

Nematicide efficacy trials in California sweetpotatoes

*CE for Pest Management Pros
Sept 2023*

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UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Cooperative Extension

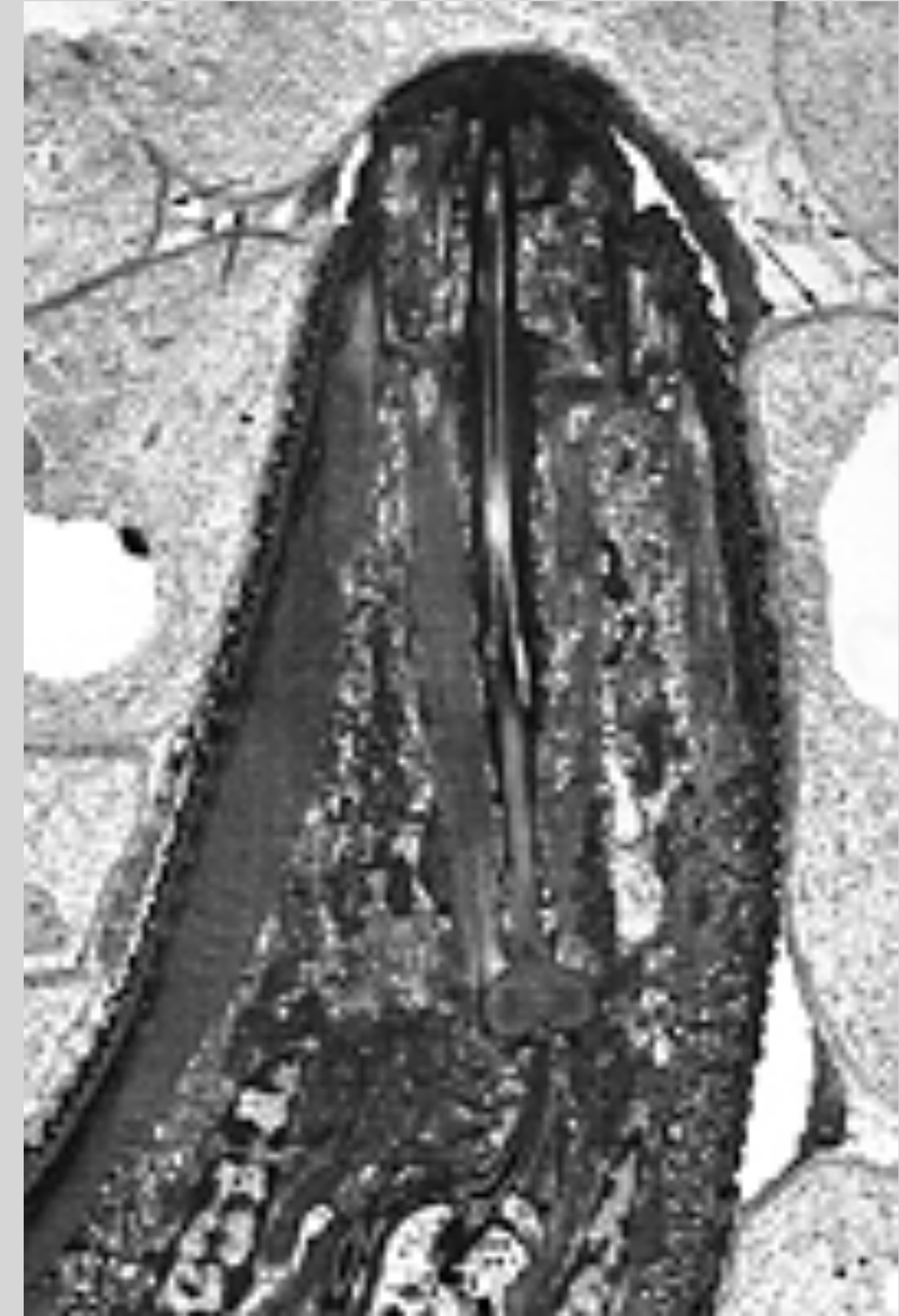
Main pest species: RKN

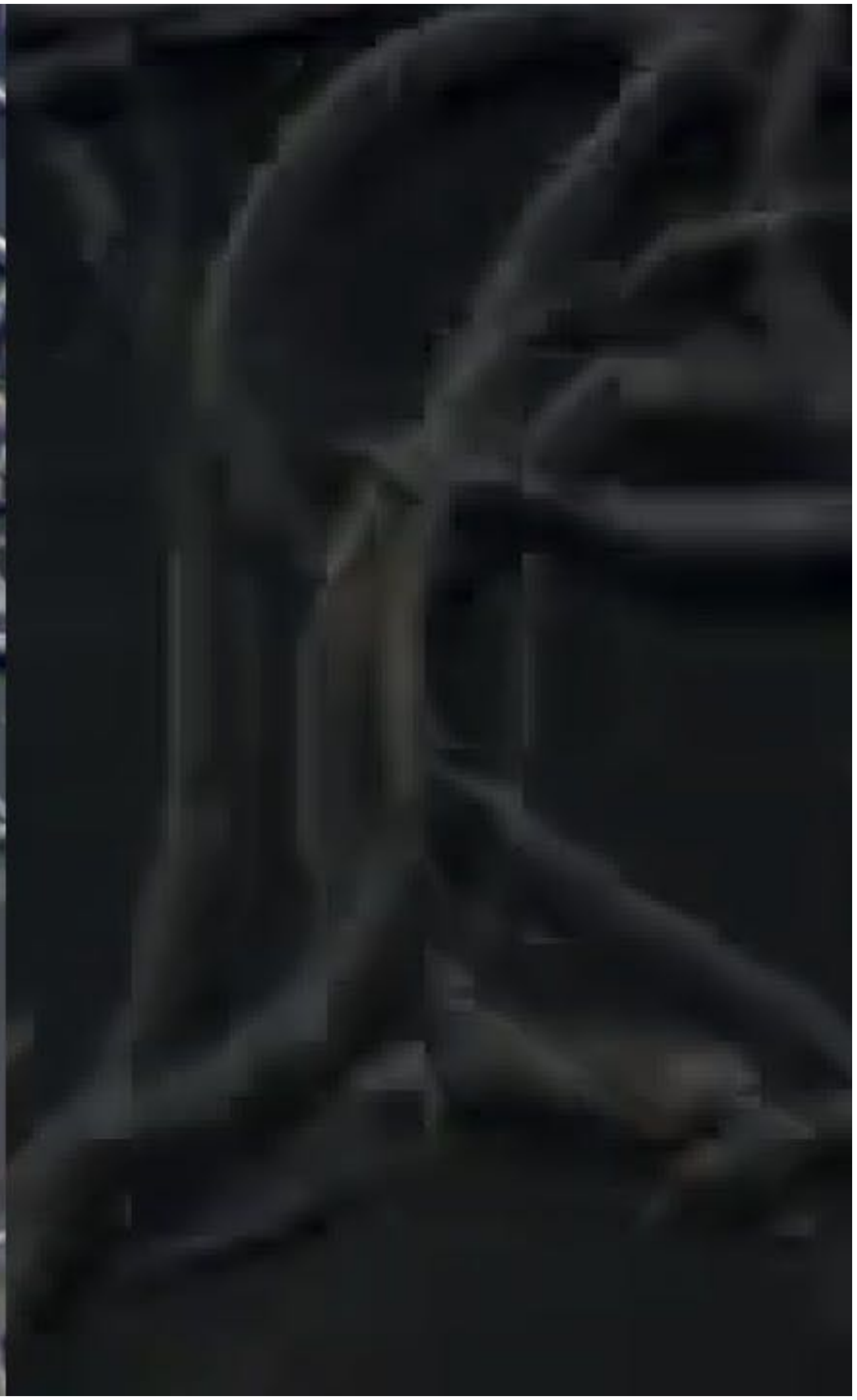
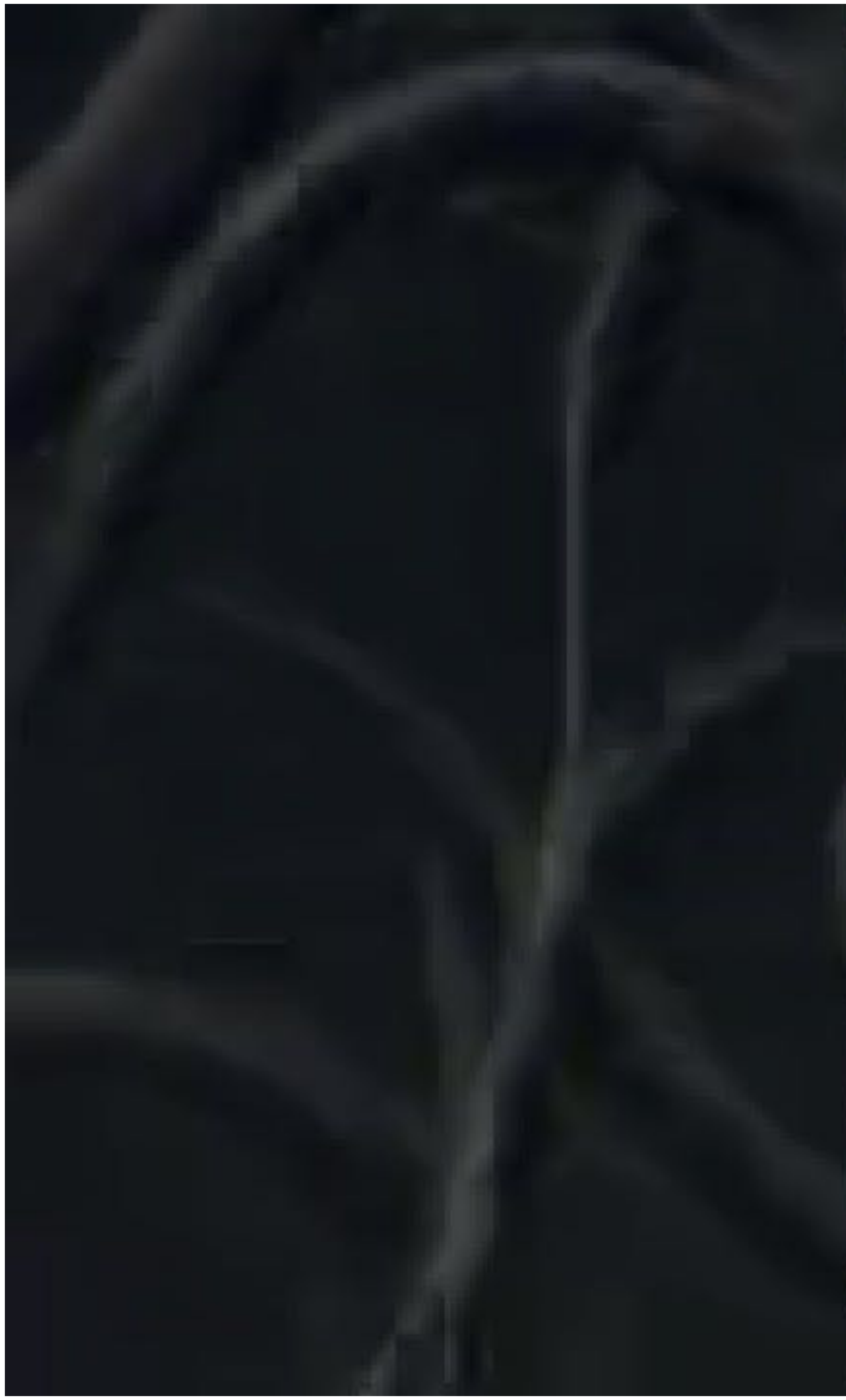
- *Meloidogyne incognita*, Southern Root Knot Nematode.
- *M. javanica*. (mostly tropical)
- *M. hapla*. Northern Root Knot nematode (not common here)
- *M. floridensis*. Peach Root Knot (new in 2017 and probably eradicated)
- **Note:** reniform nematodes (*Rotylenchulus* spp) are not in CA. Stubby root nematodes (*Paratrichodorus* spp) are not in the RKN family.



Root knot nematode biology

- Obligate plant parasites
- First described in 1855 on cucumbers: *Meloidogyne exigua*. Mitkowski, N.A. and G.S. Abawi. 2003. *Root-knot nematodes. The Plant Health Instructor*. DOI:10.1094/PHI-I-2003-0917-01
- (*M. javanica*, *M. arenaria*, *M. incognita*, and *M. hapla*) are major pests worldwide
- Can attack monocots and dicots, annuals and perennials.






Conditions favoring RKN

- Light-textured soils that have 50% or more sand, such as loamy sands and sandy loams, where plants with damaged roots quickly become stressed for water.
- Temperature: Hatch when soil at 64 F. 77 - 82 F ideal for many *Meloidogyne* spp.
- Moisture 80 - 100% field capacity
- Susceptible crops and weeds





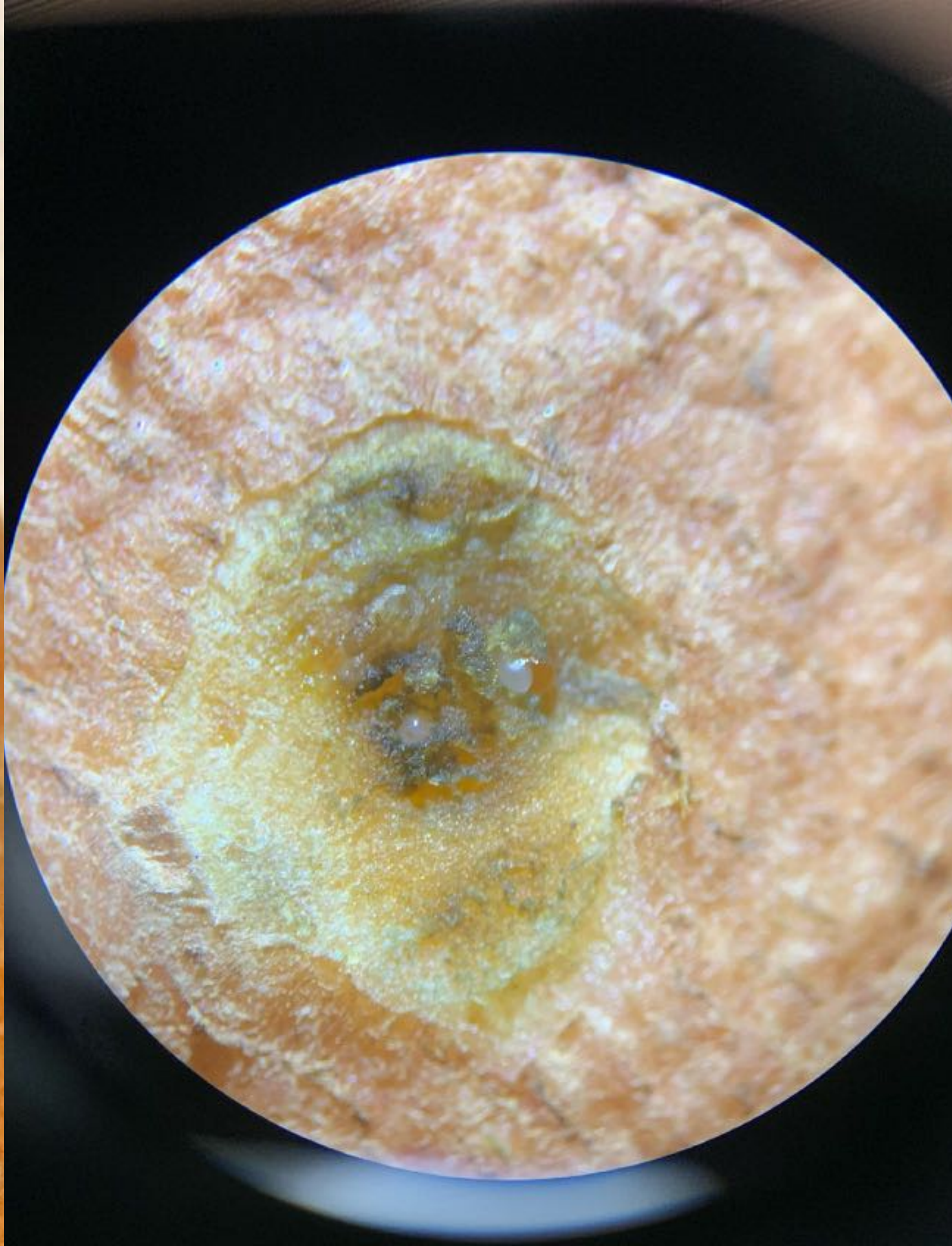
Sweetpotato
production in
CA occurs
mainly in loamy
sands and
sandy soils.

Common symptoms include abnormal leaf color, abnormal leaf form, wilting leaves, galls, swollen roots, reduced root system, dwarfing and senescence.

Reduced yield and quality

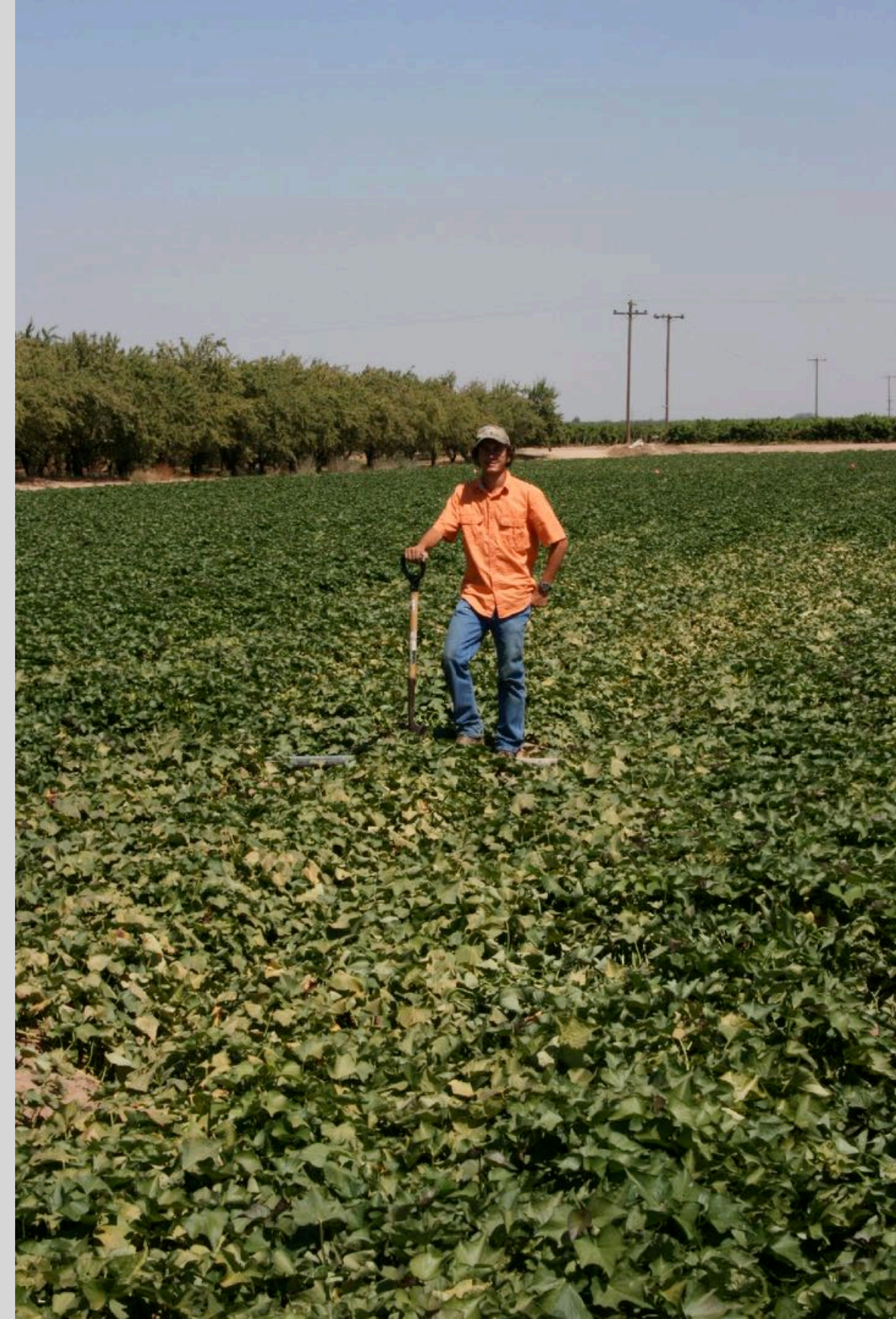






RKN impacts

- Infect at least 50% of all crops worldwide, > \$100 billion annually.
- Reduced yield: peaches 20%, sweetpotatoes 50%,
- Reduced quality.
- Secondary problems: Fusarium, crown gall, reduced tolerance to abiotic stress (water, salt).



Tomatoes: F3 and other Fusarium diseases

RKN reduces resistance in resistant
varieties





Nematode Management

- Clean seed and sanitation (sweetpotatoes, onions, orchards)
- Crop rotation and fallow
- Biocontrol agents (fungi, viruses, bacteria)
- Resistant cultivars
- fumigation & solarization
- nematicides

cover crops and weeds

- nightshades, purslane, mallow, velvetleaf, mustards, lambsquarters, nutsedge can be hosts
- Merced rye, Sudangrass usually considered to be non hosts.

cheeseweed (Malva, mallow)

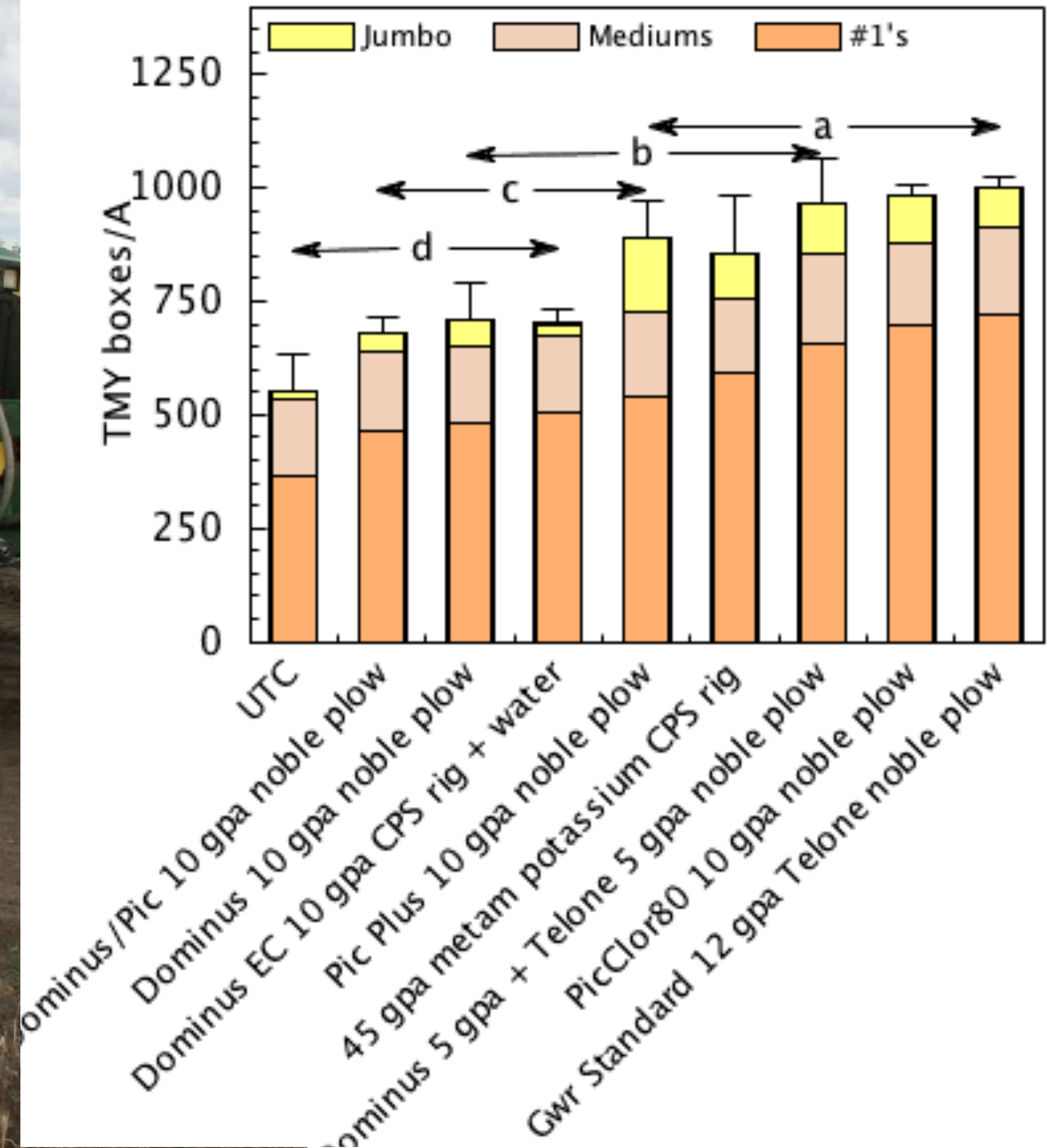


Fumigation



Dominus Fumigation Trial 2015

Covington Sweetpotato Yield



Situation

- Nematodes, especially RKN, remain the main pest issue for sweetpotato growers in CA.
- Telone (1,3-D) is the standard control method, but regulatory caps limit use to ~ 25 - 50% in impacted townships.
- Metam (Vapam) products are expensive and have reduced efficacy.
- All fumigants have a long list of regulatory restrictions, require FMPs, & significant buffer zones.



older chemistry

- Vydate. Oxamyl. Cat I (Danger). Also insecticide.
- Mocap. Ethoprop. Cat I (Danger). Also insecticide.

RESTRICTED USE
Due to Acute Toxicity And Toxicity
For retail sale to and use only by Certified Applicators or persons covered by the Certified Applicator's certification.

DU PONT


DuPont™
Vydate® L

insecticide/nematicide

Water Soluble Liquid
1 GALLON CONTAINS 2 LBS. ACTIVE INGREDIENT

<i>Active Ingredient</i>	<i>By Weight</i>
Oxamyl [Methyl N,N'-dimethyl-N-[(methyl carbamoyl)oxy]-1-thiooxamimidate]	24%
<i>Inert Ingredients</i>	76%
TOTAL	100%

Contains Methanol
EPA Reg. No. 352-372

KEEP OUT OF REACH OF CHILDREN
DANGER  **POISON**
PELIGRO

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand this label, find someone to explain it to you in detail.)

FIRST AID
Contains an N-methyl carbamate that inhibits cholinesterase.
IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to

Root knot nematode (RKN) management in sweetpotatoes with new nematicides (2016)

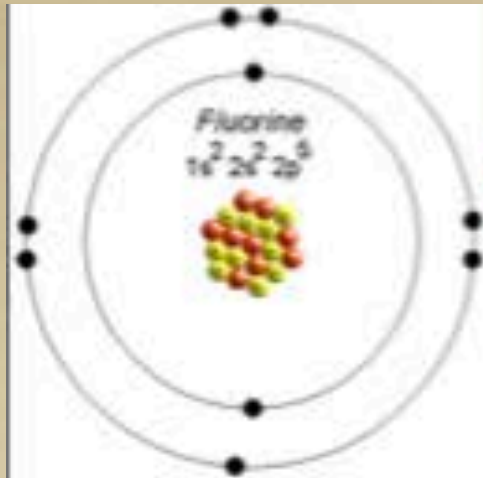


Scott Stoddard, UC Cooperative
Extension Merced County
Antoon Ploeg, UC Riverside Dept. of
Nematology



University of California
Agriculture and Natural Resources

Making a Difference
for California



New fluorine (3-F) nematicides

Chemical name	Trade name	Structure	Soil movement / solubility (water)	Soil 1/2 life	MOA	Tox. Cat.
Fumigants (1,3-D)	Many		Good- Gas	Short < 14 d	?	Danger
Oxamyl	Vydate		Good- 240,000 ppm	Short 7 d	AChEI 	Danger
Fluensulfone	Nimitz 		Medium- 545 ppm	Short 7-17 d	?	Caution
Fluopyram	Velum 		Poor – 10 ppm	Long > 200 d	SDHI 	Caution
Fluazaindolizine	Salibro (reg '20)		Medium+ 2000 ppm	Medium 30 d	?	Caution

New products are less toxic and more selective – true nematicides

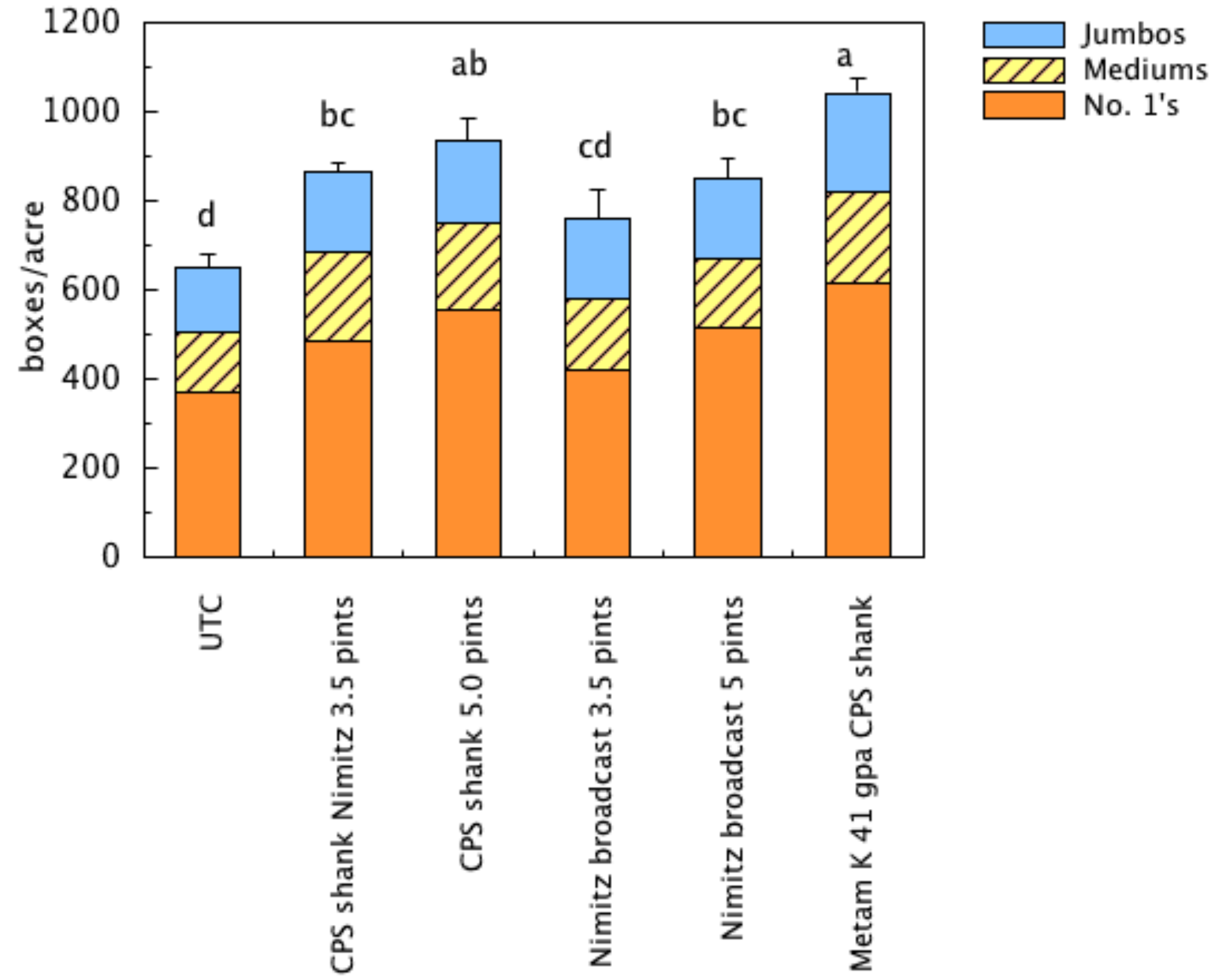
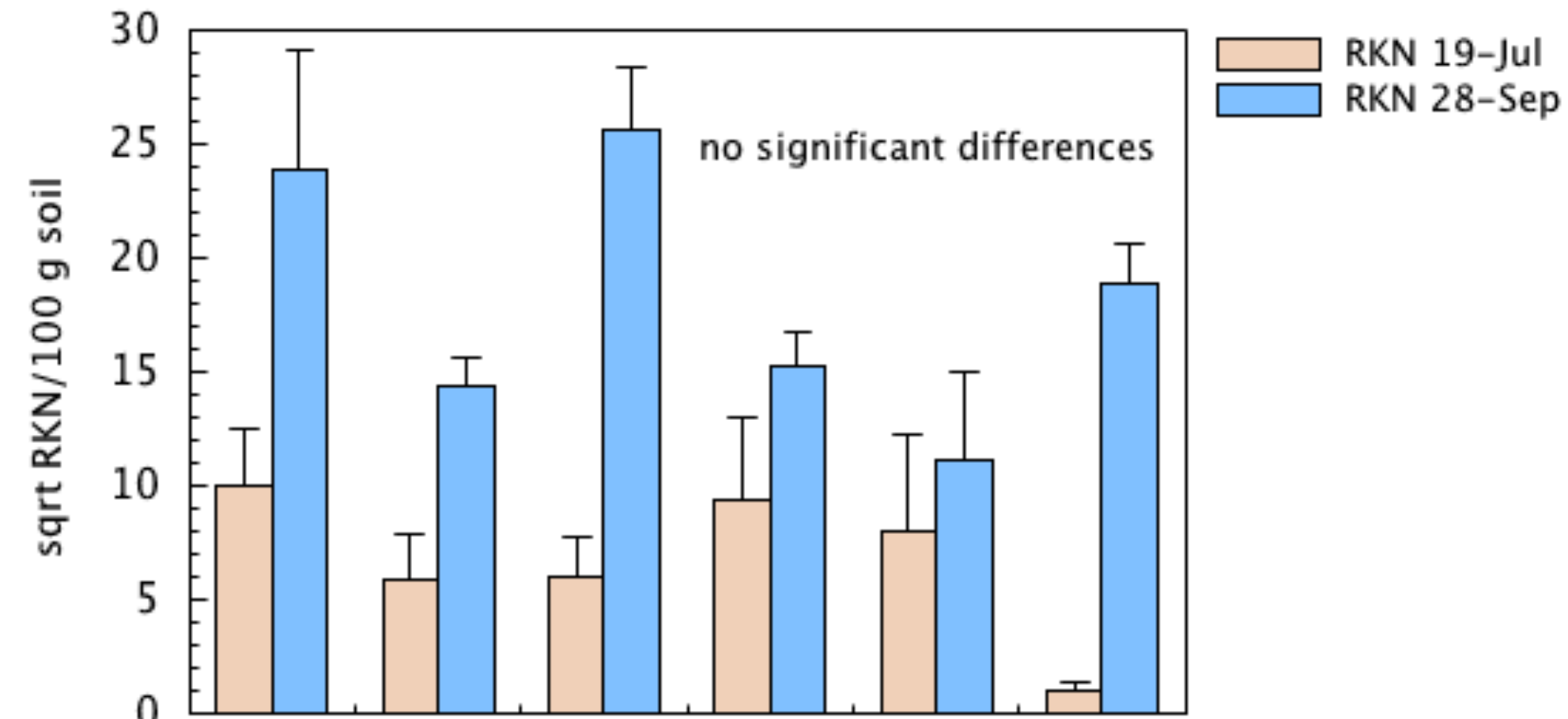
New modes of action – or unknown;

Different soil behavior – efficacy and application

**Metam applied at 3",
6", and 9" on 9"
centers.**



Nimitz Trial on Sweetpotatoes
Merced County 2016





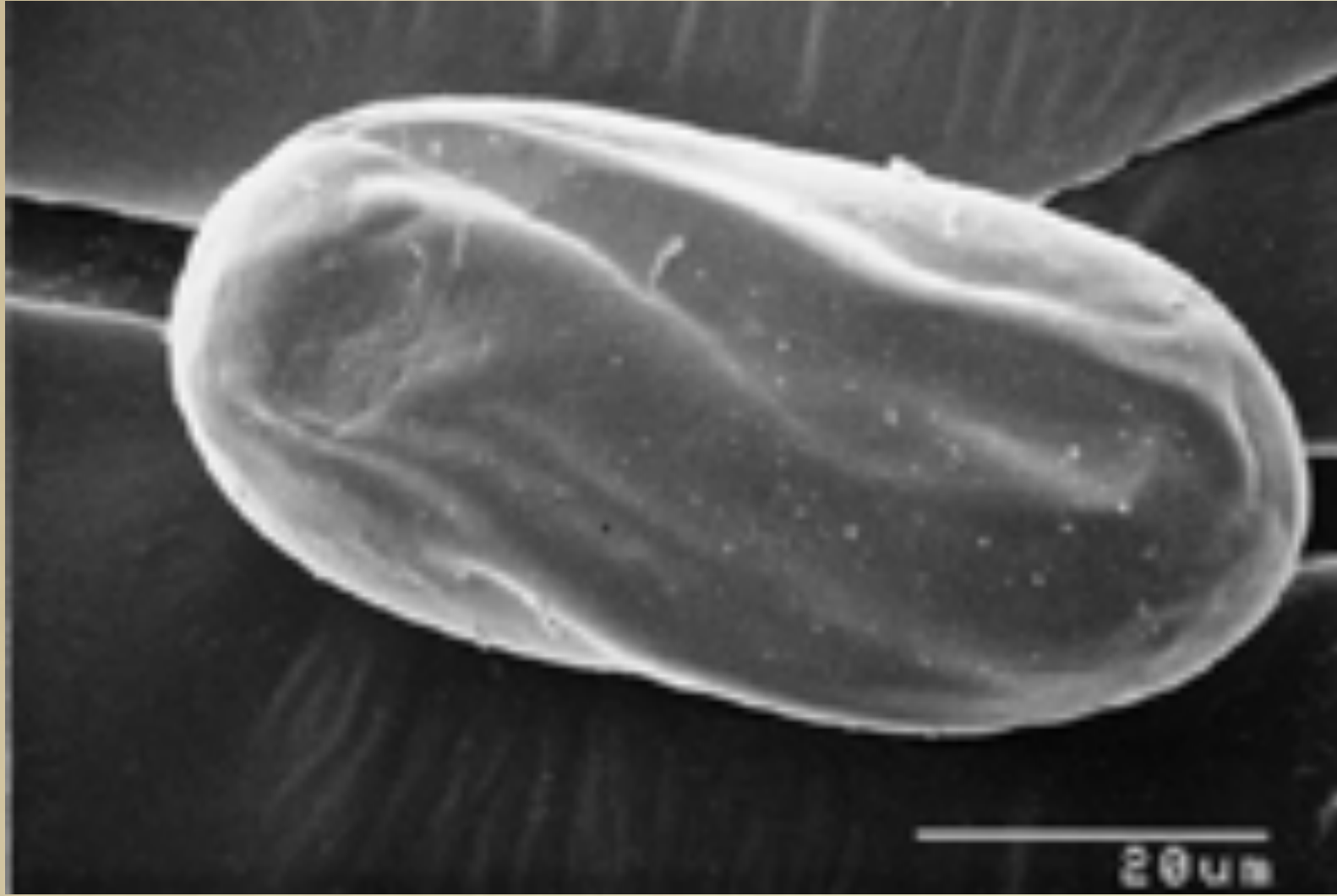
2017 Merced County Trial:

Evaluate Nimitz, Velum One, and Salibro (Q-80) with different rates, timings, and methods of application.

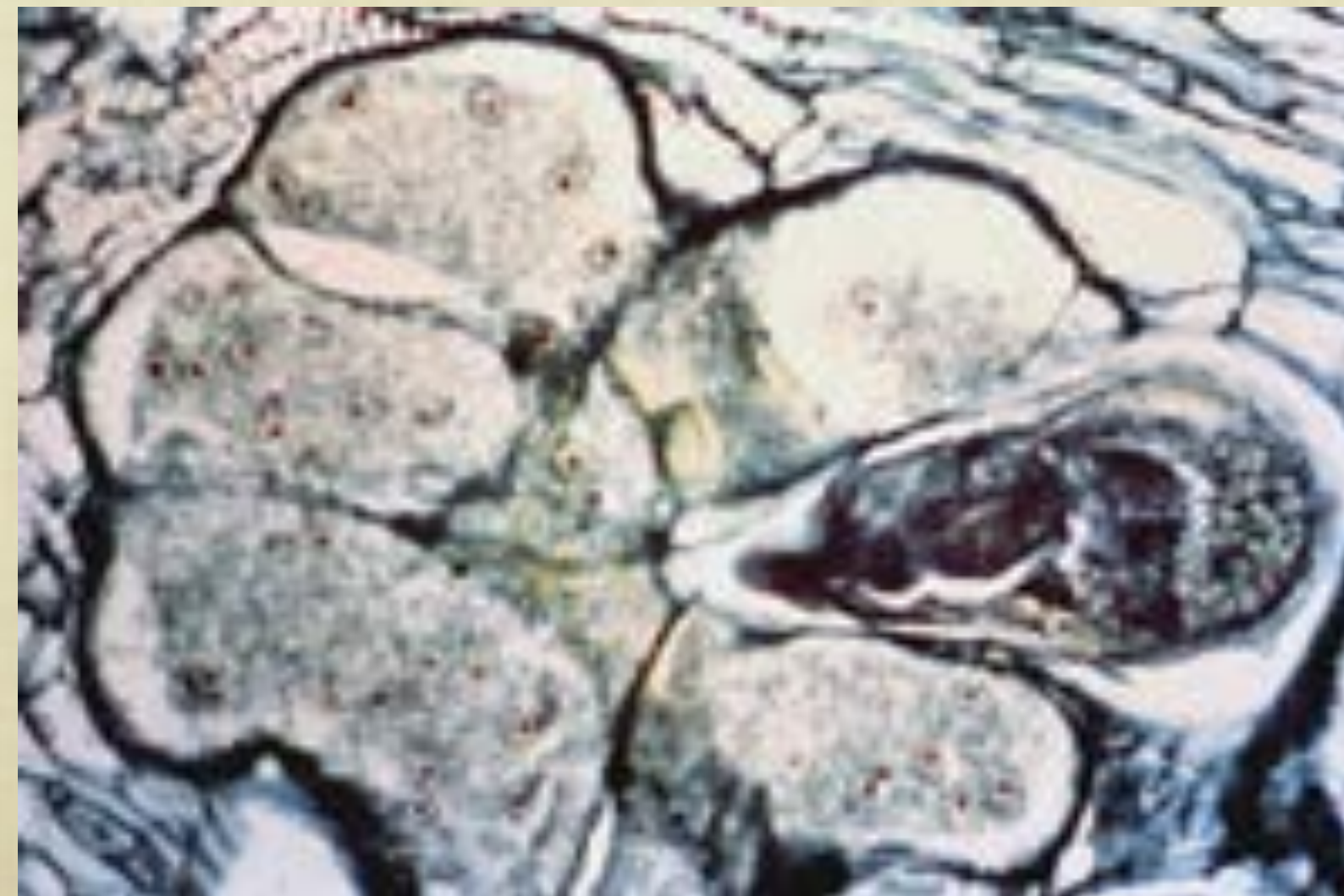
at plant in transplant water
side drizzle

4 & 6 weeks POST:
drip application

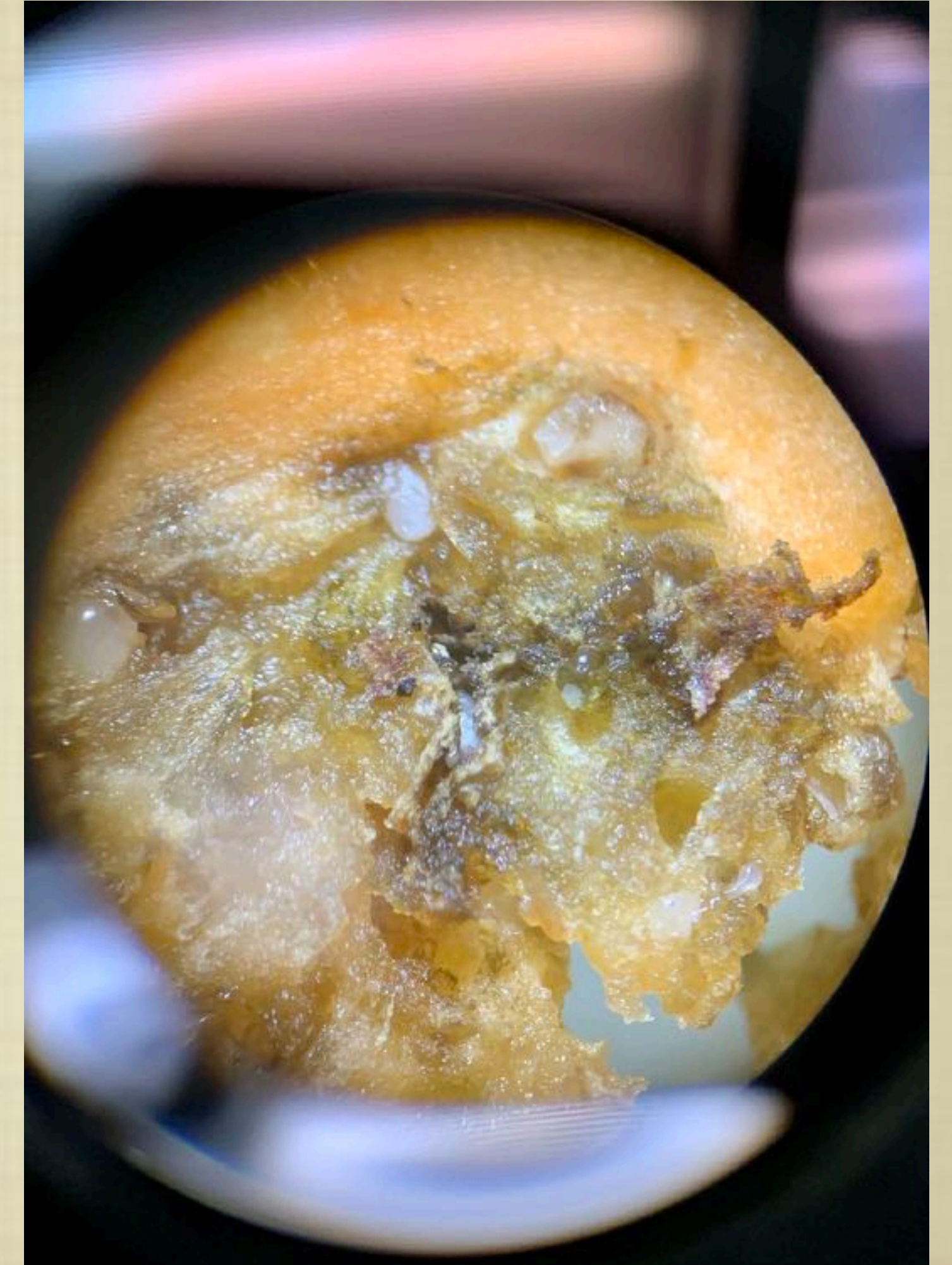
2 weeks (temp dependent)



egg



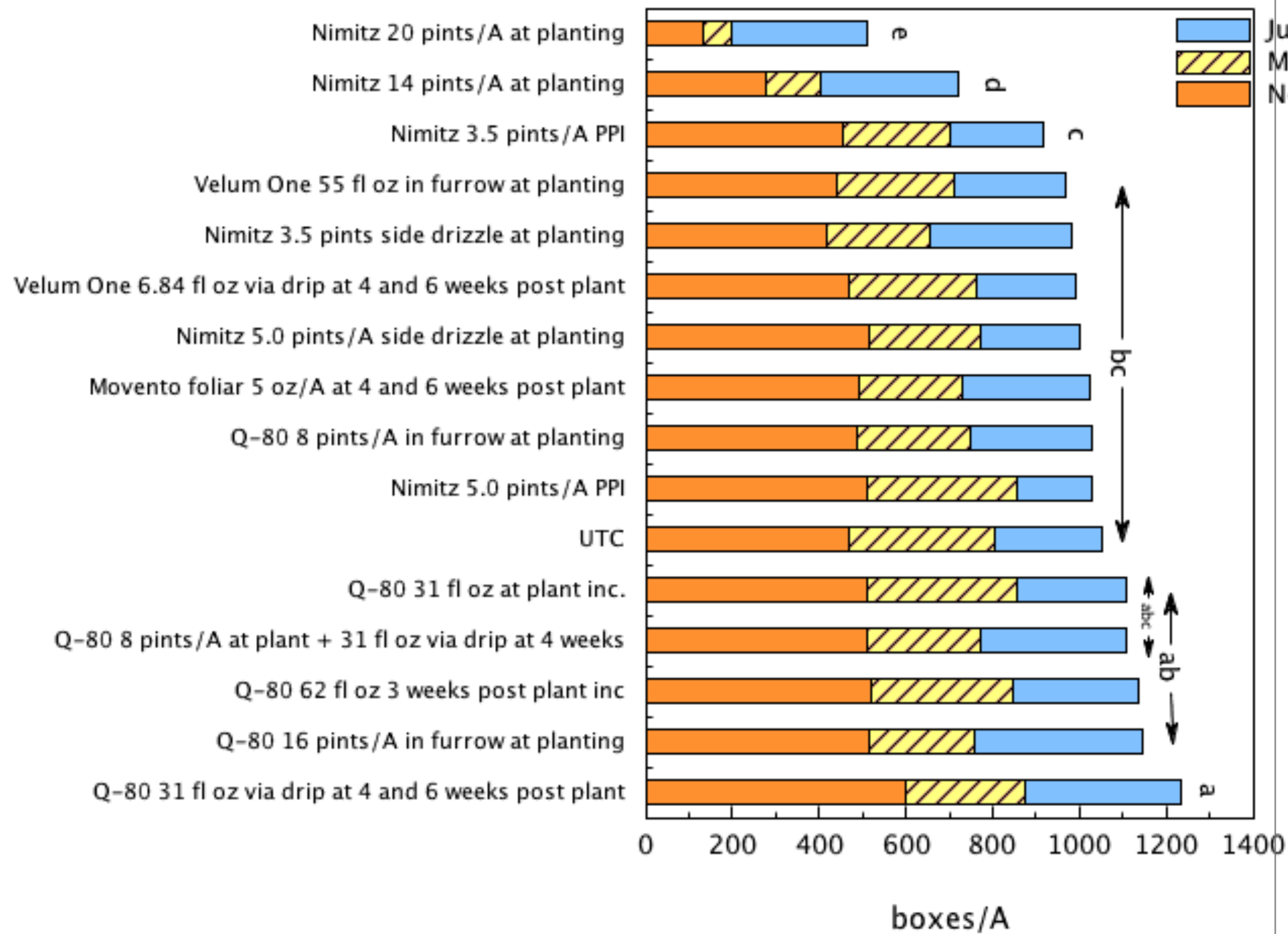
J2 and giant-cells



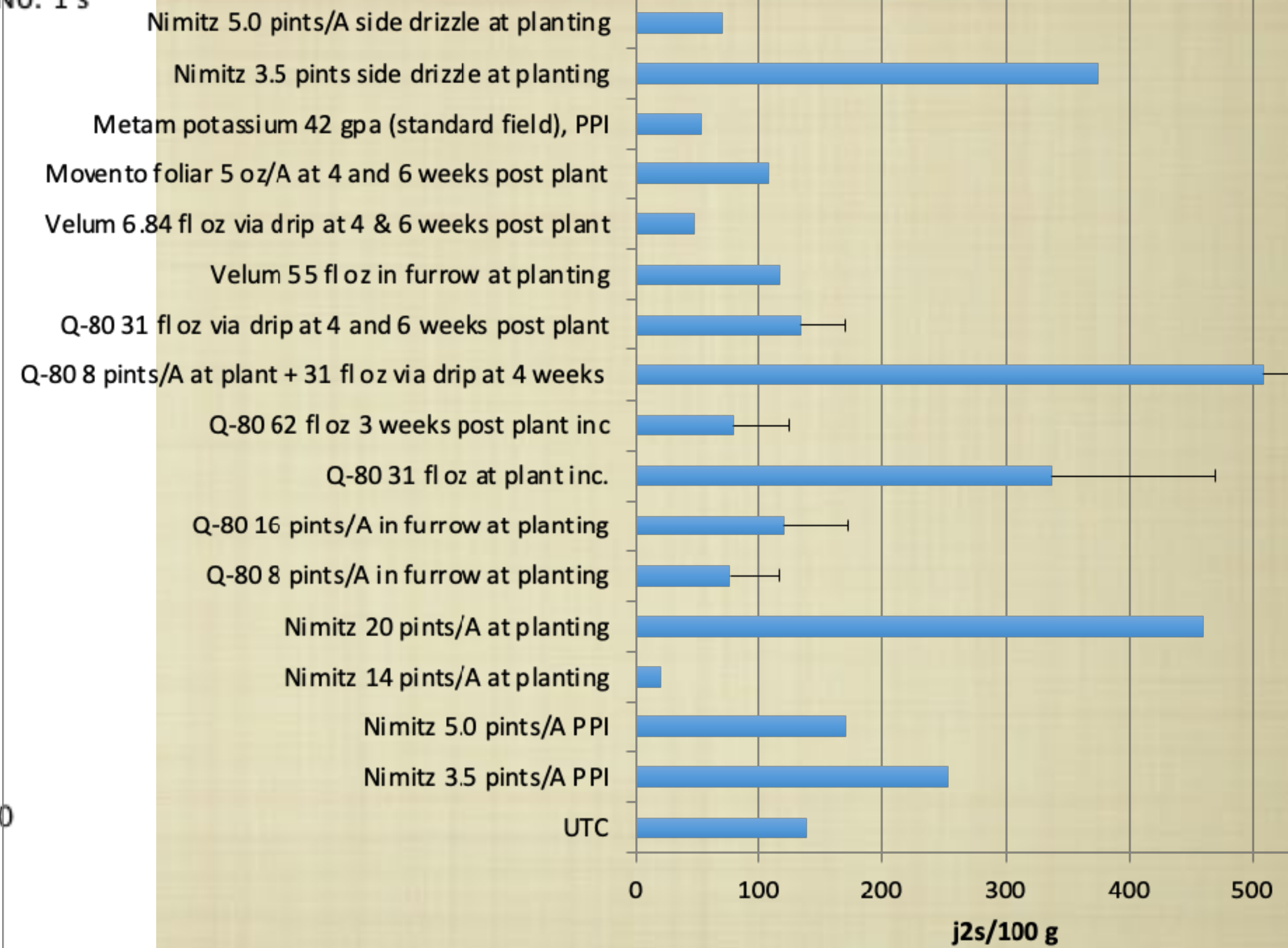
adult females

No significant impact on RKN counts

Sweetpotato Nematicide Trial, Target location 2017

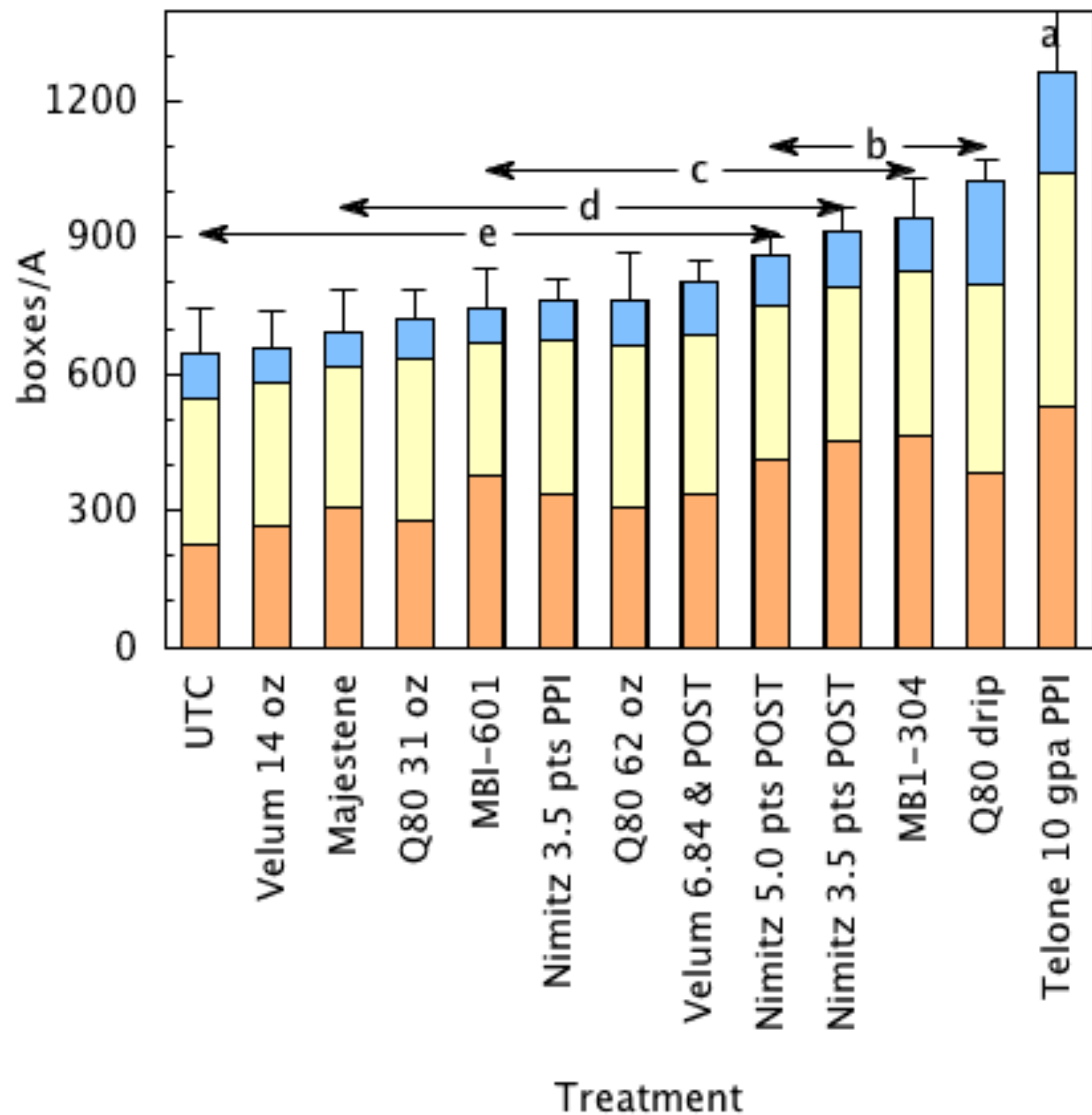


Merced 2017 fall RKN



Nematicide Trial on Sweetpotatoes

Atwater, CA 2018



■ M Jumbos
■ M Meds
■ M No. 1's



- 8 Q-80 31 fl oz/A at plant in transplant water
- 9 Q-80 62 fl oz at plant in transplant water
- 10 Q-80 31 fl oz/A by drip at 4 & 6 weeks

Table 2. Nematode analyses, early July and end of August.

treatment	7/6/18 # per 500 g			8/31/18 # per 500 g		
	Root Knot	Stubby Root	Ring	Root Knot	Stubby Root	Ring
	<i>Meloidogyne</i>	<i>Paratrichodorus</i>	<i>Mesocriconema</i>	<i>Meloidogyne</i>	<i>Paratrichodorus</i>	<i>Mesocriconema</i>
1 UTC	510	28	732	290	0	332
2 MBI-601	366	52	376	528	18	244
3 Majestene	494	10	20	254	6	88
4 MB1-304	138	62	0	410	0	372
5 Nimitz 3.5 pts PPI	570	120	304	842	9	1876
6 Nimitz 3.5 pts POST	662	36	176	322	0	544
7 Nimitz 5.0 pts POST	1996	8	44	436	0	248
8 Q80 31 oz	152	10	56	454	0	116
9 Q80 62 oz	48	0	156	418	0	315
10 Q80 drip	314	18	28	742	34	592
11 Velum 14 oz	206	136	608	358	9	152
12 Velum 6.84 & POST	246	60	32	940	0	332
13 Telone std	0	132	0	542	22	428

July 16 sampling: composite of all 4 plots

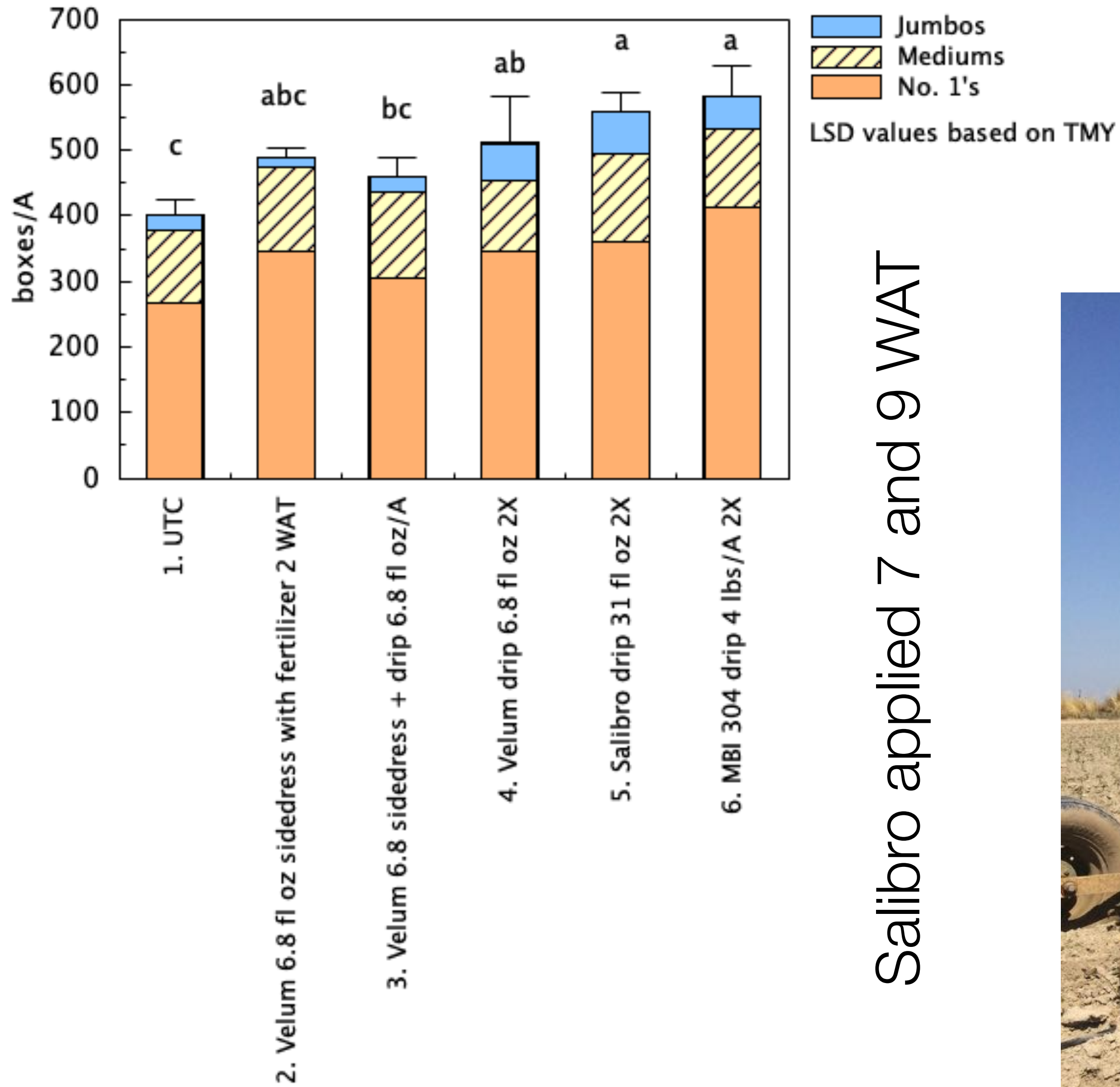
Aug 31 sampling: average of samples from reps 1 & 3.

0 - 12", middle of plot, 4 cores per plot

Analyzed by Nematodes Inc., Selma, CA



Sweetpotato Nematicide Trial 2019
cv "Burgundy"



Salibro applied 7 and 9 WAT

2019: Velum shanked with sidedress fertilizer



2020 Drip Trial

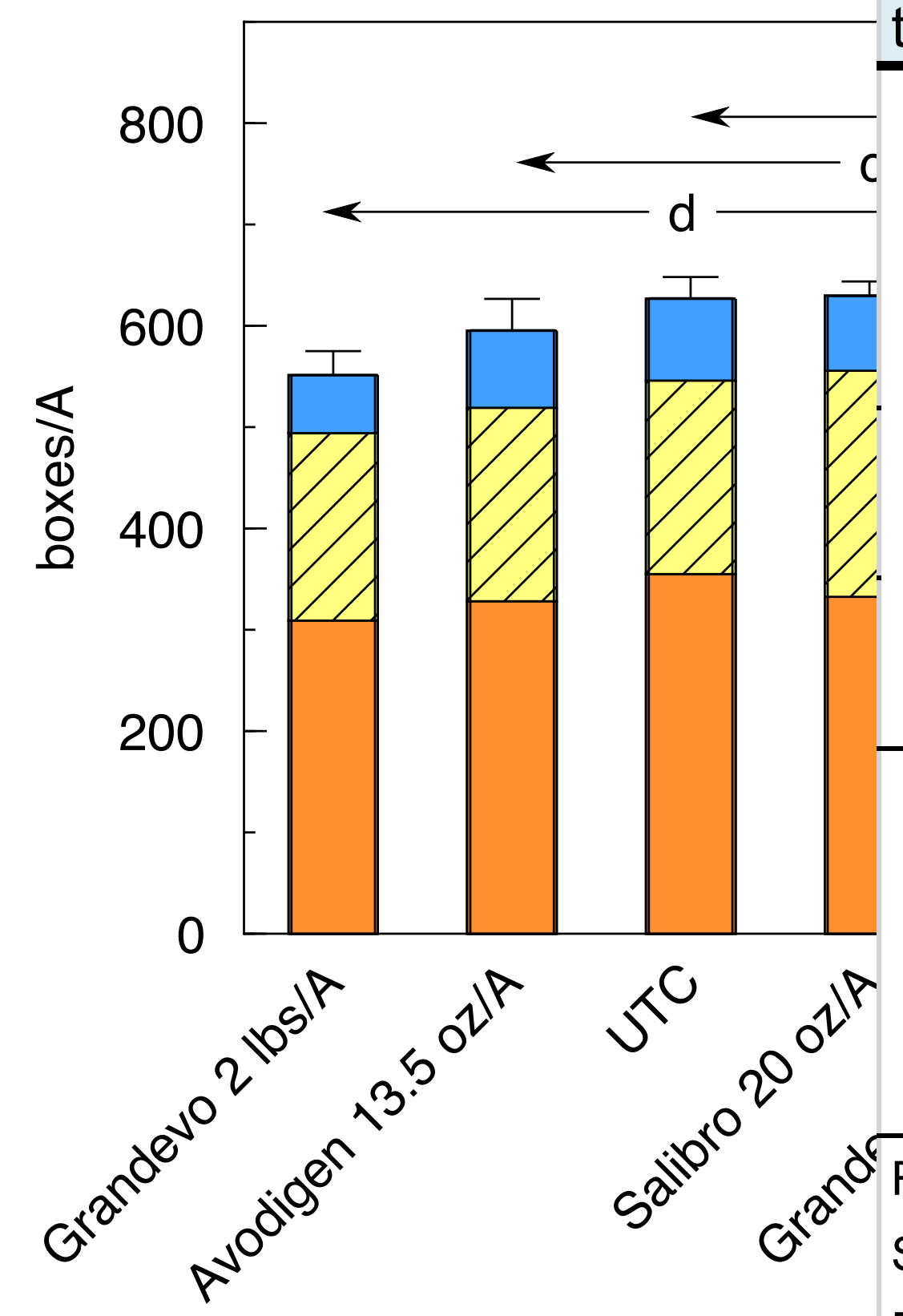


Table 2. Nematode sampling results, sweetpotato nematicide trial, Merced County 2020

Sweetpotato Merced treatment	June: # J2's per 250 cc soil		July: # J2's per 250 cc soil		
	Root Knot	SR	Root Knot	Ring	SR
	Meloidogyne	Paratrich.	Meloidogyne	MX	Paratrich.
1 UTC	232	101	372	28	0
2 Salibro 20 oz/A @ 4 and 6 WAT			380	68	17
3 Salibro 30 oz/A @ 4 and 6 WAT			290	85	8
4 Grandevo 2 lbs/A @ 2 and 4 WAT			326	47	15
5 Grandevo 4 lbs/A @ 2 and 4 WAT			324	118	5
6 Velum 14 fl oz/A @ 4 WAT			479	72	22
7 Velum 7 fl oz/A @ 4 and 6 WAT			356	69	4
8 FMC Avodigen 13.5 fl oz/A at 4 and 6 WAT			504	285	3
9 Telone 12 gpa (1)	0	183	2	0	61
Average	232	101	379	97	9
LSD 0.05	---	---	ns	ns	ns
CV, %	---	---	94	119	138

Ring MX (Mesocriconema xenoplax)
 SR (Stubby Root - Paratrichodorus)
 Root knot - Meloidogyne incognita

1) Telone values omitted from AOV and are shown for comparison only



2021 Trial

Salibro at 30 oz/A
drip applied
June 9 and 25
33 and 49 days
after planting.

Significant
increase as
compared to UTC
($p < 0.05$)



2021 Nematicide trial video



2022: Can application timing improve sweetpotato yield response?

Salibro EARLY: 30 fl oz at 4 & 6 WAT

Salibro LATE: 30 fl oz at 6 & 8 WAT

Salibro 3X: 20 fl oz at 6, 8, & 10 WAT

via surface drip



Putting it all together...

Yield differences between drip applications of Velum and Salibro nematicides in commercial sweetpotato fields, Merced County 2017 – 2021.

	UTC	Salibro drip	Velum drip	Salibro	Velum	Salibro vs	Velum vs
Year	TMY bins/A	TMY bins/A	TMY bins/A	p=0.05	p=0.05	UTC, %	UTC, %
2017	42.0	49.4	39.6	*	ns	17.6%	-5.7%
2018	25.7	41.1	32.0	*	ns	59.9%	24.5%
2019	16.1	22.3	20.4	*	*	38.5%	26.7%
2020	31.4	36.7	35.2	*	ns	16.9%	12.1%
2021	9.1	13.8	10.9	*	ns	51.6%	19.8%
2022	24.3	31.2	31.8	*	*	28.4%	30.9%
AVERAGE						35.5%	18.0%
TMY = Total Marketable Yield							
Untreated (UTC) compared to split application of Salibro (60 fl oz/A) or Velum (14 fl oz/A).							
* significant difference at the 95% confidence level. NS = not significant.							

FLUAZAINDOLIZINE

GROUP

N-UN

NEMATICIDE

Salibro™

[Alternate Brand Name: GF-3880]

NEMATICIDE

Reklemel™ active

For Agricultural Use Only

Active Ingredient

Fluazaindolizine:

8-Chloro-N-[(2-chloro-5-methoxyphenyl)sulfonyl]

-6-(trifluoromethyl)-imidazo[1,2-a]pyridine-2-carboxamide41.15%

Other Ingredients58.85%

Total100.00%

By Weight

A C C E P T E D

09/06/2023

Under the Federal Insecticide, Fungicide
and Rodenticide Act as amended, for the
pesticide registered under

EPA Reg. No. **352-932**

This product is a suspension concentrate (SC). Shake well before using.

Contains 4.17 lb. active ingredient per gallon.

Keep Out of Reach of Children

CAUTION

Guava Root Knot nematode in NC

- *Meloidogyne enterolobii*
- considered to be the most damaging RKN in the world
- multiple (>8) counties in NC, 1 in LA
- State quarantines in place (NC, LA, but not CA)



2023 Guava Survey

- Heather Scheck and AC
- 350 samples planned this fall (Merced and Kern counties).



Summary

- While fumigants work better than nematicides, Salibro has shown significant sweetpotato yield increases as compared to the untreated control. Biologicals have not performed well in comparison.
- Nematode counts are not affected by nematode treatments.
- Best method: split applications through the drip for Velum, Salibro, or Majestine at 4 - 6 weeks after transplanting give better results as compared to a single shot.





Thank you.

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