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)

MORE RECENT ADDITIONS:

- TELONE II (1,3-D)
- METAM SODIUM
- TEMIK (ALDICARB)
- RESISTANT VARIETIES

COLUMBIA ROOT-KNOT NEMATODE ON POTATOES:

PREVENTION
- WASHING EQUIPMENT
- CERTIFIED PLANTING STOCK

DAMAGE THRESHOLDS (BASED ON FALL POPULATION LEVELS)

CROP ROTATION
- ALFALFA
- WHEAT
- FALLOW
- BARLEY
- ONIONS
- 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

WHAT IS A FIELD?

LATHHOUSE / GREENHOUSE / GROWTH CHAMBER

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?

MICROPLOTS / MESOCOSM

Auburn, AL

UCDavis

by Caswell-Chen

UNIVERSITY FIELD STATION

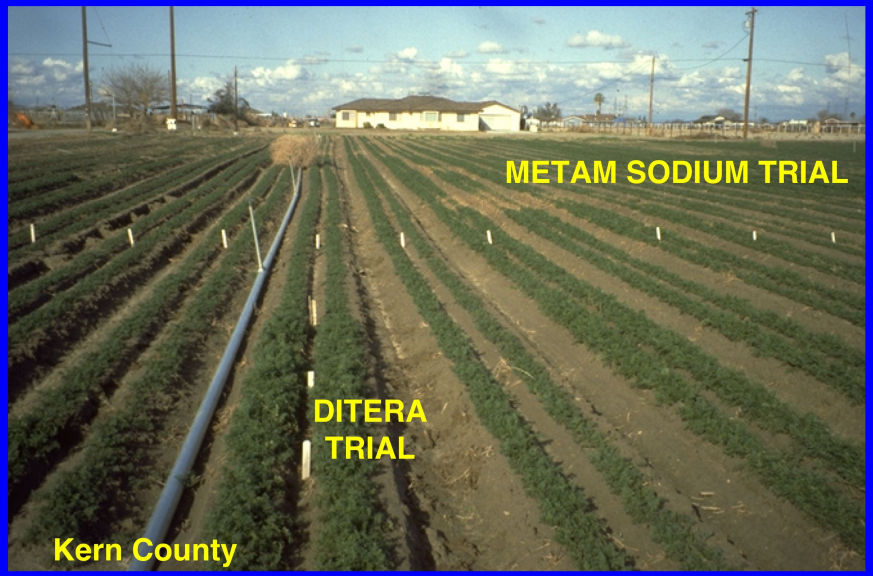
Intermountain Research and Extension Center

UNIVERSITY FIELD STATION

South Coast Research and Extension Center

UNIVERSITY FIELD STATION - TOMATO TRIAL

TWO CARROT TRIALS IN GROWER'S FIELD



PRIVATE / GROWER FIELD STATION

UC Policy Communication 18,

CAL-EPA Research Authorizations

Good Laboratory Practice (GLP) for residue trials

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.

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.

Things to record or collect

names of the local dogs,
phone number to call if you get locked in,
location of nearest medical help.
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 temperture,
% 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

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.

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.

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.

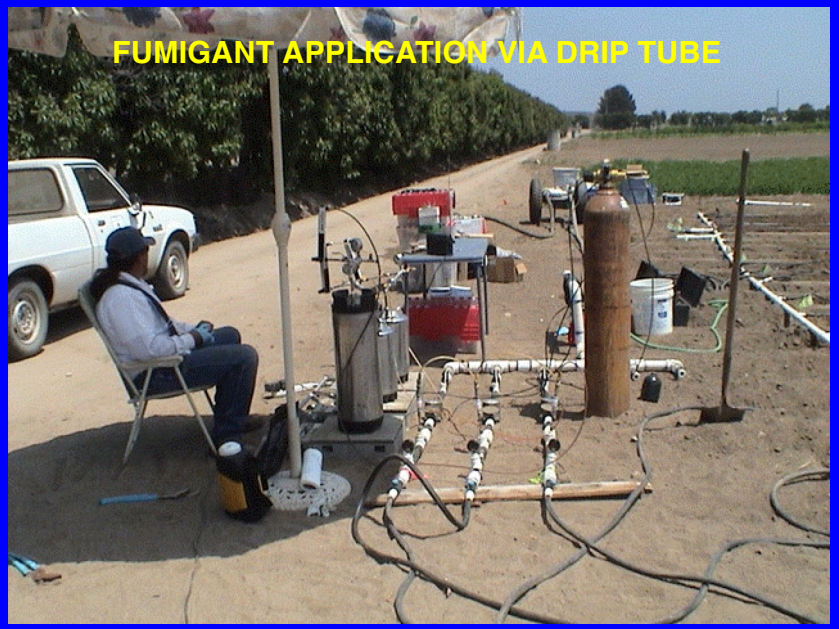
Recontamination of treated areas.

IN FURROW APPLICATION OF BIOLOGICAL NEMATICIDE

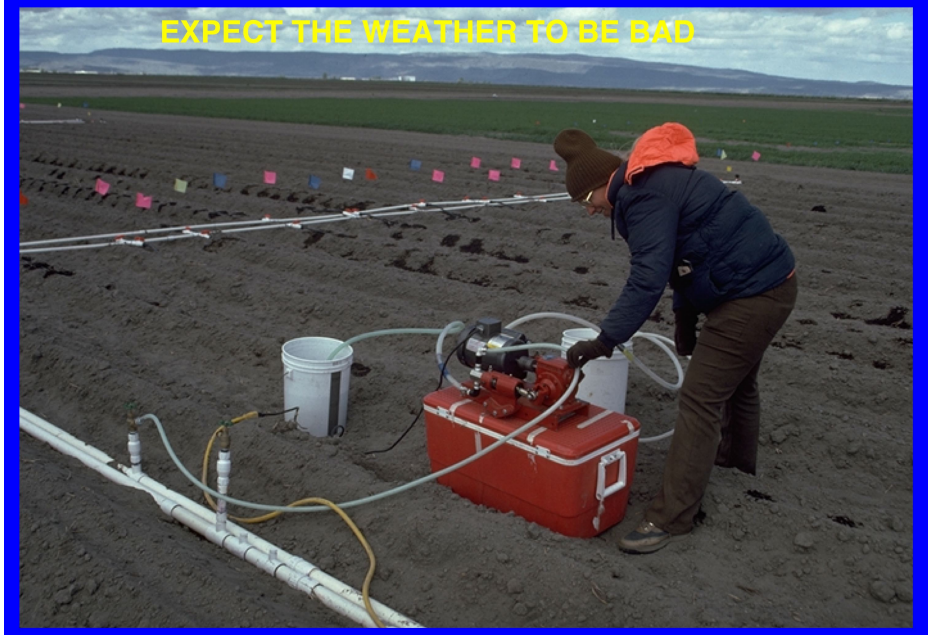
CARROT TRIAL IN GROWER'S FIELD

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 temperture.

Pretreatment

PI, from every plot

vs from untreated checks

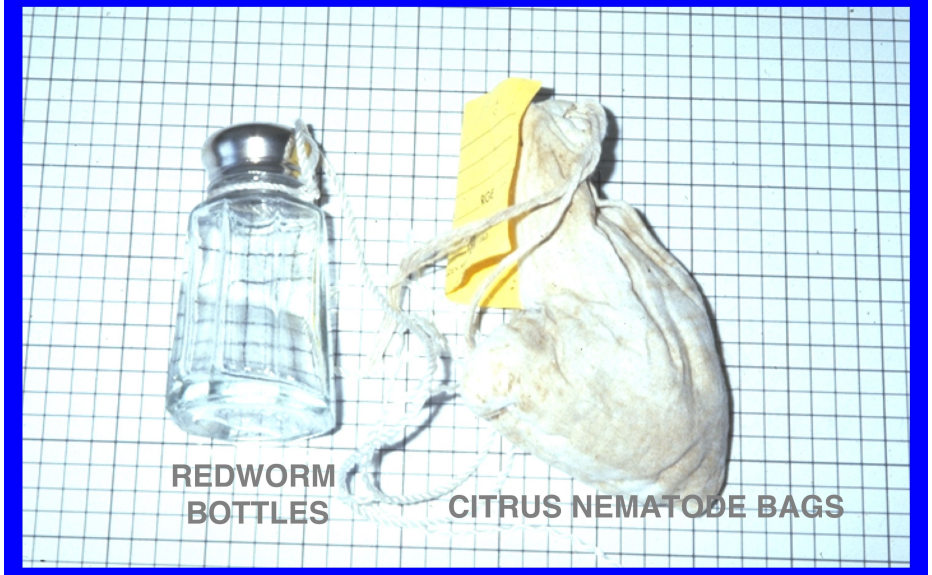
vs from each block, etc.

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).

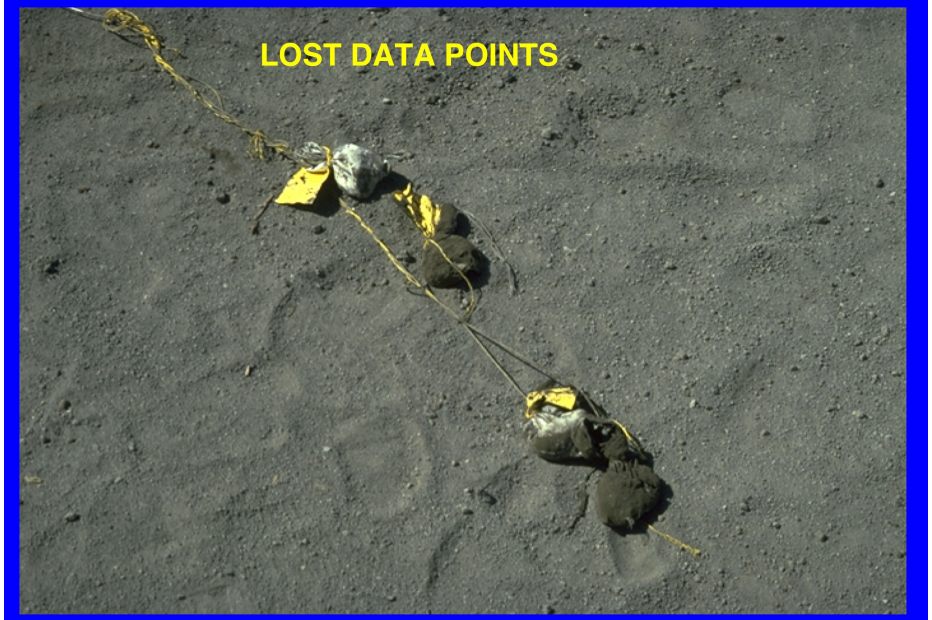
TAKING SOIL SAMPLES MID-SEASON

BIOINDICATORS: WORMS, CITRUS NEMATODE, INSECTS, SEEDS

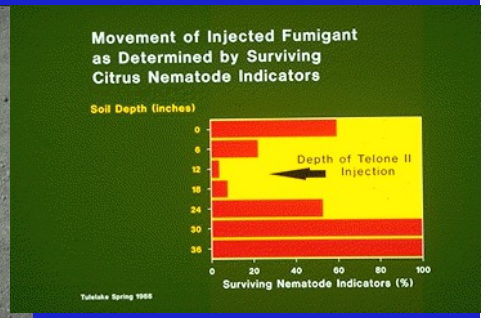


BURYING CITRUS NEMATODE BIOINDICATORS

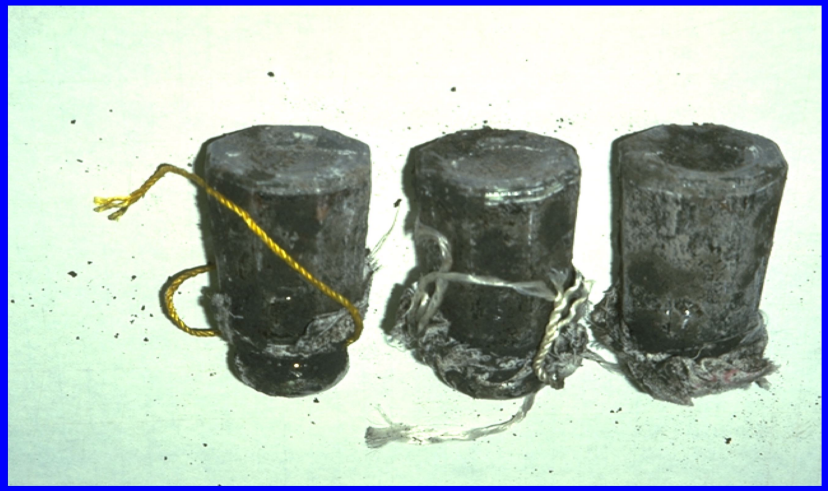
LOST DATA POINTS



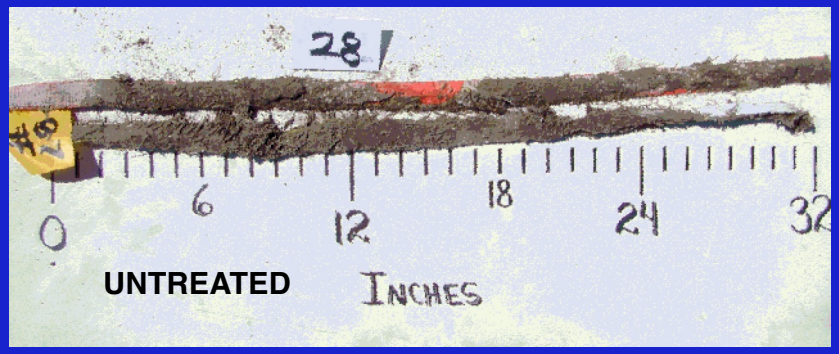
CITRUS NEMATODE
TYLENCHULUS SEMIPENETRANS



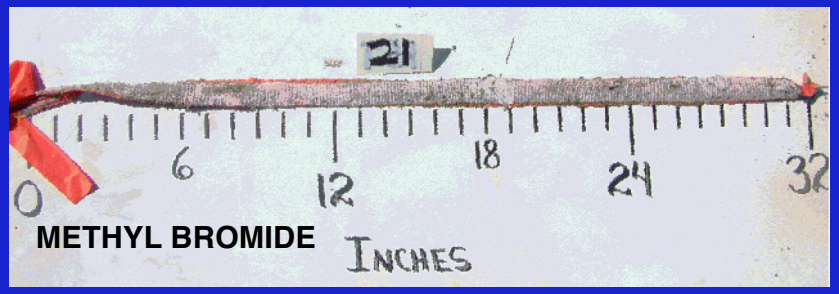
RED WORM BIOINDICATORS



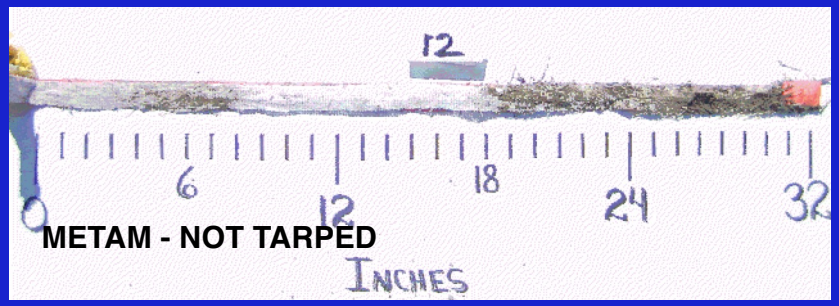
WEED TAPES / GRASS SEED INDICATORS



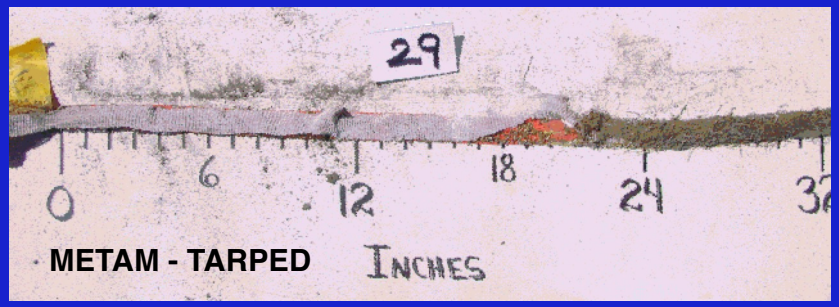
UNTREATED



METHYL BROMIDE



METAM - NOT TARPED



METAM - TARPED

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.

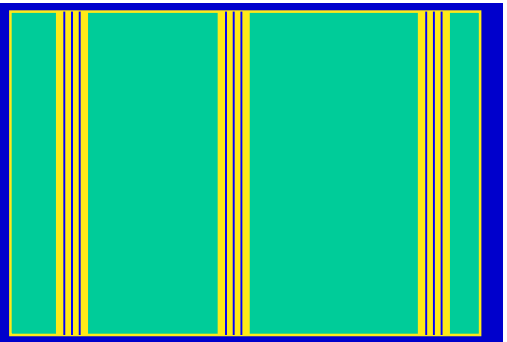
Plot size for nematode evaluation

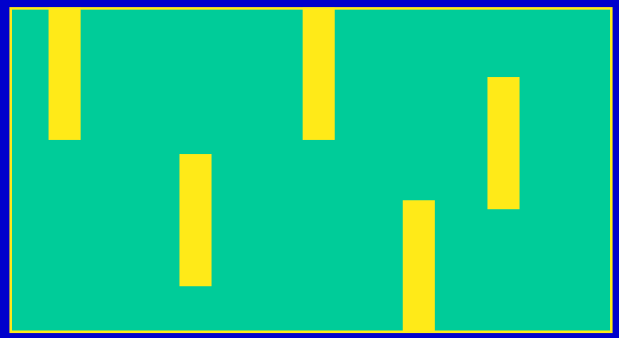
vs plot size for crop yield evaluation.

Statistical analysis programs (SAS, JMP).

FIELD TESTING:

- UNTREATED AREAS
- REPLICATION
- RANDOMIZATION
- CHEMICAL STANDARD

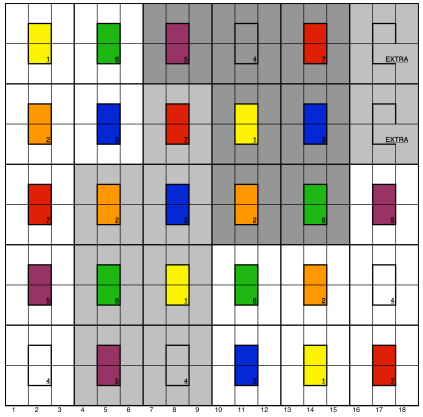




BIOFUMIGATION:
EVALUATION OF BROCCOLI RESIDUE FOR SUGARBEET CYST NEMATODE (SBCN) CONTROL
BROCCOLI IS A HOST FOR SBCN
BRASSICACEAE PRODUCE GLUCOSINOLATES
BROCCOLI DEGRADATION RELEASES ISOTHIOCYANATES
WHY IS SBCN A PROBLEM ON BROCCOLI?

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

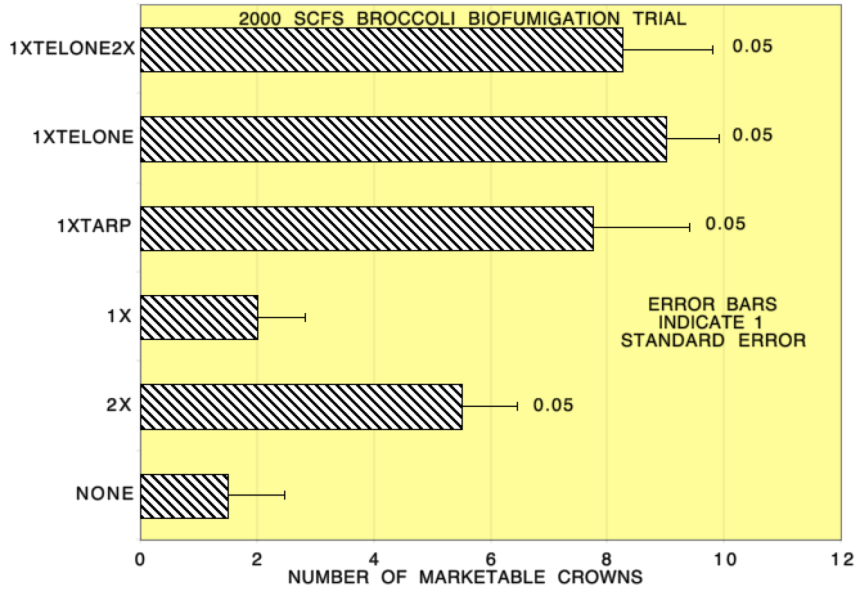
2 WEEKS TOTAL BETWEEN CROPS



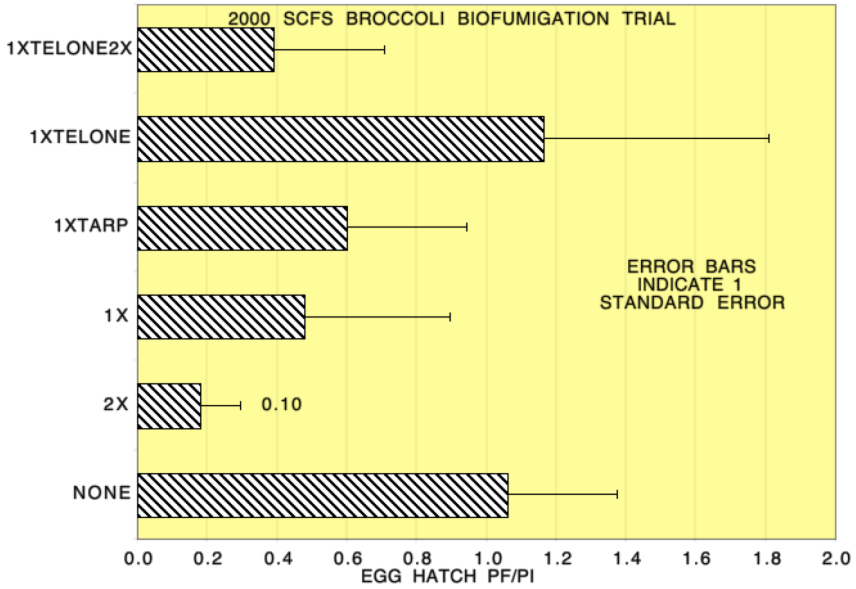
BROCCOLI MOWED AND CHOPPED

FIELD TILLED, BEDDED, AND TARPED

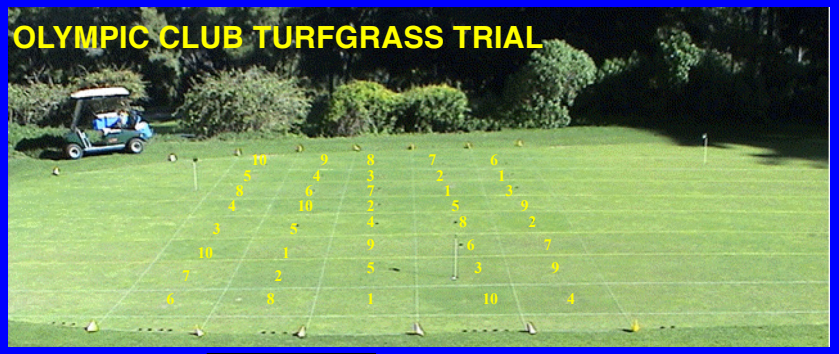
2000 - YIELD INCREASES WITH BIOFUMIGATION



2000 - NEMATODE REDUCTION WITH BIOFUMIGATION



OLYMPIC CLUB TURFGRASS TRIAL



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

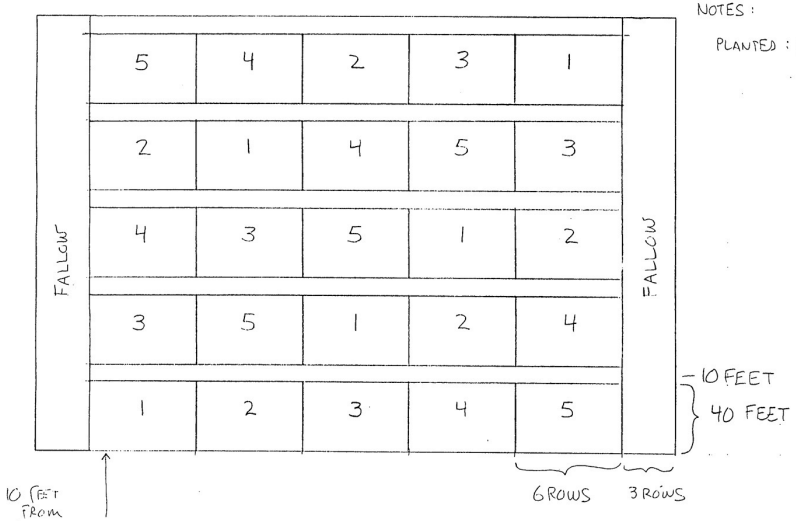
SUGAR BEET CYST PLOT
HANKS
SOUTH DAVIS

PLOT #:

1. ANGELIA (PHACELIA)
2. NEMEX (RADISH)
3. MAXI (MUSTARD)
4. PREGO (BUCKWHEAT)
5. FALLOW CHECK.

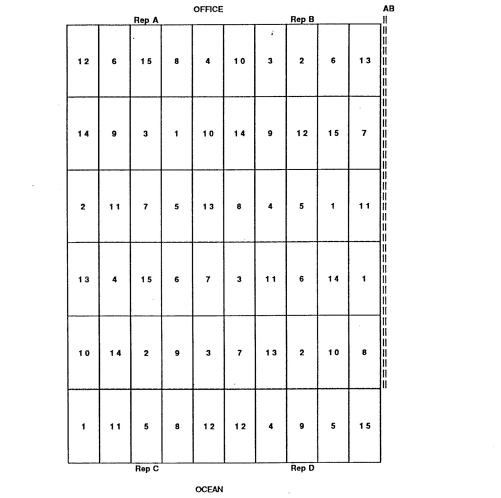
NOTES:

PLANTED: 8-20-91



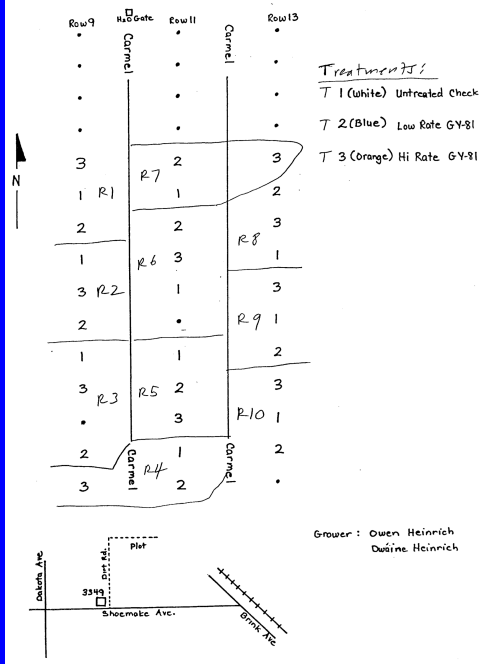
1989-90 EASTER LILY RESEARCH FOUNDATION/UC COOPERATIVE EXTENSION NEMATODE PLOT

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. GY-81 Drip Preplant
13. GY-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



Actual amount of products used on a per acre basis:
Rampart = 80 lbs of 10G/acre;
GY-81 (13% ai) 1,000 ppm for 2.5 hours = 280 gpa (36.4 lb carbon bisulfide);
1,3-D SL (65% ai) 300 ppm for 2.5 hours = 17 gpa (11 gpa 1,3-D);
Vydate L 100 ppm for 1.5 hours = 4.5 gpa (9 lbs ai);
Subdue 100 ppm for 1.5 hours = 4.5 gpa (9 lbs ai).
1,3-D injection = 40 gpa broadcast
Vapam 800 ppm for 2.5 hours= 87 gpa;

GY-81 / Bacterial Canker Plot

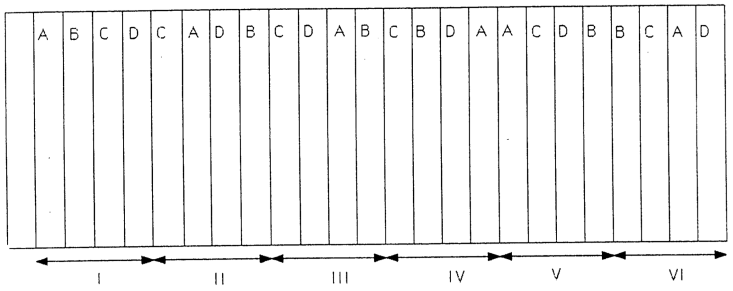


Grower: Owen Heinrich
Duaine Heinrich

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)

NORTH



REPLICATE NUMBER

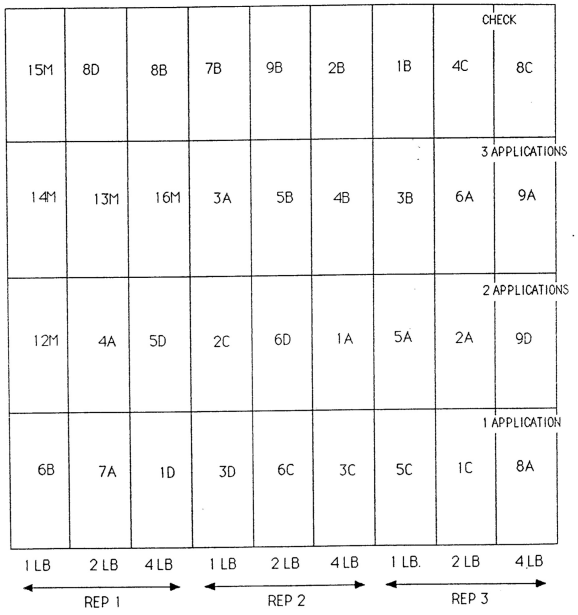
EMITTER SPACING: 41.2" (DELIVERING 0.75 GALLONS/HOUR). PLOT SIZE: 1 ROW WIDE X 8 TREES LONG.
TREATMENT DATES AND RATES: MAY 8, 1989 - GY-81 (750 PPM CS_2 FOR 8 HOURS);
NEMACUR 3 (1 GAL/TREATED ACRE, OR 340 ML IN 3 HOURS); TELONE SL (50 PPM FOR 3HOURS, OR 153 ML IN 3 HOURS).

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

N
W E
S

TREATMENT	TRT NO.	RATE	FLAG COLOR
GY-81	1	500 PPM CS2 IN 250 GALLONS OF WATER/TREE	RED
CHECK	2	1 GALLON OF 0-0-10 IN 250 GALLONS OF WATER/TREE	GREEN/BLUE

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	CK 40	GY 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



FOLIAR APPLIED VYDATE L - MCKINLEYVILLE - FORTUNE DAFFODIL

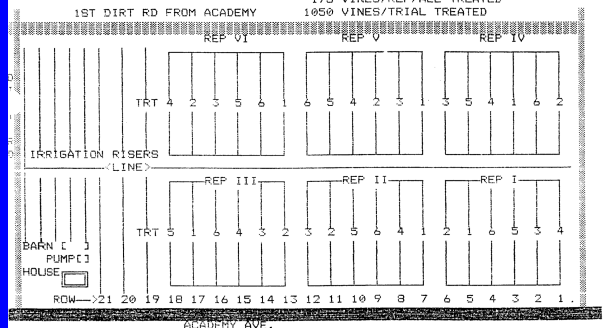
PLOT SIZE: 3 FEET X 10 FEET

UNOCAL GY-81 TEST PLOT

GROWER: DOUGLAS C. ANDERSON
LOCATION: 13709 S. ACADEMY
KINGSBURG, CA 93631

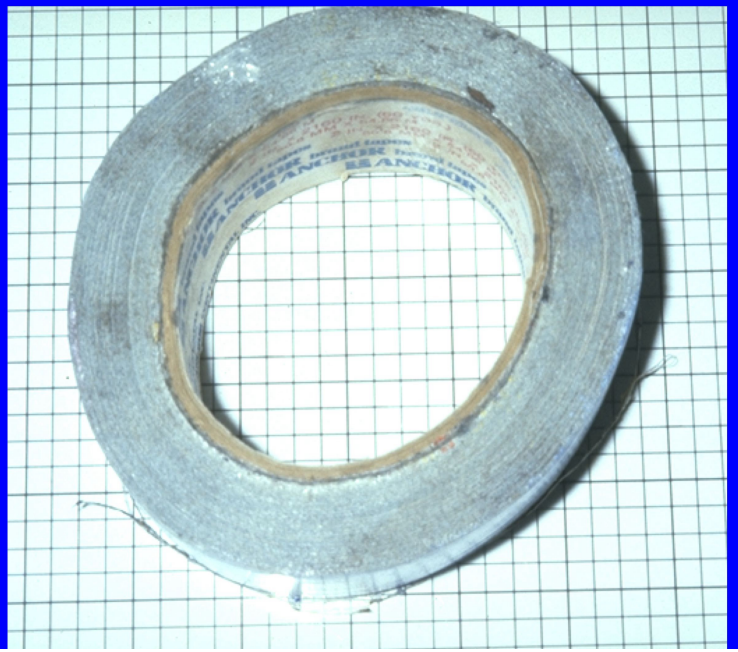
OFFICE=(209) 456-1043
PAGER=(209) 454-2529

454 VINES/ACRE (12 X 8 SPACING)
35 VINES/REP/TRT
175 VINES/REP/ALL TREATED
1050 VINES/TRIAL TREATED



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