BIOLOGY AND MANAGEMENT OF PLANT PARASITIC NEMATODES DEPARTMENT OF NEMATOLOGY **UNIVERSITY OF CALIFORNIA, DAVIS**





TYPICAL PLANT PARASITIC NEMATODE



THE MOST COMMON GENERA OF PLANT PARASITIC NEMATODES IN CALIFORNIA:

MIGRATORY ECTOPARASITES

Trichodorus - Stubby Root* Xiphinema - Dagger* Longidorus - Needle* Helicotylenchus - Spiral Criconemella - Ring Paratylenchus - Pin Hemicycliophora - Sheath

*Vectors of plant viruses

SOME GENERA CONTAIN SEVERAL IMPORTANT SPECIES

MIGRATORY **ENDOPARASITES**

Pratylenchus - Lesion Ditylenchus - Stem & Bulb Aphelenchoides - Foliar

SEDENTARY **ENDOPARASITES**

Meloidogyne - Root Knot Anguina - Seed & Leaf Gall Tylenchulus - Citrus Heterodera - Cyst

SYMPTOMS & SIGNS OF NEMATODE DAMAGE:

VISIBLE ABOVE GROUND -**ROOT SYMPTOMS -**Stuntina Galls or Swellings Chlorosis Stubby Roots Mid-day Wilting Lesions or Dark Spots Stunting Leaf Drop **Small Fruit** "Dirty Roots" Yellowing **Curling and Twisting of Leaves** and Stems Patches of Poor Growth in Field Lack of Response to Treatment For Other Problems **Premature Maturity Delayed Maturity Reduced Yield** "Unthriftiness"

HOW NEMATODES INJURE PLANTS:

- 1. Mechanical injury penetration and movement through tissues
- 2. Cellular changes A. Death of cells (necrosis)
 - B. Changes in growth of cells
- 3. Physiological changes in host A. Interruption in uptake and flow of water and nutrients from roots
- B. Interaction in flow of food from leaves to roots
- 4. Create openings for entry of other microorganisms
- 5. Interaction with other disease producing agents
- 6. Transmission of other disease producing agents
- 7. Increase susceptibility to environmental stress

SAMPLING FOR NEMATODES: Sample part of plant affected (roots, tubers, stems, bulbs, leaves) In soil, dig into root zone where moisture is present Place soil and small roots into plastic bag Soll from several places can be combined Collect about 1 guart of soil and roots Sample healthy areas also and place in separate bag Seal bags and keep cool (do not freeze) Label bags - name, address, sample location, date, crop history, existing crop, next proposed crop Notify laboratory that is to receive samples **EXTRACTION EQUIPMENT & PROCEDURES:**

Sieving Sugar Flotation Fenwick Can Sugar Centrifugation Elutriator Staining Roots Greenhouse Bioassay Baermann Funnel Mist Select appropriate procedure for nematode species of interest.

NEMATODE MANAGEMENT OPTIONS: PREVENTION CULTURAL PRACTICES BIOLOGICAL CONTROL PHYSICAL METHODS CHEMICAL CONTROL

PREVENTION:

QUARANTINE USE CERTIFIED PLANTING MATERIALS CHECK SUSPECT MATERIALS BEFORE PLANTING NEMATODES MAY BE PRESENT IN MANURE CLEAN EQUIPMENT BEFORE MOVING AVOID CONTAMINATED IRRIGATION WATER

BIOLOGICAL CONTROL: BACTERIA FUNGI PREDATORS

CULTURAL PRACTICES:

CROP ROTATION RESISTANT VARIETIES FALLOWING COVER CROPS DATE OF PLANTING & HARVEST FLOODING TRAP CROPS REMOVING PLANTS WITH SYMPTOMS SOIL AMENDMENTS

AMENDMENTS:

E.G. - GREEN MANURE, CHITIN, SESAME CHAFF, ANIMAL MANURE, HUMIC ACID, ORGANIC FERTILIZER, COMPOST, MIXTURES OF BENEFICIAL MICROBIALS STIMULATE THE GROWTH OF NEMATOPHAGOUS FUNGI IMPROVE SOIL STRUCTURE, SOIL WATER

IMPROVE SOIL STRUCTURE, SOIL WATER RETENTION, PLANT NUTRITION - (REDUCES STRESS ON NEMATODE INFESTED PLANTS) PRODUCE NEMATICIDAL BREAKDOWN PRODUCTS

CROP ROTATION FOR NEMATODE MANAGEMENT:

BASIC INFORMATION NEEDED: NEMATODES PRESENT IN FIELD HOST RANGE OF SPECIES PRESENT EXPECTED RATE OF POPULATION INCREASE EXPECTED RATE OF POPULATION DECLINE POSSIBLE CROPS AVAILABILITY OF RESISTANT VARIETIES GROWING SEASON (TIME OF PLANTING) NEMATODE DAMAGE THRESHOLD IMPORTANCE OF WEEDS

USE OF RESISTANT & TOLERANT VARIETIES:

- Nonhost or Immune plants do not allow nematode attack, including initial root invasion.
- Resistant plants may be invaded by nematodes and may show damage but chemical or physical unsuitability of the plant wil prevent population increases.

Susceptible - plants allow normal nematode reproduction and may or may not tolerate nematode attack.

Tolerant host - plants are able to withstand nematode attack.

Intolerant host - plants are more likely damaged by nematode attack.

PHYSICAL METHODS:
HOT WATER & CHEMICAL DIPS
STEAM STERILIZATION
ROOT PRUNING
(SOIL SOLARIZATION)

HOT WATER TREATMENT:

TEMPERATURE & TIME NEEDED DEPEND ON NEMATODE SPECIES CROP VARIETY OR CULTIVAR ACCURATE TIME AND TEMPERATURE CONTROLS ARE NEEDED TOO HIGH OF A TEMPERATURE OR TOO LONG OF AN EXPOSURE PERIOD CAN DAMAGE PLANT MATERIAL

MATERIAL TOO SHORT A TIME PERIOD OR TOO LOW A TEMPERATURE MAY NOT KILL NEMATODES

CHEMICAL CONTROL: HISTORICAL DEVELOPMENT OF NEMATICIDES

CARBON DISULFIDE (CS2)	YEAR 1869	TYPE FUMIGANT
*CHLOROPICRIN *METHYL BROMIDE	1936 1940'S	FUMIGANT
EDB DD (1.3-D+1.2-D)		FUMIGANT
DBCP		FUMIGANT
TELONE II (1,3-D)		FUMIGANT
FORMALDEHYDE		FUMIGANT
"MIT>>METAM-SODIUM (VAPAM, SOIL PREP, SECTAGON)	1950'S	FUMIGANT
"NEMACUR (FENAMIPHOS)	LATE	OP
*FURADAN (CARBOFURAN)	50'S &	CARB
*MOCAP (ETHOPROP)	1960'S	OP
DASANIT		OP
TEMIK (ALDICARB)		CARS
"VYDATE (OXAMYL)	1970'S	CARB (SYSTEMIC)
ENZONE (GY-81) SODIUM TETRATHIOCARBONATE>>CS2	1980'S	FUMIGANT
CLANDOSAN 618 (CHITIN/UREA)		"NATURAL"
NEMATROL (SESAME CHAFF)	-	"NATURAL"

OP=ORGANOPHOSPHATE, CARB=CARBAMATE

*currently available for use on some crops in California