

NEM 204

**EXAMPLES OF
INTEGRATED MANAGEMENT PROGRAMS**

SUGARBEET CYST NEMATODE ON SUGARBEETS:

(RASKI & ALLEN. 1948. CALIFORNIA AGRICULTURE)

**PROTECTION OF UNINFESTED LAND
CLEAN CULTIVATION OF HOST WEEDS
CROP ROTATION
EARLY PLANTING (TEMPERATURES
TOO LOW FOR INFECTION)**

COLUMBIA ROOT-KNOT NEMATODE ON POTATOES:

PREVENTION

WASHING EQUIPMENT

CERTIFIED PLANTING STOCK

**DAMAGE THRESHOLDS (BASED ON FALL
POPULATION LEVELS)**

CROP ROTATION

ALFALFA BARLEY

WHEAT ONIONS

FALLOW POTATO VARIETIES

**HARVEST DATES DETERMINED BY ACCUMULATED
DEGREE DAYS**

**CHEMICAL CONTROL ONLY IN FIELDS WITH LOW
POPULATIONS**

ECONOMIC EVALUATION OF ALTERNATIVES

**LONG RANGE COMPUTER ASSISTED PLANNING
(3-5 YEARS)**

Root-knot and stem and bulb nematode on alfalfa:

Selection of Planting Site

Certified Seed

Clean Equipment

Irrigation Management (for *D. dipsaci*)

Weed Management (fall burning for *D. dipsaci*)

Choice of Variety

Crop Rotation (for *D. dipsaci*)

Fallow

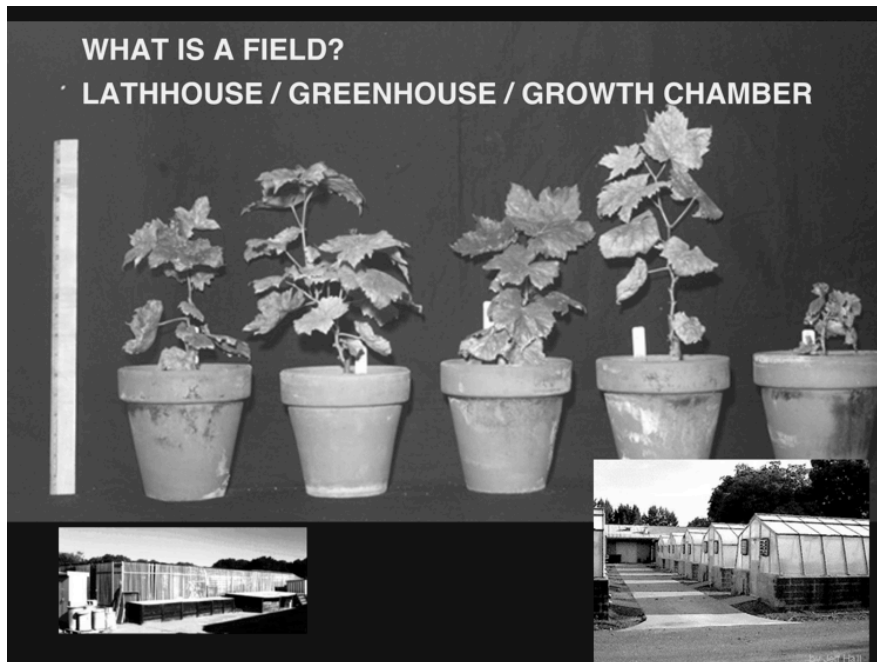
Chemicals

PTSL (Peach Tree Short Life):

1. Before planting, apply lime to adjust soil pH in the top 20 cm to 6.0-6.5.
2. Subsoil during site preparation to break up the hardpan, thereby improving water infiltration, drainage, root growth, nutrient uptake, and diffusion of nematicides.
3. In sandy soils where peach trees have been grown previously and in other soils where ring and root-knot nematodes are a problem, fumigate the soil before planting trees.
4. Plant trees that have been grown in fumigated soil or in soil free of parasitic nematodes and other diseases.
5. Plant trees propagated on Lovell or Halford rootstocks (both are very susceptible to root-knot nematodes; thus, preplant fumigation often is essential).
6. Apply nutrients and lime as needed based on soil tests, foliar analysis, and local recommendations.
7. Prune as late as possible, never before 1 January and preferably after 1 February. If earlier pruning is unavoidable, prune older trees first. Early pruning is especially hazardous for trees grown on locations where peaches were previously grown. Discontinue summer pruning (including topping and hedging) by 15 September.
8. Use recommended herbicides for weed management. Mechanical cultivation, if used, should be shallow to avoid root injury.
9. In sites where preplant fumigation was necessary, use a postplant nematicide if ring nematode populations increase. Assay soil for nematodes annually.
10. Promptly remove from the orchard and destroy all dead and dying trees.

NEM 204: NEMATODE FIELD TRIALS **What do you want to test (hypothesis)?**

- **Nematodes/hosts,**
- **Chemicals,**
- **Soil amendments,**
- **Cover crops,**
- **Resistant varieties,**
- **Damage/economic threshold,**
- **Sampling procedures,**
- **Population changes over time,**
- **Hot water or other planting stock treatments,**
- **Genetic variability**



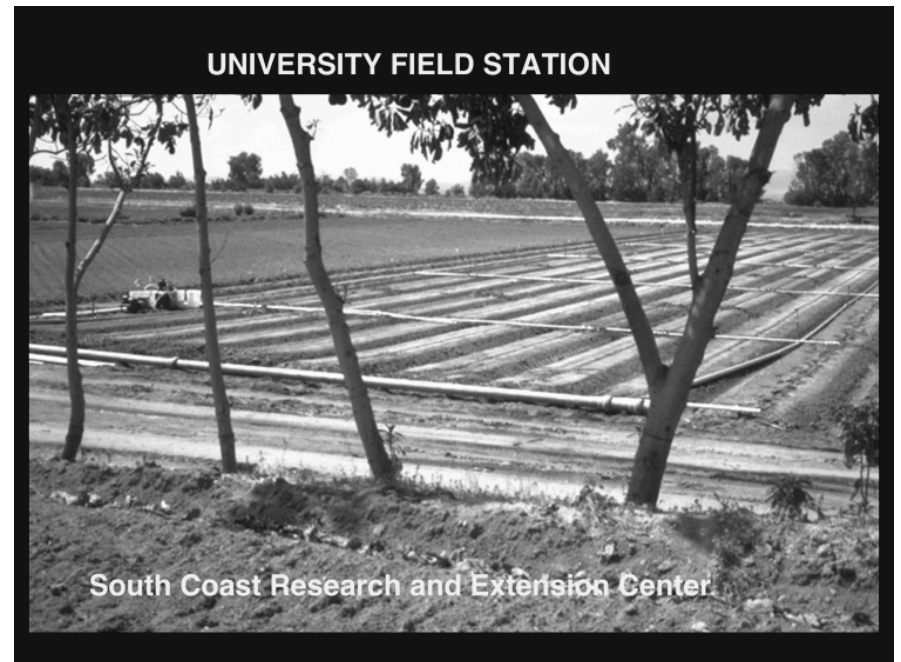
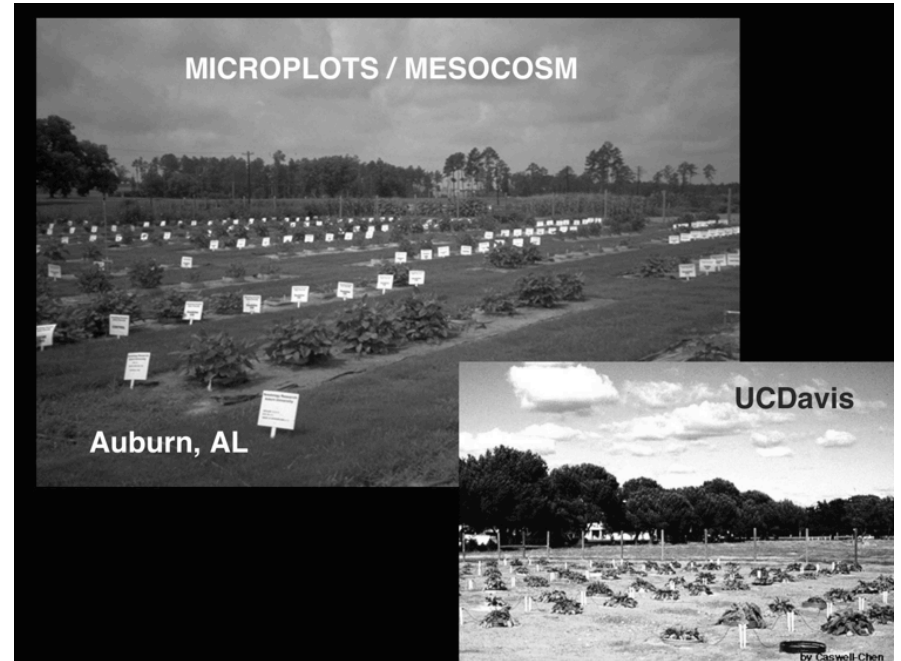
Where do you want to work?

- Microplot/Mesocosm,**
- University field station,**
- Private field station,**
- Grower's field.**

Who are your cooperators?

- Farm Advisors,**
- PCA's,**
- Growers,**
- Industry representatives**
- Field station staff.**

Before you start, establish presence of nematode population
(don't take anyone's word for it).
"Natural" vs "recently" introduced populations.
What problems are present besides nematodes.
Is the population too high or the problem too bad to correct?



UNIVERSITY FIELD STATION - TOMATO TRIAL



TWO CARROT TRIALS IN GROWER'S FIELD



PRIVATE / GROWER FIELD STATION



**HAND PLANTING
EASTER LILY
BULBLETS
8 BULBLETS PER
FOOT OF ROW**



**UC Policy Communication 18,
CAL-EPA Research Authorizations
Good Laboratory Practice (GLP) for residue trials**

Transportation to the field

Take 2 vehicles if possible

(or 1 vehicle and a cellular phone).

Where are the car keys?

If not on a paved road, consider backing in.

Park away from areas used by farm equipment.

Do as much beforehand as possible

But expect to make changes in the field.

Don't be afraid to make decisions.

Make a list

Don't forget the duct tape or the water.

Take extra of everything.

Preliminary plot map,

Rate calculations,

Premeasuring of materials,

Label plot stakes,

Label flags,

Make labels for samples.

Things to record or collect

plot name, location,

plot map, which way is north,

persons present,

getting back to the same location,

host, nematodes,

number of treatments,

experimental design,

plot size (length and width of each replicate),

crop row width, number of replicates,

soil sample (for soil type, % organic matter, pH, etc.),

soil temperature,

% soil moisture (important for fumigation treatments),

general weather conditions, type of irrigation, fertilizer,

weed and pest control, application dates,

rate calculations,

methods of application and incorporation,

planting date, harvest date,

closest CIMIS or other weather station

previous cropping history, previous nematicide use.

MINIMUM CRITERIA NEEDED TO BE ABLE TO EVALUATE AN EFFICACY TRIAL:

**GENUS OF NEMATODE
UNTREATED CONTROL
ESTABLISH PRESENCE OF NEMATODES PRIOR TO TRIAL
COMMON NAME OF TEST PLANT
MINIMUM OF THREE REPLICATES
RANDOMIZED DESIGN
NEMATODE COUNT AT LEAST 6 WEEKS AFTER PLANTING
STATISTICAL ANALYSIS OF RESULTS
OBSERVATIONS ON PHYTOTOXICITY**

**Don't assume a biological or natural product is safe,
use same precautions as when applying chemicals.**

**Don't assume a chemical is as safe
as its current label indicates.**

Work upwind of products being applied.

Applying treatments

**Assign one person (two is better)
to guide applicators to plots to be treated.**

For chemicals record

**type of formulation,
names and amounts of active ingredients,
lot number, date received,
amount of water or other material used to
dilute product,
band width,
depth of application,
shank spacing,
time between application and incorporation,
application rate,
rate calculations.**

Liquids

**hand injection gun,
hand sprayers,
drench (sprinkler can),
soil vs foliar applications,
calibration.**

Granules, powders.

**Methods of incorporating liquids,
granules and powders.**

**Application in irrigation water,
flood, basin, furrow, sprinkler, drip.**

Location of established irrigation systems.

Recontamination of treated areas.

IN FURROW APPLICATION OF BIOLOGICAL NEMATOCIDE



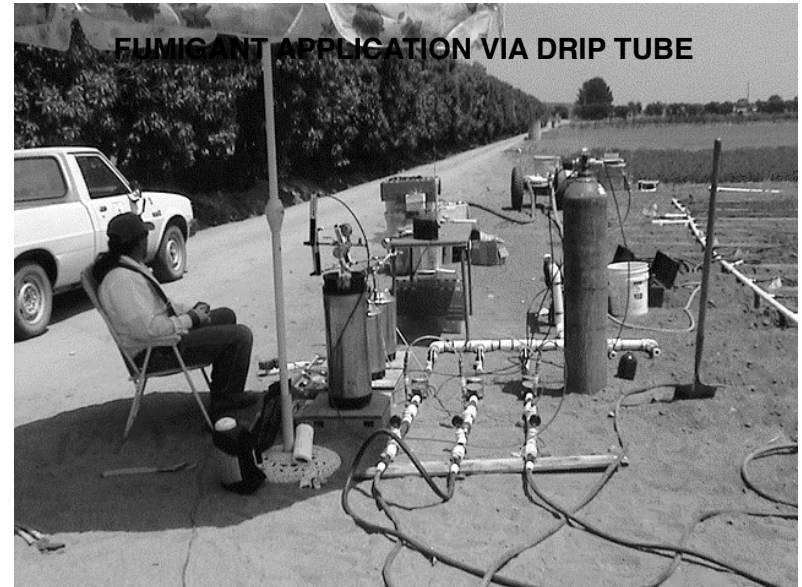
CARROT TRIAL IN GROWER'S FIELD



WALNUT TRIAL IN GROWER'S ORCHARD



FUMIGANT APPLICATION VIA DRIP TUBE



EXPECT THE WEATHER TO BE BAD



IT WILL PROBABLY BE EVEN WORSE THE NEXT DAY



PHOTOGRAPHS



SAFETY: DON'T EXPECT THE EQUIPMENT OPERATOR TO SEE YOU.



Safety

Never assume an equipment operator can see you
or hear you.

For chemical trials

gloves, Tyvek suits, rubber boots, respirator,
cleaning up.

Accidents - where's the nearest telephone/hospital?

Shade

Water

IT ALWAYS TAKES LONGER THAN YOU THINK IT WILL



WHAT ABOUT LUNCH?

SOIL SAMPLES



One day sampling could = 8 Weeks processing/counting

Nematode Samples (the greatest cost in a trial):

Consider -

- number of subsamples per sample,
- sampling method,
- depth,
- extraction method,
- storage time and temperature.

Pretreatment

- PI, from every plot
- vs from untreated checks
- vs from each block, etc.

Posttreatment but preplant
(depends on initial population).

Postplant (depends on expected rate of change
of nematode population).

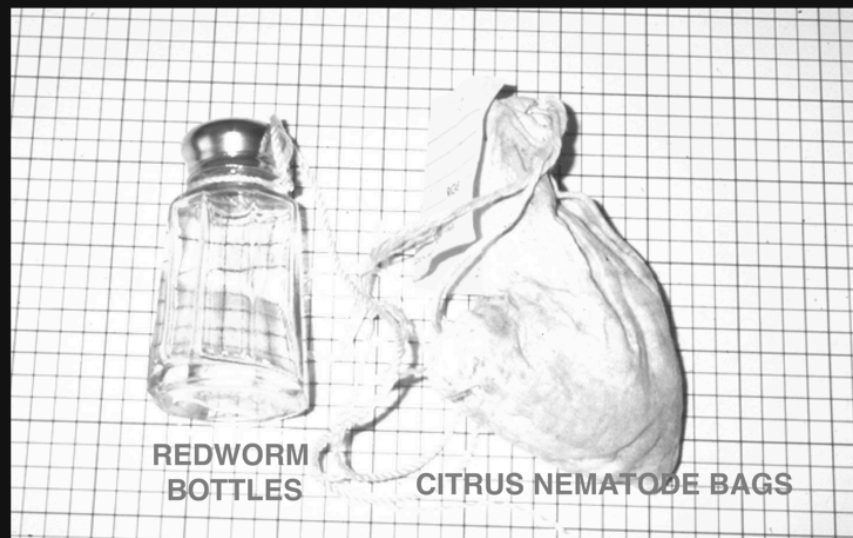
Harvest

Pf,
grading nematode damage to crop quality
above or belowground,
root-gall ratings (no best method, record what you do).

TAKING SOIL SAMPLES MID-SEASON

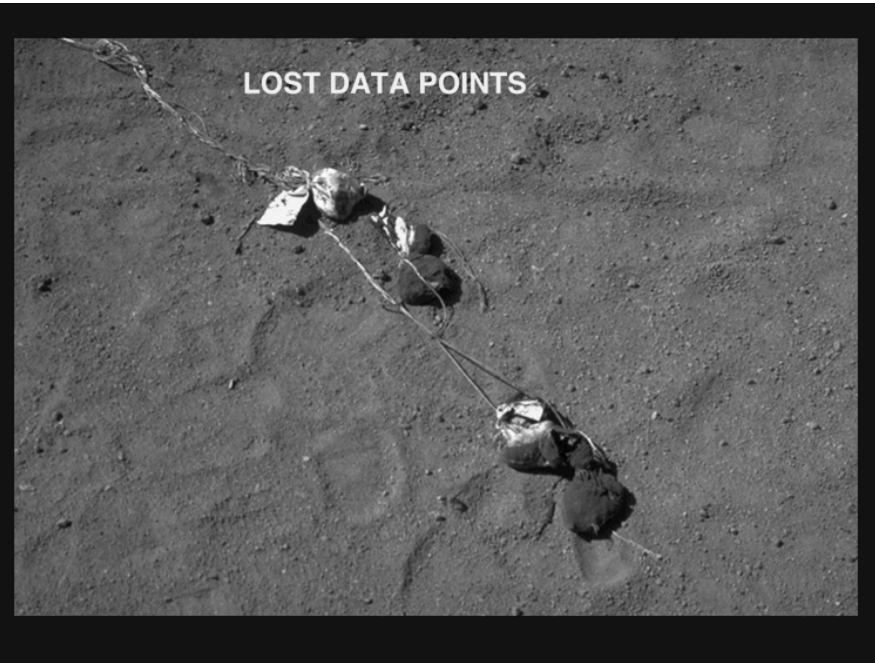


BIOINDICATORS:
WORMS, CITRUS NEMATODE, INSECTS, SEEDS

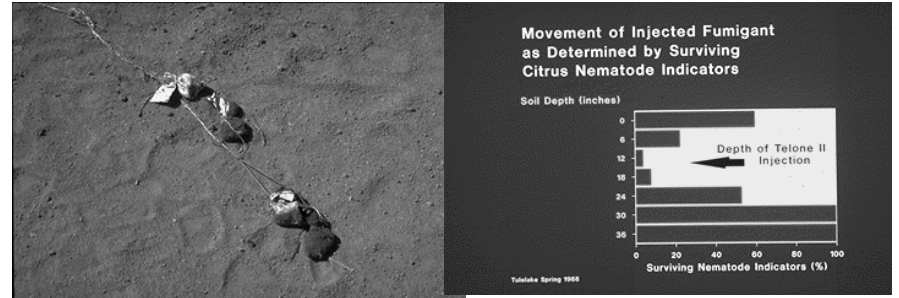
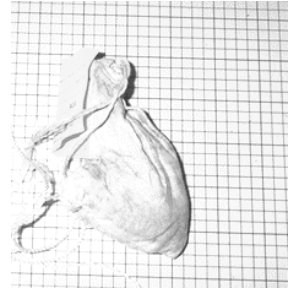


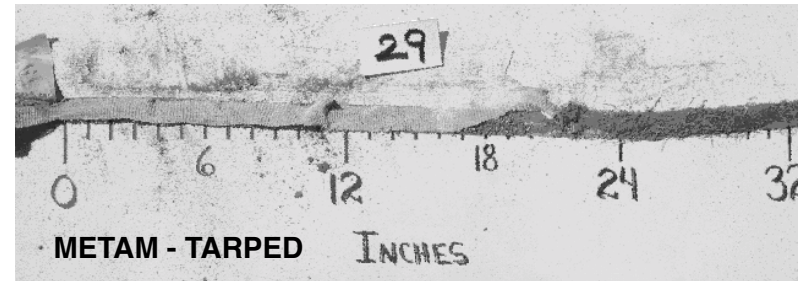
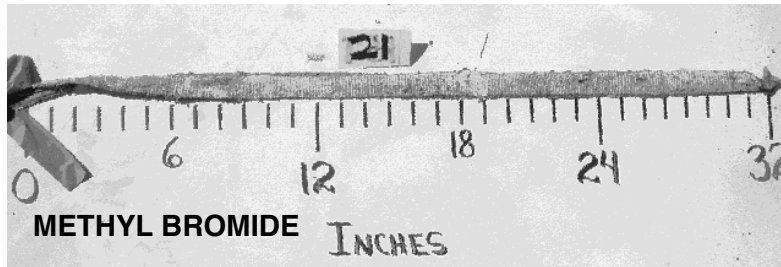
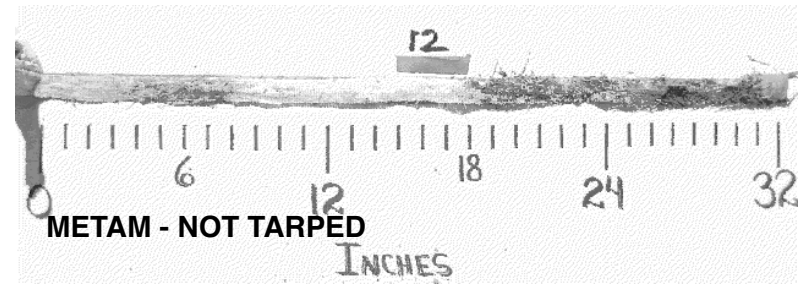
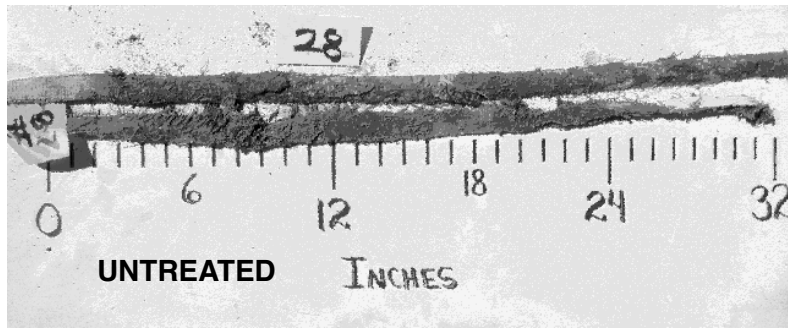
BURYING CITRUS NEMATODE BIOINDICATORS





**CITRUS NEMATODE
TYLENCHULUS SEMIPENETRANS**





Crop Samples
Standcount
Phytotoxicity
Midseason assessments

Harvest
hand harvest
semicommercial with experimental sized equipment
combination of experimental and grower equipment

Interactions of treatments with other pathogens.
Effects of treatments on nontarget organisms.
Potential for nematode treatments to affect other pathogens.



ROOT GALL RATING



HARVESTING EASTER LILY TRIAL



HAND HARVESTING GRAPES



MECHANICAL HARVESTING OF PRUNES



MECHANICAL HARVESTING OF PRUNES



MECHANICAL HARVESTING OF PRUNES



MECHANICAL HARVESTING OF PRUNES



MECHANICAL HARVESTING OF PRUNES



POTATO FIELD DAY



EASTER LILY FIELD DAY



Plot designs.

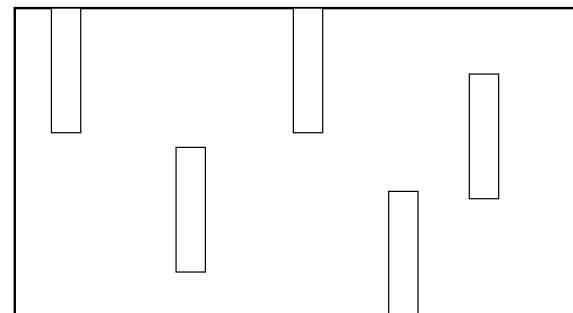
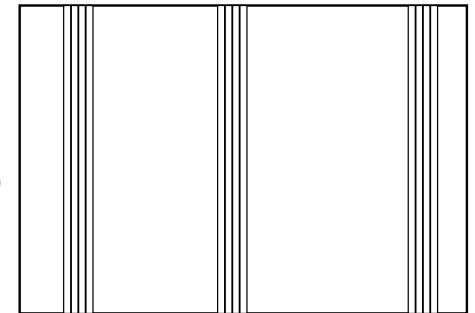
**There is no single correct way or best way
to do an experiment.**

Plot size for nematode evaluation

vs plot size for crop yield evaluation.

Statistical analysis programs (SAS, JMP).

**FIELD TESTING:
UNTREATED AREAS
REPLICATION
RANDOMIZATION
CHEMICAL STANDARD**

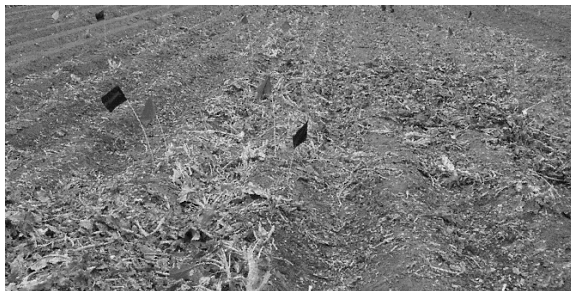
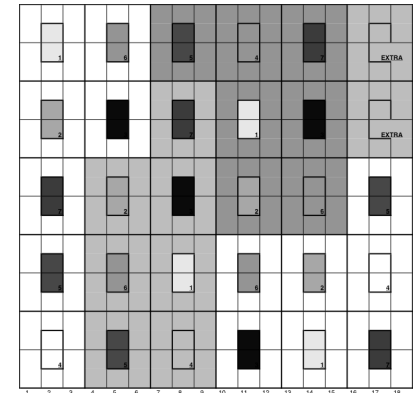


**BIOFUMIGATION:
 EVALUATION OF BROCCOLI RESIDUE FOR
 SUGARBEET CYST NEMATODE (SBCN) CONTROL
 BROCCOLI IS A HOST FOR SBCN
 BRASSICACEAE PRODUCE GLUCOSINOLATES
 BROCCOLI DEGRADATION RELEASES
 ISOTHIOCYANATES
 WHY IS SBCN A PROBLEM ON BROCCOLI?**



**TREATMENTS:
 TELONE II 1X (9 GPA)
 TELONE II 2X (18 GPA)
 1X BROCCOLI
 2X BROCCOLI
 NONE
 TARP
 COMBINATIONS
 RCB
 4 REPS**

**2 WEEKS TOTAL
 BETWEEN CROPS**

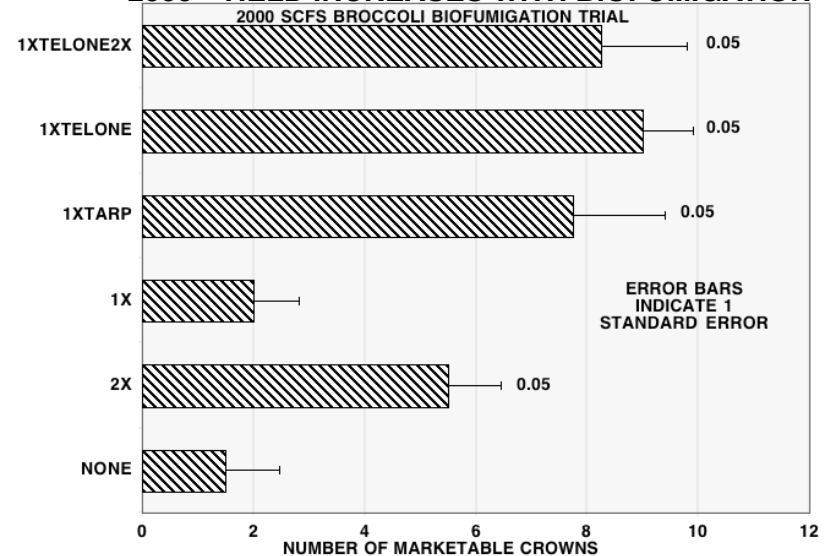


**BROCCOLI
 MOWED
 AND
 CHOPPED**

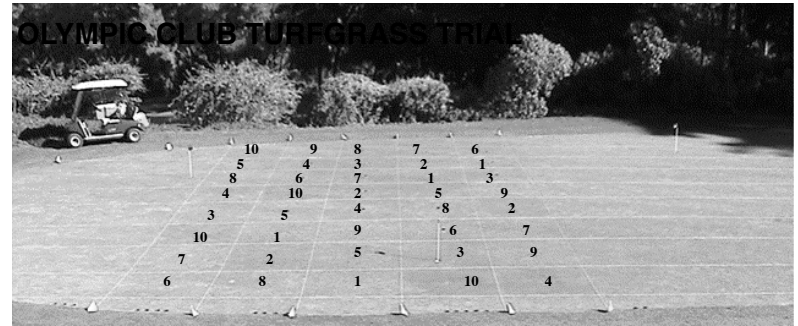
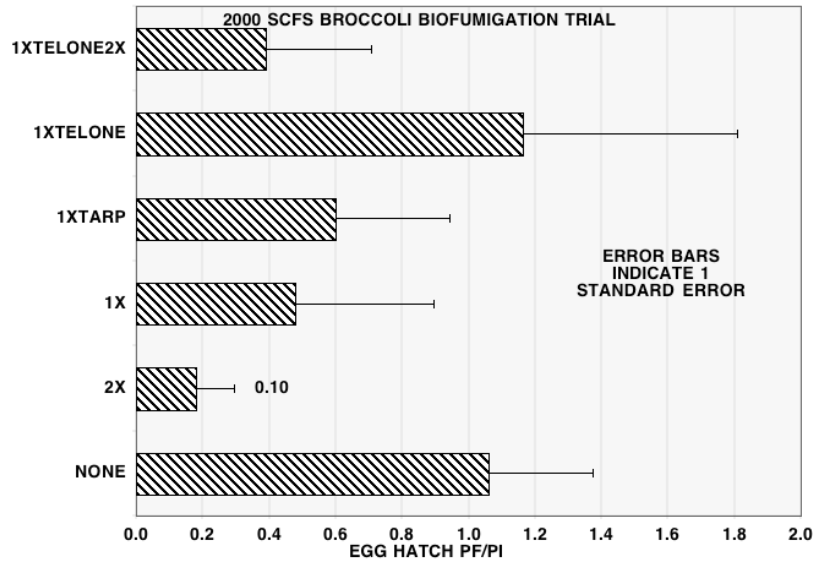
**FIELD
 TILLED,
 BEDDED,
 AND
 TARPED**



2000 - YIELD INCREASES WITH BIOFUMIGATION



2000 - NEMATODE REDUCTION WITH BIOFUMIGATION

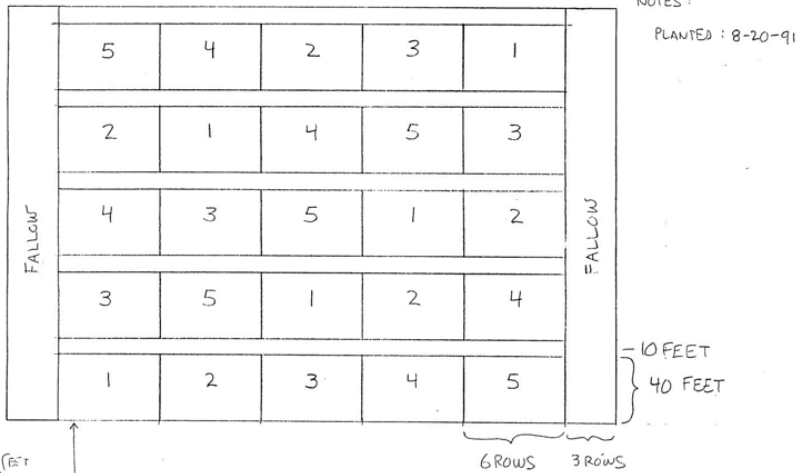


	10	9	8	7	6
IV	5	4	3	2	1
	8	6	7	1	3
III	4	10	2	5	9
	3	5	4	8	2
II	10	1	9	6	7
	7	2	5	3	9
I	6	8	1	10	4

- NUMBER TREATMENT**
- 1 UNTREATED
 - 2 NEMACUR 10G
 - 3 DITERA DF
 - 4 A-1641 HIGH
 - 5 A-1641 LOW
 - 6 QUILLAJA LOW
 - 7 QUILLAJA HIGH
 - 8 XRM 5053
 - 9 FORE
 - 10 FOSTHIAZATE

SUGAR BEET CYST PLOT

- Plot #
- 1. ANGELIA (PIACELIA)
 - 2. NEMEX (RADISH)
 - 3. MAXI (MUSTARD)
 - 4. PREGO (BUCKWHEAT)
 - 5. FALLOW CHECK.



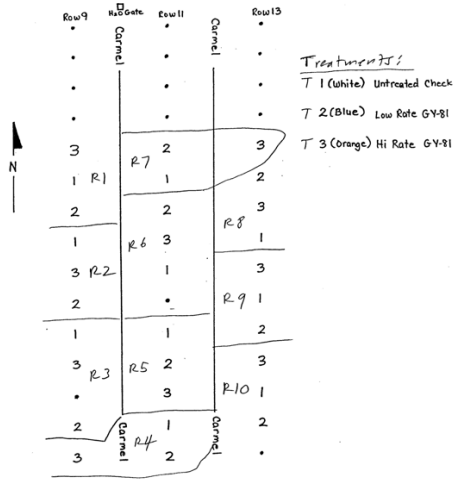
1989-90 EASTER LILY RESEARCH FOUNDATION/UC COOPERATIVE EXTENSION NEMATODE PLOT

1. Check
2. Check
3. 1,3-D Injection
4. 1,3-D Injection + Rampart
5. 1,3-D Injection + Rampart + Subdue Drip
6. 1,3-D Injection + Rampart + Vydate Drip
7. Vapam Drip
8. 1,3-D Injection + Subdue & Vydate Drip
9. Vapam Drip Preplant + Vydate Drip Postplant
10. Vapam Drip Preplant + Subdue Drip Postplant
11. Vapam Drip Preplant + Subdue & Vydate Drip Postplant
12. GV-81 Drip Preplant
13. GV-81 Drip Preplant + Subdue & Vydate Drip Postplant
14. 1,3-D SL Drip Preplant
15. 1,3-D SL Drip Preplant + Subdue & Vydate Drip Postplant

	OFFICE										AB
	Rep A					Rep B					
	12	6	15	8	4	10	3	2	6	13	
	14	9	3	1	10	14	9	12	15	7	
	2	11	7	5	13	8	4	5	1	11	
	15	4	15	6	7	3	11	6	14	1	
	10	14	2	9	3	7	13	2	10	8	
	1	11	5	8	12	12	4	9	5	15	
	Rep C					Rep D					

Actual amount of products used on a per acre basis:
 1,3-D Injection = 40 gpa broadcast
 Rampart = 80 lbs of 10G/acre; Vapam 800 ppm for 2.5 hours = 87 gpa;
 GV-81 (15% a.i.) 1,000 ppm for 2.5 hours = 280 gpa (56.4 lb carbon bisulfide);
 1,3-D SL (60% a.i.) 200 ppm for 2.5 hours = 17 gpa (11 gpa 1,3-D);
 Vydate I 100 ppm for 1.5 hours = 4.5 gpa (9 lbs a.i.);
 Subdue 100 ppm for 1.5 hours = 4.5 gpa (9 lbs a.i.).

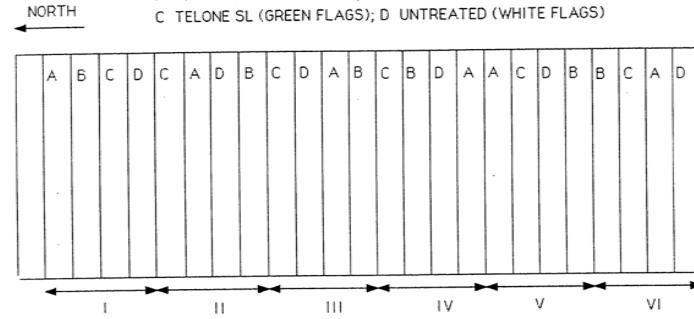
GY-81 / Bacterial Canker Plot



Grower: Owen Heinrich
Dudine Heinrich

TEHAMA COUNTY PRUNE TRIAL - PACIFIC FARMS - DRIP IRRIGATED ORCHARD - FIELD 56
 FRENCH PRUNE ON 29C - PLANTED 1984 - TREE SPACING: 20' X 20' - 109 TREES/ACRE

A GY-81 (ORANGE FLAGS); B NEMACUR 3 (BLUE FLAGS);
 C TELONE SL (GREEN FLAGS); D UNTREATED (WHITE FLAGS)



EMITTER SPACING: 41.2" (DELIVERING 0.75 GALLONS/HOUR). PLOT SIZE: 1 ROW WIDE X 8 TREES LONG.
 TREATMENT DATES AND RATES: MAY 8, 1989 - GY-81 (750 PPM CS₂ FOR 8 HOURS);
 NEMACUR 3 (1 GAL/TREATED ACRE, OR 340 ML IN 3 HOURS); TELONE SL (50 PPM FOR 3 HOURS,
 OR 153 ML IN 3 HOURS).

GY-81 - DRENCH TRIAL ON PRUNES - PACIFIC FARMS - TEHAMA COUNTY

TREATMENT	TRT NO.	RATE	FLAG COLOR
GY-81	1	500 PPM CS ₂ IN 250 GALLONS OF WATER/TREE	RED
CHECK	2	1 GALLON OF 0-0-10 IN 250 GALLONS OF WATER/TREE	GREEN/BLEU

REP 6	GY 6	GY 12	GY 18	CK 24	CK 30	CK 36	GY 42	CK 48	GY 54
REP 5	CK 5	CK 11	CK 17	GY 23	GY 29	GY 35	CK 41	GY 47	CK 53
REP 4	GY 4	GY 10	GY 16	CK 22	CK 28	CK 34	GY 40	CK 46	CK 52
REP 3	CK 3	CK 9	CK 15	GY 21	GY 27	GY 33	GY 39	CK 45	GY 51
REP 2	CK 2	CK 8	CK 14	GY 20	GY 26	GY 32	GY 38	CK 44	GY 50
REP 1	GY 1	GY 7	GY 13	CK 19	CK 25	CK 31	CK 37	GY 43	CK 49

A B C

								CHECK	
15M	8D	8B	7B	9B	2B	1B	4C	8C	
								3 APPLICATIONS	
14M	13M	16M	3A	5B	4B	3B	6A	9A	
								2 APPLICATIONS	
12M	4A	5D	2C	6D	1A	5A	2A	9D	
								1 APPLICATION	
6B	7A	1D	3D	6C	3C	5C	1C	8A	

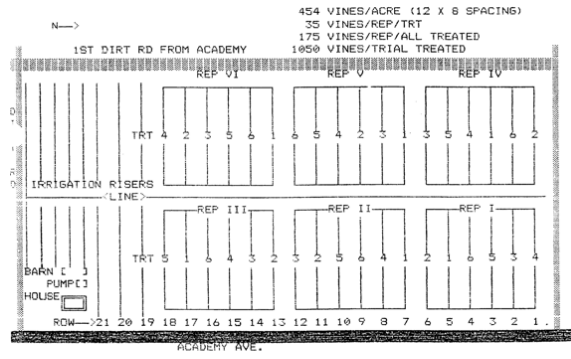
1 LB 2 LB 4 LB 1 LB 2 LB 4 LB 1 LB 2 LB 4 LB

← REP 1 REP 2 REP 3 →

FOLIAR APPLIED VYDATE L - MCKINLEYVILLE - FORTUNE DAFFODIL
 PLOT SIZE: 3 FEET X 10 FEET

UNOCAL GY-81 TEST PLOT

GROWER: DOUGLAS C. ANDERSON @FFICE=(209) 454-1043
 LOCATION: 13769 S. ACADEMY PAGER=(209) 454-2529
 KINGSBURG, CA 93631



TRT	PPM	FORMULATED	LENGTH OF APP. HRS.
1	300	6.25 GPA	6
2	300	12.50 GPA	12
3	600	12.50 GPA	6
4	600	25.00 GPA	12
5	900	18.75 GPA	6
6	UTC		

DON'T FORGET THE DUCT TAPE



DON'T FORGET THE DUCT TAPE