Nematodes: Biology and Control

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AGRICULTURE

What are Nematodes?

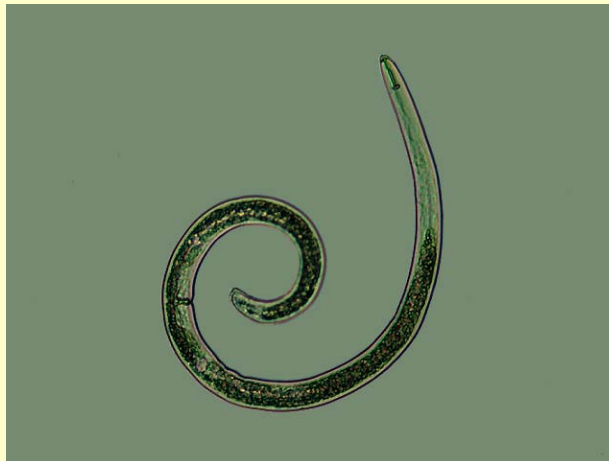Nematodes are non-segmented roundworms

They are animals

They have their own Phylum (a VERY broad taxonomic grouping)

More than 20,000 species of nematodes

Only 10% - 20% of nematode species parasitize plants

Most crops have only a few nematode parasites of economic importance

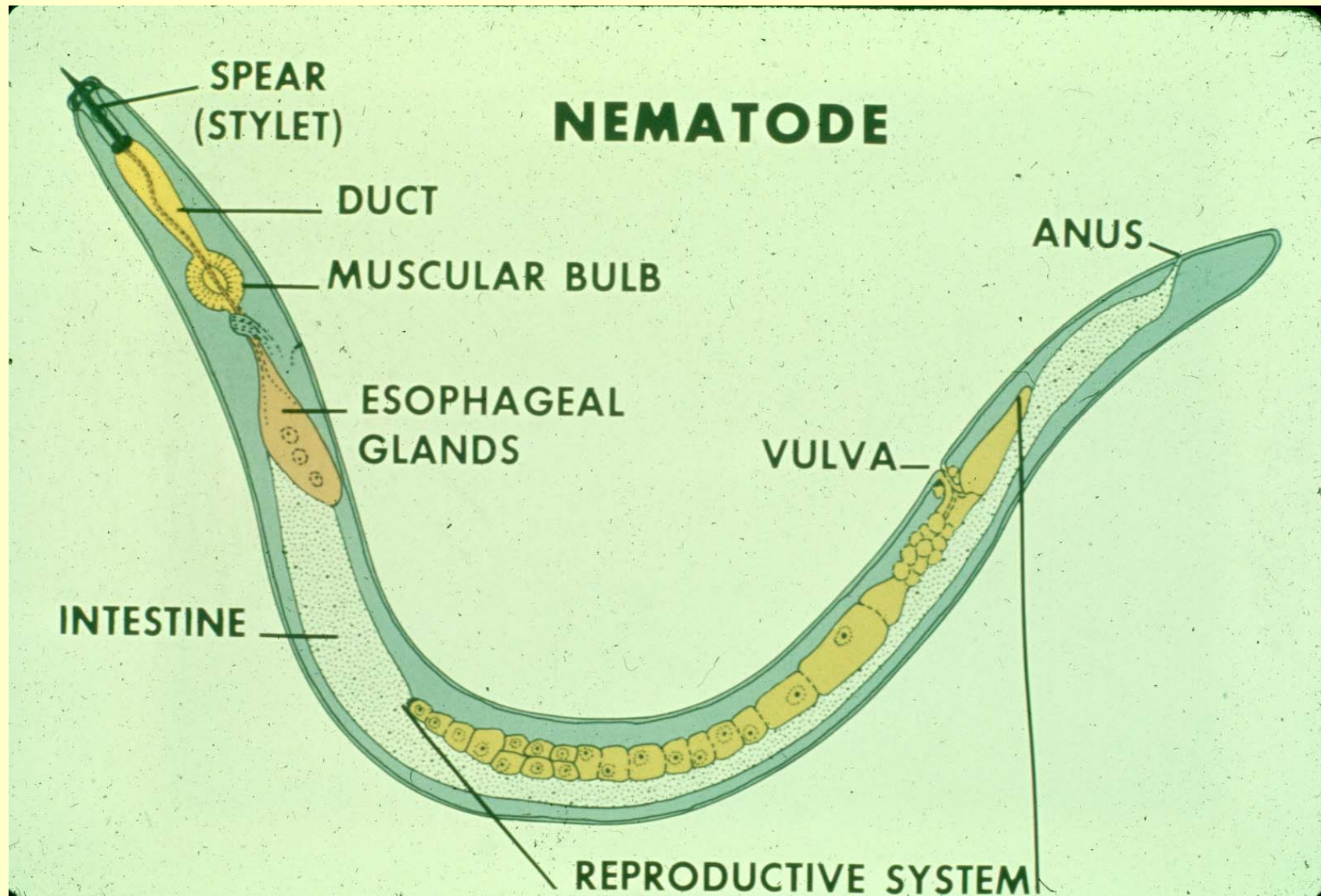# Plant-Parasitic Nematodes are a Relatively New Discovery
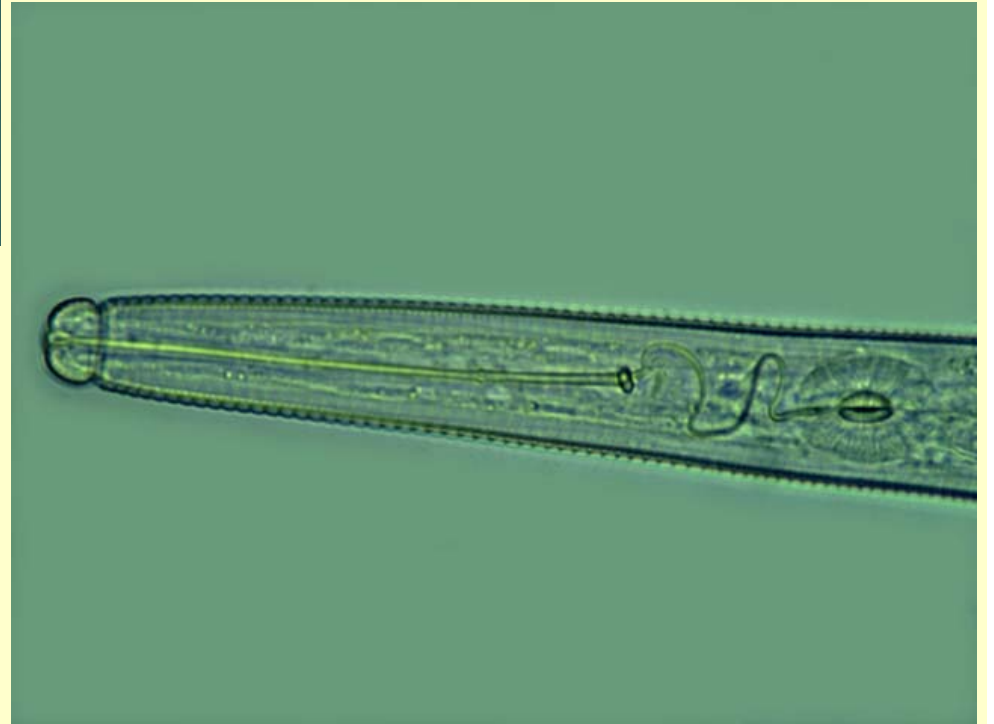
The first report was 1743

The study of nematodes really started between 1850 and 1900

The first nematology class was in 1948

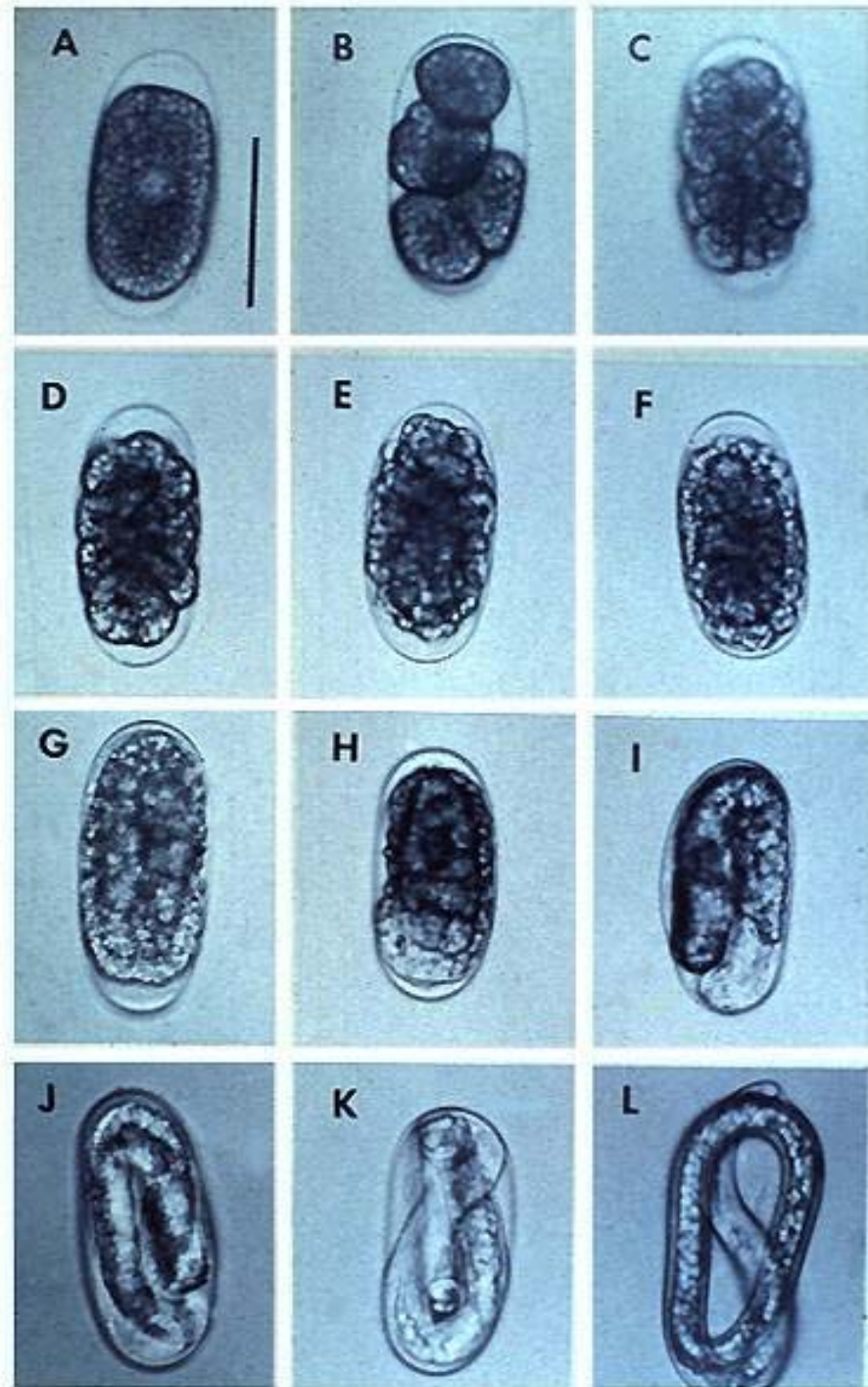The first chemical control methods were in the 1940s (fumigants)

NEMATODE

SPEAR (STYLET)

DUCT

MUSCULAR BULB

ESOPHAGEAL GLANDS
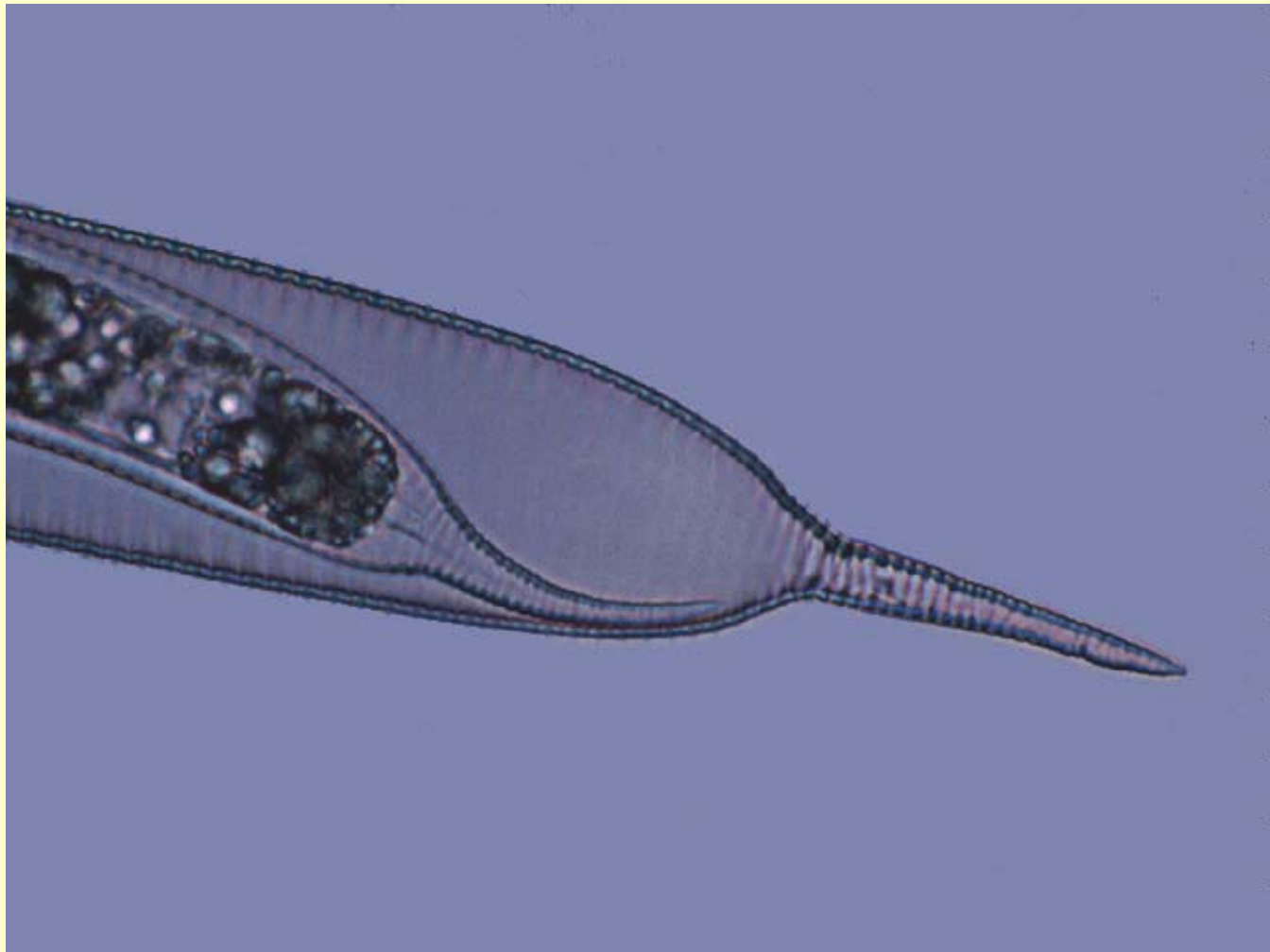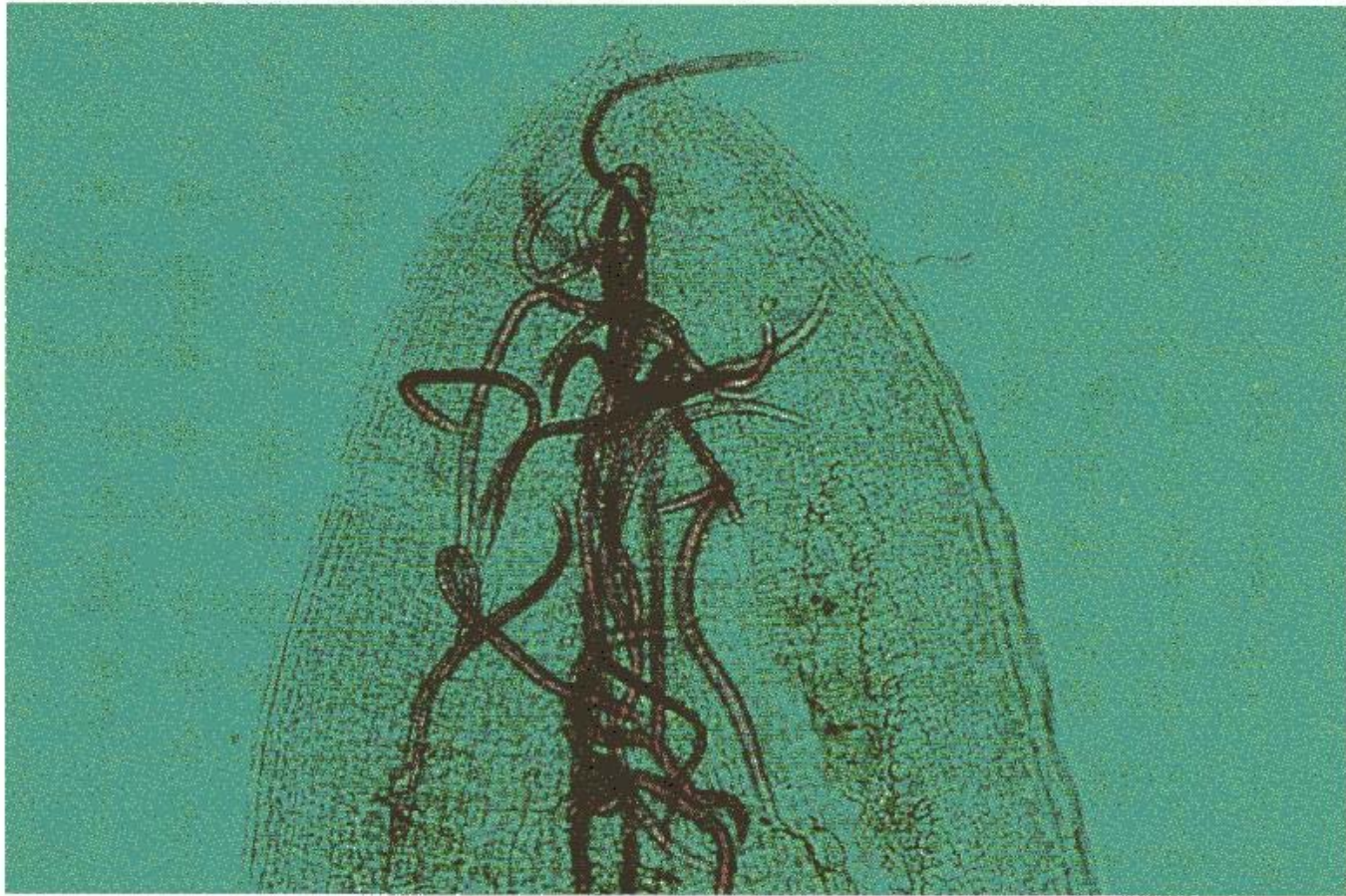
ANUS

VULVA

INTESTINE

REPRODUCTIVE SYSTEM

Nematodes Lay Eggs

Often useful to think of nematodes as being biologically similar to insects

Nematodes go through several molts

Endoparasites: root-knot nematodes

cyst nematodes

lesion nematodes

Ectoparasites:

most plant parasitic nematodes

Types of Damage

Physical damage to the roots:

>> damaged root tips

>> prolific branching

>> poorly formed tap root

>> disrupt root morphology

Metabolic sink – plant energy directed to feeding the nematode instead of growing the plant

>> Mostly a problem with endoparasites

Symptoms

Yellowing

Stunting

Deformed roots

Poor growth

Poor response to fertilizer and irrigation
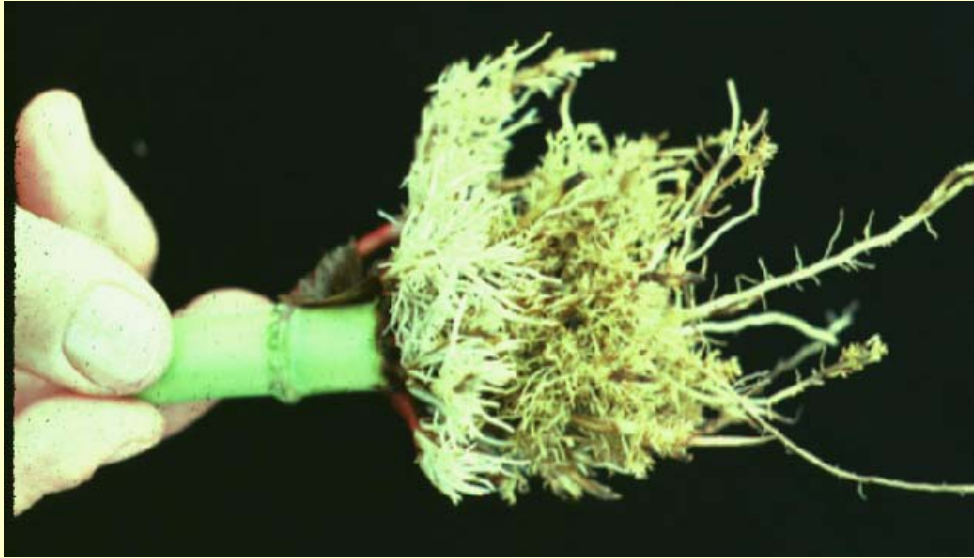
Generic Responses to Poor Root Function

Yellowing may
be dramatic
or subtle

Nematode distribution is rarely uniform, so damage occurs in patches

Stunted roots may also exhibit excessive branching

Tap roots may be abnormal or fail to develop if they are damaged in the seedling stage

Poor response to fertilizer and irrigation is a direct result of a poorly functioning root system

Some nematodes may have a synergistic interaction with other pathogens

Which nematodes have been shown to damage southern pines?

Pinus taeda – loblolly pine

Pinus elliottii – slash pine

Pinus palustris – longleaf pine

Pinus taeda – Loblolly pine

1. *Meloidogyne megatyla* – root-knot nematode
2. *Meloidogyne floridensis* – root-knot nematode
3. *Meloidodera floridensis* – false root-knot nematode
4. *Trophotylenchus floridensis*
5. *Radophilis similis* – burrowing nematode
6. *Hemicycliophora vidua* – sheath nematode
7. *Paratrichodorus minor* - stubby root nematode
8. *Hoplolaimus galeatus* – lance nematode
9. *Pratylenchus brachyurus* – lesion nematode

Pinus taeda – Loblolly pine

10. *Gacilicus crenata*

11. *Criconemella xenoplax* – ring nematode

12. *Helicotylenchus dihystera* – spiral nematode

13. *Tylenchorhynchus claytoni* – stunt nematode

14. *Bursaphelenchus xilophilus* – pine wilt nematode

15. *Longidorus* sp. – needle nematode

Pinus elliottii – Slash pine

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Pinus palustris – Longleaf pine

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How do you determine if you have a nematode problem?

Observe symptoms and determine that the cause is nematodes (diagnostic sample)

Sample the current crop to determine if a nematode problem will damage the next crop (predictive sample)
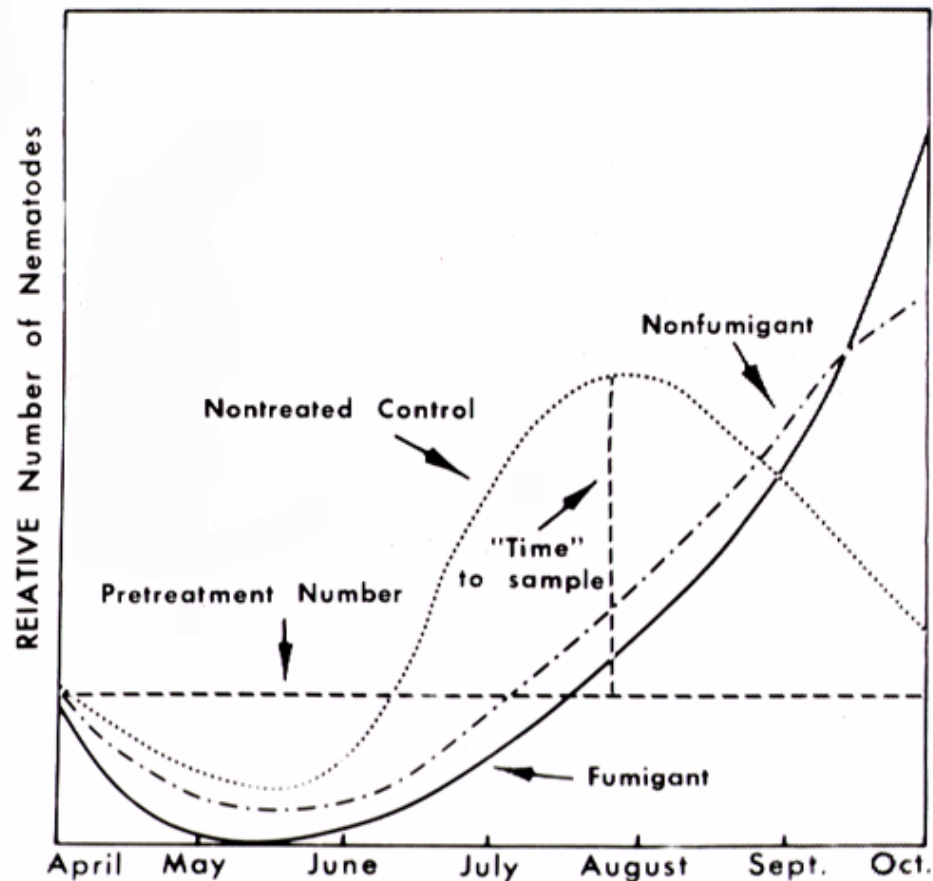
Either way, you have to sample

When do you sample?

Sample when soil temperatures are above 65F.

Sample actively growing plants.

Do <u>NOT</u> sample dry soil.

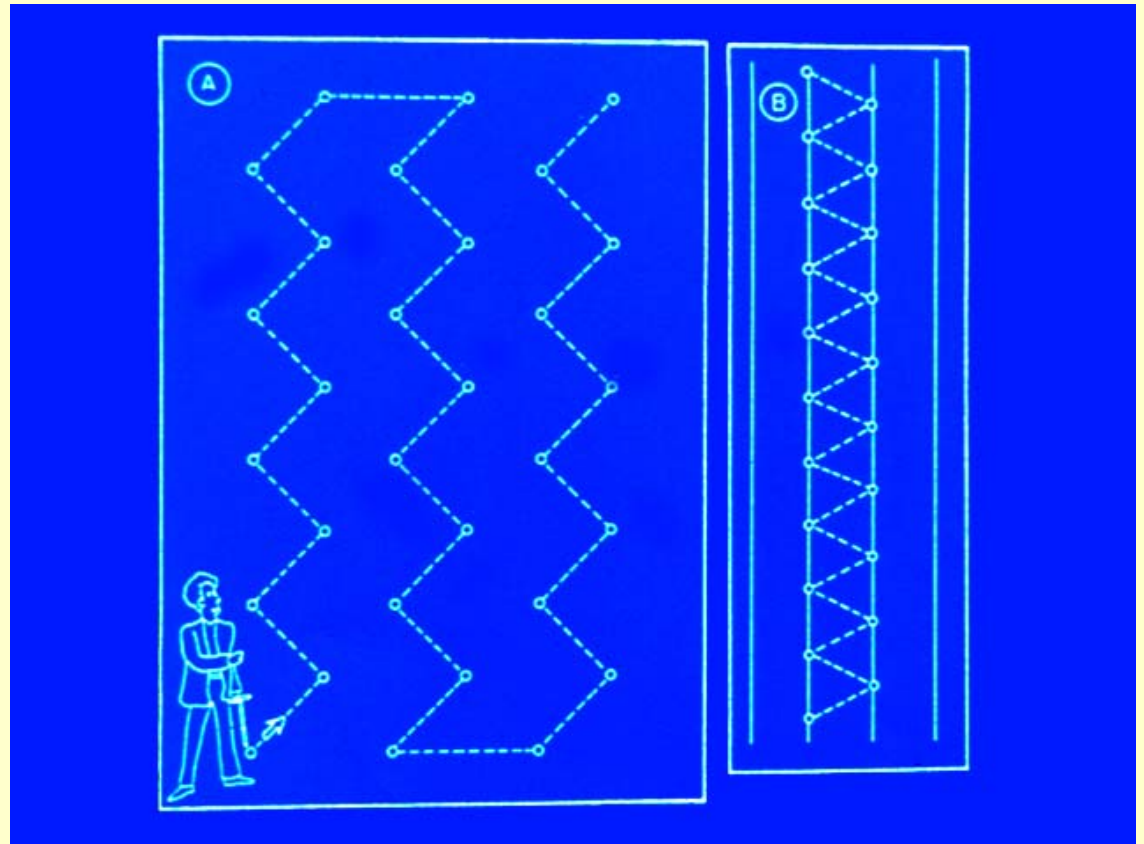Soil sampling for nematodes is not as precise as we would like.

Where do you sample?

Sample must be representative of the area.

Smaller areas can be sampled more accurately.

Sample in the root zone only.

Sampling fallow soil may not be meaningful.

Samples need to be handled correctly

Do <u>NOT</u> let samples get too hot

      Keep samples out of the sun

      Do <u>NOT</u> leave them in your truck

Do <u>NOT</u> let samples get dry

      Seal inside plastic bags

Deliver to lab quickly (ship early in the week)

Where do you send samples?

Most states have extension service nematology labs run by the Land-Grant University

Most states also have private labs that can run nematode samples. Some private consulting companies are regional with labs that serve multiple states.

County Extension Agents or other agricultural professionals can usually point you in the right direction

Once problem areas are identified, assume that they will continue to be problem areas in the future

Nematode problems do not go away!

Management Options

Fallow/crop rotation – can be effective, but it can take a long time (several years)

> More effective with some nematodes than others (*Longidorus*)
>
> You <u>MUST</u> control weeds

Chemical control:

> If anything worked as well as methyl bromide for the same cost, we would already be using it

In vegetable production, a combination of chemicals has shown promise to be nearly as effective as methyl bromide against a very wide variety of pests

Very high rates of 1,3-dichloropropene (Telone) with chloropicrin plus metam sodium (Vapam)

Problem: Can require a long pre-plant interval

Fumigant Diffusion Pattern
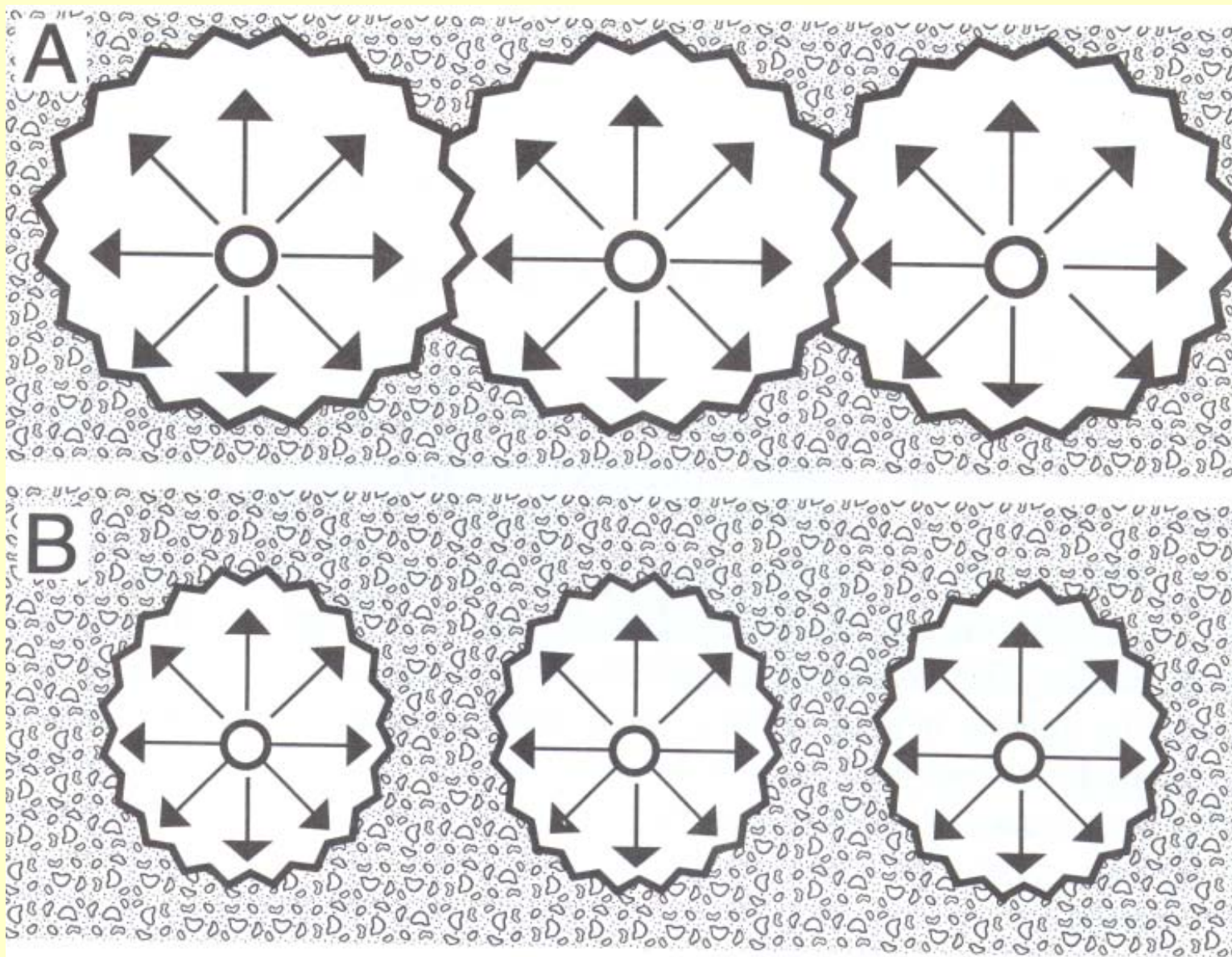
Summary

Nematode problems on pine seedlings are probably pretty uncommon in most areas

Sample for nematodes if you notice growth problems and there is no other obvious cause

Collect a random soil sample from the root zone

Handle the sample correctly (protect from heat and drying)