

Introduction to Plant Parasitic Nematodes and Their Management

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Nematodes

- Phylum Nematoda
- Roundworms
- Microbial Feeders
 - (90% plus)
- Animal Parasitic
- Human Parasitic
- Insect Parasitic
- Plant Parasitic

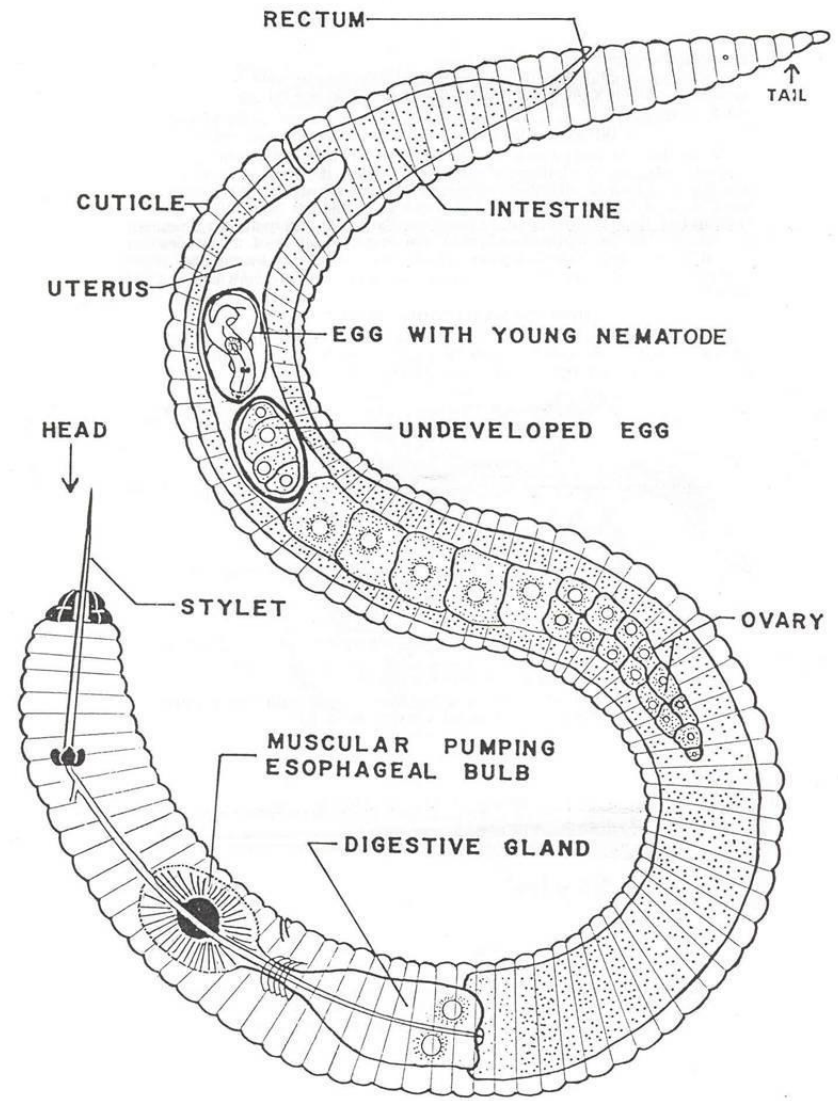
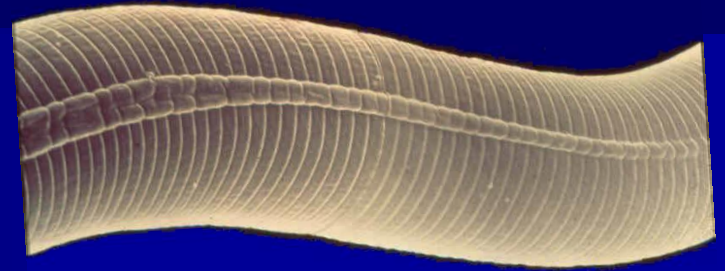


FIGURE 1.— PLANT DESTRUCTIVE NEMATODE

Interesting Facts

- Most numerous animal
- Second most numerous species
- Size: mostly microscopic
- Longest is 26 feet (in Blue whale)
- Simple morphology
- No circulatory system
- No respiratory system
- No skeleton



Examples of Non-Plant-Parasitic Nematodes

- Animal Parasites



Canine heart worms,
Ascaris

- Human Parasites



pinworms,
hookworms

- Insect Parasites

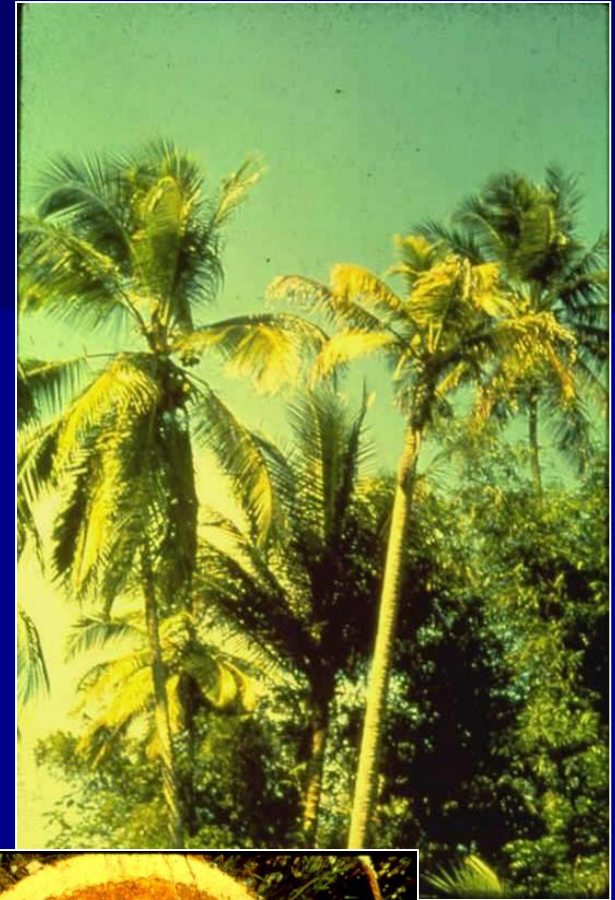


mosquitoes, mole
crickets, citrus weevils



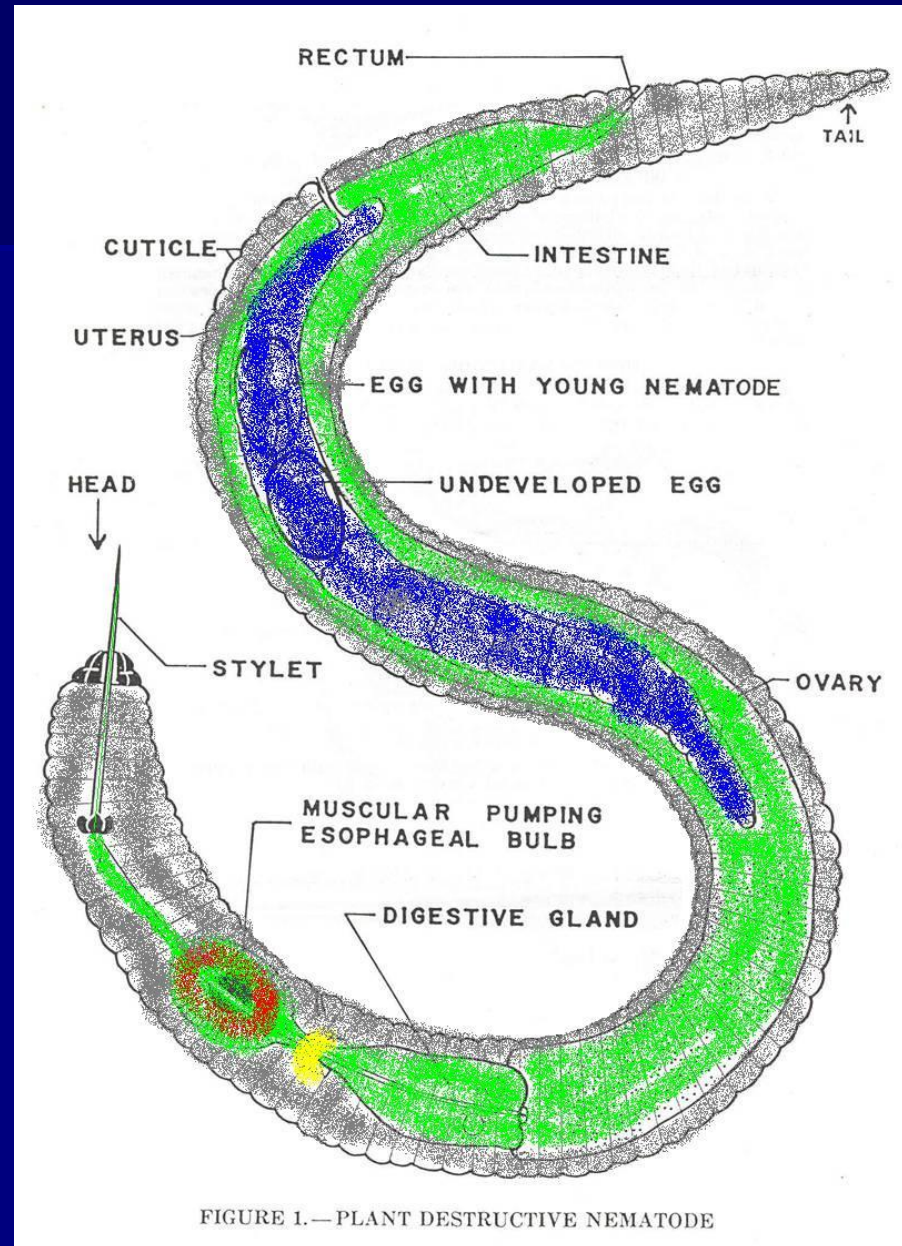
Plant-Parasitic Nematodes

- Over 6000 known species
- Present in all ecological niches
- Attacks almost all plants
- Cause 10% losses to crops
- Reduces ornamental growth
- Serious turf problems
- Big problem on tree crops



Morphology

- A nematode has:
 - Digestive organs
 - Reproductive organs
 - Excretory structures
 - Muscles
 - Nerves
 - Tough skin or "Cuticle"



Plant-parasitic nematodes all have *stylets* (spears) that penetrate cells and withdraw the contents.



Nematode Names

- Plant nematodes have both **common** and **scientific** names, some of economical importance, by common name, are:

Root-knot, Sting, Stubby-root, Reniform, Lance, Ring, Lesion, Burrowing, Citrus, Spiral, and Cyst

Feeding Habits

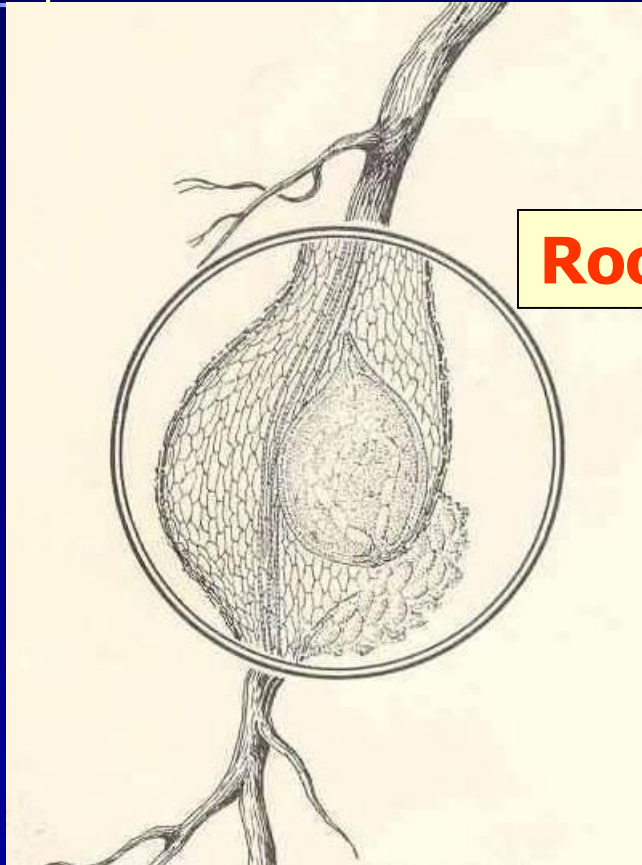
Nematodes may be grouped by feeding habit as:

- **Endoparasitic**— entire body inside the root
- **Ectoparasitic**— entire body outside the root
- **Semi-endoparasitic**- part of body inside root

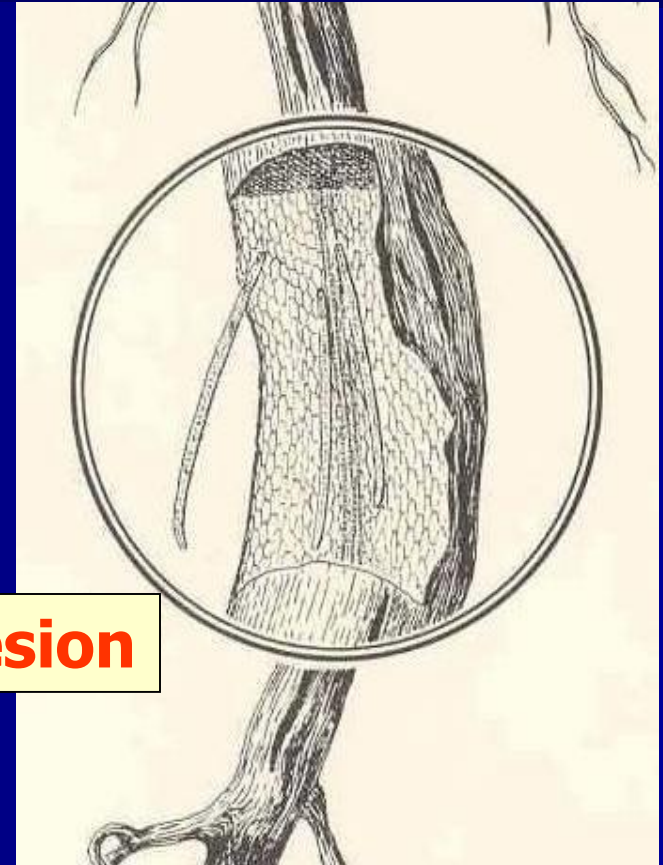
By movement when feeding, they are called:

- **Sedentary** – mostly immobile during their life
- **Migratory** – mobile for all their life.

Feeding Habits of Some Plant-parasitic Nematodes

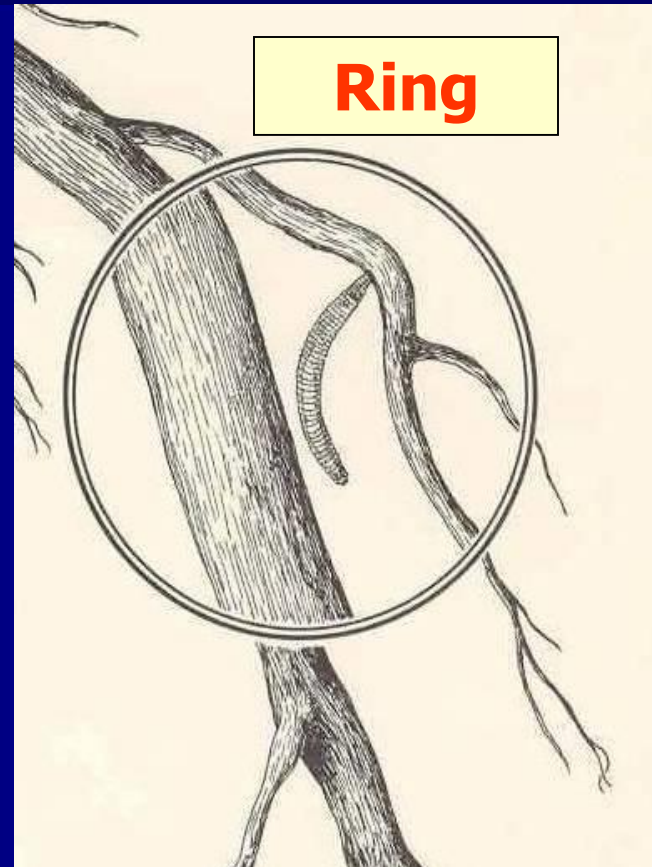
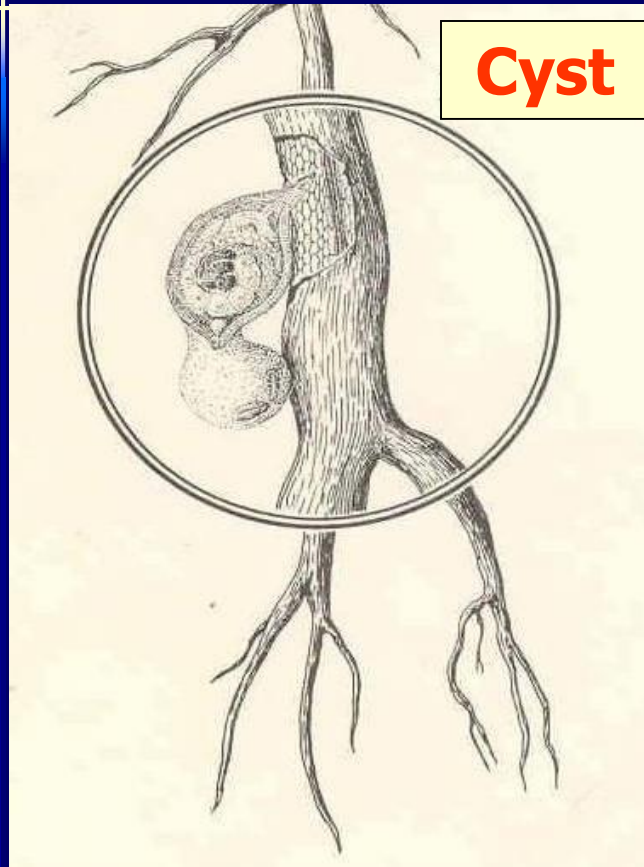


Root-knot



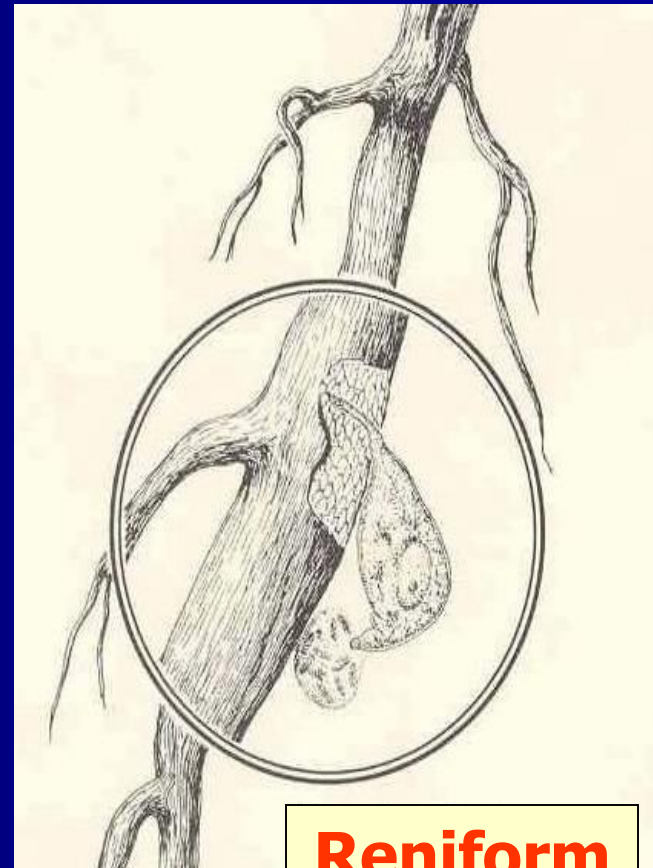
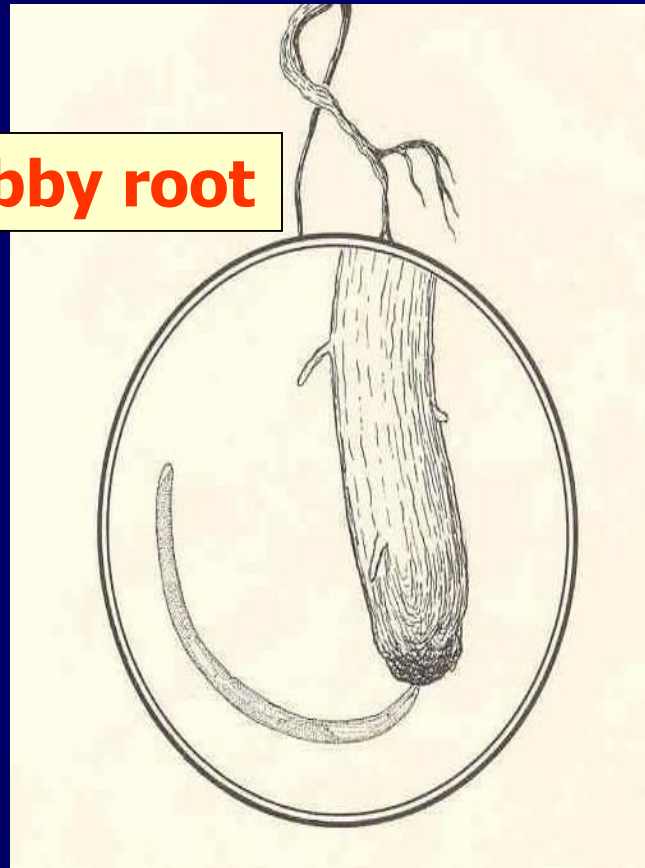
Lesion

Feeding Habits of Some Plant-parasitic Nematodes



Feeding Habits of Some Plant-parasitic Nematodes

Stubby root



Reniform

Nematode Damage

- Nematodes damage plants by reducing or modifying root mass
- Root cells are killed or modified to serve as food for the nematode
- Typical root and foliar symptoms result

Foliar Damage Symptoms

- Water and Nutrient Stress –
 - Premature Wilting
 - Leaf Yellowing (Chlorosis)
 - Plant Stunting
 - Irregular Symptom Patterns

Foliar Symptoms- Aerial View



Foliar Symptoms – Oval Pattern



Foliar Symptoms- Plant Death



Foliar Symptoms- Stunting



Foliar Symptoms- Leaf Yellowing



Foliar Symptoms- Stunting



Foliar Symptoms- Slow Decline



Foliar Symptoms- Toppling



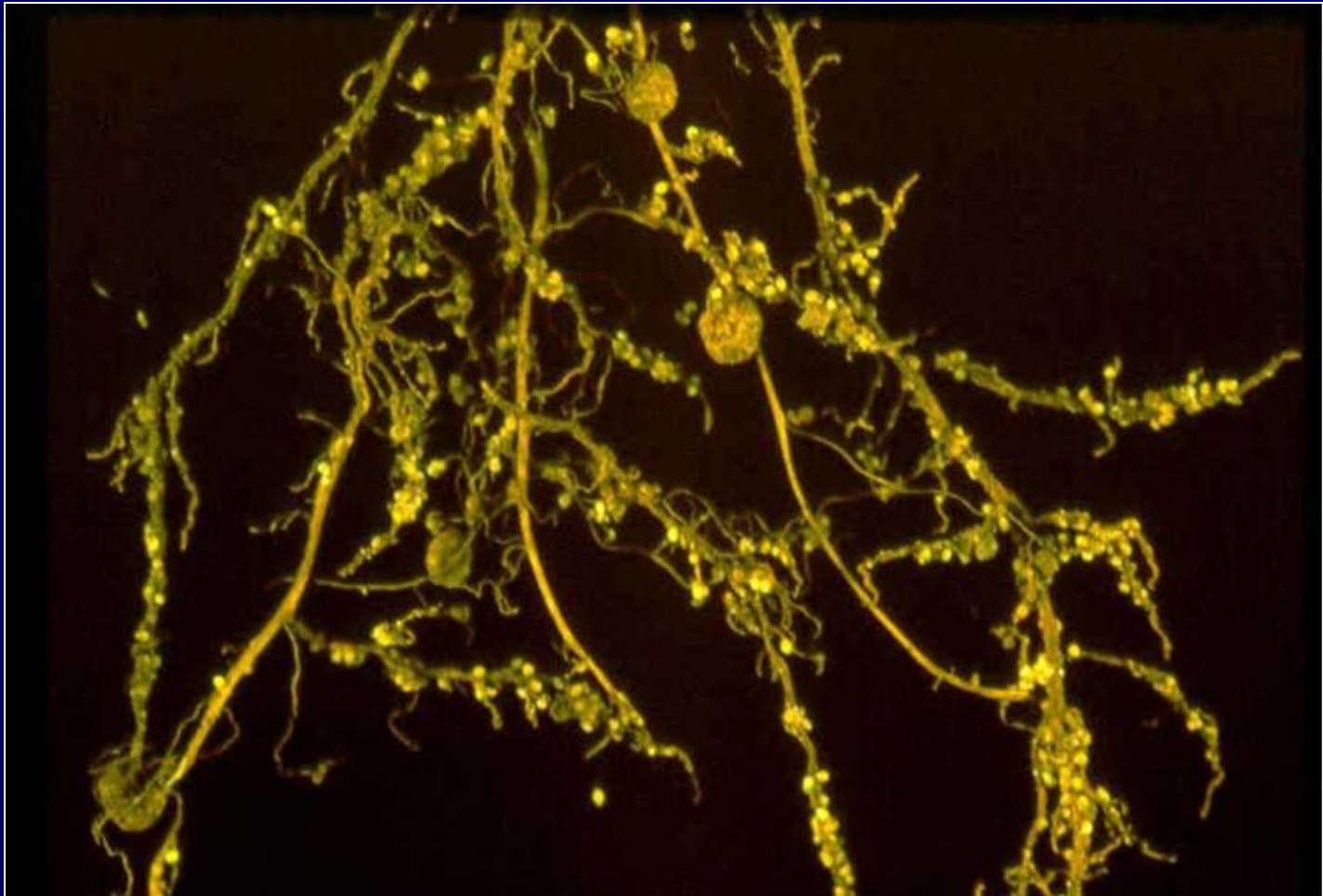
Root Damage Symptoms

- Galled Roots
- Stunted Roots
- Swollen Root Tips
- Root Lesions
- Increase in Lateral Roots

Root Symptoms- Galling



Root Symptoms- Cyst Nematodes on Roots



Root Symptoms- Peanut Pod Galling



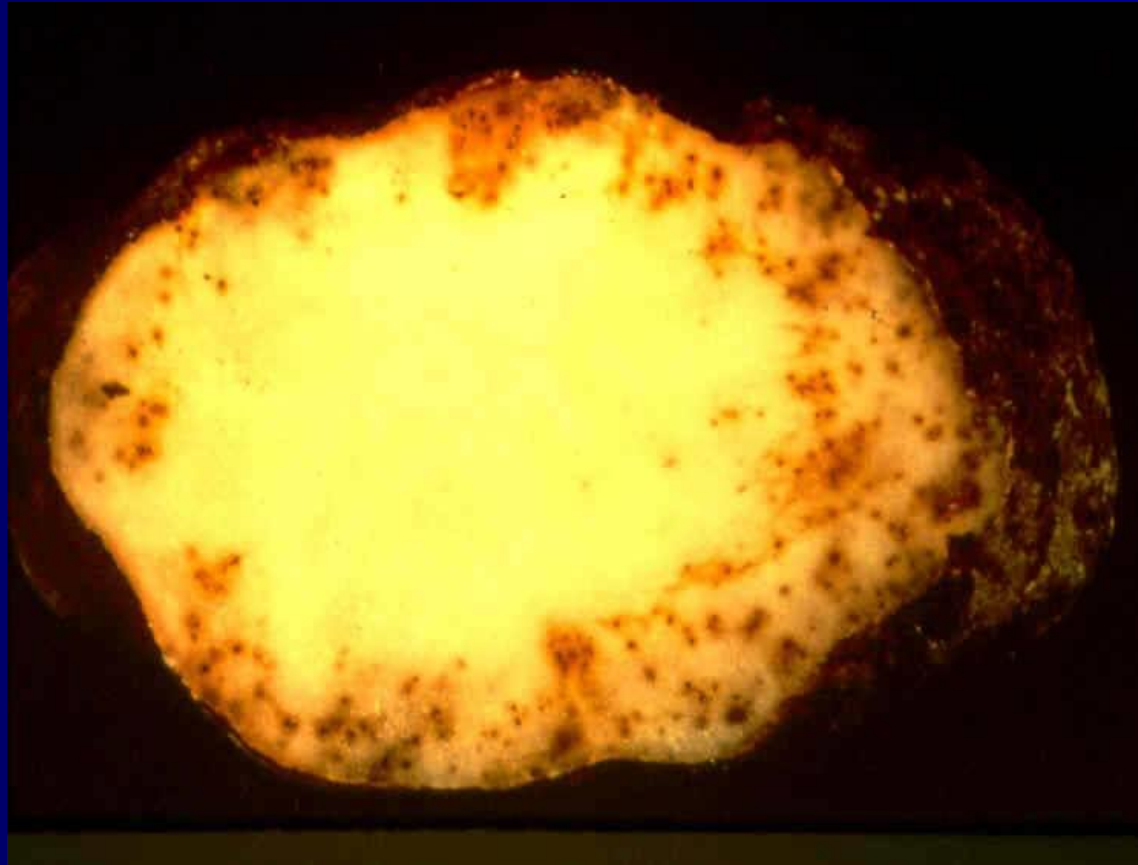
Root Symptoms- Lesions



Root Symptoms – Sweet Potatoes



Root Symptoms - Irish Potatoes



Root Symptoms- Potato Rot Nematode

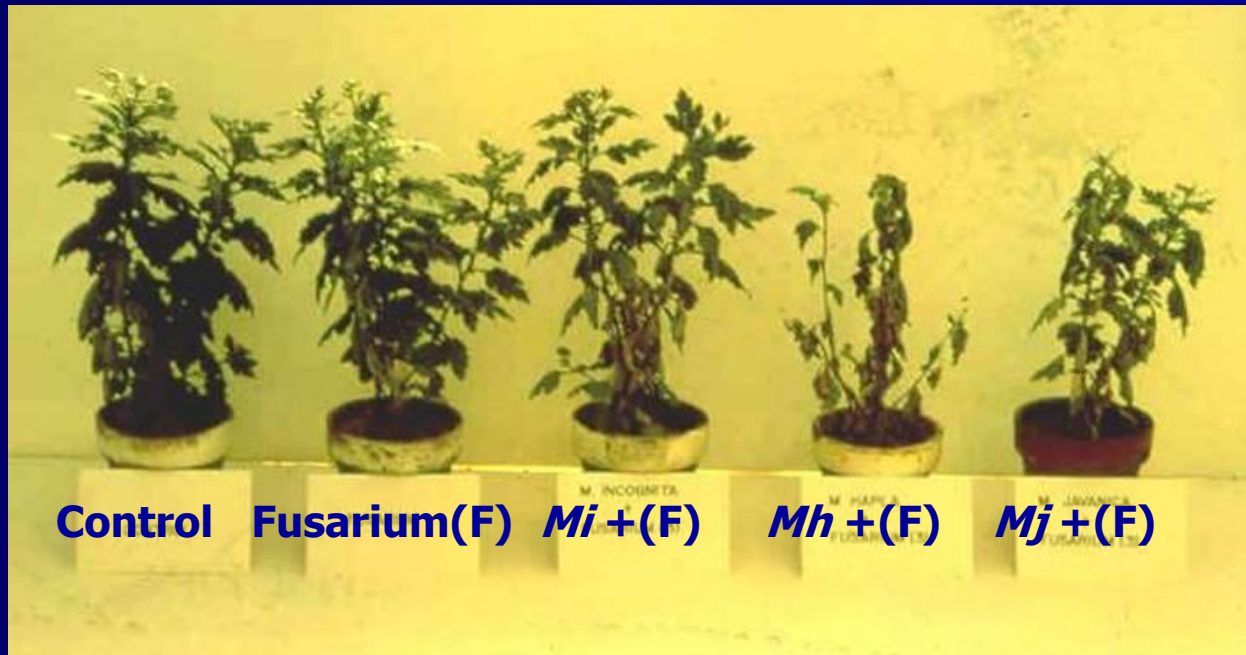


Root Symptoms- Sprangling



Disease Interactions

- Nematodes cause plant disease and can make fungal and bacterial diseases worse.



An example is Fusarium wilt where root-knot nematodes create entry points for the fungus.

Problem Identification

- Combinations of:
 - Foliar Symptoms
 - Roots Symptoms
 - Cropping History
 - Laboratory Analysis

Sampling Basics

- County Agents have kits available
- Sample 10"-12" deep; in turf 4"-6"
- Sample only in moist soils – *Not dry or wet*
- Use a plastic bag only
- Do not let the sample get too hot or cold
- Send 1 pint of soil and 1 cup of roots
- Send for extraction ASAP
- Do not allow samples to become hot or frozen, either way nematodes will be killed

Management Methods

- Exclusion
- Sanitation
- Rotation
- Plant Resistance
- Fallow
- Solarization
- Nematicides

Exclusion / Sanitation

- Buy or grow transplants that are nematode-free.
- Use nematode-free soil or potting medium
- Clean tools and equipment when changing areas or fields
- Remove infected plant roots

Rotation

- Move garden to a new location
- Rotate grasses with broadleaf plants
- Plant cover crops that are poor hosts
- Keep weeds in check, many are hosts
- Maintain high organic matter levels
- Irrigate frequently and use higher fertilizer rates

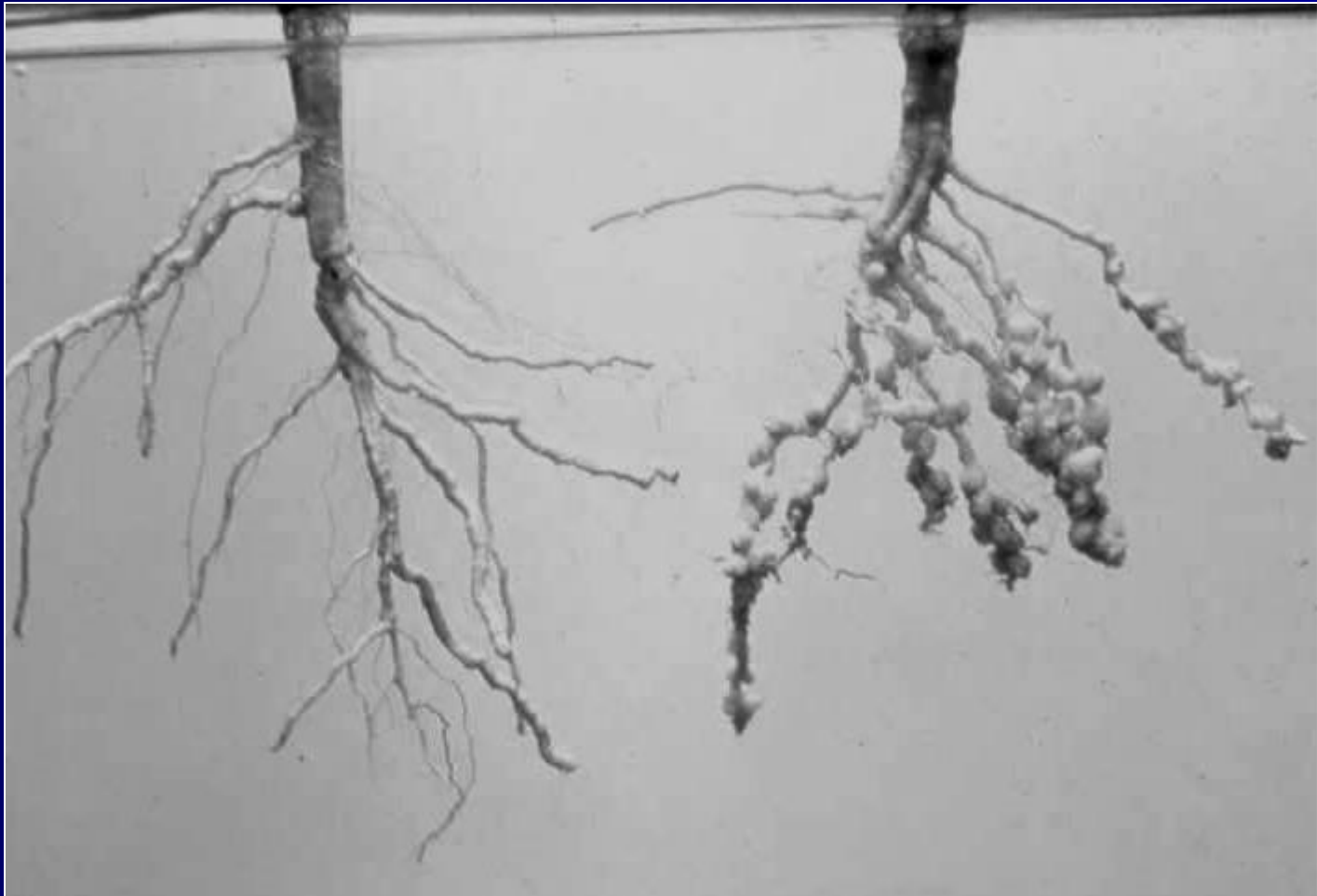
Soybean Rotation



Resistance

- Resistance breeding has been mainly to root-knot nematode (*Meloidogyne spp.*)
- Resistance, however, may be to only 1 root-knot species
- Examples of resistance can be found in tomato, snap bean and some southern peas
- Little resistance is available to other nematode species

Resistant/Not Resistant



Solarization

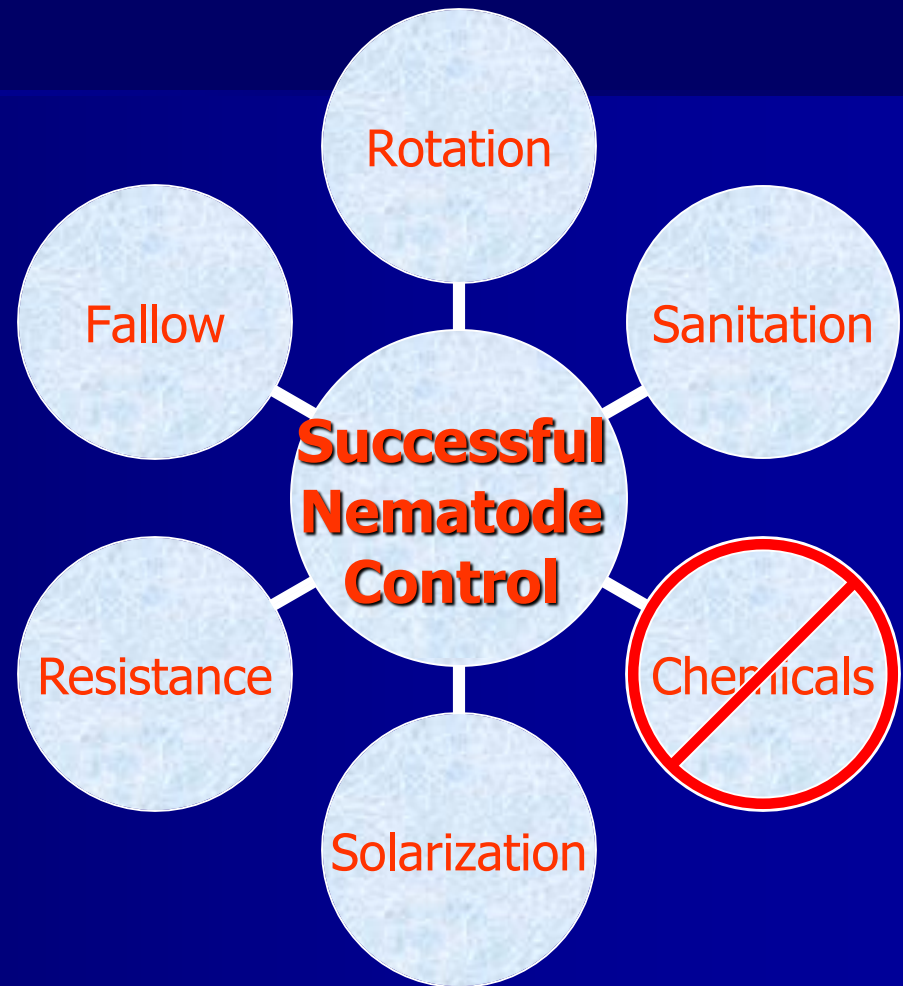
- Only works moderately well with nematodes
- Has added advantage of reducing weed problems
- Use clear plastic, make sure soil is tilled and moist
- Use in the hottest months and leave 6-8 weeks

Solarization- Laying Clear Plastic



Management Summary

- No single practice will control nematodes, so two or more control methods must be used.



FAQ - Organic Matter

Does compost and organic matter control nematodes?

- The answer is generally no, however, they increase water and nutrients available to the plant.
- Thus a healthier plant can tolerate more nematode damage.

FAQ - Resistance

My nematode 'resistant' plant still had lots of nematode damage?

- A resistant plant is 'resistant' to only a nematode to which it was bred
- For example, a plant may be resistant to only one type (specie) of nematode but not others

FAQ – Wet or Dry

Do nematodes cause damage under both wet and dry conditions?

- Greatest damage is caused when conditions are dry.
- Wet conditions mask some damage until root rotting from nematode damage begins.

FAQ - Nematicides

What is the best 'nematicide' available for nematodes?

- All effective nematicides are restricted use chemicals and cannot be bought without a pesticide license
- Products found in garden stores are 'at best' nematode suppressants.
- Generally, these products are not recommended for nematode control

FAQ - Fallow

Is fallow recommended for nematode management?

- Fallow makes sense because, if nematodes cannot feed, they will starve, however:
- Many weeds are host to nematodes, thus they must not be allowed to grow.
- At least one growing season of fallow must be used and fallow depletes soil organic matter
- During the 'winter', most nematodes are relatively dormant and do not feed anyway.

UF/IFAS EDIS Publications

http://edis.ifas.ufl.edu/TOPIC_Nematodes

- General Nematology
- Nematodes in the Yard
- Lawn Pest Nematodes
- Landscape Nematodes
- Urban Tree Pest Nematodes
- Vegetable Nematodes
- Fruit Pest Nematodes



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