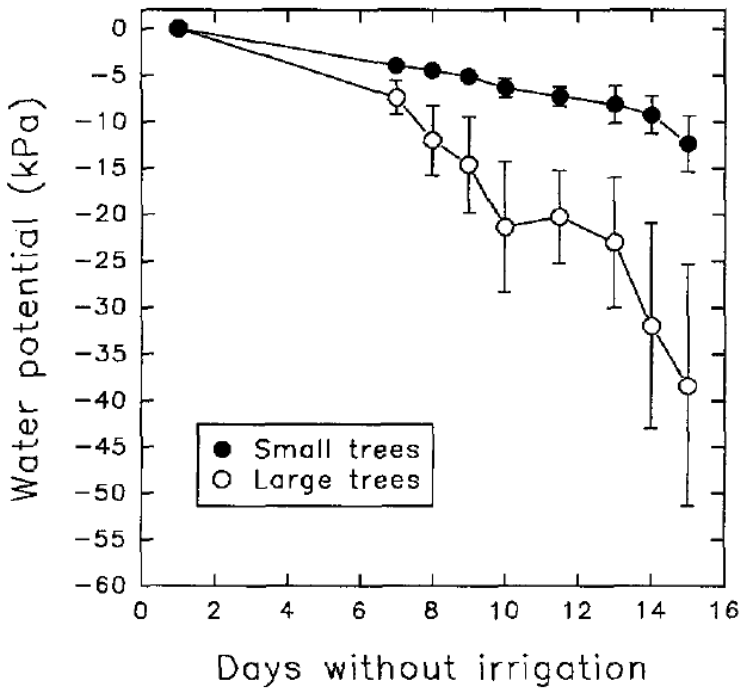

Disease progression

- Small trees with few roots support many sting nematodes
- Large trees with many roots support few sting nematode
- Soil moister beneath small trees, favoring the nematode

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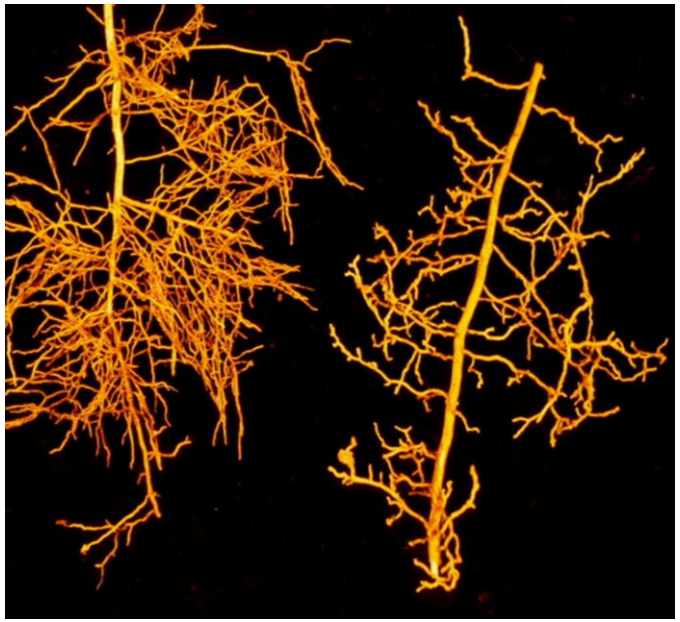

Summary

- 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.
- Root damage very apparent. 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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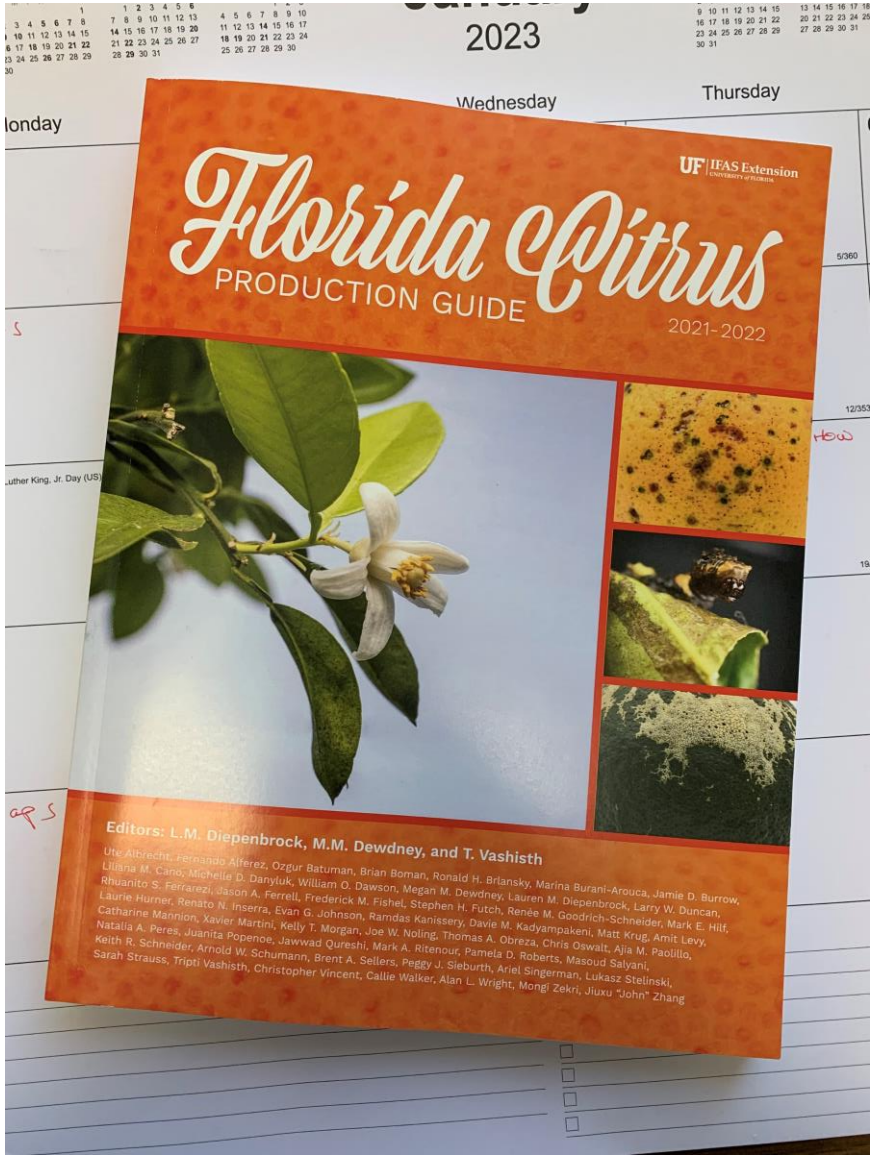
Nematode IPM
(in order of importance)

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



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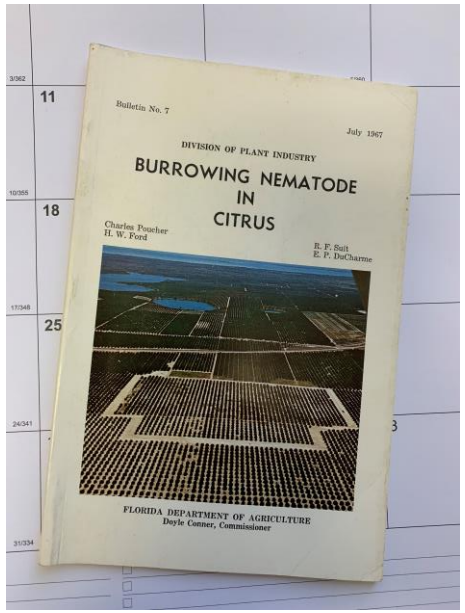
Sting nematode IPM

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

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

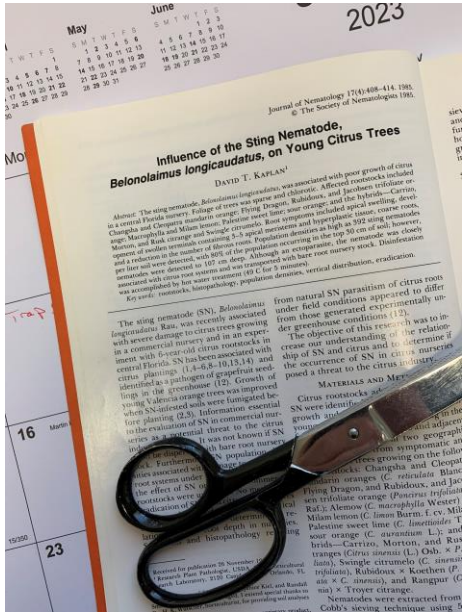


Sting nematode IPM

- 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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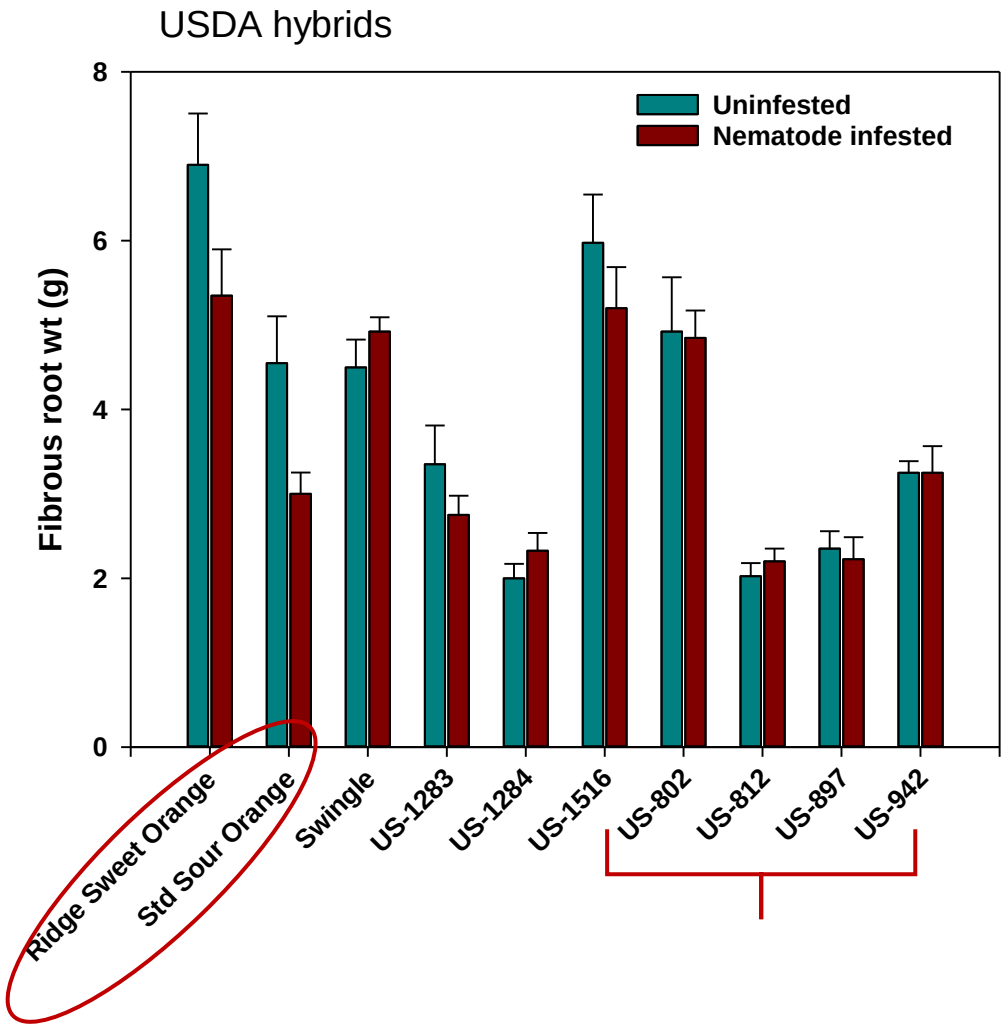
Rootstock tolerance

- CRDF trials with newer and experimental UF and USDA rootstocks are ongoing



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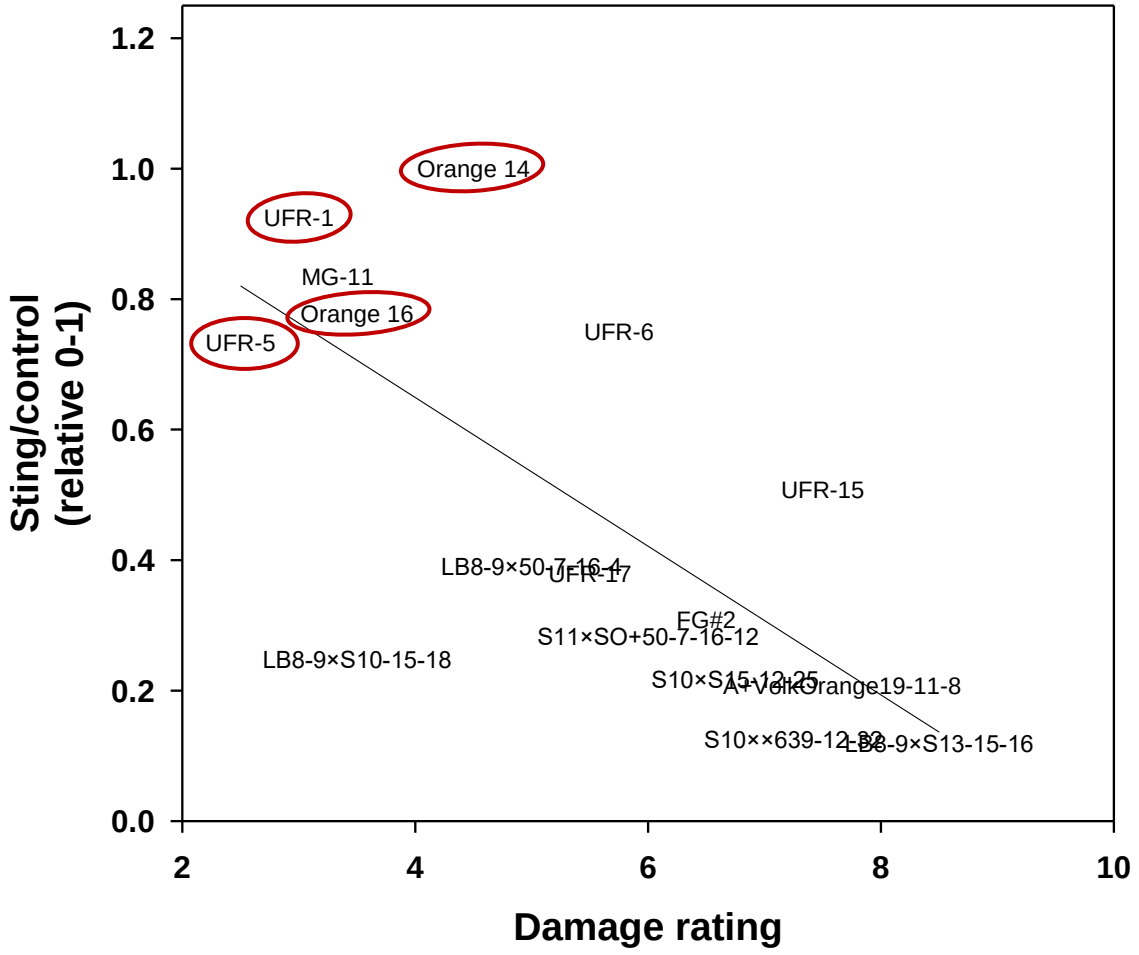

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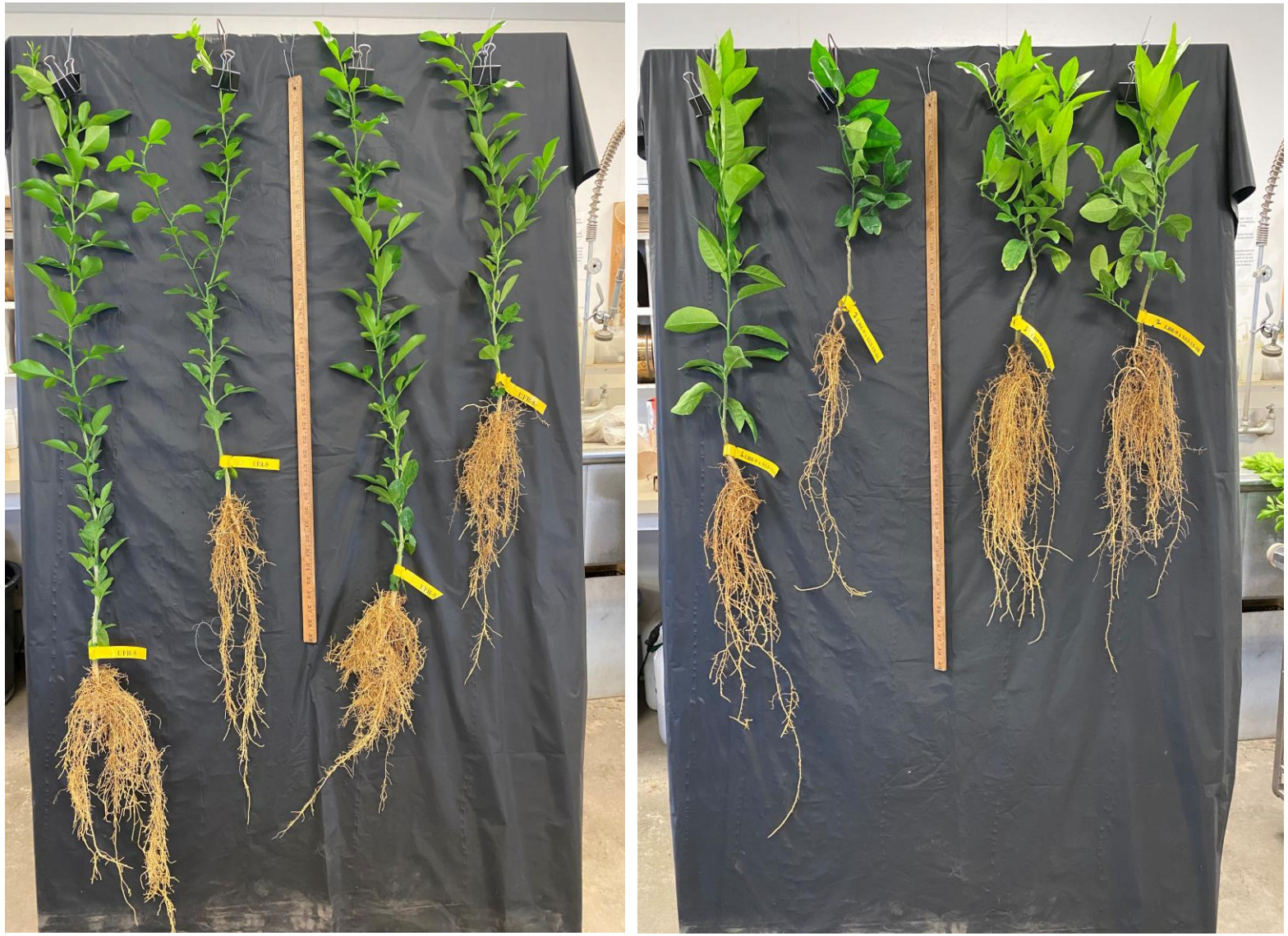
Rootstock tolerance

- To date some lines appear more tolerant (left) than others (right)
- Validation trials of best lines vs conventional lines in greenhouse
- Sting nematode resistance trials in greenhouse
- Performance of new rootstocks in CRAFT trials and commercial groves.

+ nematode - nematode + nematode - nematode



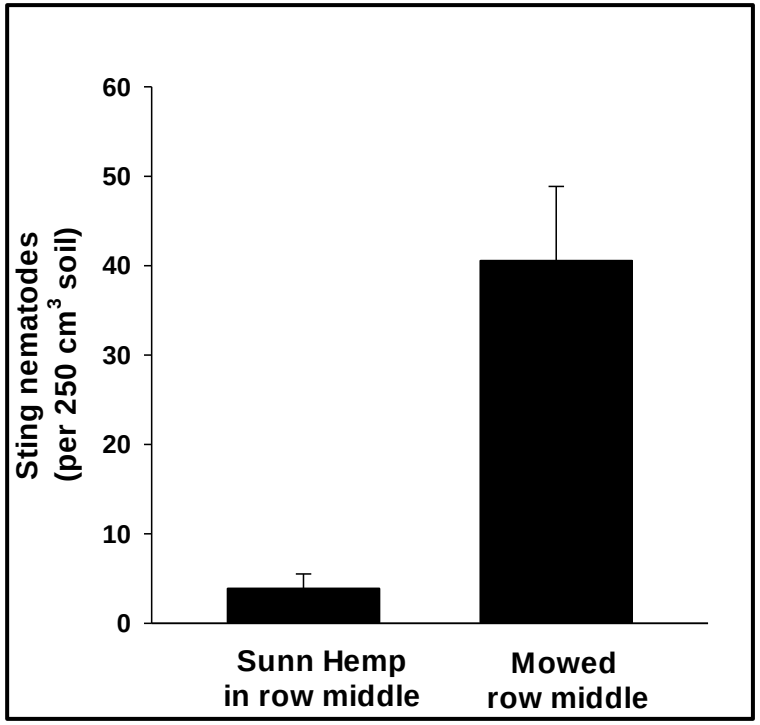
Sting nematode IPM

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

Cultural practices

Non-host cover crops

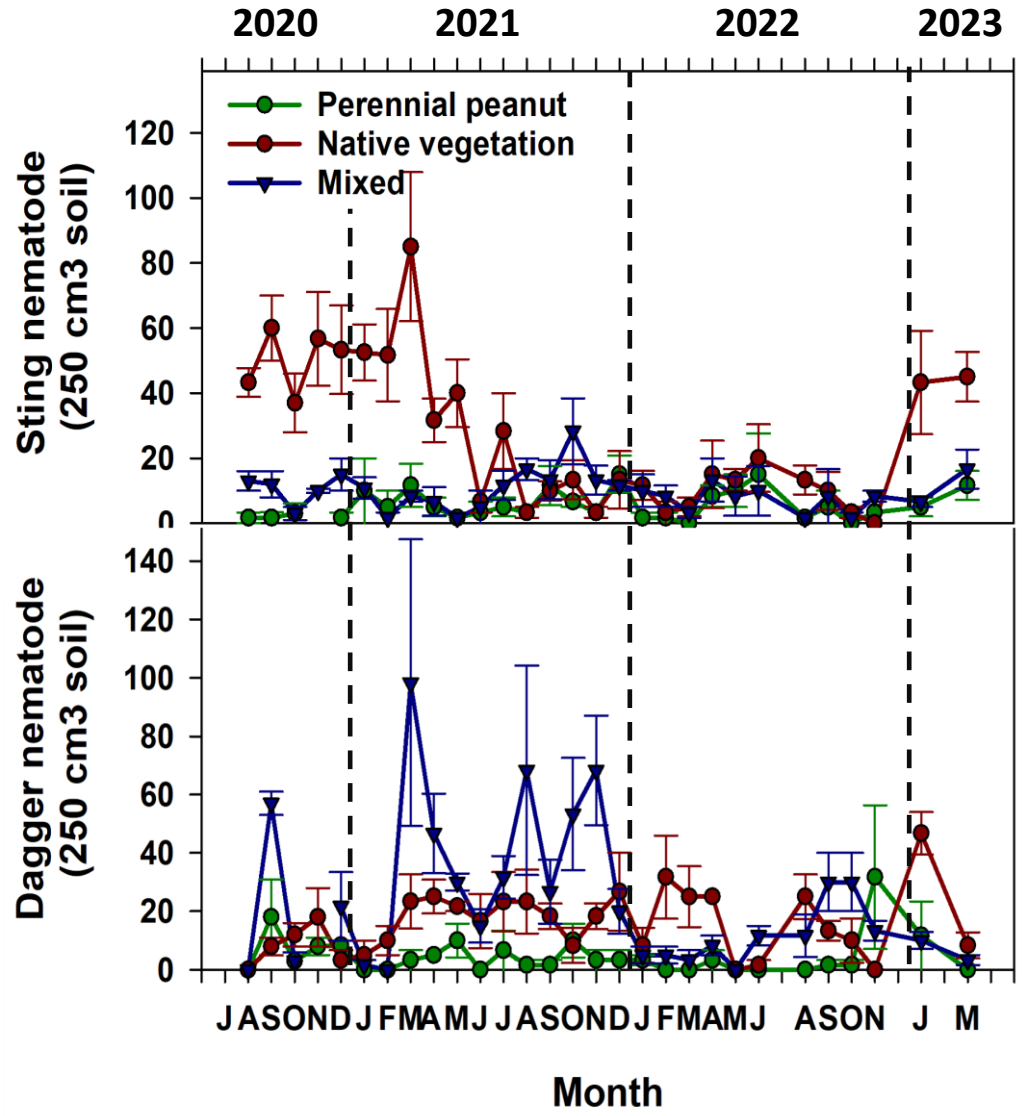
- Sunn hemp (*Crotalaria juncea*) can suppress sting nematode prior to planting.
- Not practical for row middle management.
- Excellent green manure.



Cultural practices

Non-host cover crops

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



Sting nematode IPM

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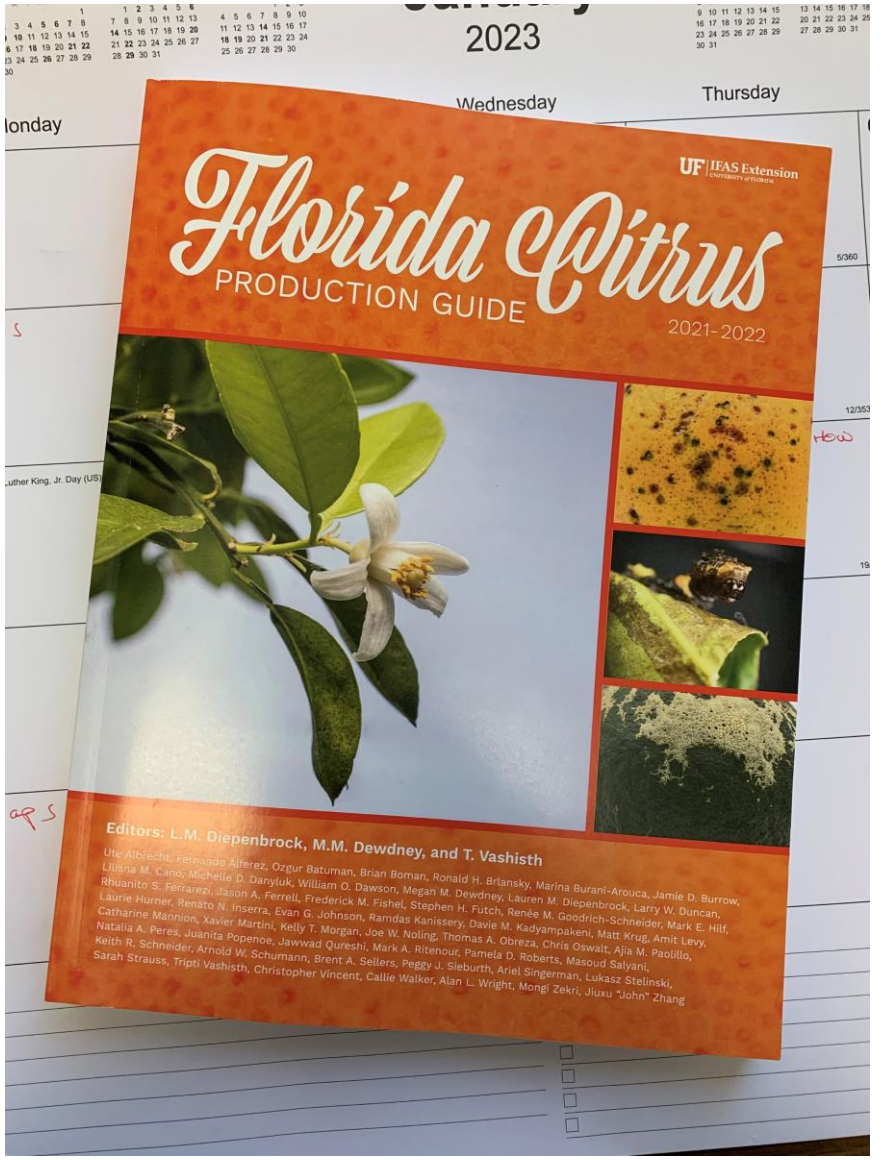
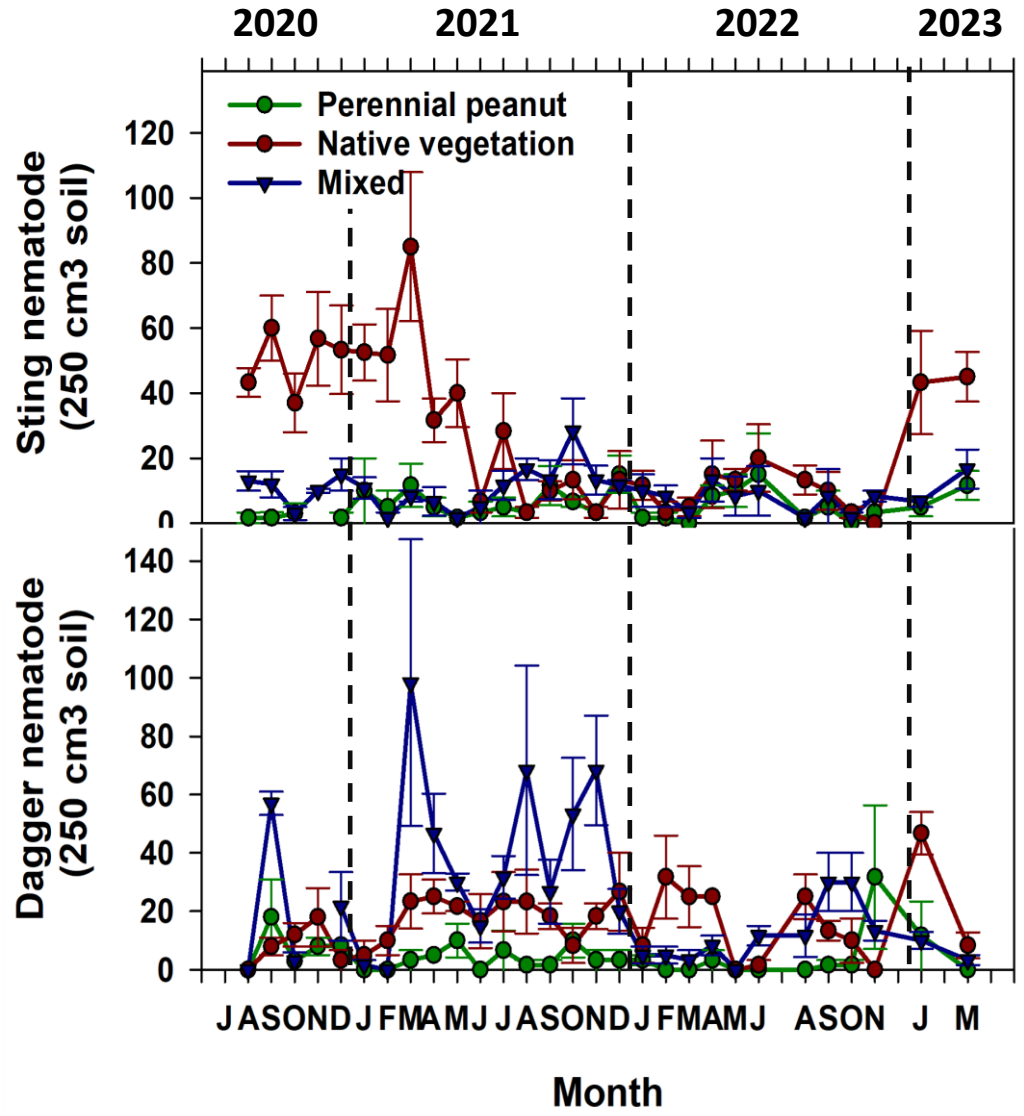


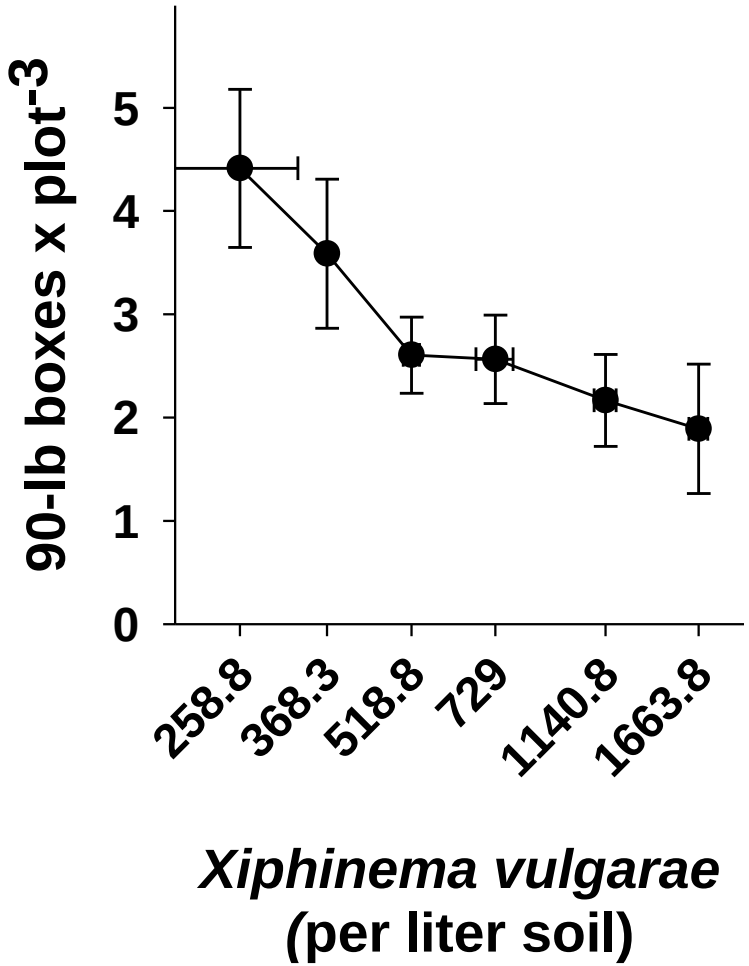
Monitoring

- Necessary for rational decisions
- Seasonality not evident
- Ectoparasites are the only species with unambiguous symptoms on citrus.



Monitoring

- Necessary for rational decisions
- Seasonality not evident
- Ectoparasites are the only species with unambiguous symptoms on citrus.
- Sting nematode populations resurge following nematicide use. Repeated applications required (spring and fall).



New nematicide chemistries

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 of the citrus nematode

Recently registered products have new modes of action that are highly toxic to nematodes, but less toxic to mammals and birds by several orders of magnitude than existing carbamate products.

- ✓ Vydate® L (*oxamyl; AChEI MOA; LD_{50} 5.4*)
- ✓ Nimitz® (*fluensulfone; Unknown MOA; LD_{50} 671*)
- ✓ Salibro™ (*fluazaindolizine; Unknown MOA; LD_{50} TBD*)
- ✓ Velum® Prime (*fluopyram; SDI MOA; LD_{50} >2000*)

Potential to rotate in order to avoid accelerated microbial degradation.

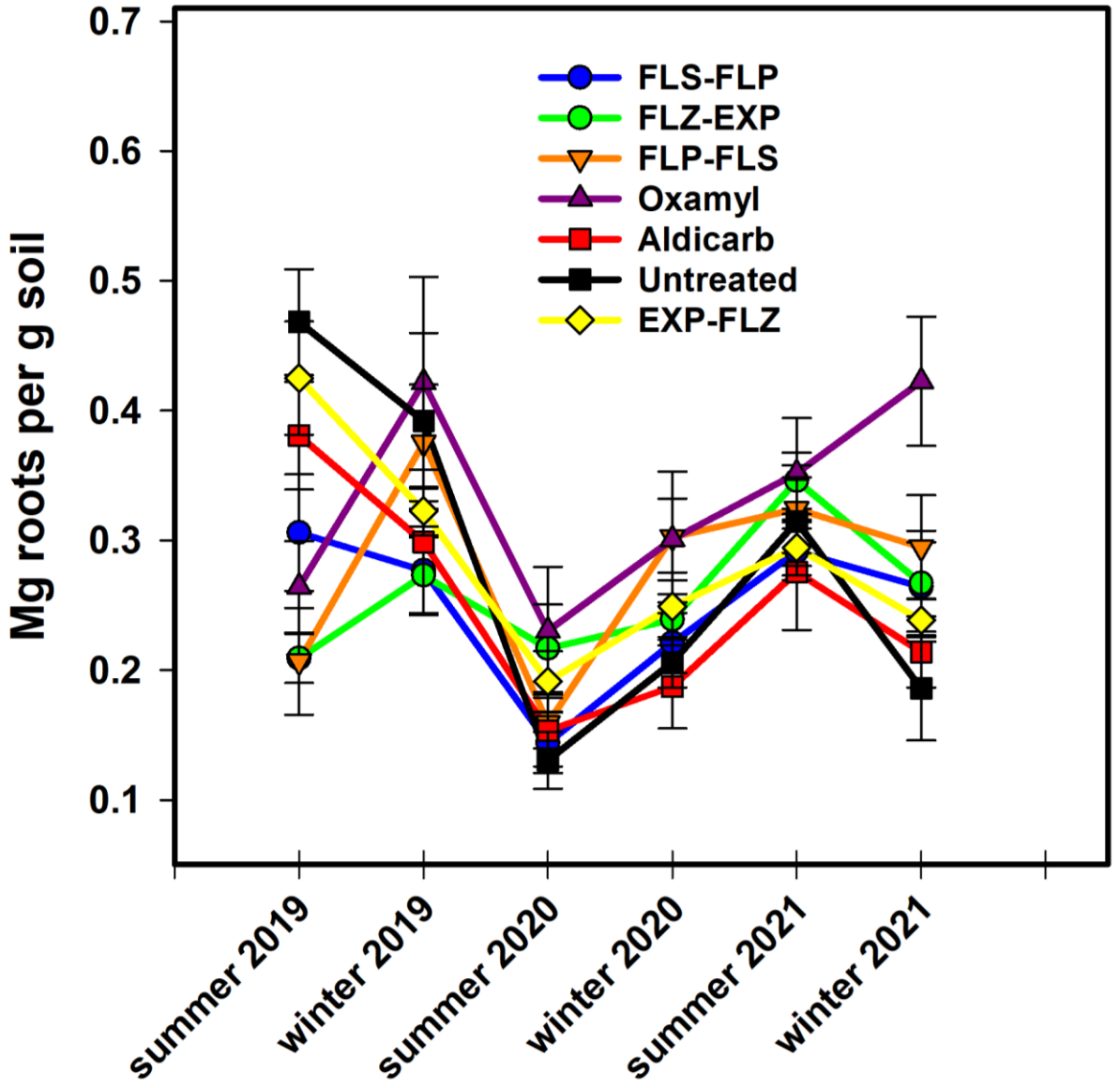
New chemistries are also much less soluble than organophosphate or carbamate nematicides, thus posing less risk to groundwater.

All nematicides are expensive and pose some environmental risk.

Sampling is the basis of rational IPM!

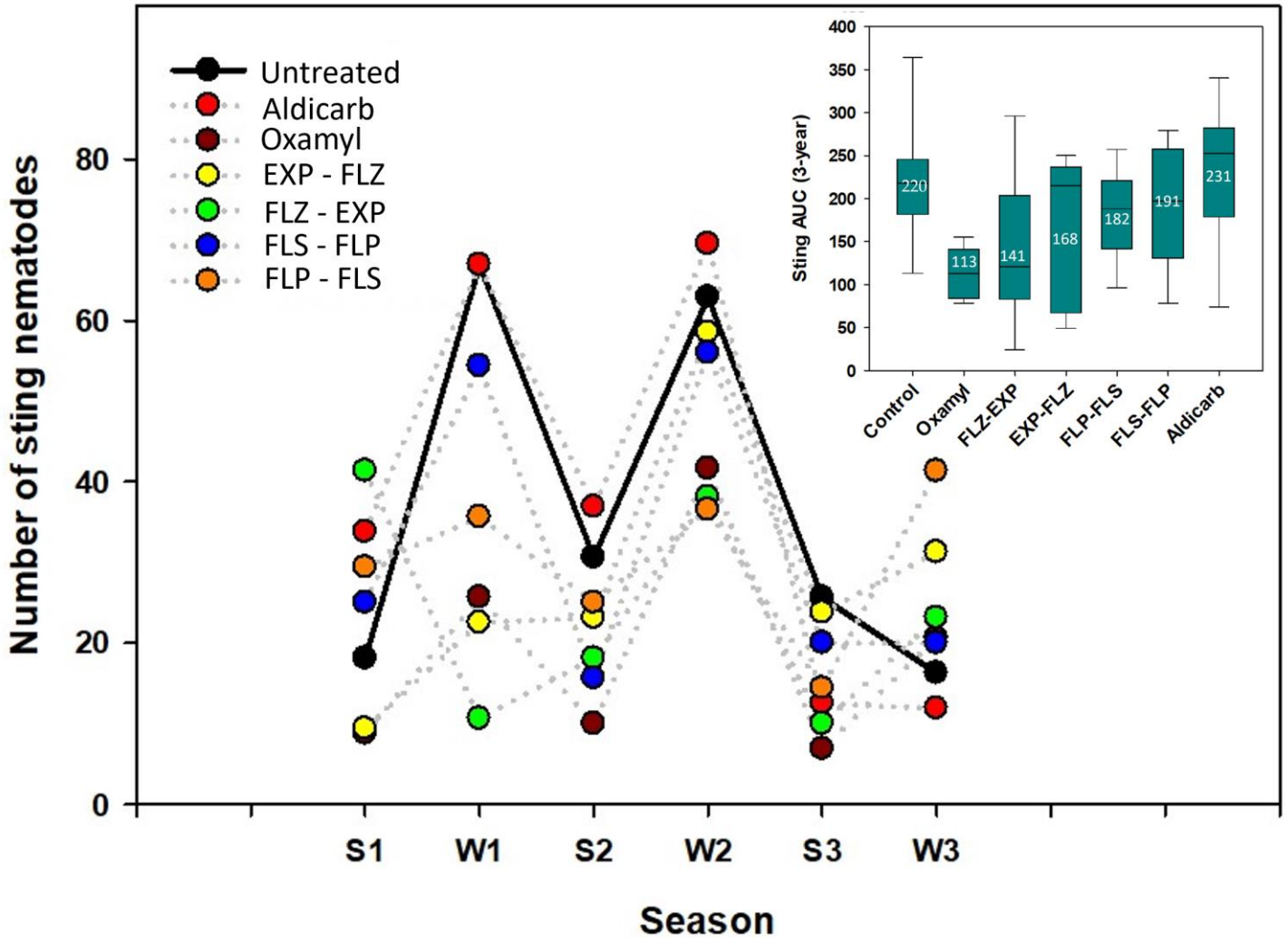
Chemical management

- 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.



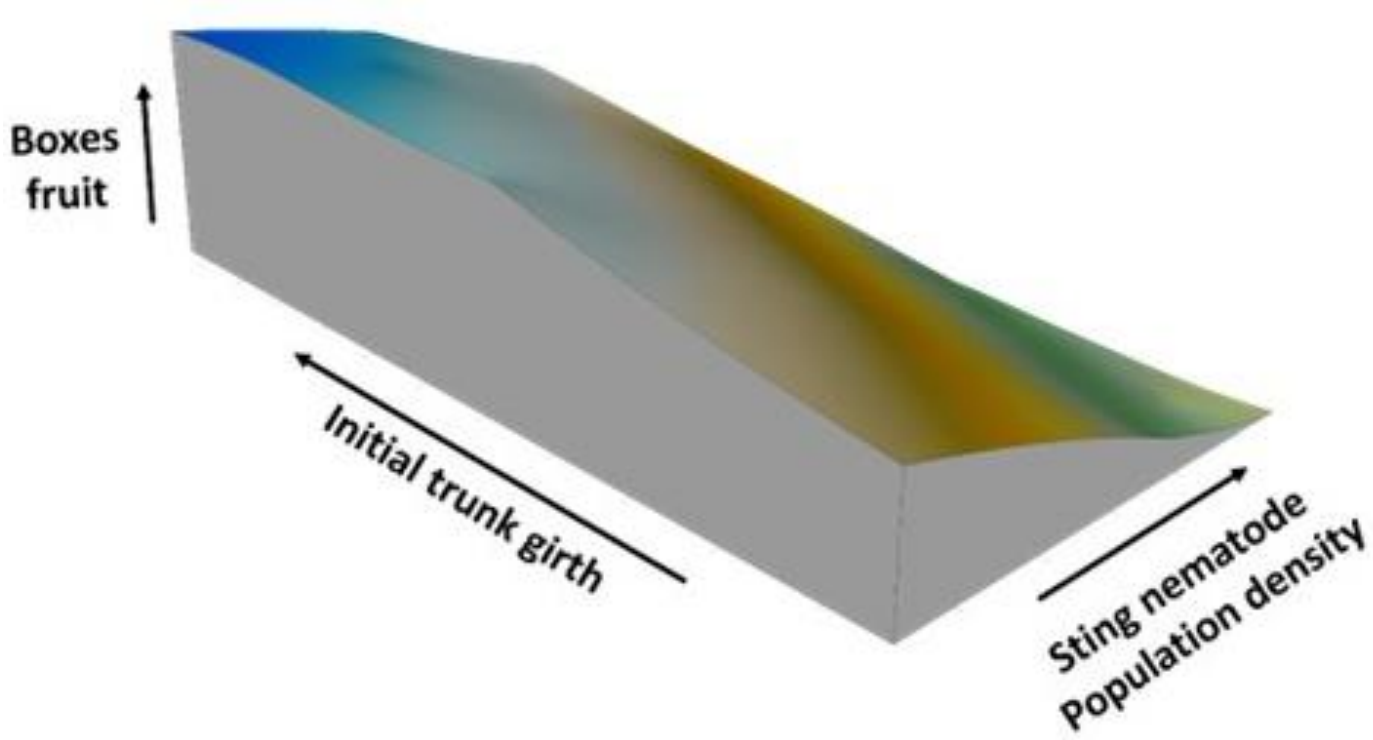
Chemical management

- 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.



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
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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!