Non Fumigant Nematicides

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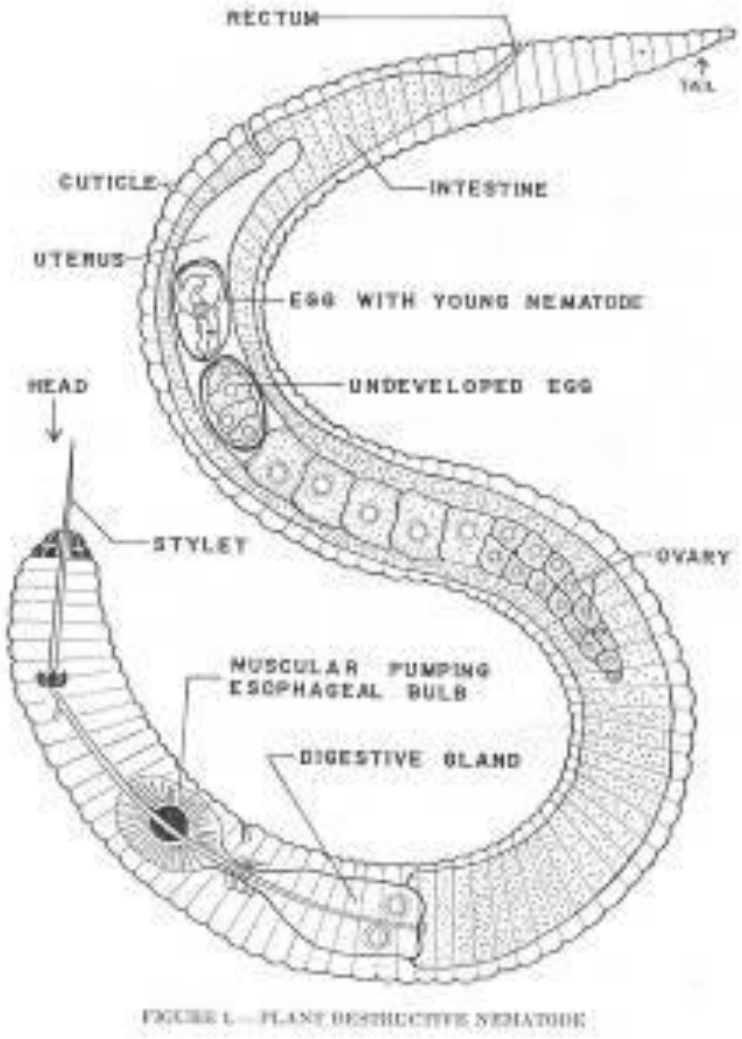
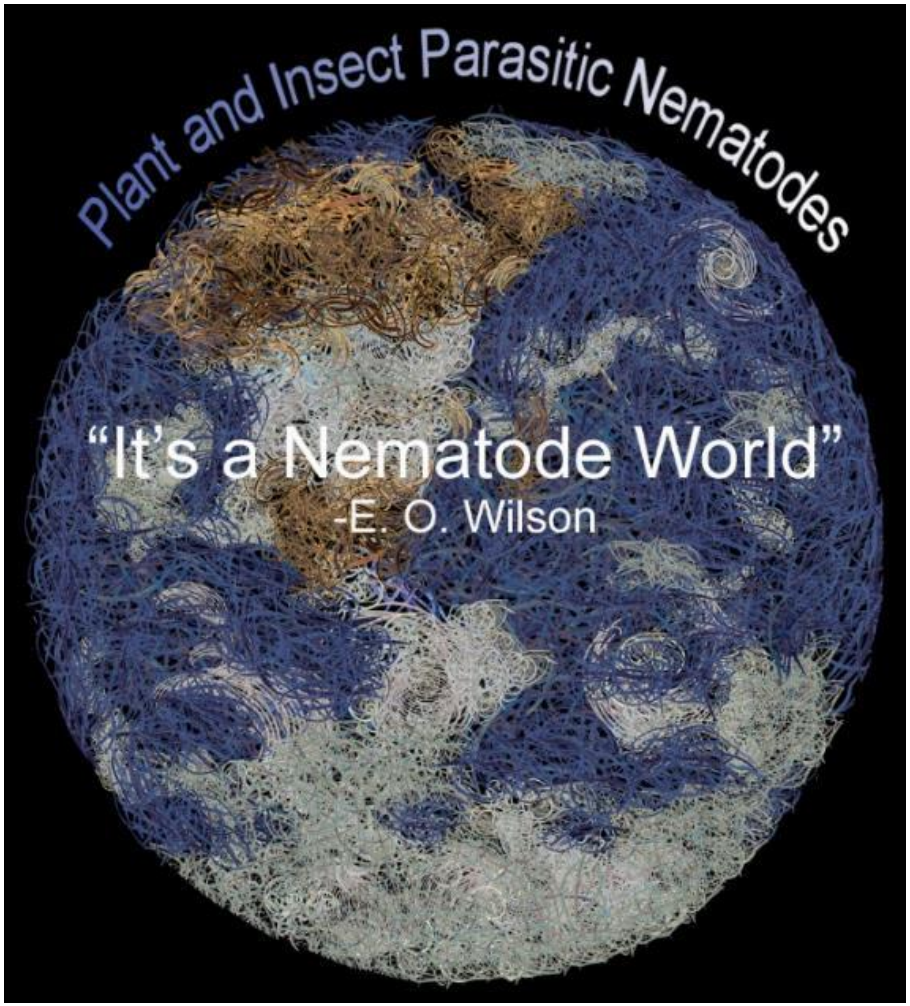
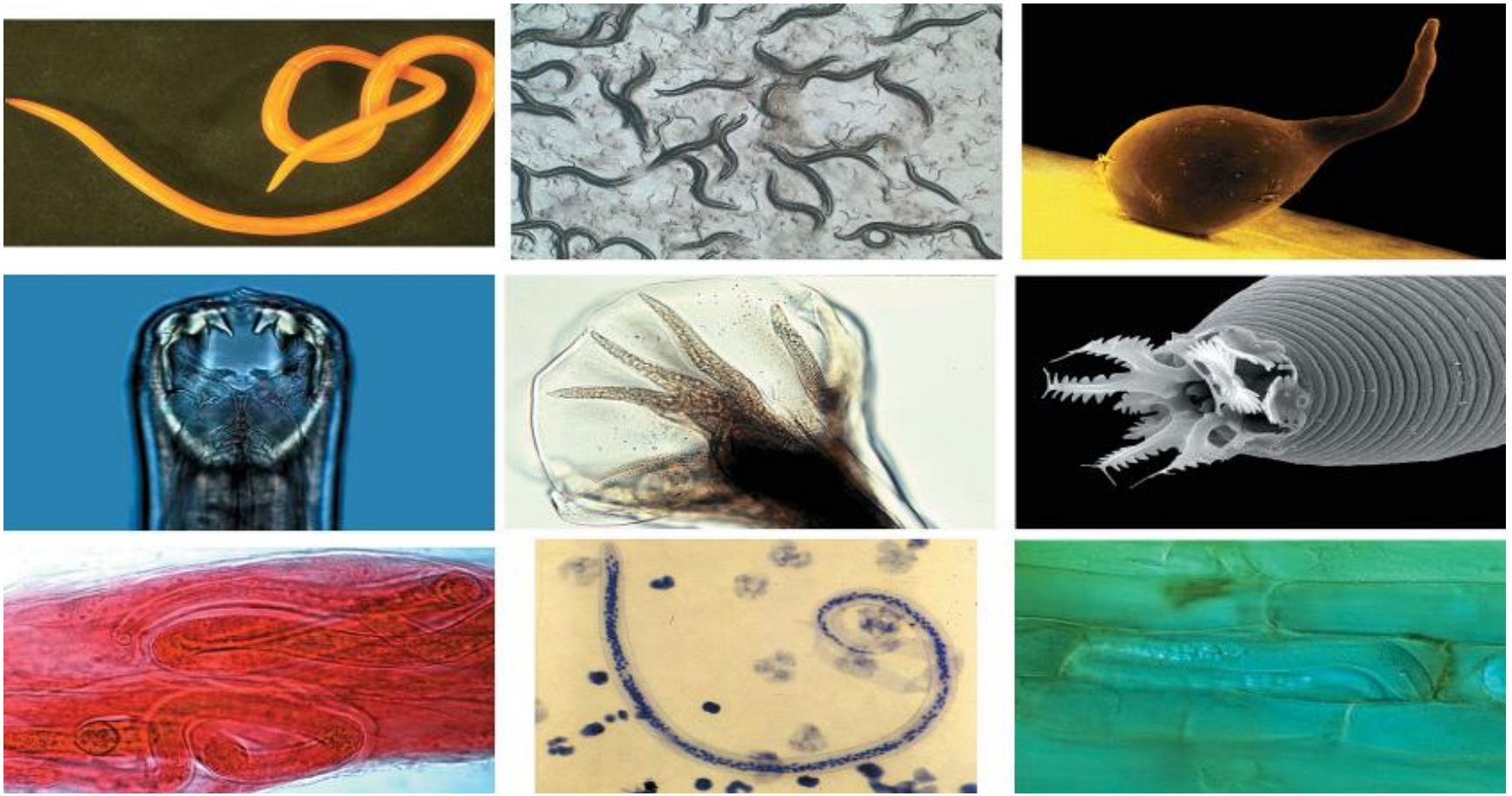
What is a nematode?



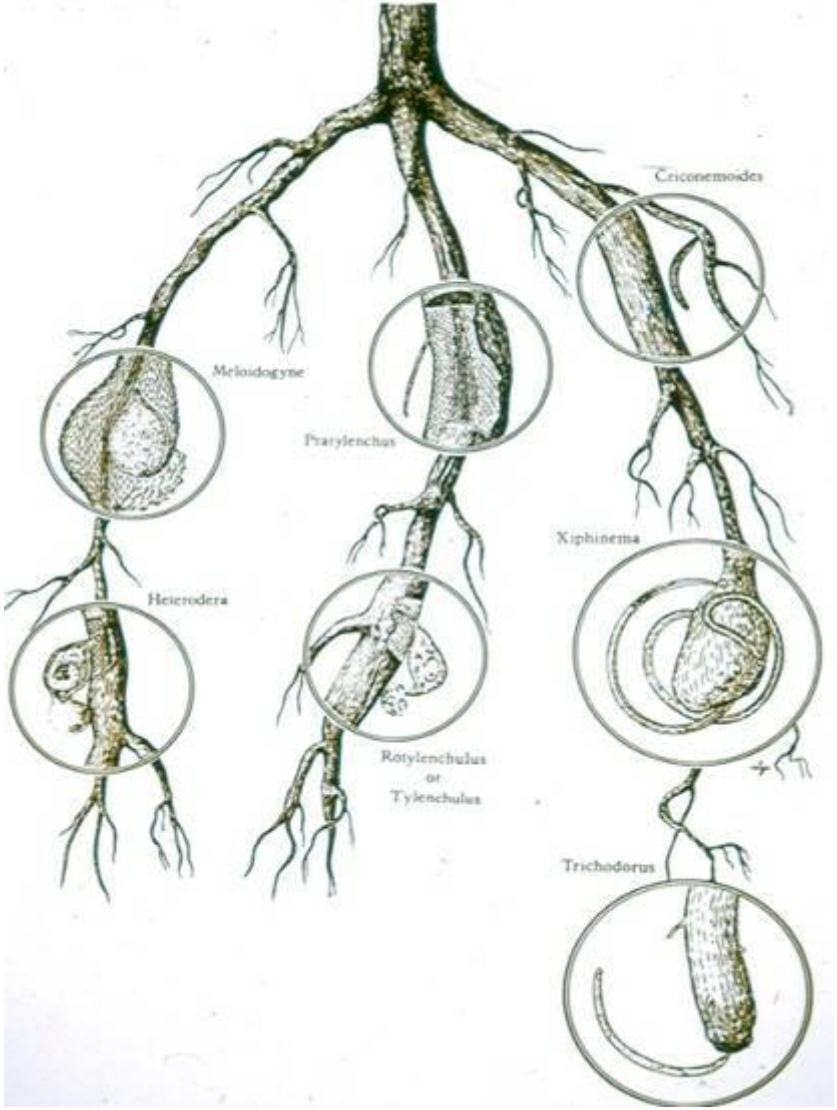


Diversity of nematodes



Thomas Blumenthal & Richard E Davis VOLUME 36 | NUMBER 12 | DECEMBER 2004 **NATURE GENETICS**

Feeding habits of plant parasitic nematodes



Inside or outside roots:

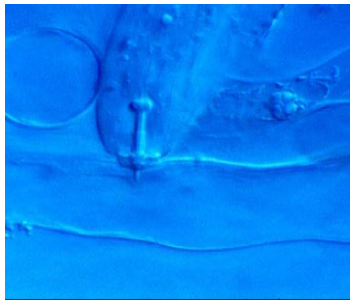
- Endoparasitic– entire body inside the root
- Ectoparasitic– entire body outside the root
- Semi-endoparasitic- part of body inside root

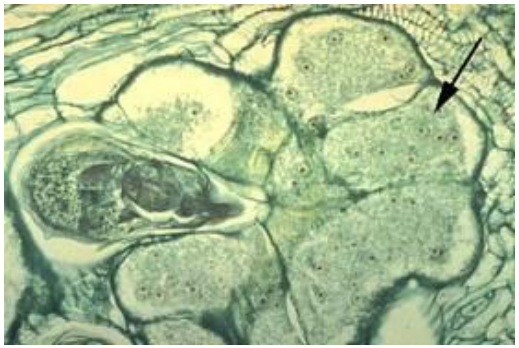
Mobile or immobile:

- Sedentary – mostly immobile during their life
- Migratory – mobile for all their life.

How nematodes injure plants?

- **Mechanical injury**
- **Physiological changes**
- **Reducing root mass**





- **Interact with soil fungi and bacteria**
- **Suppress rhizobia/VAM**
- **Transmission of** several viruses
- **Increase susceptibility to environmental stress**

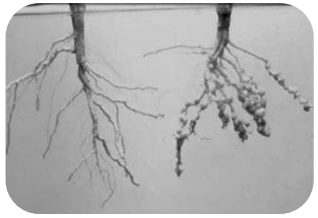
Nematode Management

Sanitation

Crop rotation

Biocontrol

Solarization



Plant Resistance / Tolerance

Steaming

Biofumigation

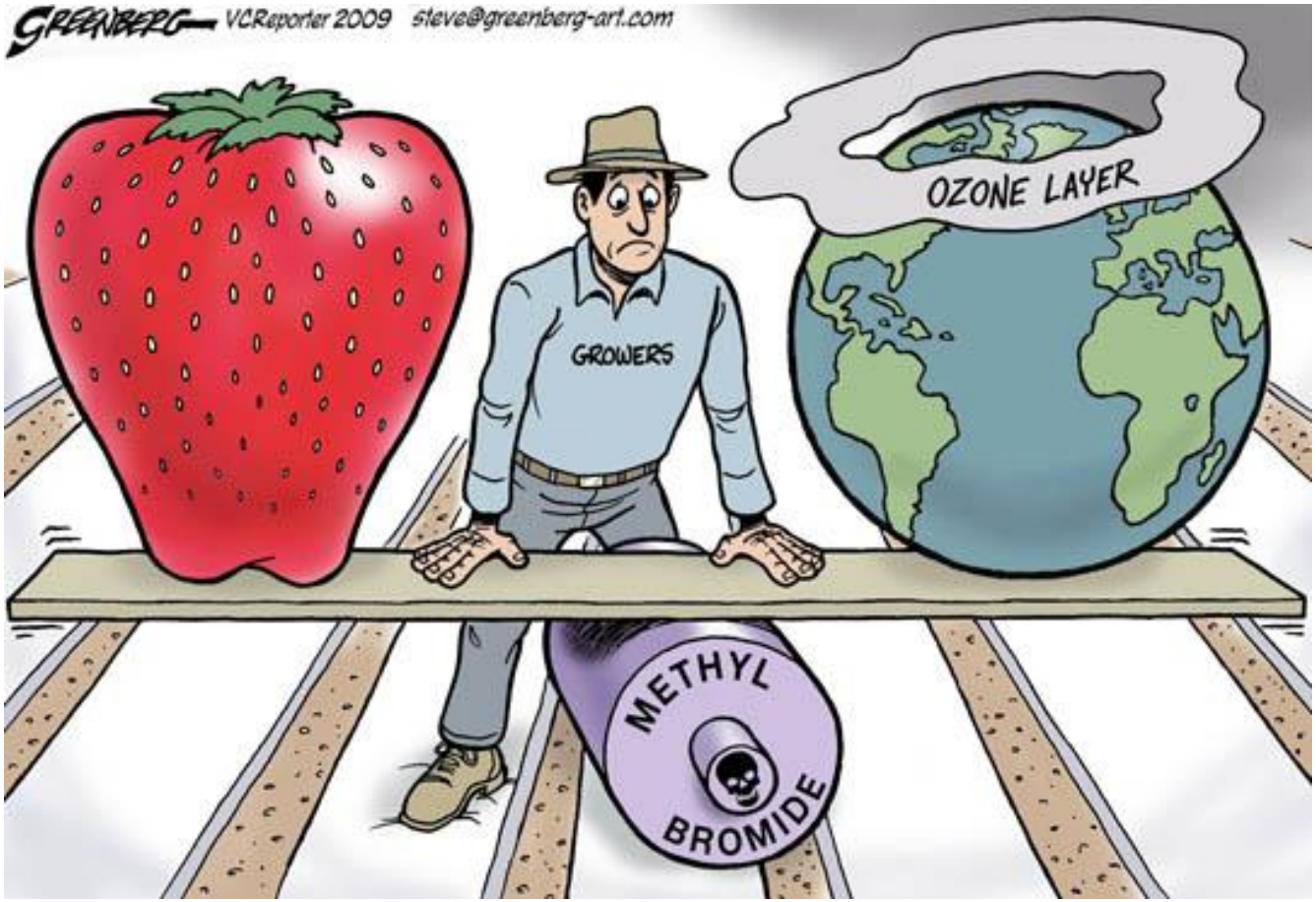
Cover crops

Good agronomy

Tillage

Nematicides

Methyl Bromide … *RIP 1932-2016*

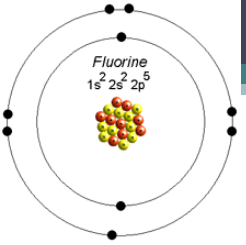


Brief History of Nematicides

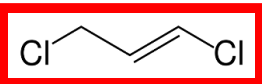
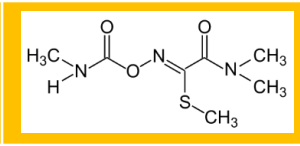
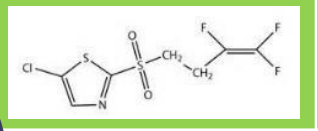
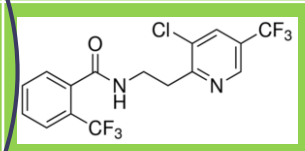
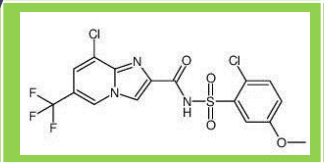
- 1st nematicides: fumigants - biocides
  - CS_2 (1869), chloropicrin (1920), methyl bromide, DBCP, 1,3-D, Metam (1940s)

- 2nd wave: organophosphates / carbamates - insecticides
  - Fenamiphos, aldicarb (1960s), oxamyl, ethoprophos (1970s)

- 3rd wave: selective / safer nematicides
  - Late 2010's-2020's: New more specific nematicides, new biological nematicides



New fluorine (3-F) nematicides

Chemical name	Trade name	Structure	Soil movement / solubility (water)	Soil ½ life	MOA	Tox. Cat.
Fumigants (1,3-D)	Many		Good- Gas	Short < 14 d	?	Danger
Oxamyl	Vydate		Good- 240,000 ppm	Short 7 d	AChel 	Danger
Fluensulfone 	**Nimitz**		Medium- 545 ppm	Short 7-17 d	?	Caution
Fluopyram 	**Velum**		Poor – 10 ppm	Long > 200 d	SDHI 	Warning
Fluazaindolizine	**Salibro (2020)**		Medium+ 2000 ppm	Medium 30 d	?	TBD

New products are less toxic and more selective – true nematicides

New modes of action – or unknown;

Different soil behavior – efficacy and application

Biological Nematicides

Majestene

Bacterial toxins, *Burkholderia* spp.

MAJESTENE™ BIONEMATICIDE

Dazitol

Capsacin (Capsicum) and allyl isothiocyanate (mustard oil)

Melocon

Nematode parasitc fungus, *Paecilomyces lilacinus*

NemaKill

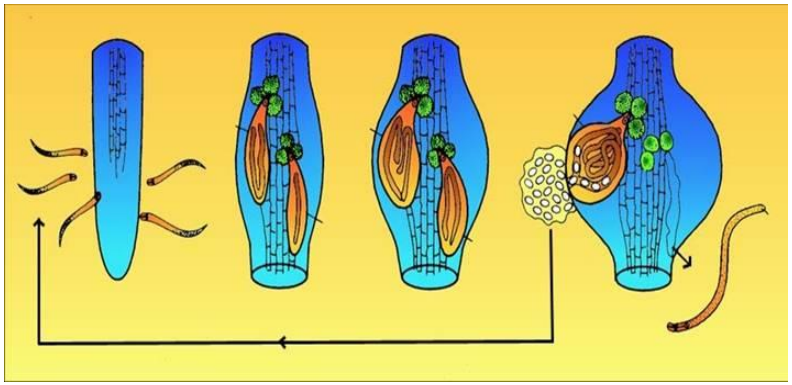
Cinnamon, clove and thyme oil

Gulf Coast REC Research Farm

Beach sand … root-knot nematode = *Meloidogyne javanica*

Root-knot nematodes (*Meloidogyne* spp.)

- **#1 nematode in Florida + the world, many crops**
- **Many species in FL**
- **Endoparasitic - Root galls**



Tomato trial, fall 2016 - root gall ratings

Root-knot nematode soil counts - end of season

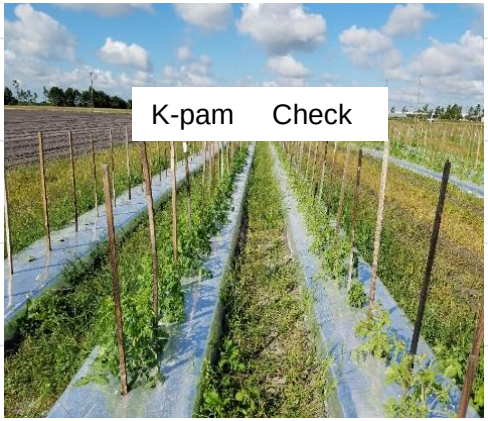
Pre-plant and post-treatment soil counts were very low (0-1 J2 / 200 cc soil)

UTC highest root-knot counts; no difference among other PPN: stubby, lance, sting, lesion, spiral, ring, sheath nematodes

Plant vigor(NDVI) during the season

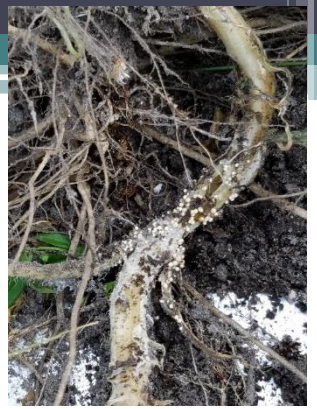
Greenseeker

3-F nematicides similar crop vigor, in between check and K-pam

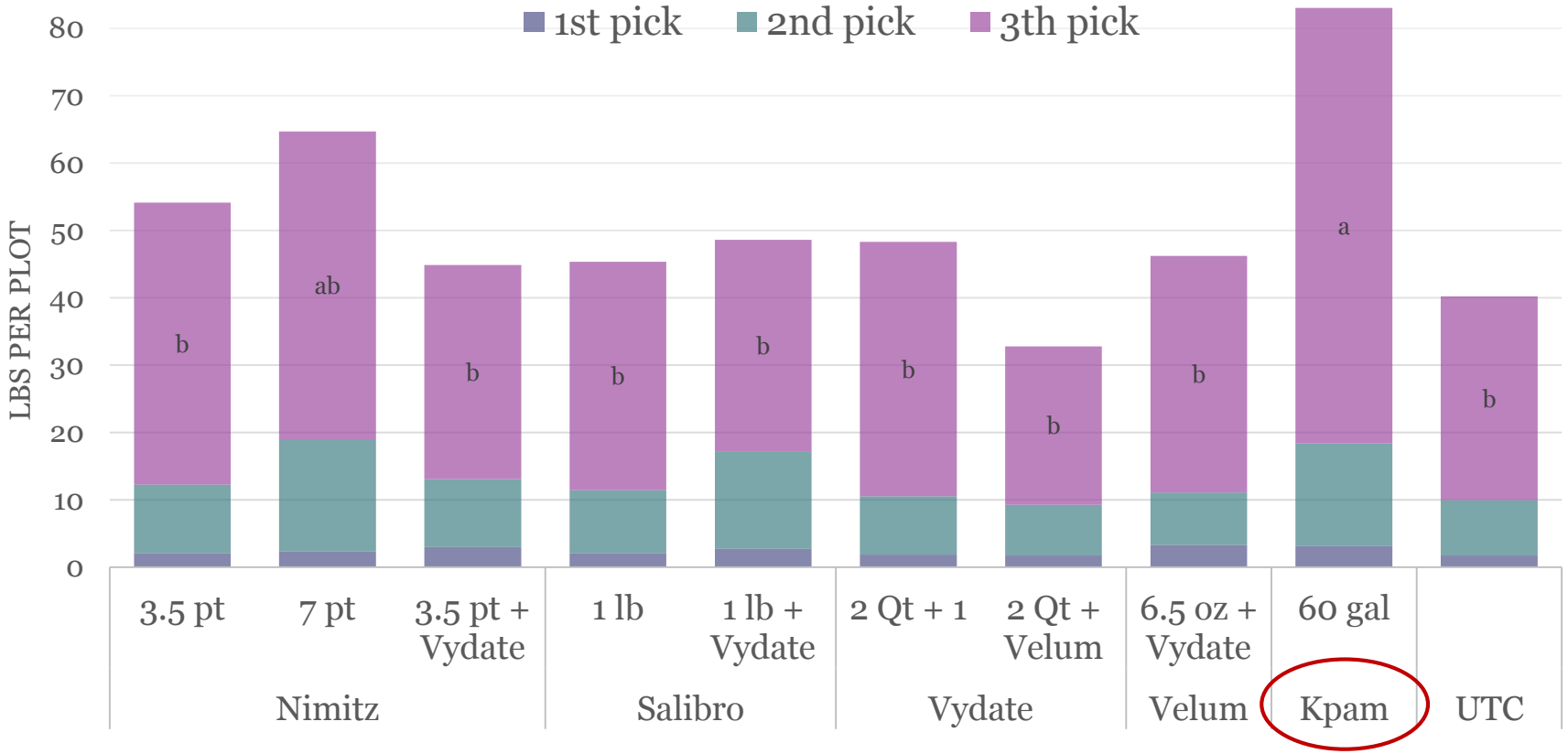


Tomato Fruit Yield - 3 picks

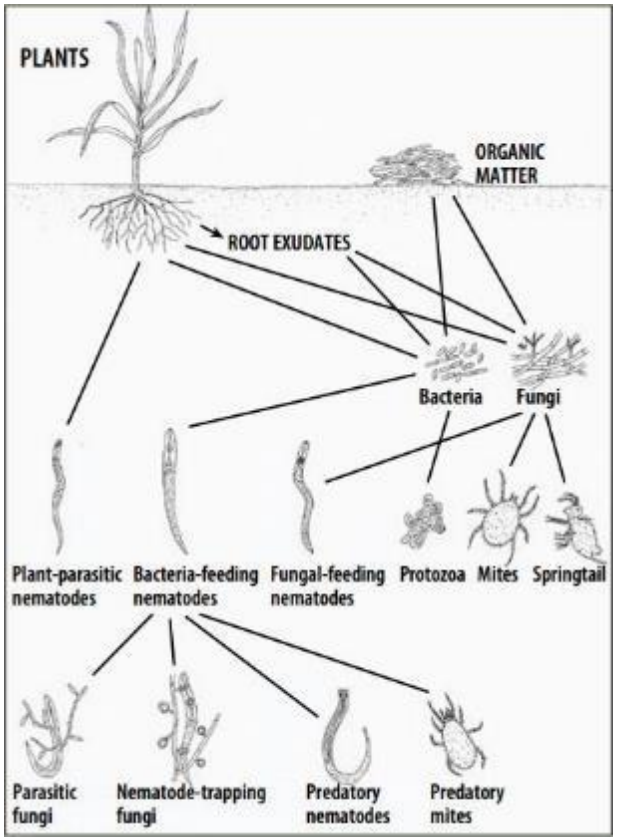
No difference 1st and 2nd pick; K-pam greatest 3rd pick

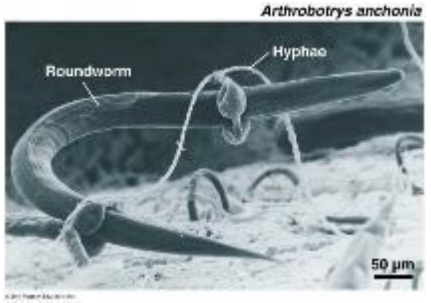


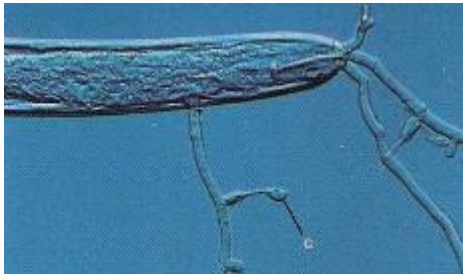
Sclerotium rolfsii

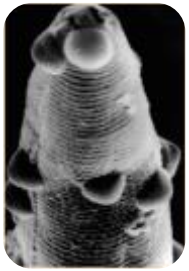


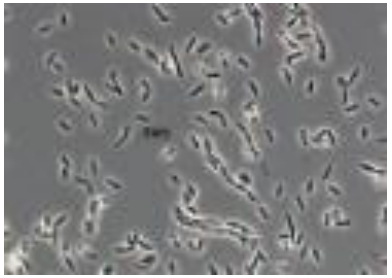
Impact on non-plant-parasitic nematodes in soil?

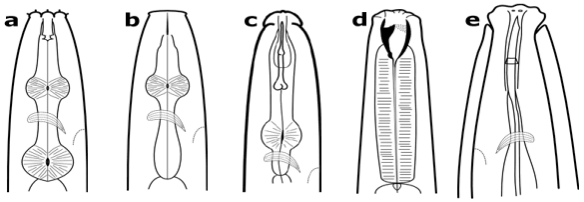






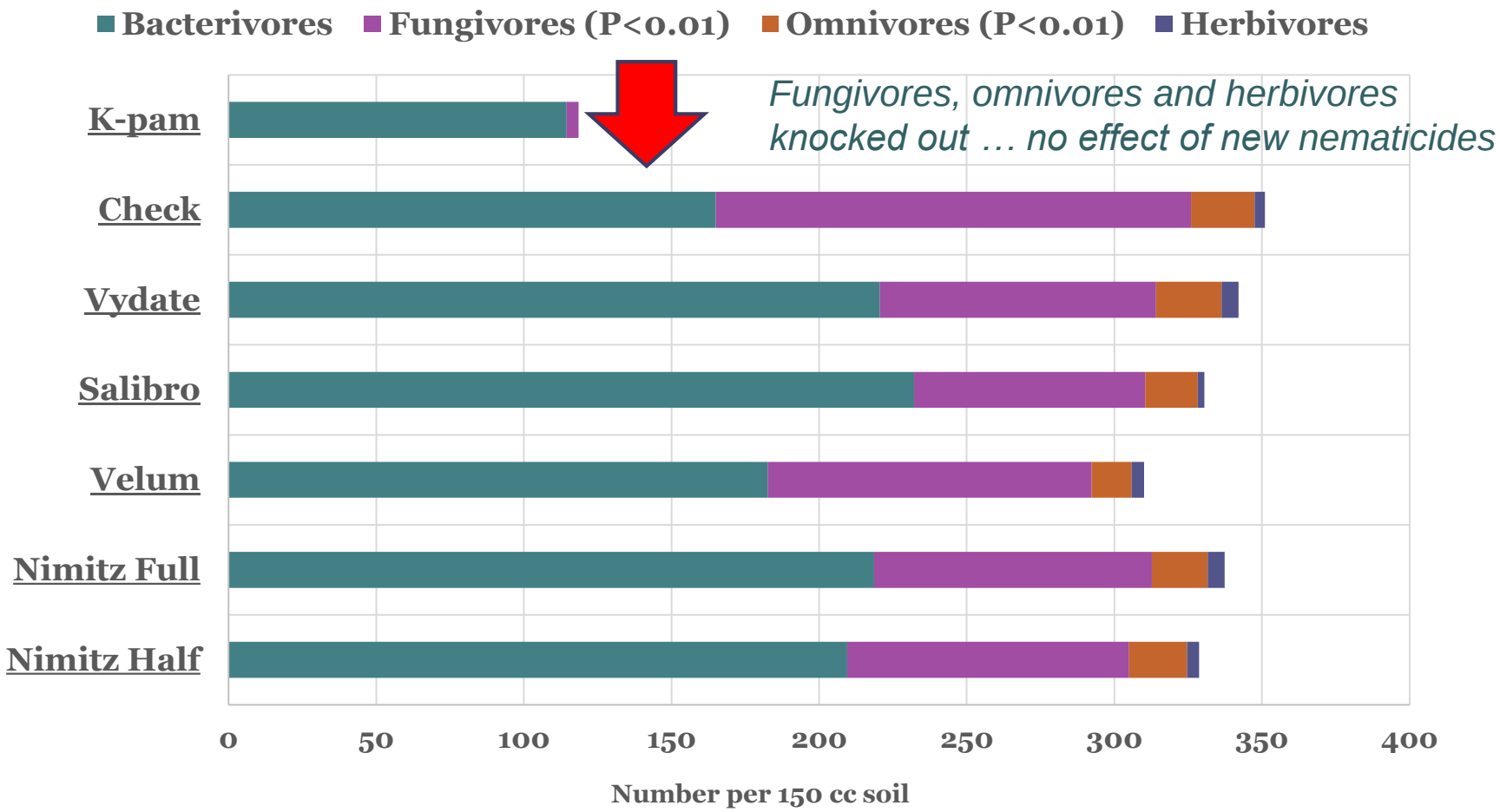






Nematodes can be classified into different feeding groups based on the structure of their mouthparts. (a) bacterial feeder, (b) fungal feeder, (c) plant feeder, (d) predator, (e) omnivore.

Nematode feeding groups in tomato - Early season, 10-20 days post-treatment

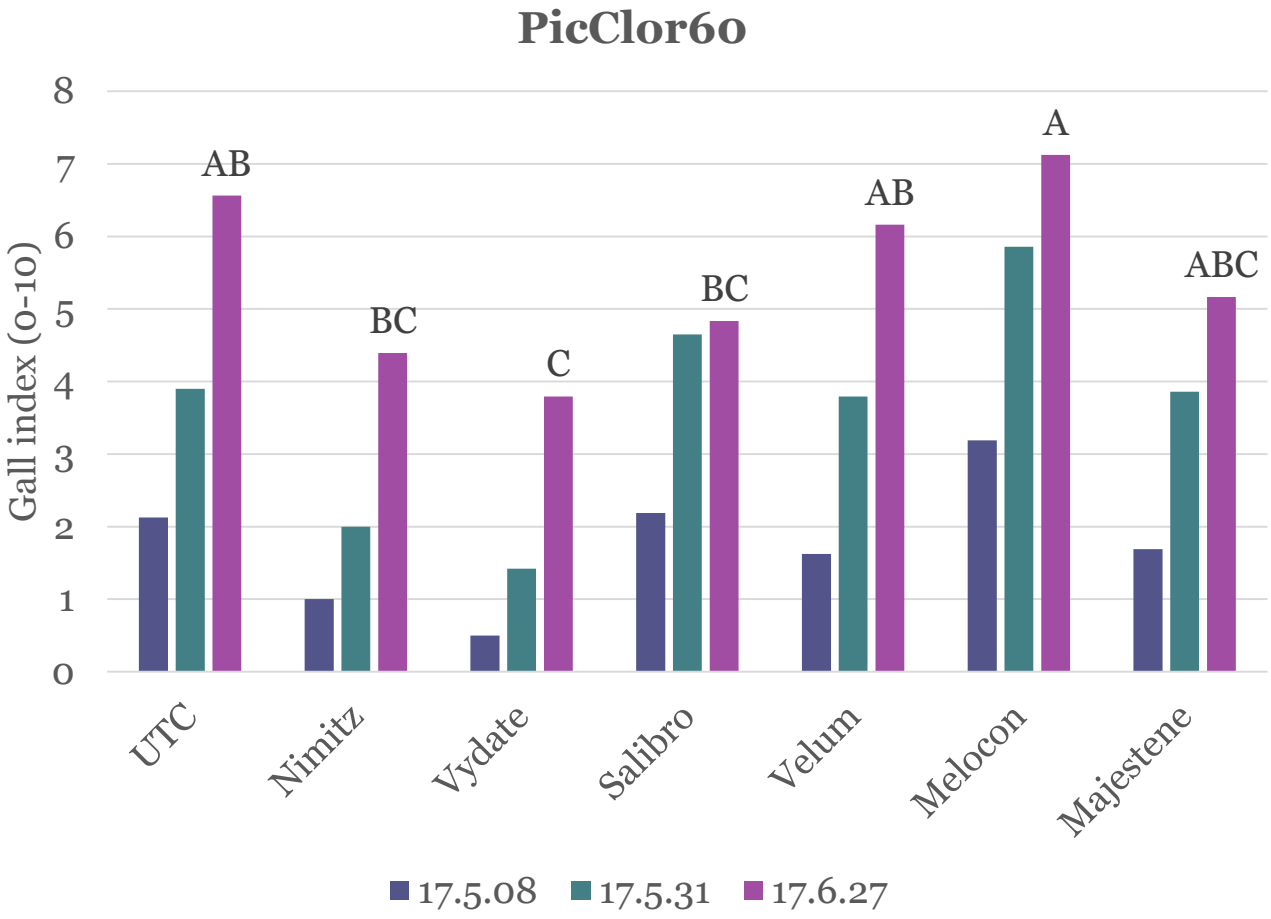


Tomato Trial, spring 2017, GCREC

1	2	3	4	5	6	7	8	9
PicClor60			No fumigant			Pic100		
Chemical / biological								

Root gall ratings on tomato (0-10)

Medium-high RKN pressure



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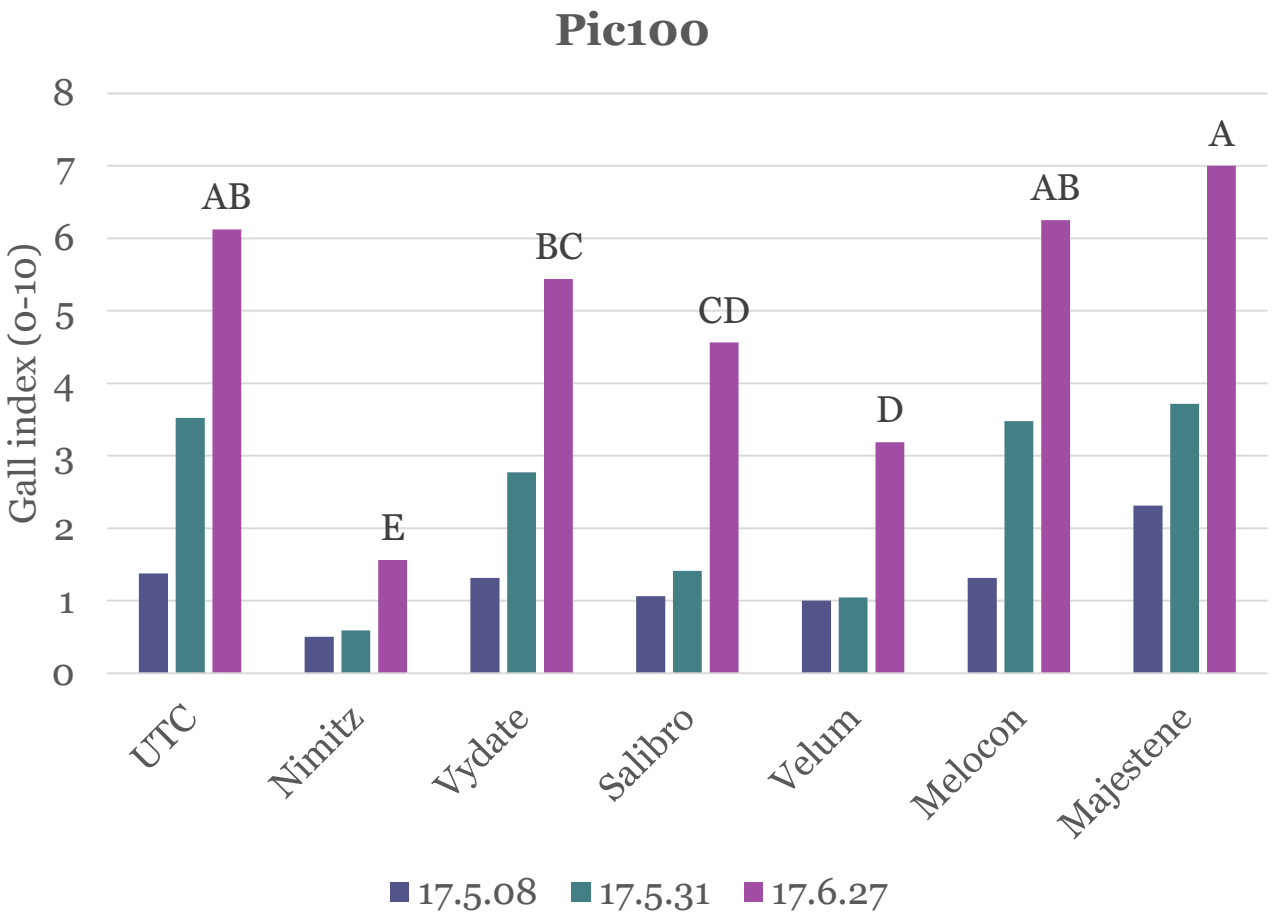

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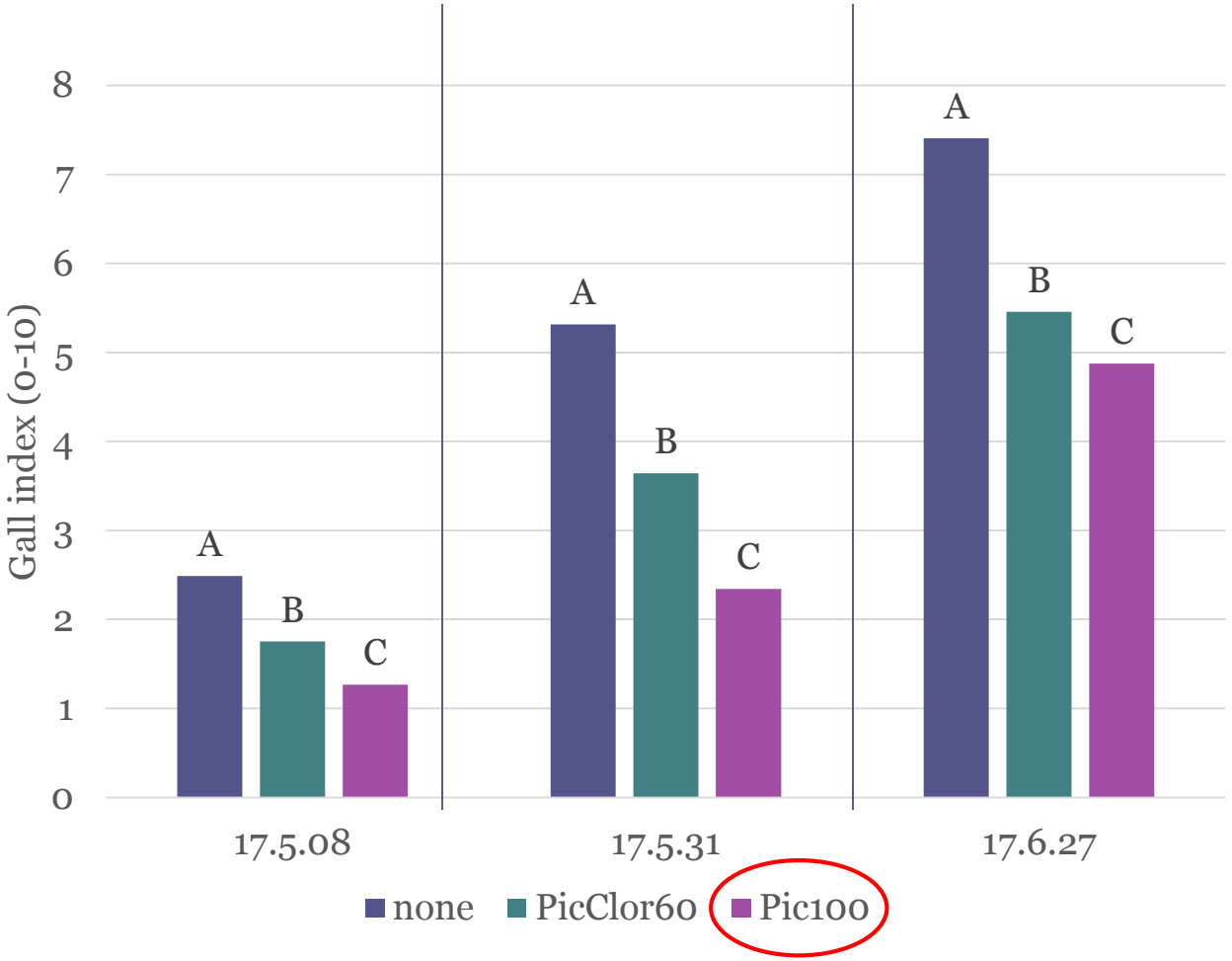

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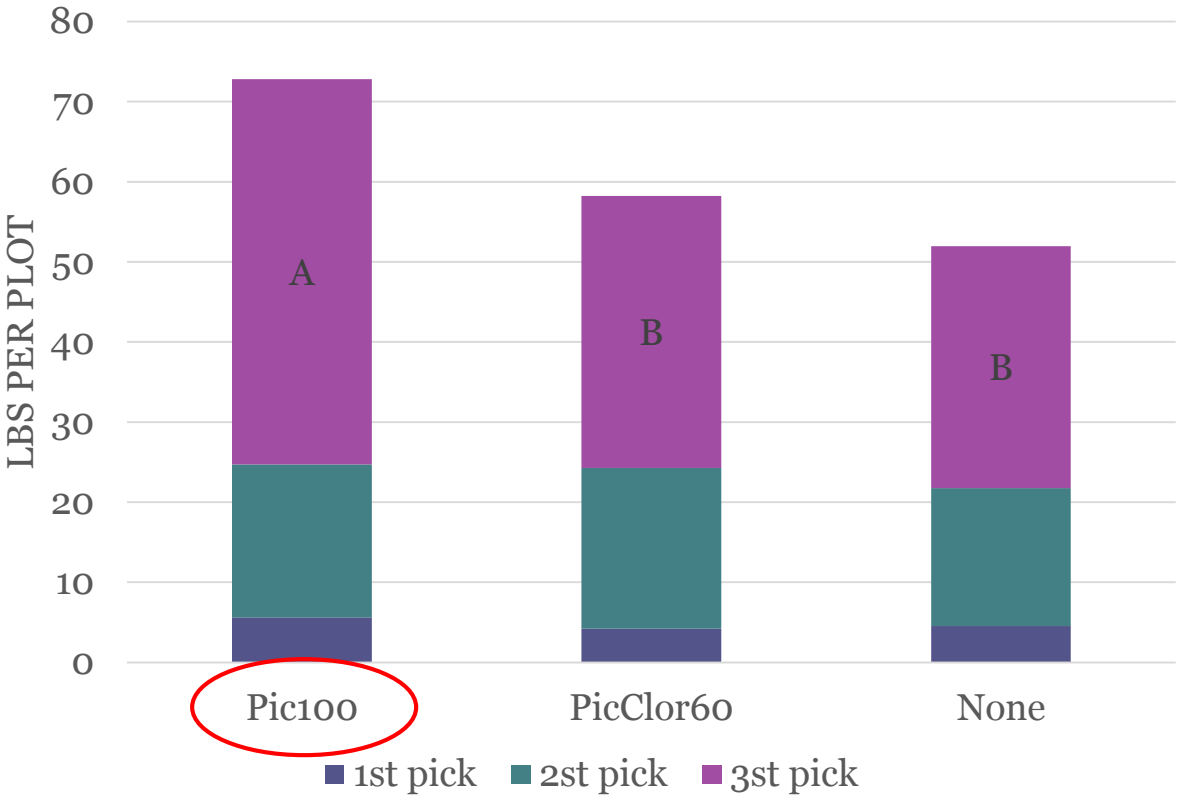
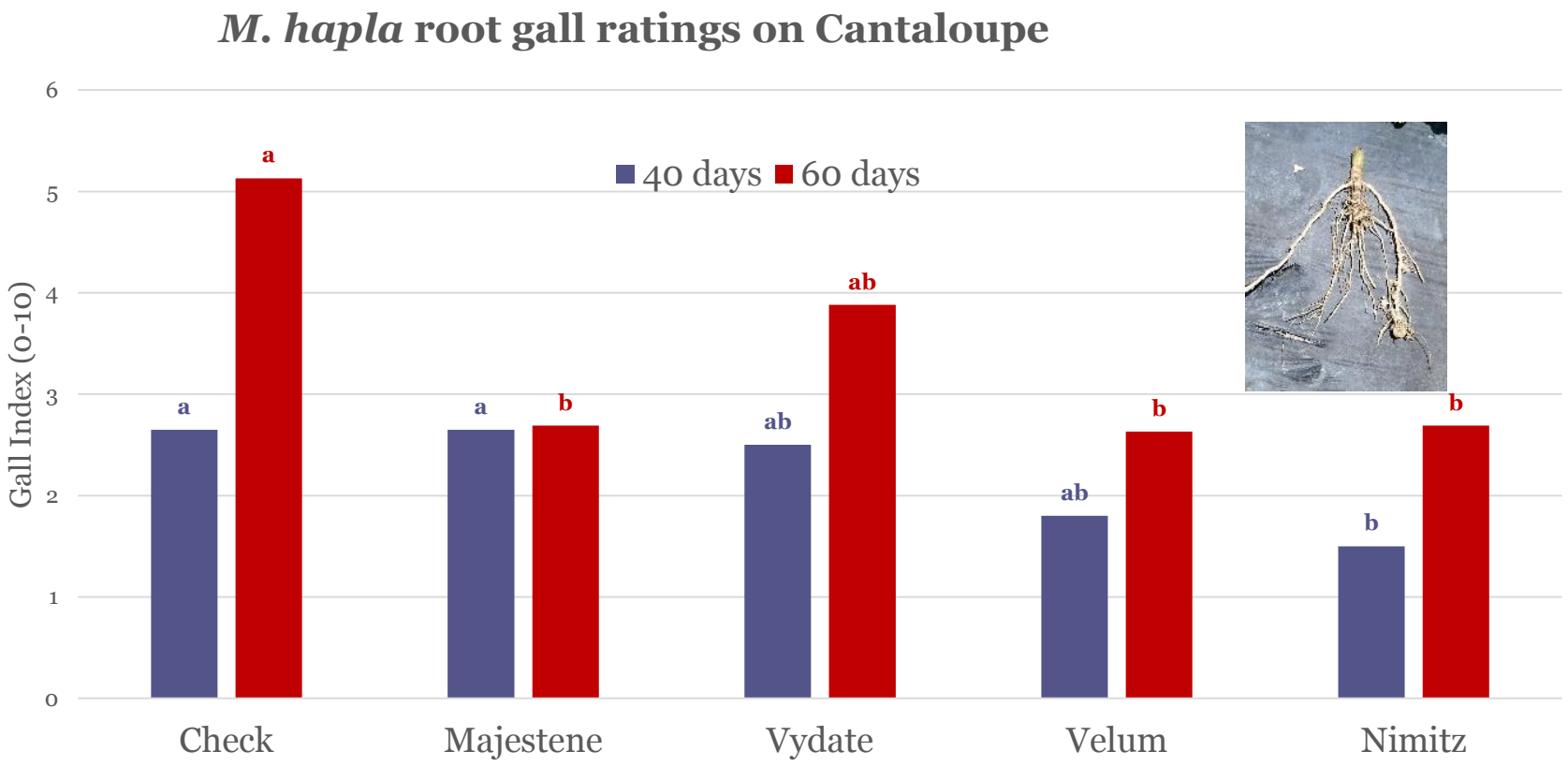


Two on farm nematicide rescue trials March-April 2017: (1) cantaloupe double crop after strawberry, Dover FL

- Northern root-knot nematode!
- **Nimitz** @ 7 pts 7 days pre-plant
- **Velum** @ 6.5 oz 2 days pre-plant
- **Vydate and Majestene** 1 day pre-plant and 40 days post plant, resp. 2 qt + 1 qt and 2 gal + 1 gal
- Root galls after 6 and 8 weeks

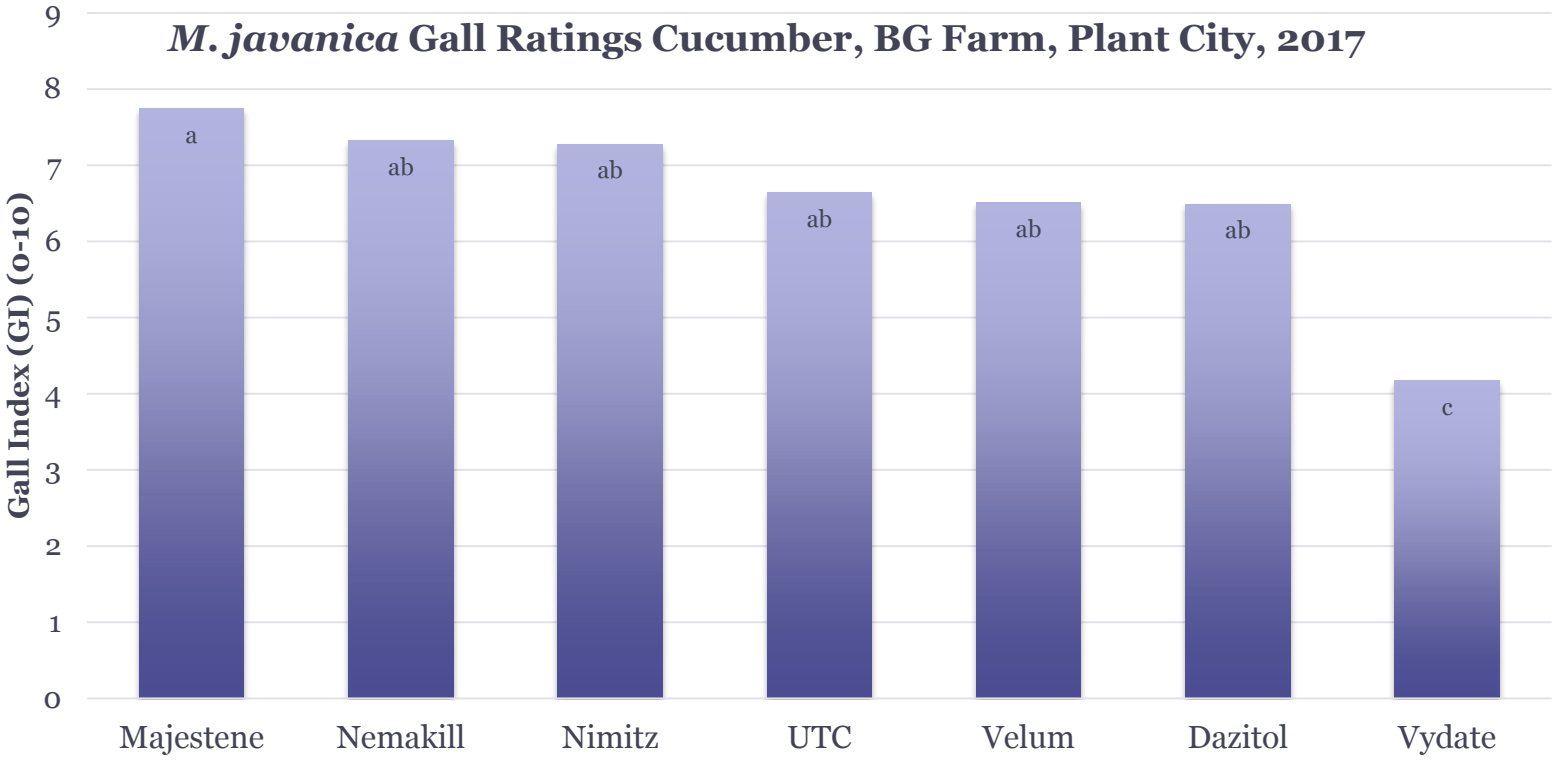
Nematode infection on double-crop cantaloupe, Dover, FL, 2017, *M. hapla*, northern root-knot



(2) cucumber(pickle) double crop after cucumber, Plant City

- High level of Javanese root-knot nematode (*M. javanica)*
- Applied Nimitz, Velum, Vydate, Majestene, Dazitol and Nemakill thru drip

Nematode infection on double-crop cucumber, Plant City, FL, 2017 - *M. javanica* - Javanese root-knot



Farming w/o Fumigants in Florida ?

Anaerobic/biological soil disinfestation

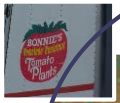
Soil steaming

Solarization

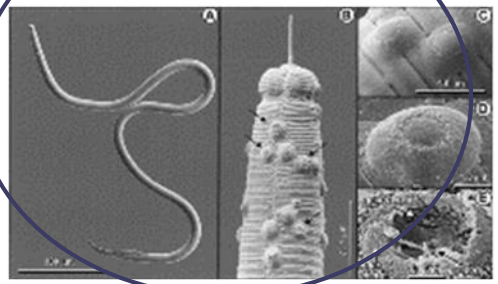
Non-fumigant nematicides

MAJESTENE BIONEMATICIDE

Resistant cv's



Natural enemies / Biocontrol



Cover crops

Biofumigation

GCREC Nematology

- **Nematicide Testing**
- **New nematode problems**
- **Nematode resistance**
- **Nematode-diseases**
- **Cover crops**
- **Suppressive soils**
- **Other crops – Hops**

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Facebook: https://www.facebook.com/uflnematology/

Thanks Adama, Corteva, Bayer CropScience, Marrone BioInnovations for support