NEMATODE CONTROL STRATEGIES UPDATE

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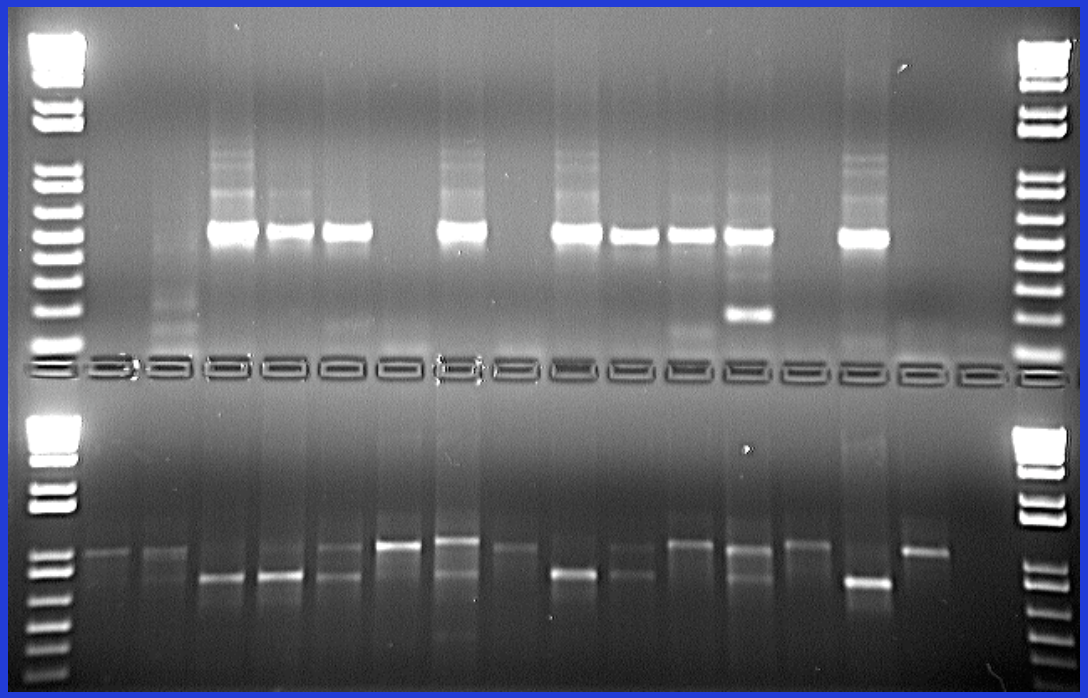
PROBLEMS WITH ROOT-KNOT NEMATODE ON NEMATODE RESISTANT TOMATOES:

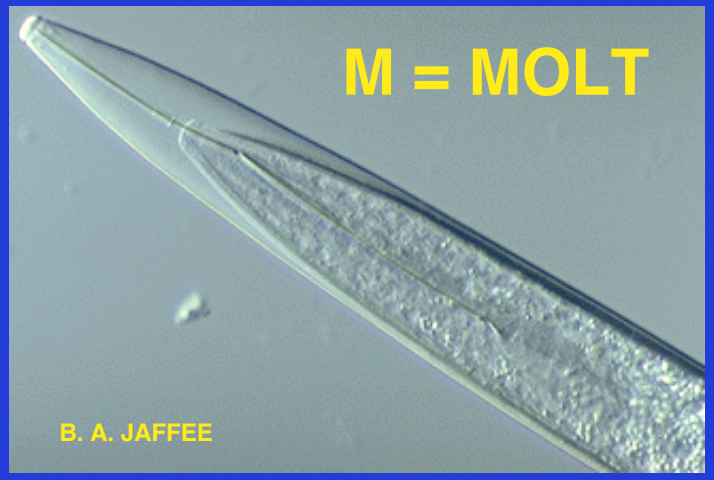
- **Mi-1 IS A SINGLE DOMINANT GENE**
- **ALL VARIETIES HAVE THE SAME RESISTANCE GENE**
- **RESISTANT TO *MELOIDOGYNE INCOGNITA, M. JAVANICA, M. ARENARIA*.**
- **NOT RESISTANT TO *M. HAPLA***
- **PLANTS WITH UP TO 5 GALLS ARE CONSIDERED "RESISTANT"**
- **RESISTANCE BREAKING RACES FIRST FOUND IN 1995**
- **SELECTED FROM WITHIN NATIVE POPULATION IN THE FIELD**

WILLIAMSON LAB (UCDAVIS):

- 9 RESISTANCE BREAKING RACES IN CULTURE
  - 6 FROM YOLO COUNTY
  - 2 FROM LOS BANOS
  - 1 FROM NORTH CAROLINA



LIFE CYCLE OF A NEMATODE:



SIZE

M

M

M

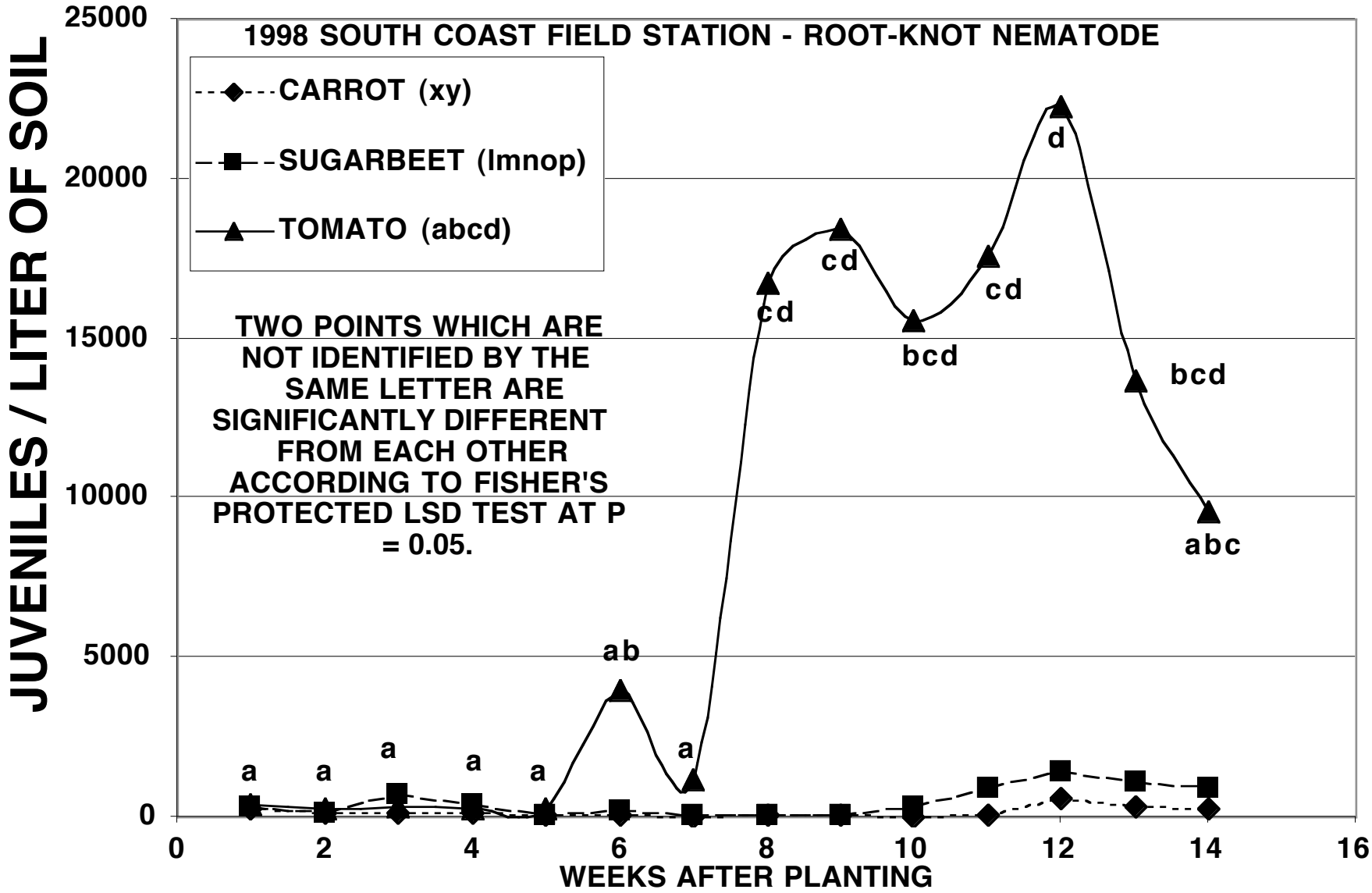
M

EGG J1 J2 J3 J4 ADULT

TIME

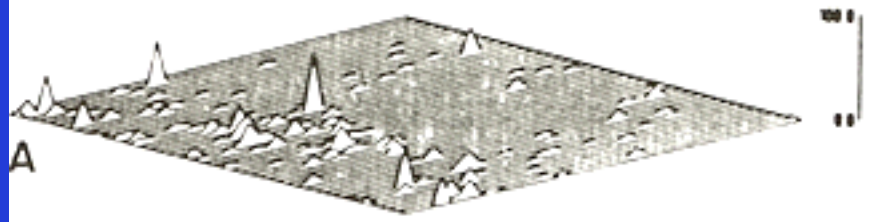
J = JUVENILE OR LARVA

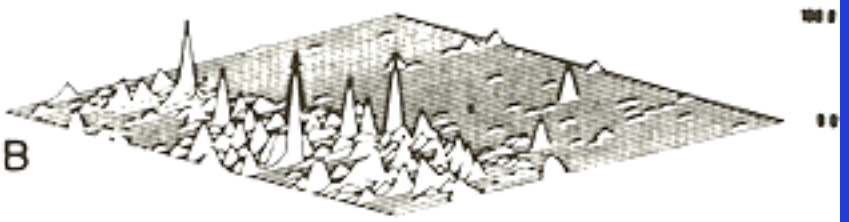
WHEN SHOULD YOU SAMPLE FOR NEMATODES?



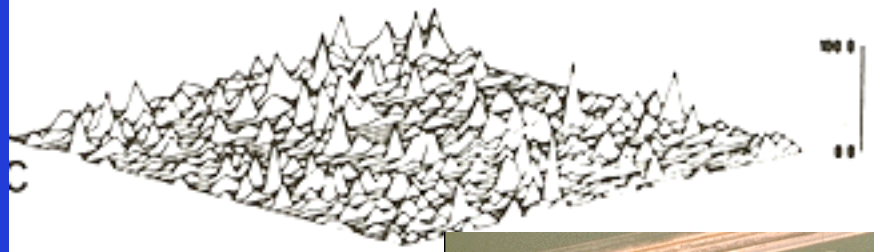
WHEN SHOULD YOU TREAT FOR NEMATODES?

SAMPLING FOR NEMATODES:





NEMATODES ARE NOT TYPICALLY UNIFORMLY DISTRIBUTED - MULTIPLE SUBSAMPLES / SAMPLE



pcok

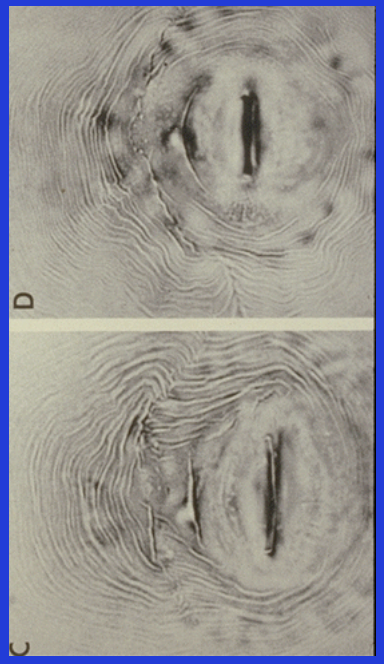
EFFECT OF SOIL TYPE ON NEMATODE REPRODUCTION:

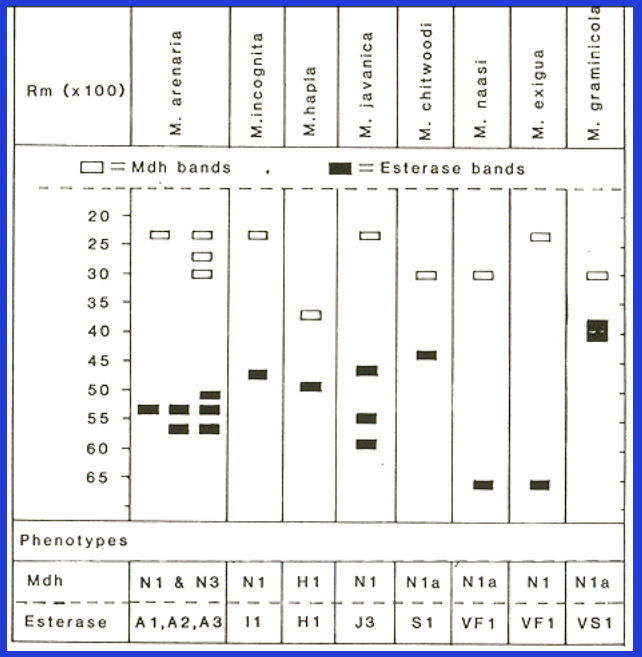
SANDY SOILS TEND TO HAVE HIGHER POPULATIONS THAN CLAY SOILS

BUT POPULATIONS IN CLAY SOILS GET HIGH ENOUGH TO CAUSE A PROBLEM

TESTING FOR RESISTANCE BREAKING RACES:

- MICROSCOPIC EXAMINATION OF JUVENILES - NO
- PERINEAL PATTERN ANALYSIS - NO
- ISOZYME ELECTROPHORESIS OF ADULTS - NO
- BIOASSAY - RECENTLY DEVELOPED BY WILLIAMSON LAB
- PCR MARKERS FOR JUVENILES - UNDER INVESTIGATION BY WILLIAMSON LAB





CULTURAL PRACTICES:

- CROP ROTATION
  - RESISTANT VARIETIES
  - FALLOWING / WEED CONTROL
  - COVER CROPS / GREEN MANURES / BIOFUMIGATION
  - TRAP CROPS
  - FLOODING
- DATE OF PLANTING
- SOIL AMENDMENTS

HOW LONG BEFORE YOU CAN PLANT TOMATOES AGAIN?

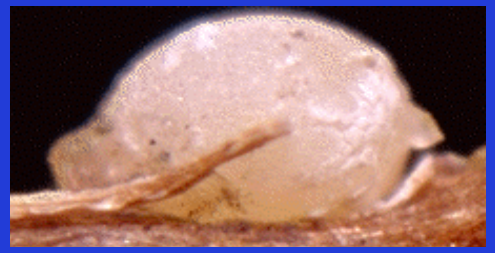
TYPICAL CROPS AND GROWING SEASONS FOR YOLO COUNTY:

* TOMATOES (SUMMER)
* CUCURBITS (SUMMER)
* SUGARBEETS (FALL OR SPRING PLANTED)
* ALFALFA (PERENNIAL)
* GRAIN (WHEAT, OATS, BARLEY) (WINTER)
* CORN (SUMMER)
* SUNFLOWER (SUMMER)
* SAFFLOWER (SUMMER)
* BEANS (SUMMER)
* RICE (SUMMER)
* FALLOW

STEM & BULB NEMATODE ON ALFALFA

TYPICAL NEMATODES FOR YOLO COUNTY:

COMMON NAME	SCIENTIFIC NAME
ROOT KNOT	*MELOIDOGYNE INCOGNITA* (I) (80% OF THE TIME) MELOIDOGYNE ARENARIA (A) *MELOIDOGYNE JAVANICA* (J) *MELOIDOGYNE HAPLA* (H)
SUGARBEET CYST	*HETERODERA SCHACHTII*
LESION	*PRATYLENCHUS THORNEI* (T) *PRATYLENCHUS NEGLECTUS* (N)
STEM & BULB	*DITYLENCHUS DIPSACI* (SEVERAL BIOTYPES)



HOST RANGE:

CROP	NEMATODE				
	ROOT KNOT	CYST	LESION	STEM & BULB	RESISTANT VARIETIES
TOMATOES	YES	NO	N	NO	I,J,A
CUCURBITS	YES	NO	T	NO	NO
SUGARBEETS	YES	YES	T	NO	NO
ALFALFA	YES	NO	N,T	YES	TOLERANT
GRAIN	I,J,A	NO	T,N	OATS	NO
CORN	I,J,A	NO	T,N	NO	NO
SUNFLOWER	YES	NO	?	NO	NO
SAFFLOWER	YES	NO	?	NO	NO
BEANS	YES	NO	T	NO	YES
RICE	?	NO	NO	NO	NO
FALLOW	NO	NO	NO	NO	

ROOT-KNOT SPECIES:
I = *INCOGNITA* J = *JAVANICA*
A = *ARENARIA*

LESION SPECIES:
T = *THORNEI* N = *NEGLECTUS*

WHAT ARE THE BEST ROTATION CROPS?

HOST RANGE:

CROP	ROOT KNOT SUSCEPTIBLE
TOMATOES	YES
CUCURBITS	YES
SUGARBEETS	YES
ALFALFA	TOLERANT
GRAIN	I,J,A
CORN	I,J,A
SUNFLOWER	YES
SAFFLOWER	YES
BEANS	YES (RESISTANT VARIETIES)
RICE	?
FALLOW	NO

ROOT-KNOT SPECIES:

I = *INCOGNITA* J = *JAVANICA* A = *ARENARIA*

HOW LONG BEFORE YOU CAN PLANT TOMATOES AGAIN?

ROOT KNOT NEMATODE ON PROCESSING TOMATOES - SAN JOAQUIN VALLEY

NUMBER OF LARVAE/GRAM OF SOIL

FALL	PERCENT DECLINE	SPRING	INCREASE	FALL	% OF NORMAL YIELD
		0.01	1000 X	10.0	100
0.31	85	0.05	500 X	23.8	98
1.56	85	0.25	150 X	37.3	85
4.06	85	0.65	75 X	48.0	65
6.25	85	1.00	55 X	54.8	53

THE USE OF NEMATODE DAMAGE/ECONOMIC THRESHOLDS IS OFTEN LIMITED BY THE METHODS AVAILABLE TO DETECT NEMATODES.

FALLOW
NO CROP - NO WEEDS -
NEMATODES STARVE
EFFECTIVENESS -
EXCELLENT -
COST - ??

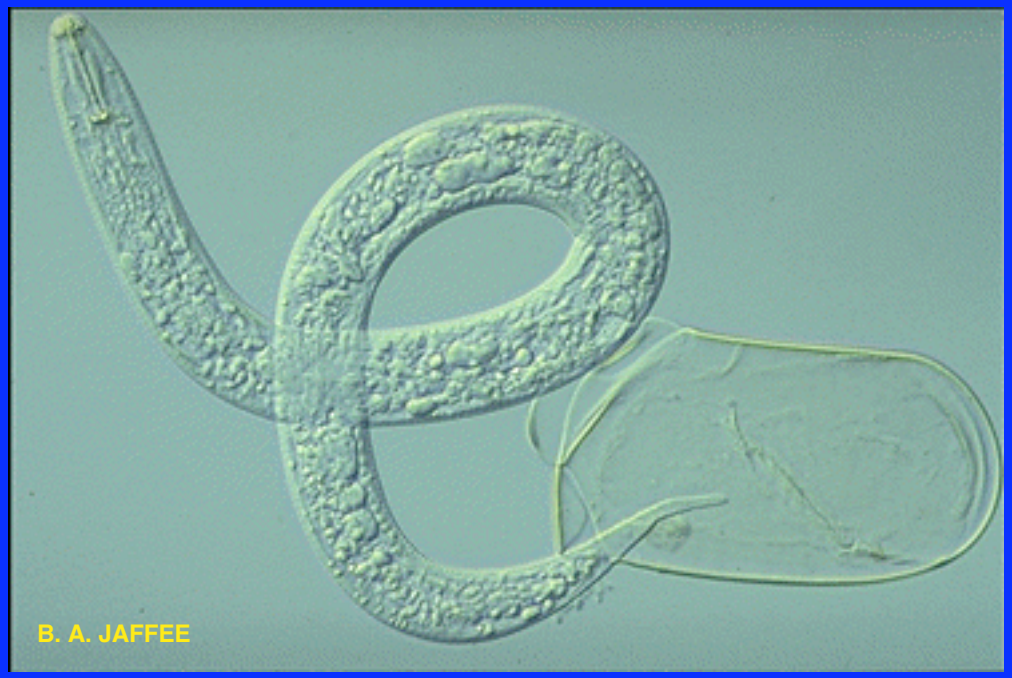
DRY VS WET,
SOIL DISTURBANCE,
COST OF WEED
CONTROL

ROOT-KNOT NEMATODE

RATE OF DECLINE/ YEAR	YEARS OF FALLOW
85 %	0.25 - 2

TRAP CROPPING:

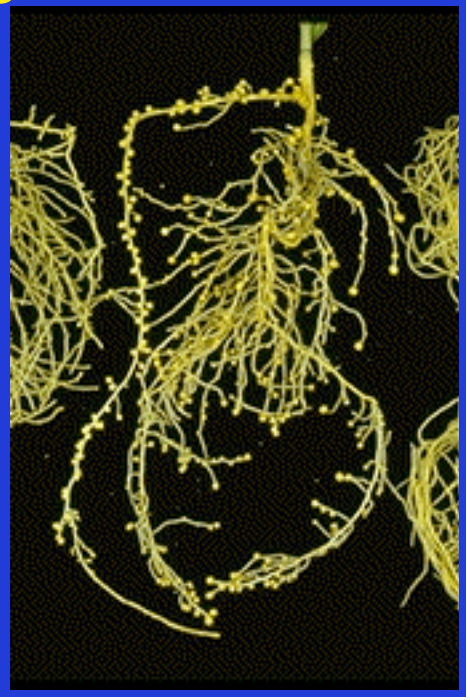
- **JUVENILE ENTERS ROOT AND BEGINS FEEDING**
- **IMMATURE FEMALE NO LONGER ABLE TO MOVE**
- **DESTROY CROP BEFORE FEMALE LAYS EGGS**
- **PLANT COMMERCIAL CROP**



NEMATODE / HOST ASSOCIATION DATABASES

H. FERRIS, E. CASWELL-CHEN, B. WESTERDAHL
FROM URL: http://ucdnema.ucdavis.edu/
SELECT: VIEW DATABASES

NEMABASE Nematode-Host Association Database
(can also be obtained from ucipm website)
Nematode Common-Scientific Name Database
Plant Common-Scientific Name Database
Lownsbery Nematode-Host Association Database
Radewald California Ornamental Nematode-Host Association Database
Nematode Primer Database
Knowledge Planning Database



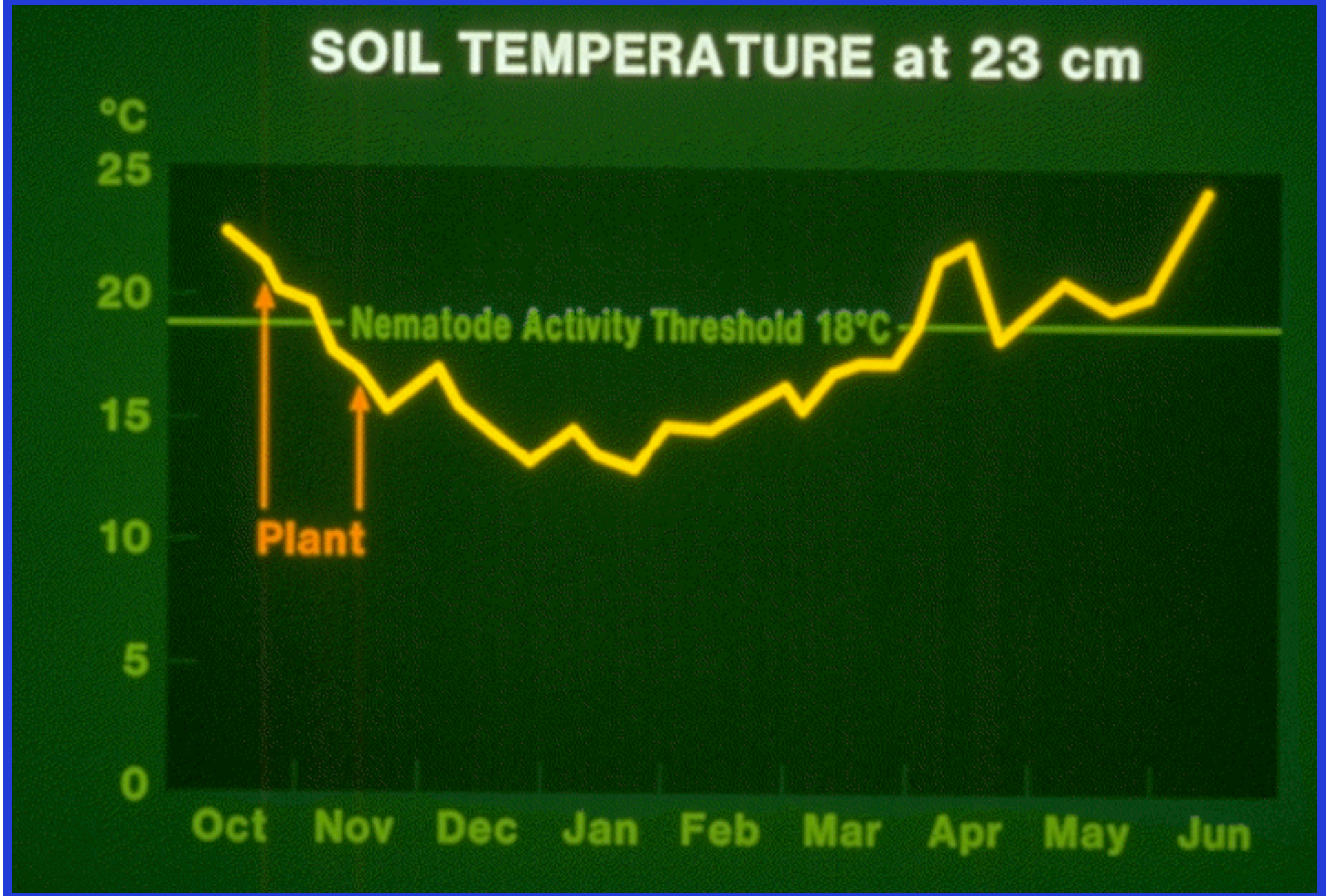
TO SELECT A COVER CROP
YOU NEED TO KNOW WHICH SPECIES YOU HAVE?

SUMMARY OF HOST-NEMATODE RESPONSES ON COVER CROPS:

	Root Knot			
	Northern *Meloidogyne hapla*	Southern *Meloidogyne incognita*	Javanese *Meloidogyne javanica*	Peanut *Meloidogyne arenaria*
Marigold	Host	Host	Host, Trap Crop	Non Host
Sudan, SS-222	Poor Host	Good Host	Host	Host
Barley, Columbia	Host	Poor Host	Good Host	Host
Cahaba White Vetch	Good Host	Poor Host	Host, Trap Crop	Host
Salina Sweet Clover	Host	Poor Host	Poor Host	Nonhost
Moapa Alfalfa	Susceptible	Poor Host	Poor Host	Nonhost
Coker 916 Wheat				
Nova II Vetch	+	-	-	-
Blando Brome Grass	Host	Nonhost		

DATA SUMMARY BY M.V. MCKENRY, 1991
+ = PROBABLE HOST, - = PROBABLE NONHOST, BASED ON DATA FROM GEORGIA AND S. CAROLINA

PLANTING IN COOLER SOILS CAN REDUCE DAMAGE

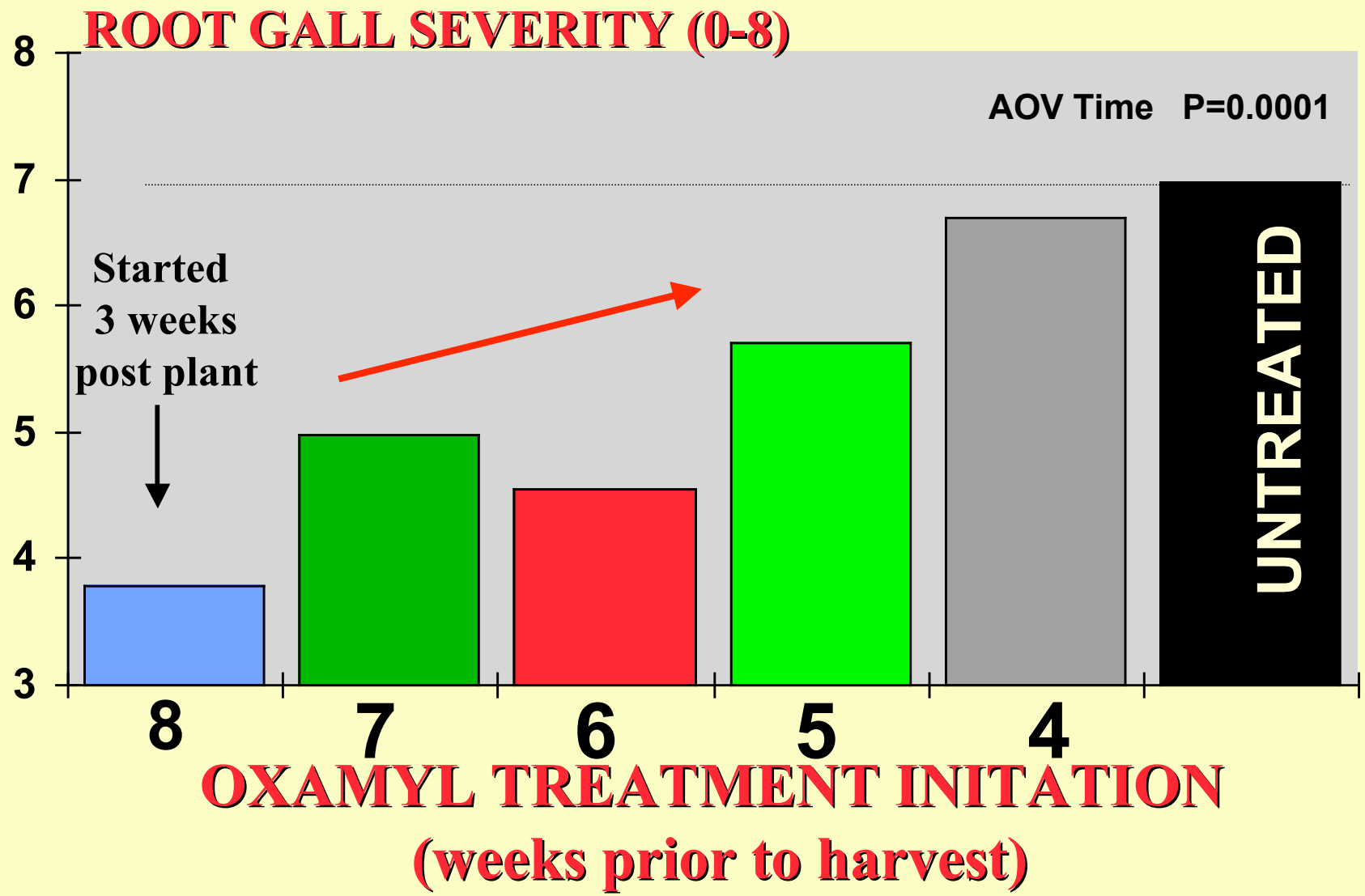


TREATMENT OPTIONS:

- **SHANK INJECTION -**
  - **TELONE II (1,3-DICHLOROPROPENE)**
  - **TELONE C-17 (WITH CHLOROPICRIN)**
- **DRIP IRRIGATION -**
  - **TELONE EC (TARP)**
  - **INLINE (1,3-D + 33% CP) (TARP)**
  - **METAM SODIUM**
  - **METAM POTASSIUM**
  - **ENZONE**
  - **VYDATE (OXAMYL)**

Time of Discovery / Postplant Treatment Initiation

"Is it ever to late to initiate treatment"



Noling, 1998 ***"Sooner weekly treatments initiated the better"***

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GENERAL CONCLUSIONS

- *Vydate L in drip – higher frequency at modest rates is most effective. (6x@1qt better 3x@2qt)*
- *Start Vydate L drip treatments close to planting date.*
- *Use Highest Vydate L rate in 1st application to get ppm needed.*

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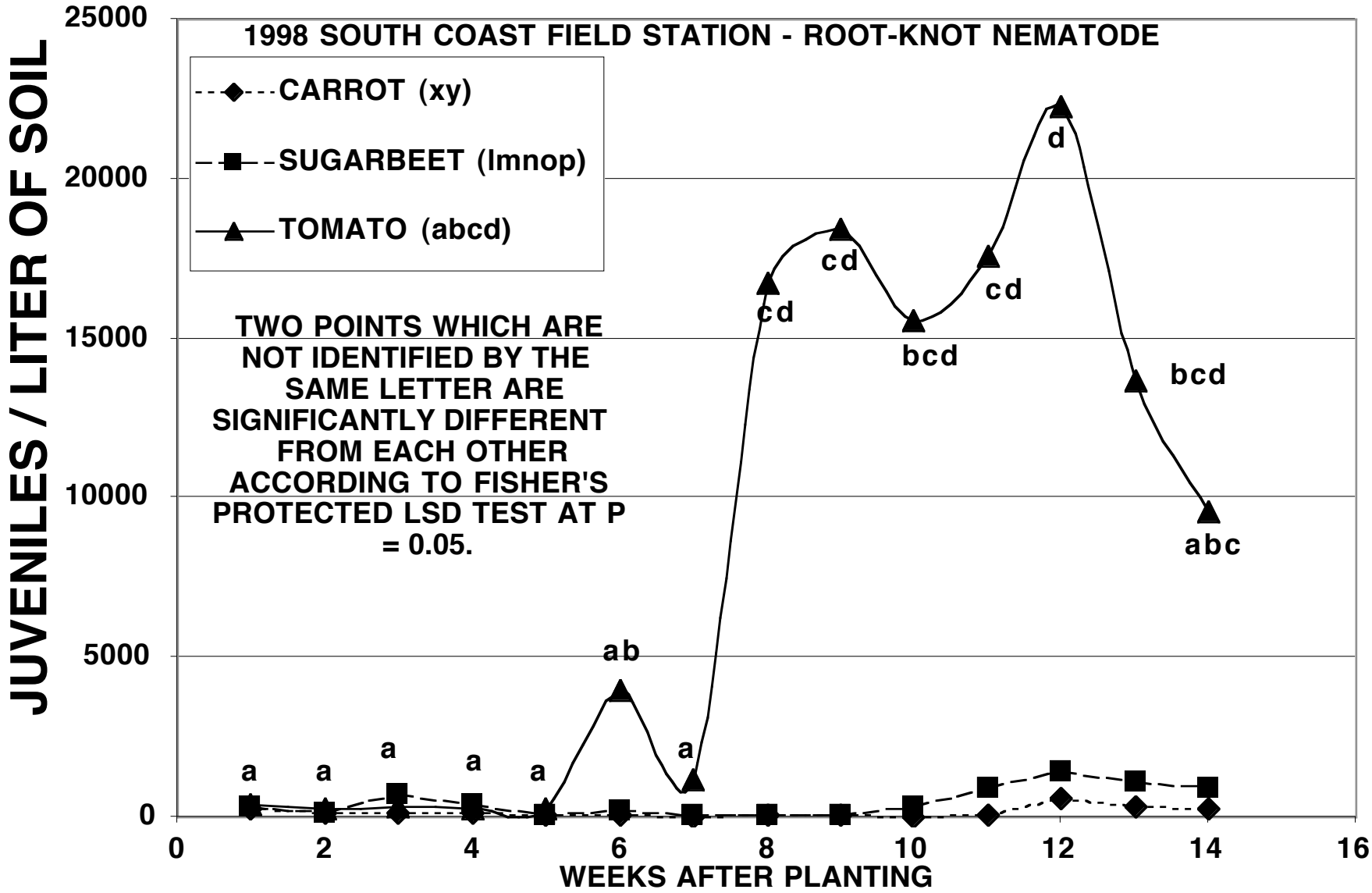
GENERAL CONCLUSIONS

- *Don't expect miracles from crop rescue, identify problem fields before planting.*
- *Under high pressure, use 2 qts Vydate L in drip for first two apps.*
- *Combine Vapam + Vydate L treatments for broadest spectrum*

WHEN SHOULD YOU SAMPLE FOR NEMATODES?



WHEN SHOULD YOU TREAT FOR NEMATODES?

IF YOU HAVE A RESISTANCE BREAKING RACE:

- DON'T PLANT NEMATODE RESISTANT TOMATOES FOR AT LEAST 2 YEARS
- USE A PREPLANT FUMIGANT NEMATICIDE FOLLOWED BY A SUSCEPTIBLE VARIETY OR A ROTATION CROP
- MOST ROTATION CROPS WILL BE SUSCEPTIBLE TO ROOT-KNOT NEMATODE
- NEMATODE RESISTANT ALFALFA IS NOT NEMATODE RESISTANT, IT WILL MAINTAIN THE POPULATION
- PLANTING IN COOLER SOIL SHOULD REDUCE DAMAGE NEMATODES REPRODUCE MORE SLOWLY, ROOTS CAN BECOME ESTABLISHED

IF YOU DON'T HAVE A RESISTANCE BREAKING RACE:

- ALTERNATE BETWEEN A RESISTANT VARIETY AND FUMIGATION WITH A SUSCEPTIBLE VARIETY OR ROTATION