Organic Management of Nematodes

Philip Waisen

February 7, 2023

Sustainable Agriculture

Preamble

'Silent Spring' Is Now Noisy Summer

Pesticides Industry Up in Arms Over a New Book

Rachel Carson Stirs Conflict—Producers Are Crying 'Foul'

By JOHN M. LEE

The $300,000,000 pesticides industry has been highly irritated by a quiet woman author whose previous works on science have been praised for the beauty and precision of the writing.

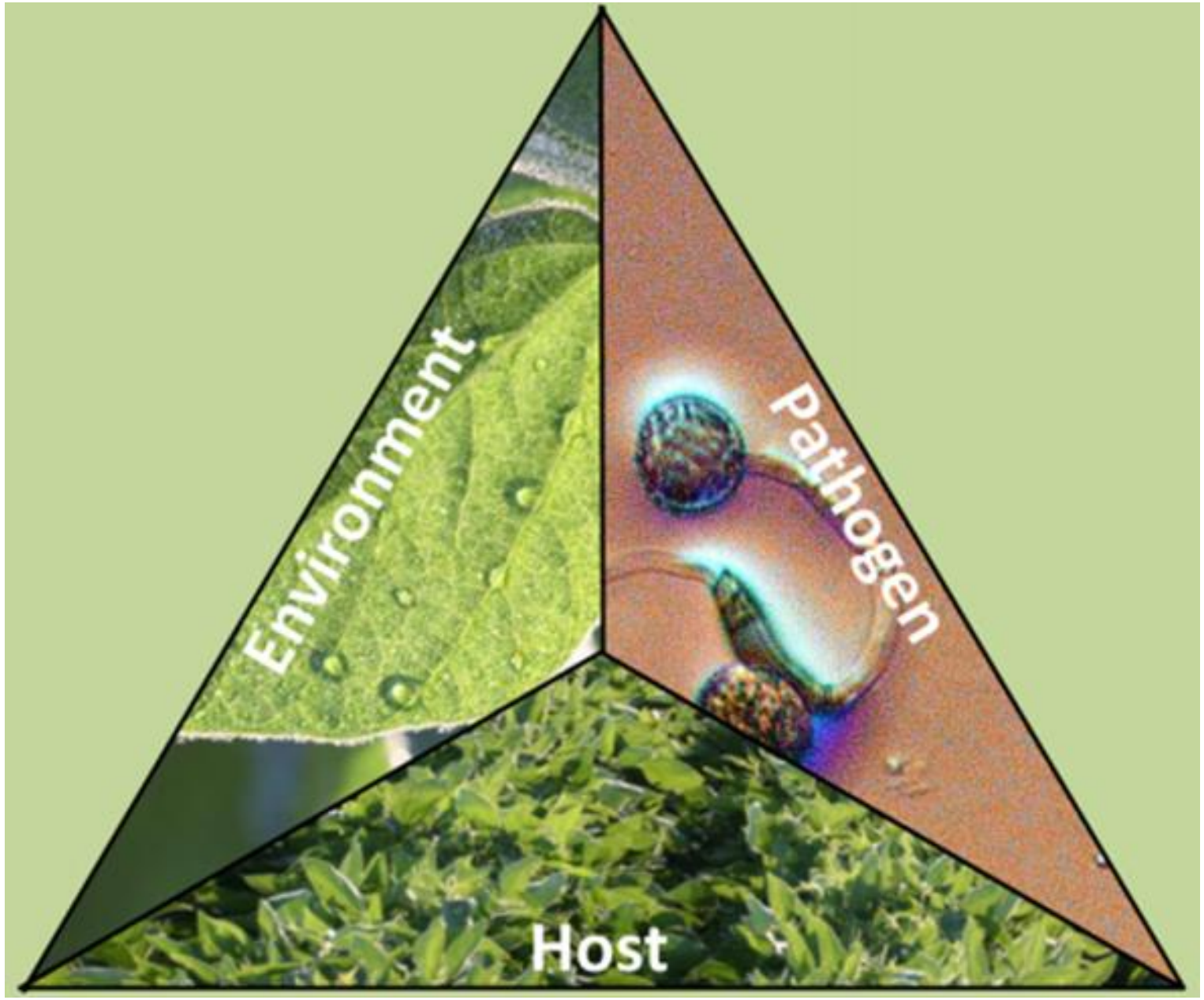
The author is Rachel Carson, whose "The Sea Around Us" and "The Edge of the Sea" were best sellers in 1951 and 1955. Miss Carson, trained as a marine biologist, wrote gracefully of sea and shore life.

In her latest work, however, Miss Carson is not so gentle, fending the use of their products. Meetings have been held in Washington and New York. Statements are being drafted and counter-attacks plotted.

A drowsy midsummer has suddenly been enlivened by the greatest uproar in the pesticides industry since the cranberry scare of 1959.

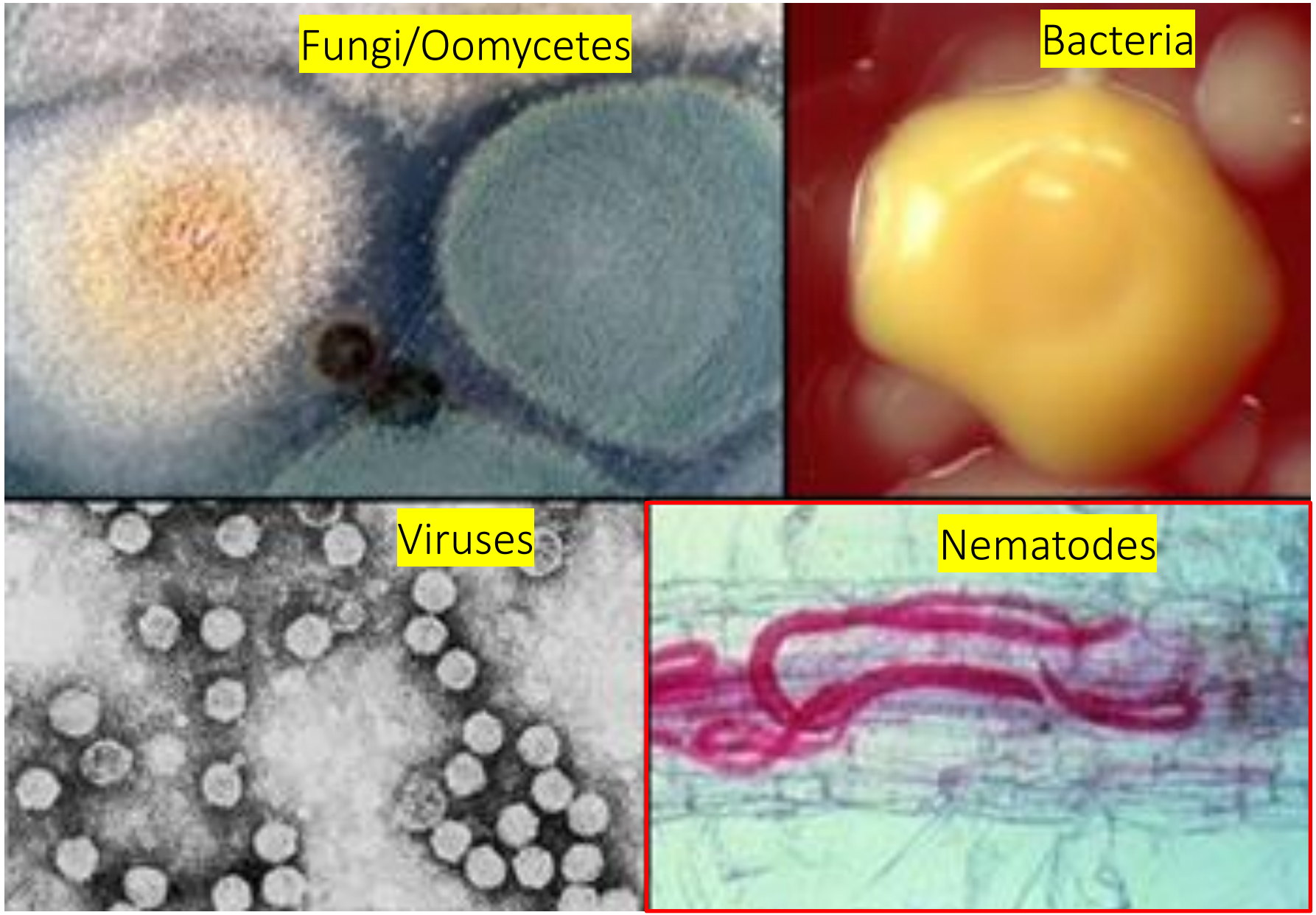
Miss Carson's new book is entitled "Silent Spring." The title is derived from an idealized situation in which Miss Carson envisions an imaginary town where chemical pollution has silenced "the voices of spring."

A Disease Triangle

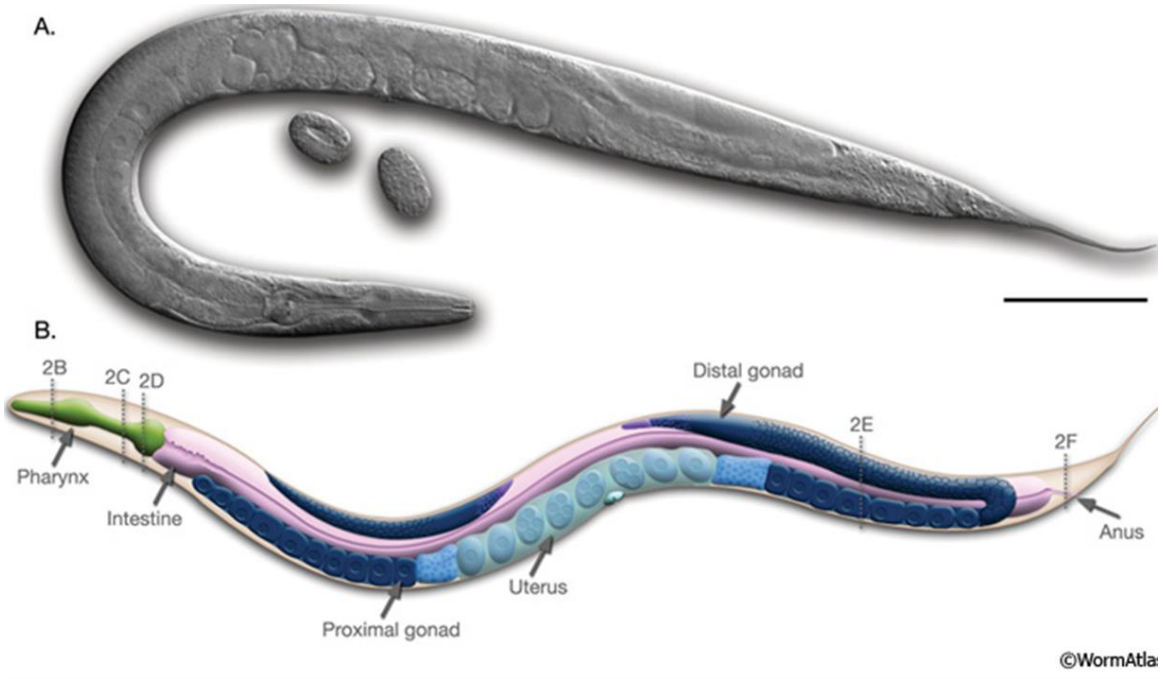


Carlson S, 2020

Major Plant Pathogen Groups



What is a Nematode?



Microscopic (20-25 µm wide)

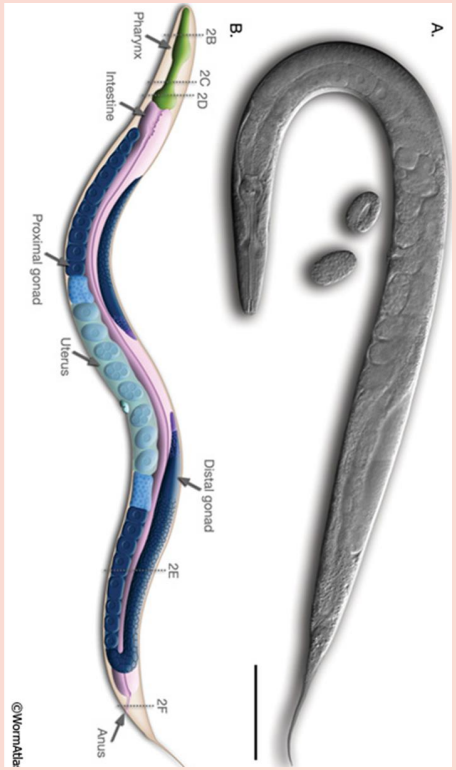
Unsegmented round worms

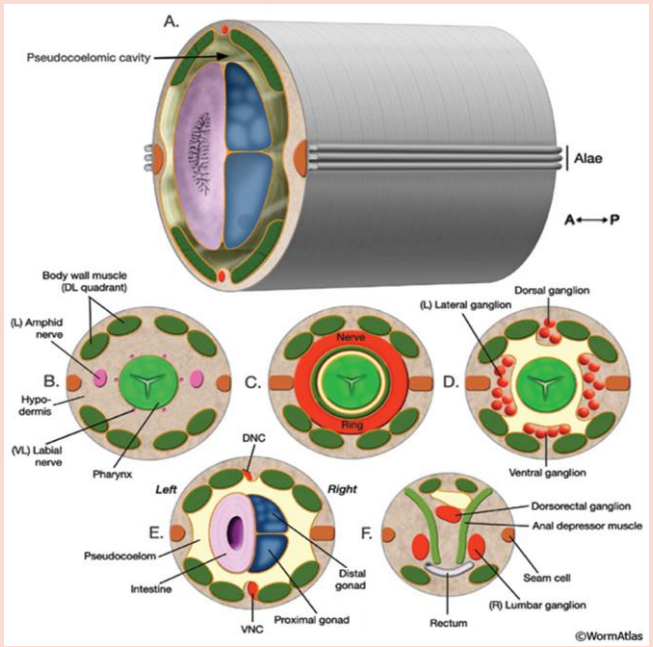
Thread-like (Vermiforms)

Bilaterally symmetrical

With digestive, nervous, excretory, reproductive, ~~circulatory~~, ~~skeletal~~, and ~~respiratory~~ systems

Pseudocoelom



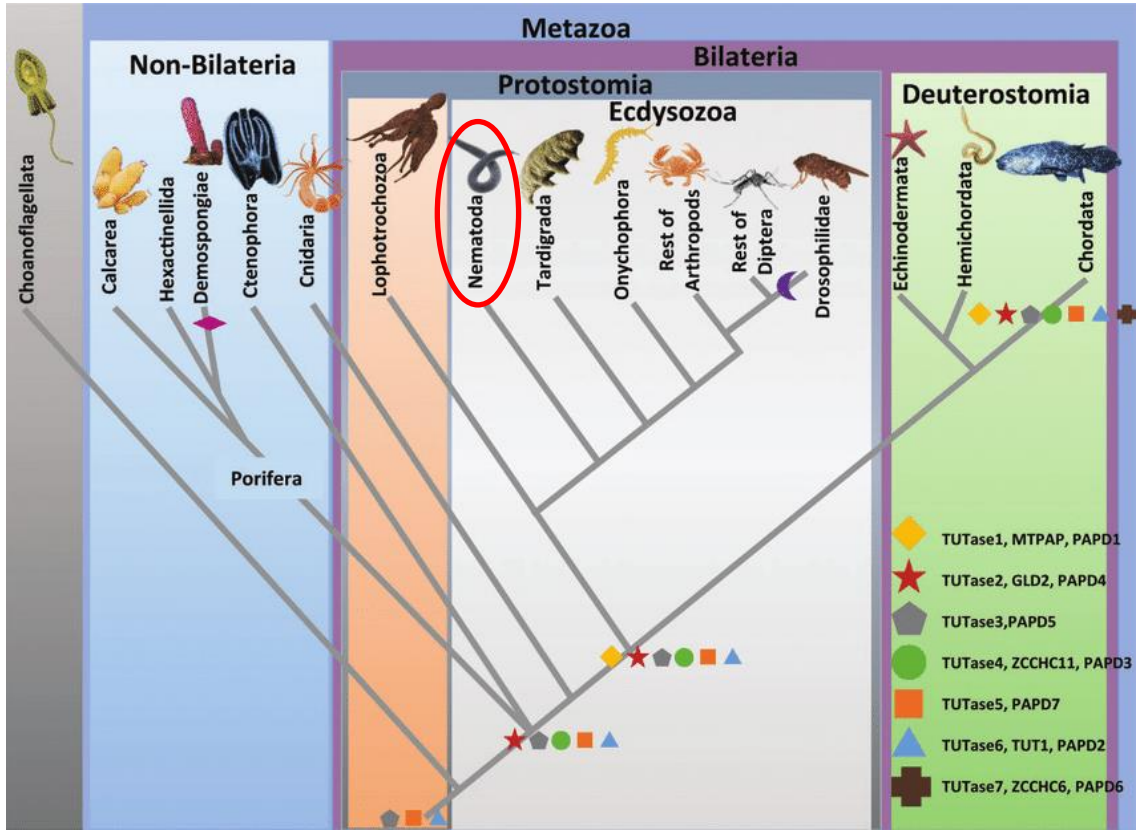


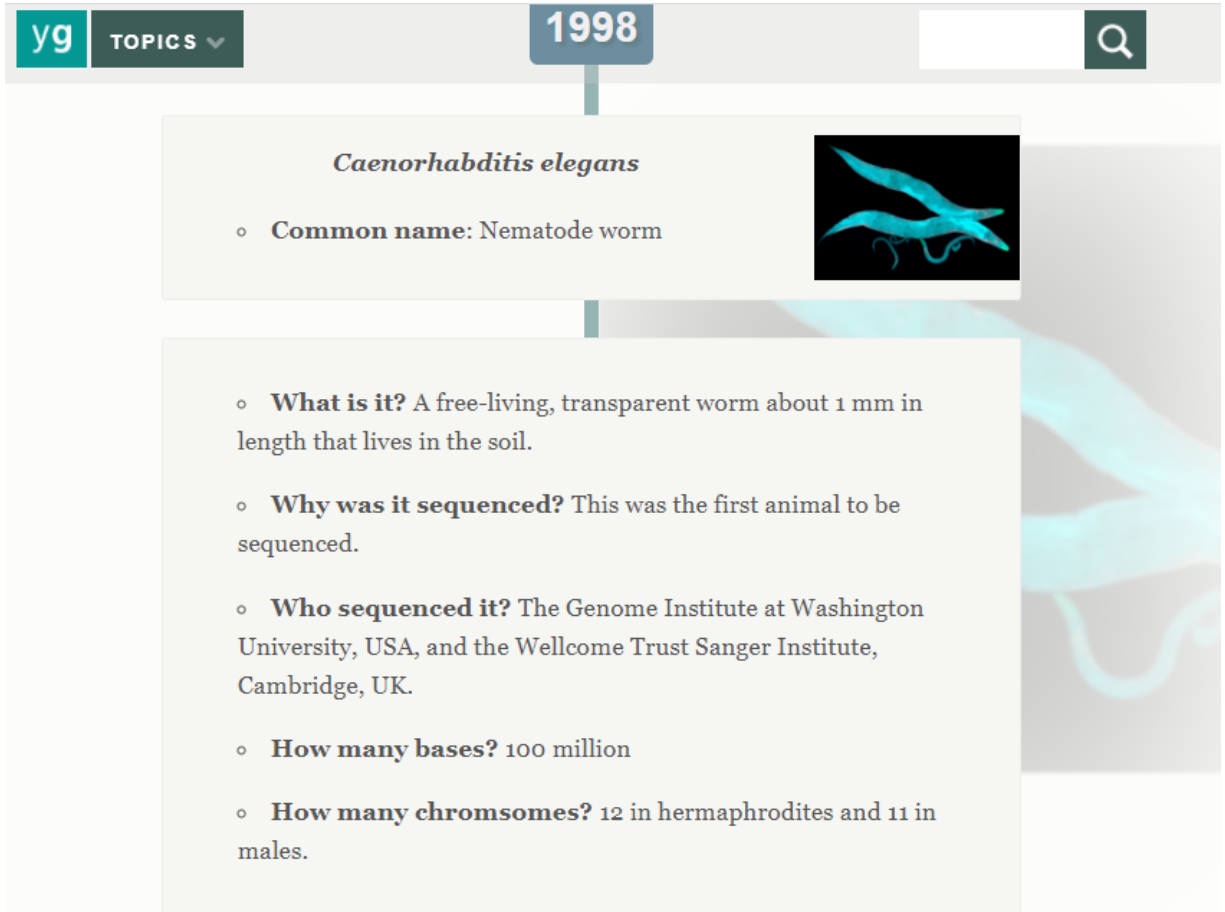
A fluid-filled body cavity lying inside the external body wall of the nematode that bathes the internal organs, including the alimentary and reproductive systems.

Two Quick Facts About Nematodes

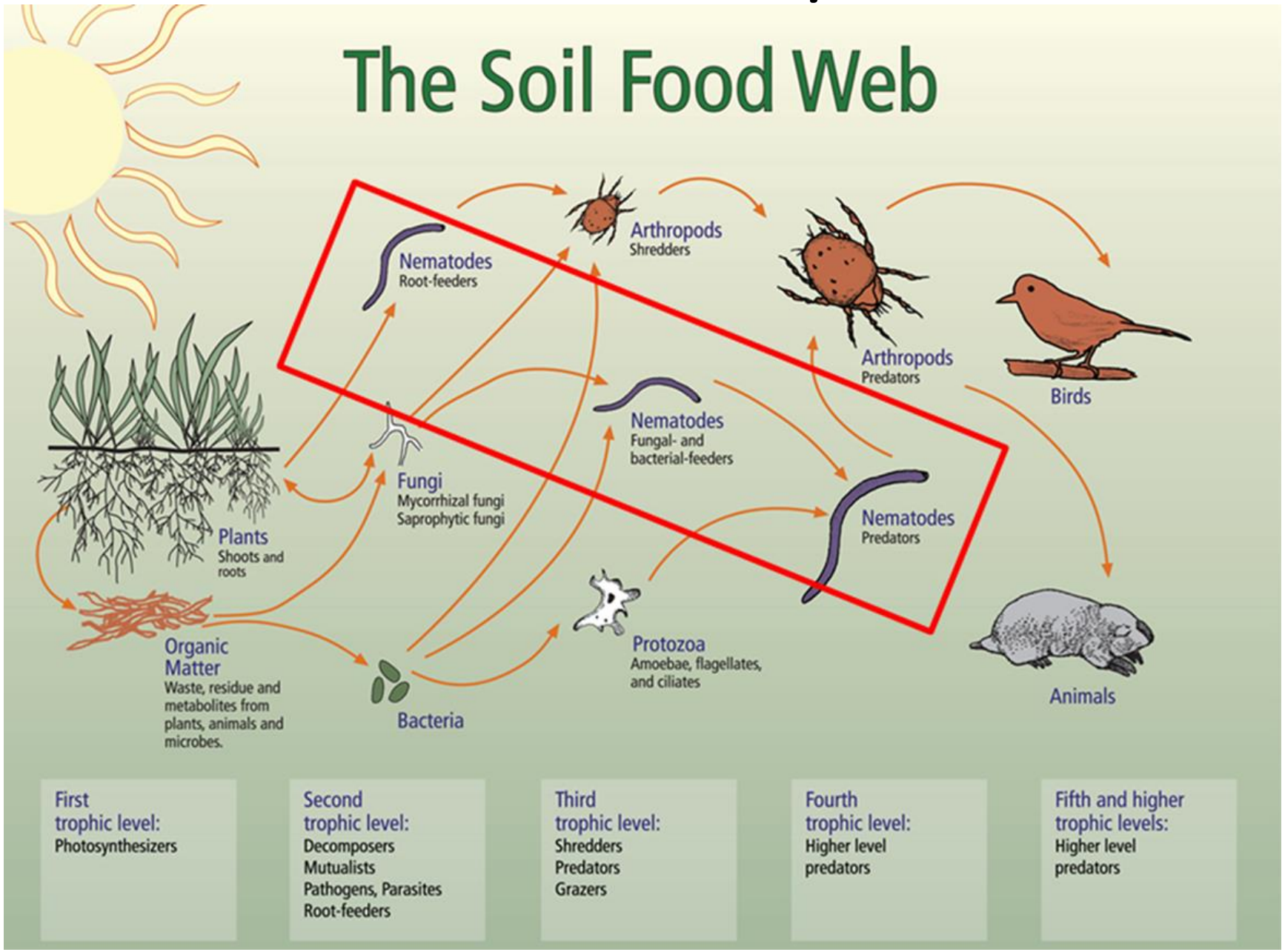
1. Most abundant metazoan

2. The first animal/multicellular organism whose genome was sequenced



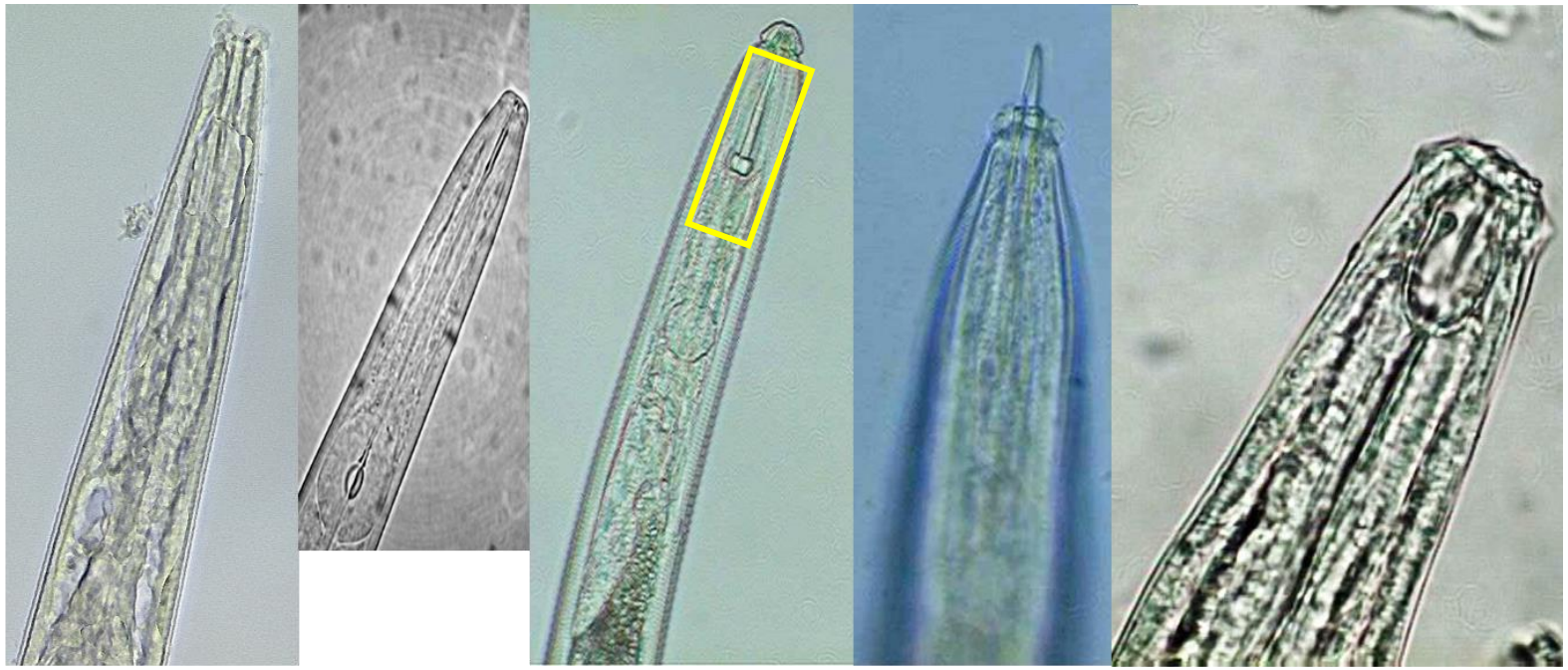


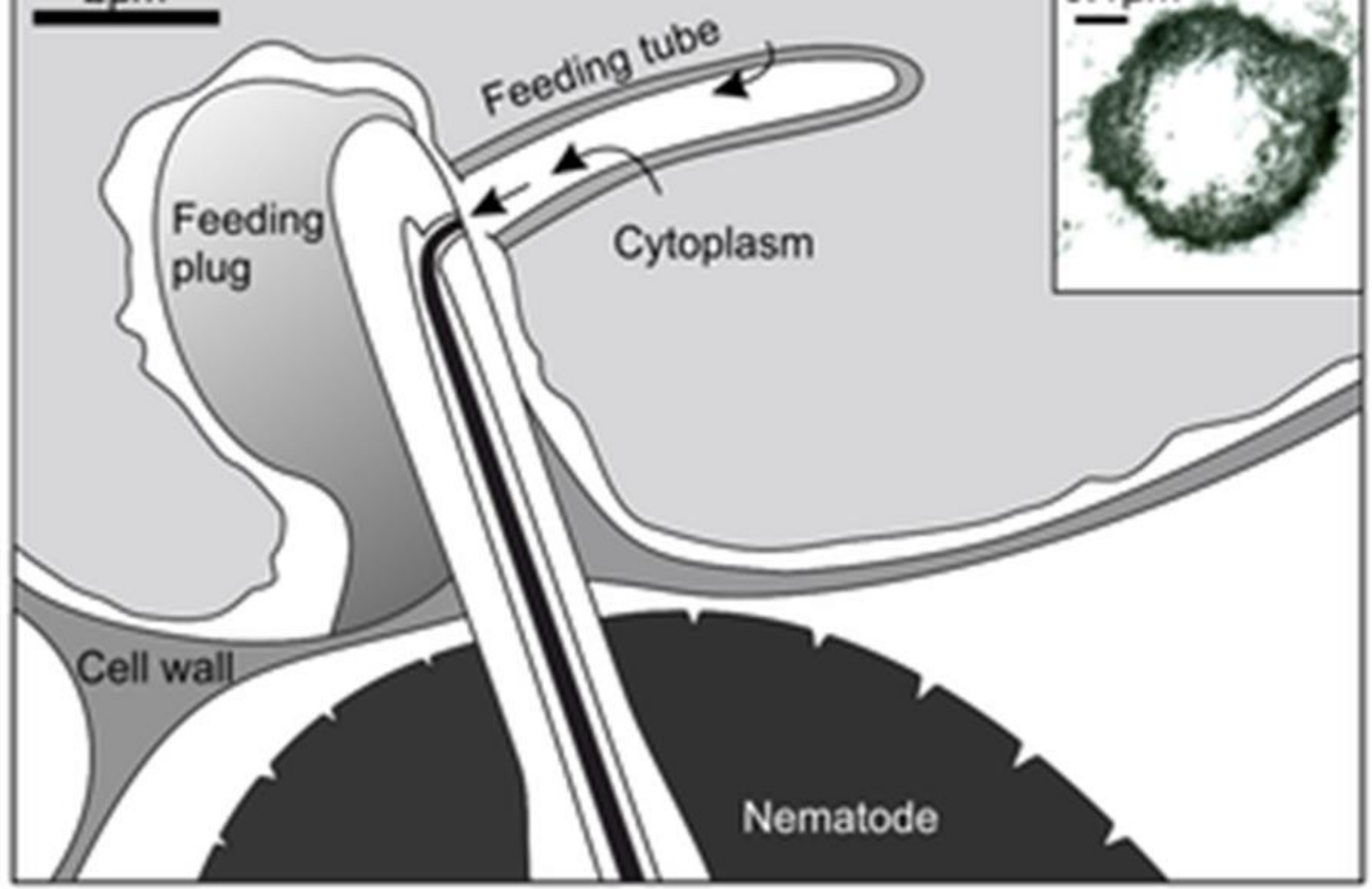
Nematode Community in the Soil

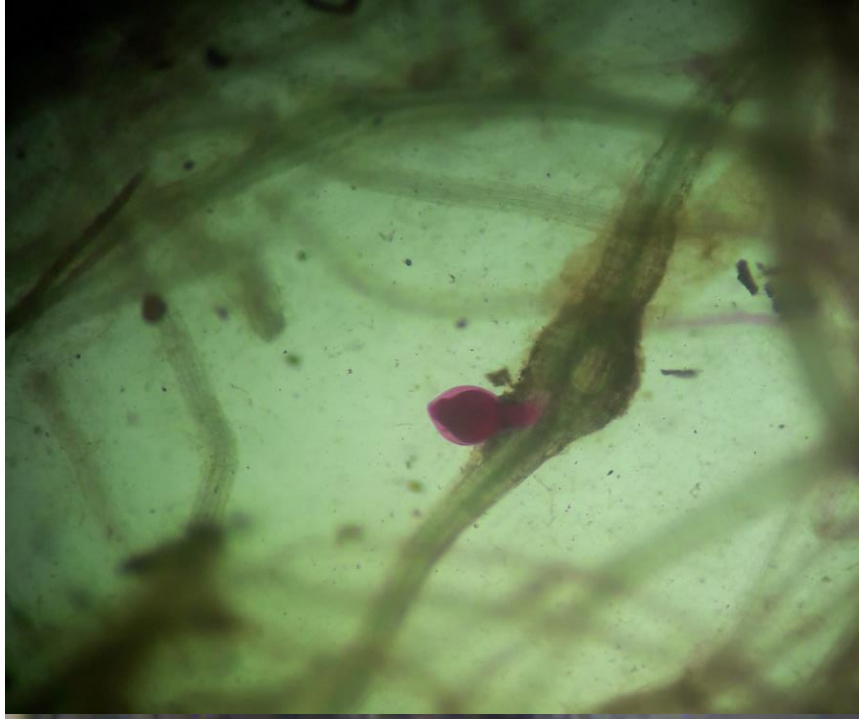


USDA/NRCS

What are Plant-Parasitic Nematodes?




Feeding tube
Feeding plug
Cytoplasm
Cell wall
Nematode




Sting nematode
(Belonolaimus sp.)
feeding on root
Directed and edited by
Janet E. Painter
Worms by
Sadia Bekal
Footage by
Sadia Bekal and
Janet E. Painter
Executive Producer
Kris N. Lambert
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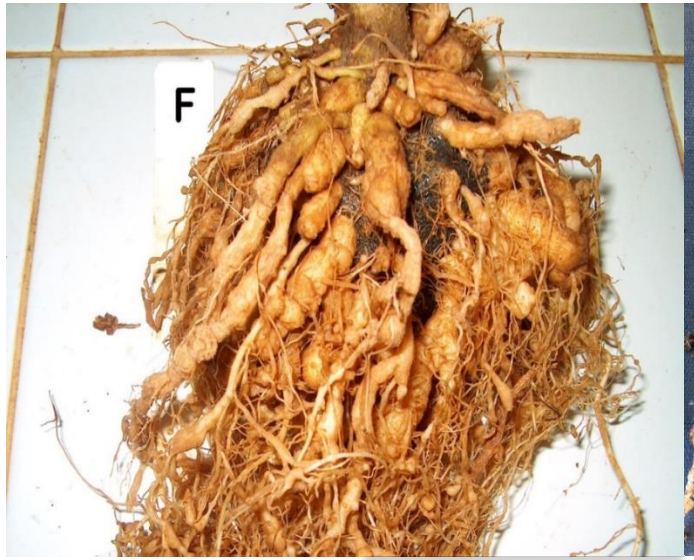
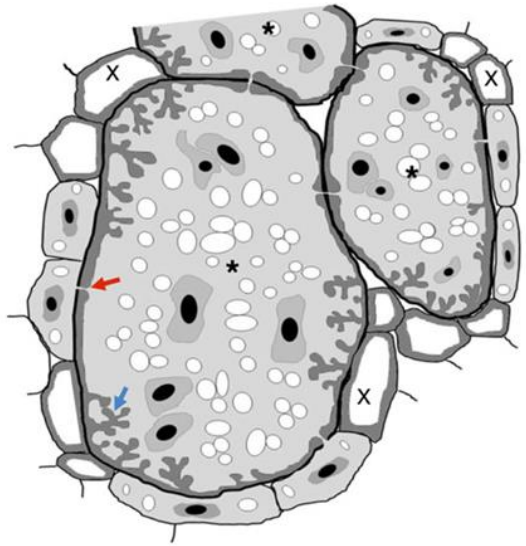
Infection





Giant Cell

Rodiuc et al. 2014

Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo, Bugwood.org

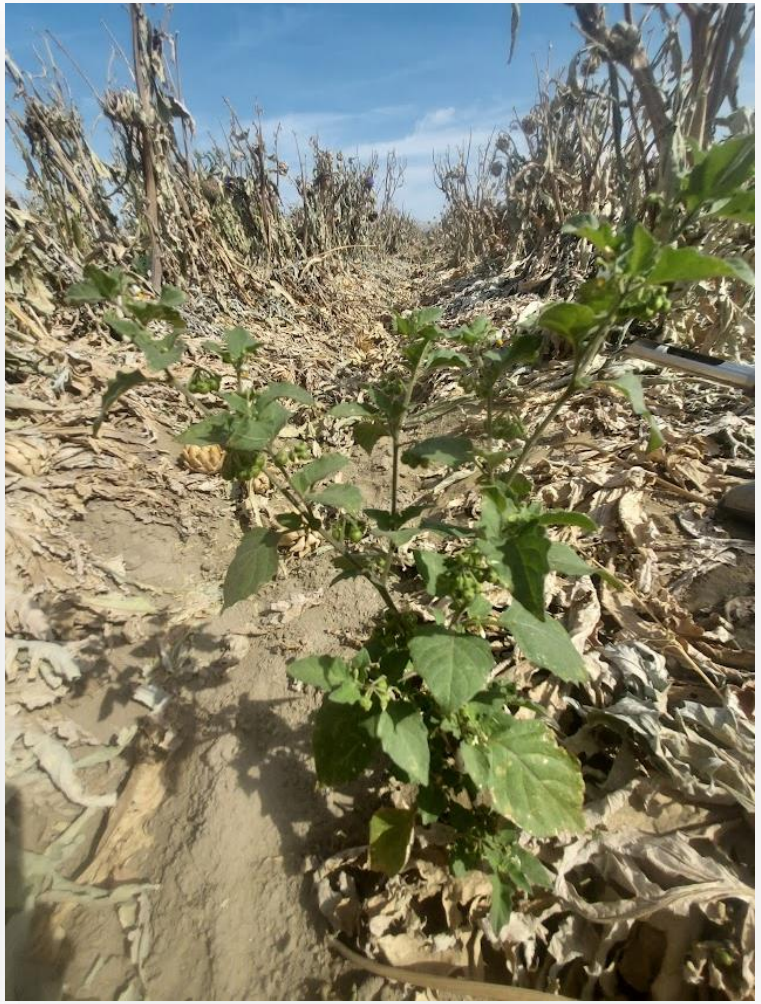
Which of these apply to the organic system?

Management of Plant-Parasitic Nematodes

- Biological control
- Cultural control
- Natural Host Resistance
- ~~Transgenic/GMO~~
- ~~Chemical control~~
- IPM

Case studies

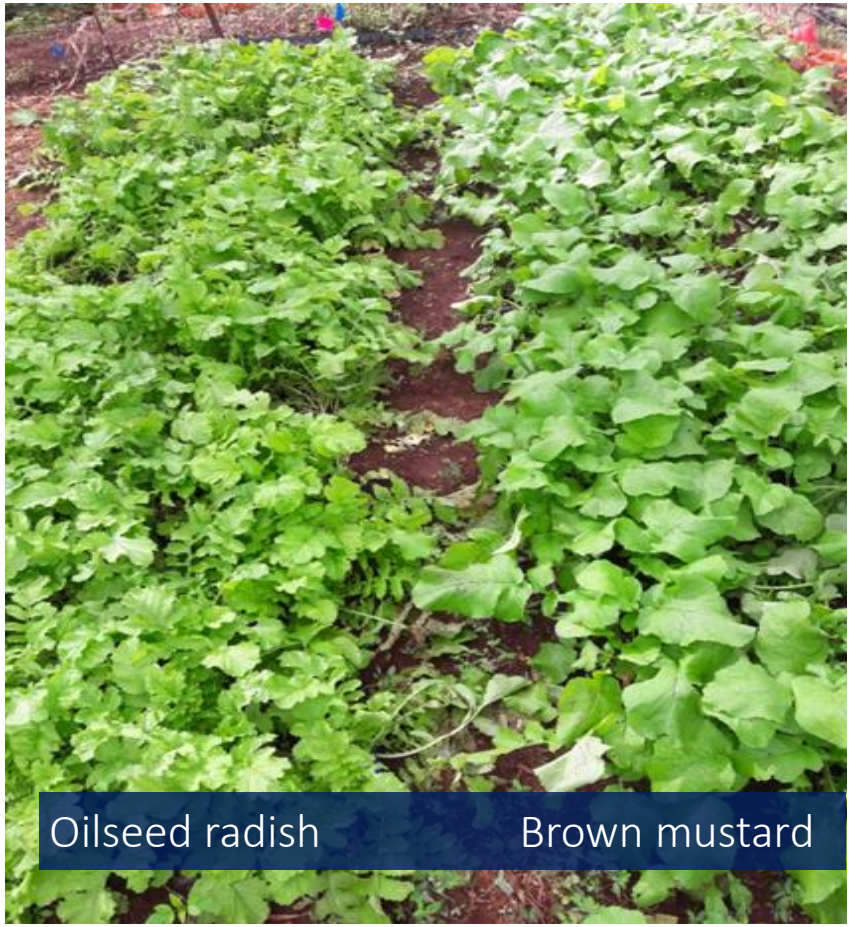
1. Weed Control – Alternate Hosts

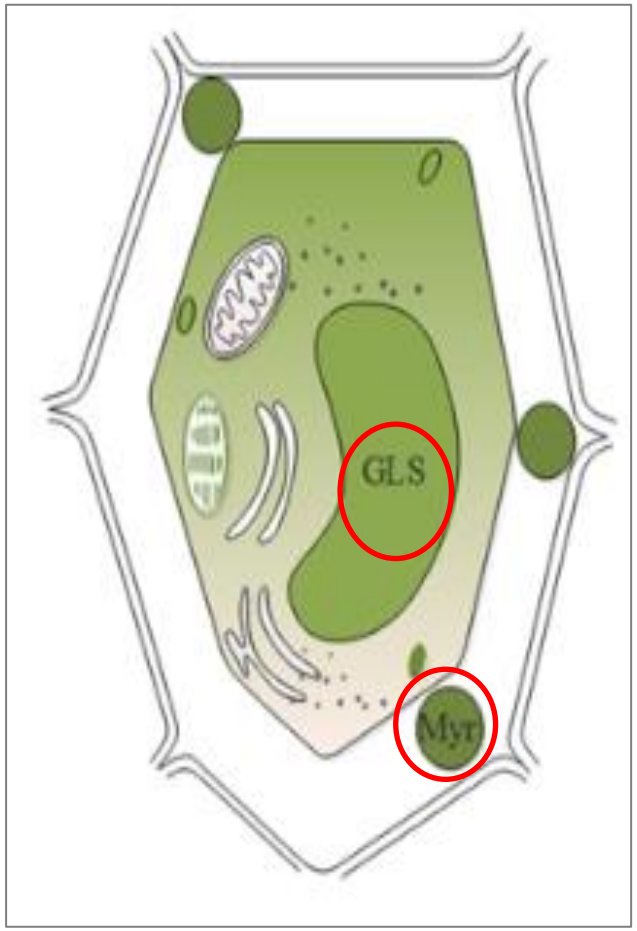


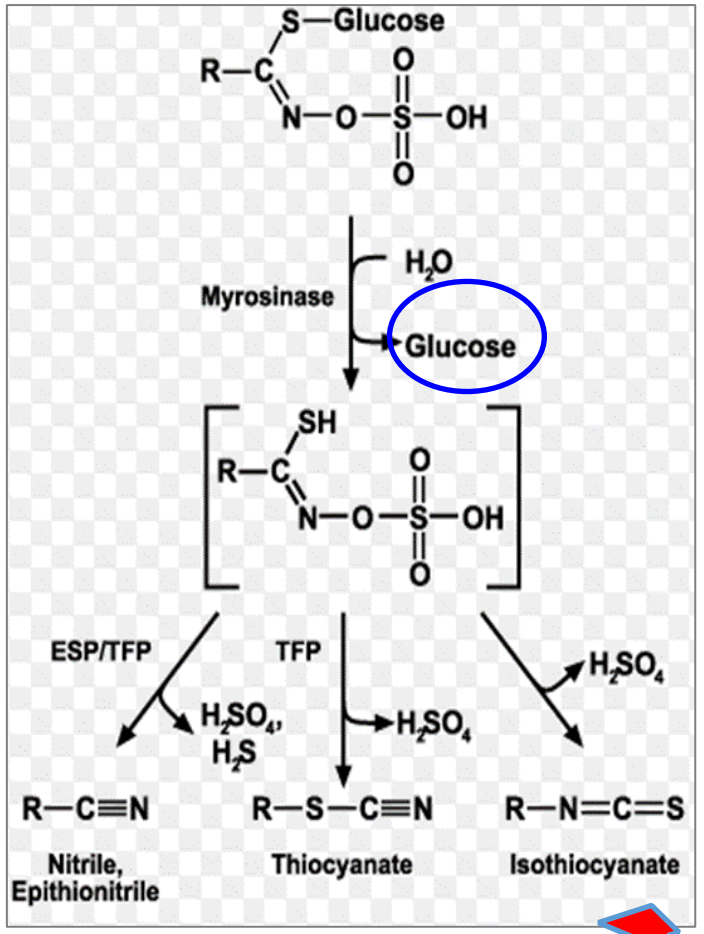
Common Lambsquarters (*Chenopodium* spp.)

2. Cover Crops with Biofumigant Properties - Allelopathy

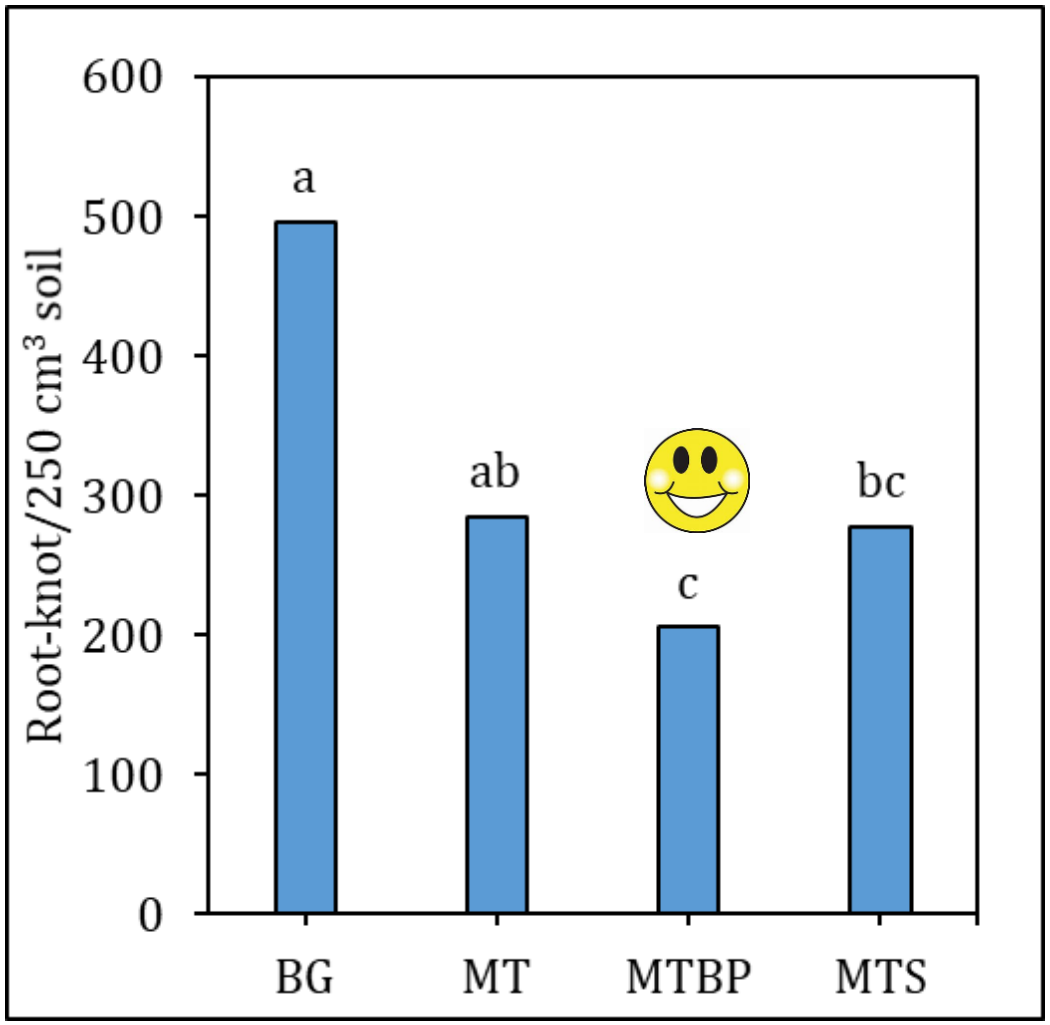
Biofumigant - Production of isothiocyanates

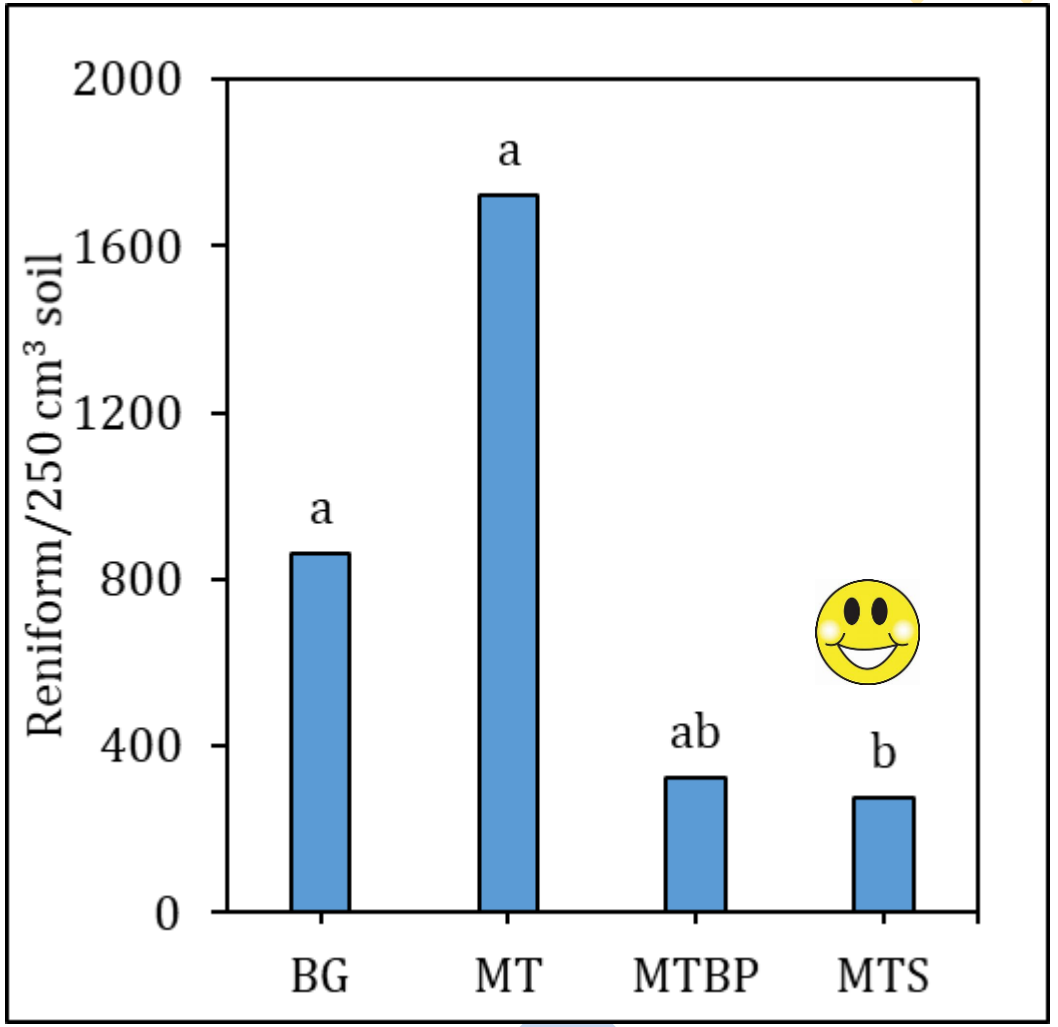




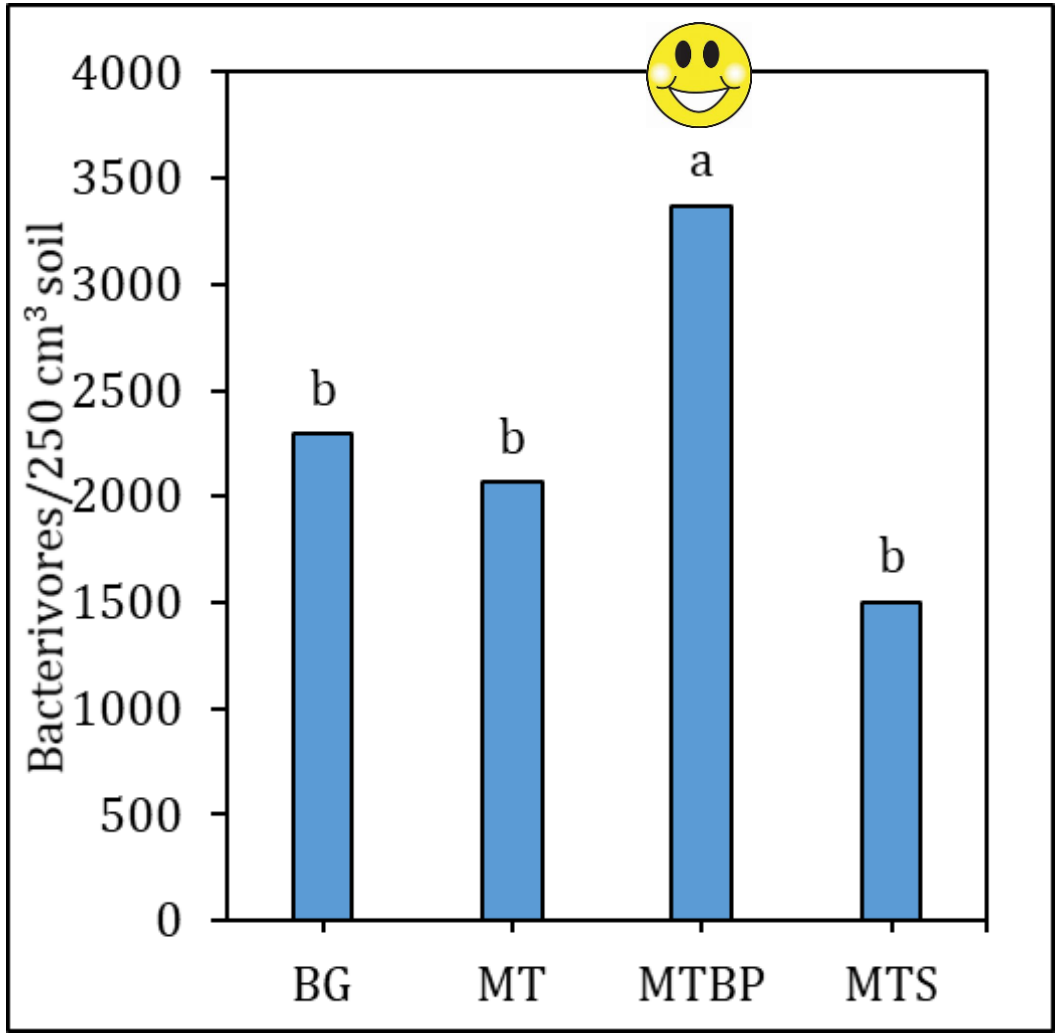


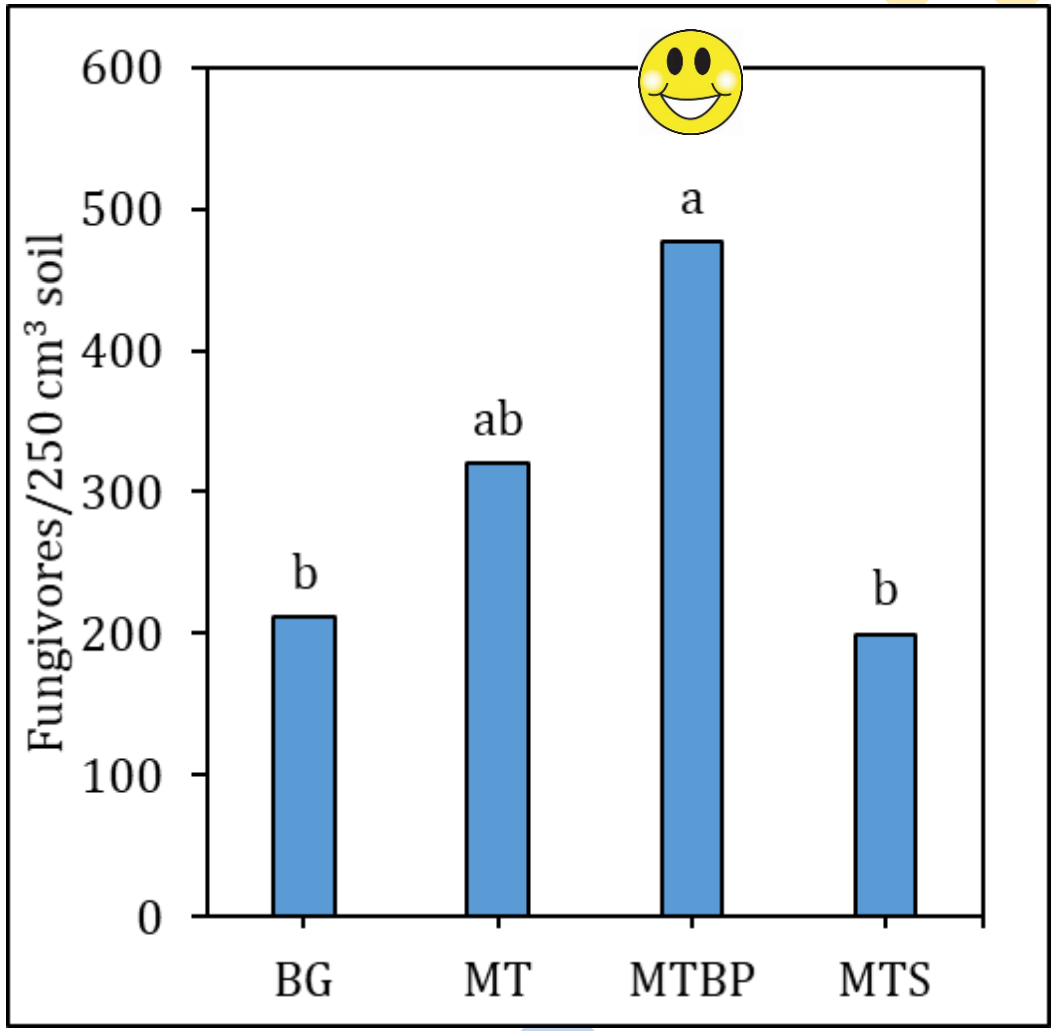
Biofumigation Effects on Target Nematodes



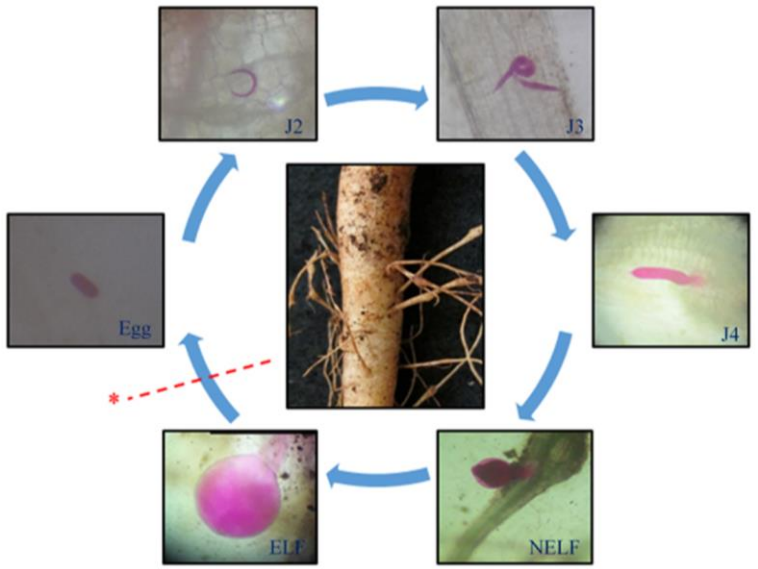


Biofumigation is Compatible with Soil Health





Biofumigation Effects, Trap Crop Effect, Non-Host Effect, and Nitrogen Contribution



- 97-102 lb N/ac (240 lb N/ac)

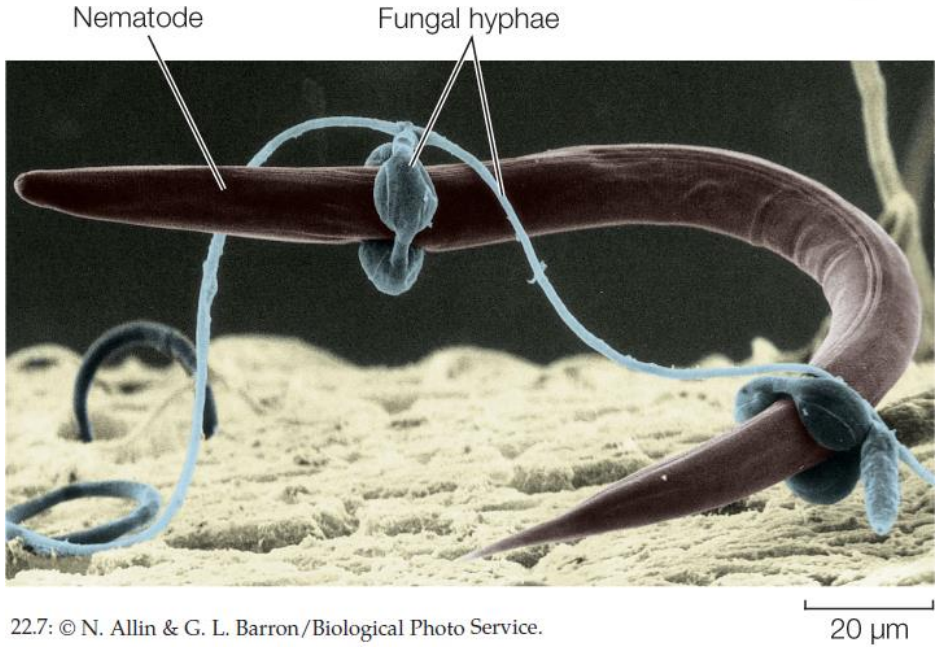
Nematode Control + Nitrogen Contribution

Organic Amendments Recruit Natural Biological Control Agents

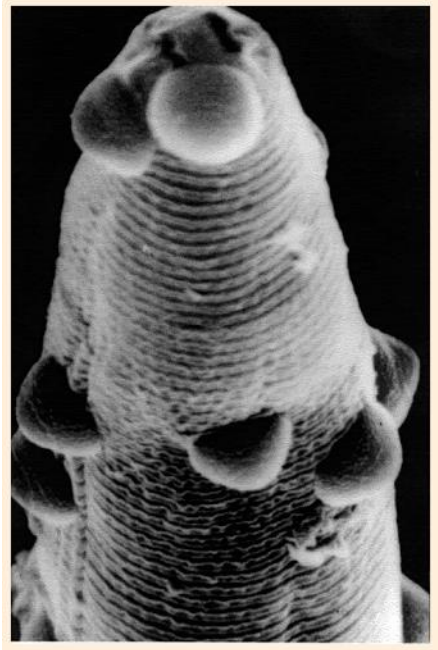
- Bacteria
- Fungi
- Nematodes (predators)
- Arthropods (mites)

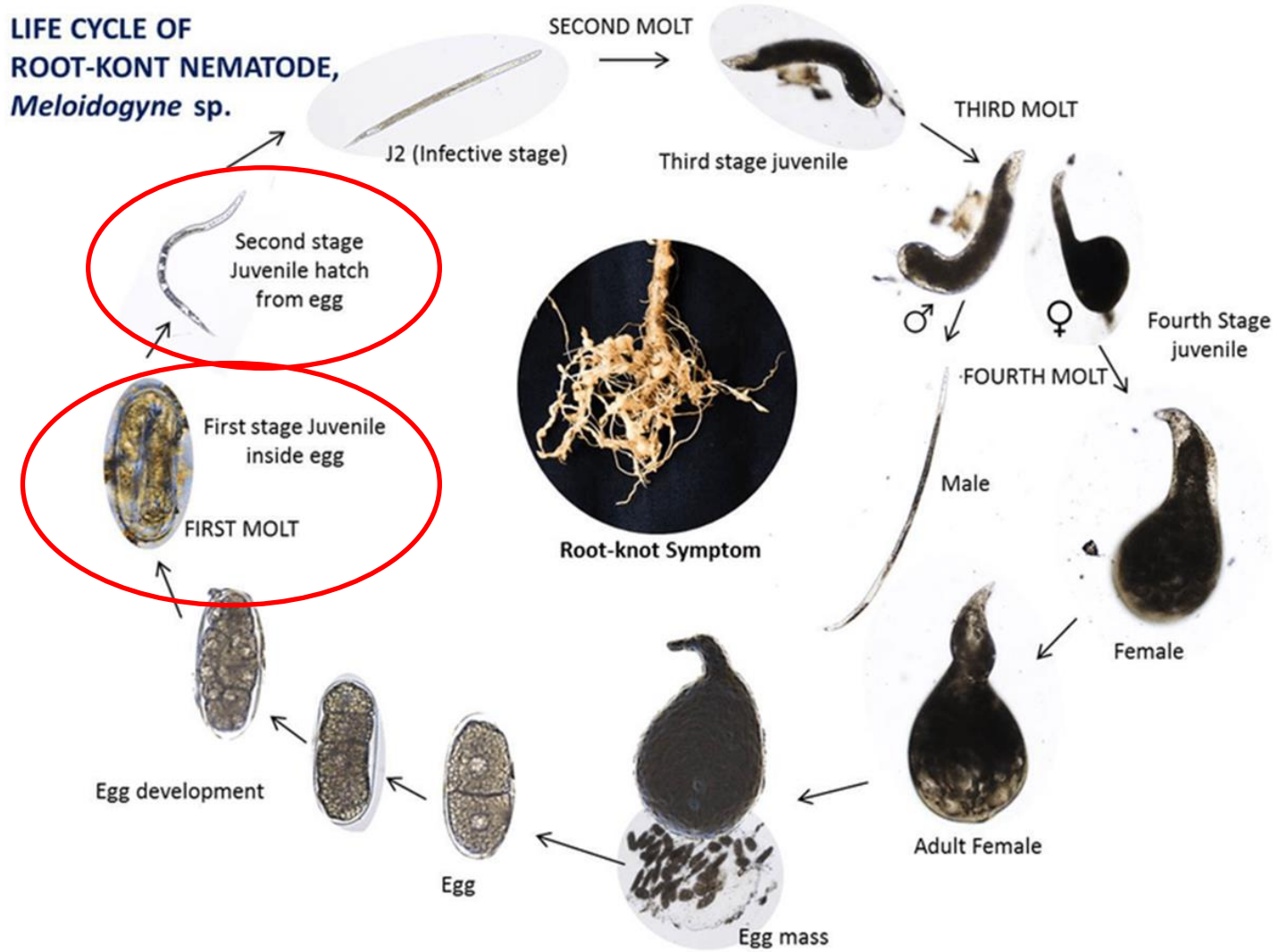
Natural enemies

- **Classical biocontrol**
- **Augmentative biocontrol**
- **Conservation biocontrol**



22.7: © N. Allin & G. L. Barron/Biological Photo Service.





Eggs survive extreme environments and in the absence of a host and re-emerge when the host is detected. Second-stage juvenile is the vulnerable stage to be killed. Practices that can stimulate hatch of the surviving eggs is critical.

3. Reduction of Initial Nematode Inoculum – Reduction of Egg Bank

- Apply root exudates of a host plant 2 weeks prior to planting:

- **Eggs** - Suicidal hatching in the absence of host

- **Juveniles** - Depletion of energy reserves (lipid reserves)

VELUM®

NIMITZ® Pro G
Nematicide

For nematode control in Bermudagrass, St. Augustinegrass, Zoysiagrass, Centipedegrass, Seashore Paspalum, Tall Fescue, and Creeping Bentgrass on Golf Courses, Sports Fields, Commercial Turfgrass Areas, Sod Farms and Residential Turfgrass Lawns

Intended for use by a Commercial Applicator.

ACTIVE INGREDIENT:	% BY WT.
Fluensulfone: 5-chloro-2 (3,4,4-trifluoro-but-3-ene-1-sulfonyl)-thiazole	1.5%
OTHER INGREDIENTS*:	98.5%
TOTAL:	100.0%

KEEP OUT OF REACH OF CHILDREN
CAUTION/
PRECAUCION

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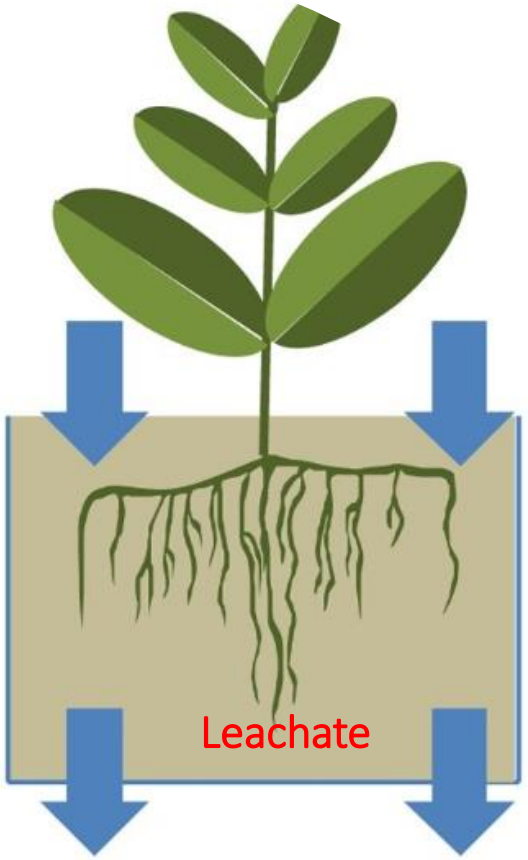
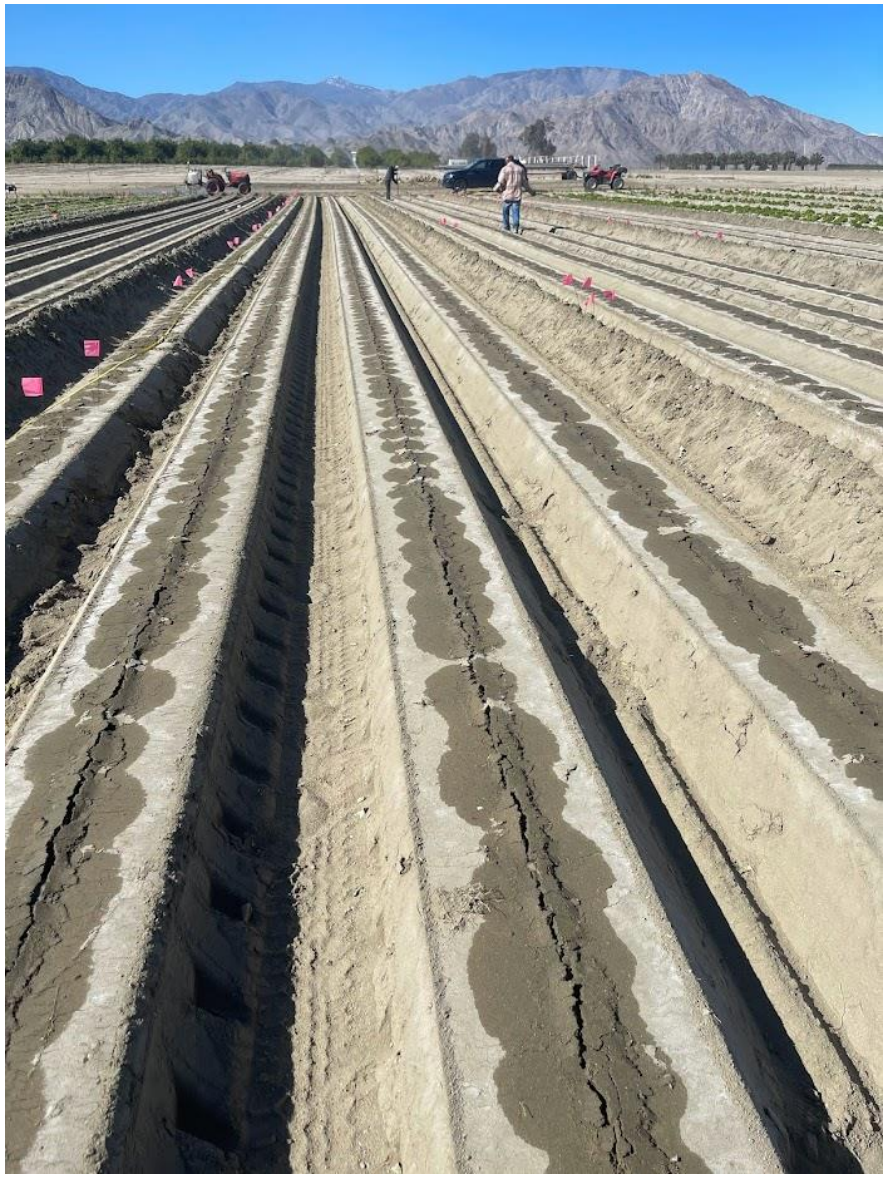


Leverage Use of Next Generation Nematicides - Integrate Reduced-Risk Nematicides + Root Exudates/Hatching Factors

California Department of Food & Agriculture Funded Project (#SA-5981-05) investigating RKN hatch induction with root exudates + reduced-risk nematicides

Injecting Root Exudates in Root-Knot Nematode Infested Field



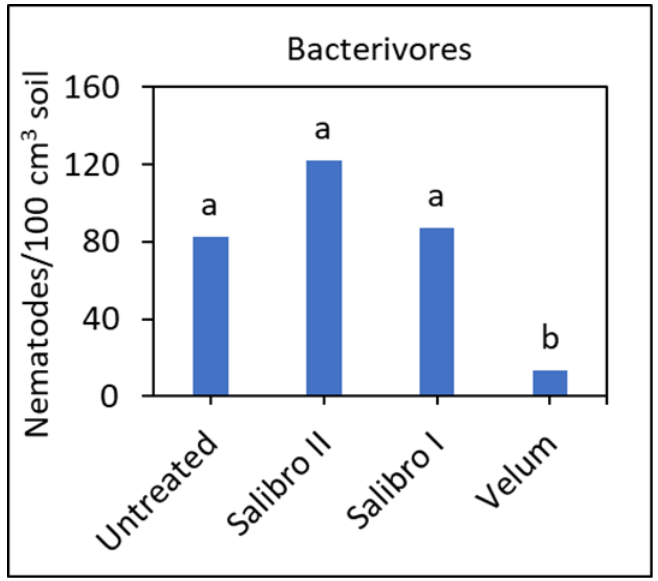
Salibro is a New Reduced-Risk Nematicide and is Compatible with Soil Health

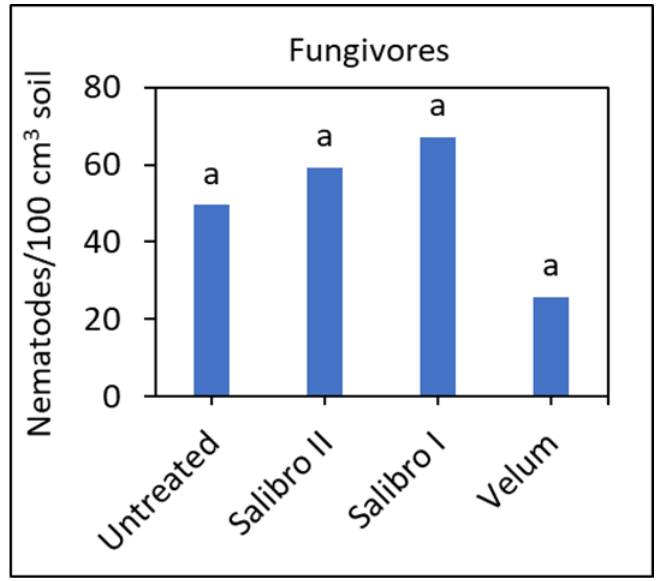
Salibro:

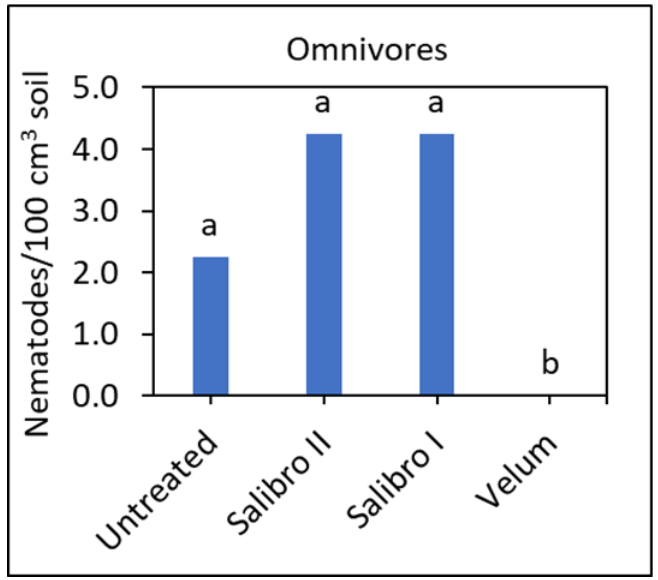
- No effect on beneficial nematodes
- Salibro II suppressed RKN
- Salibro I did not suppress RKN

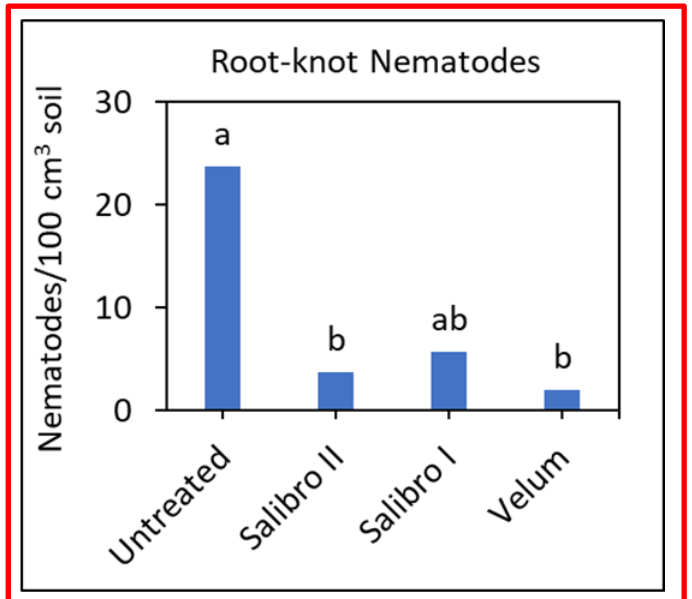
Velum:

- Suppressed RKN
- Suppressed beneficial nematodes
- Negatively impacted soil health



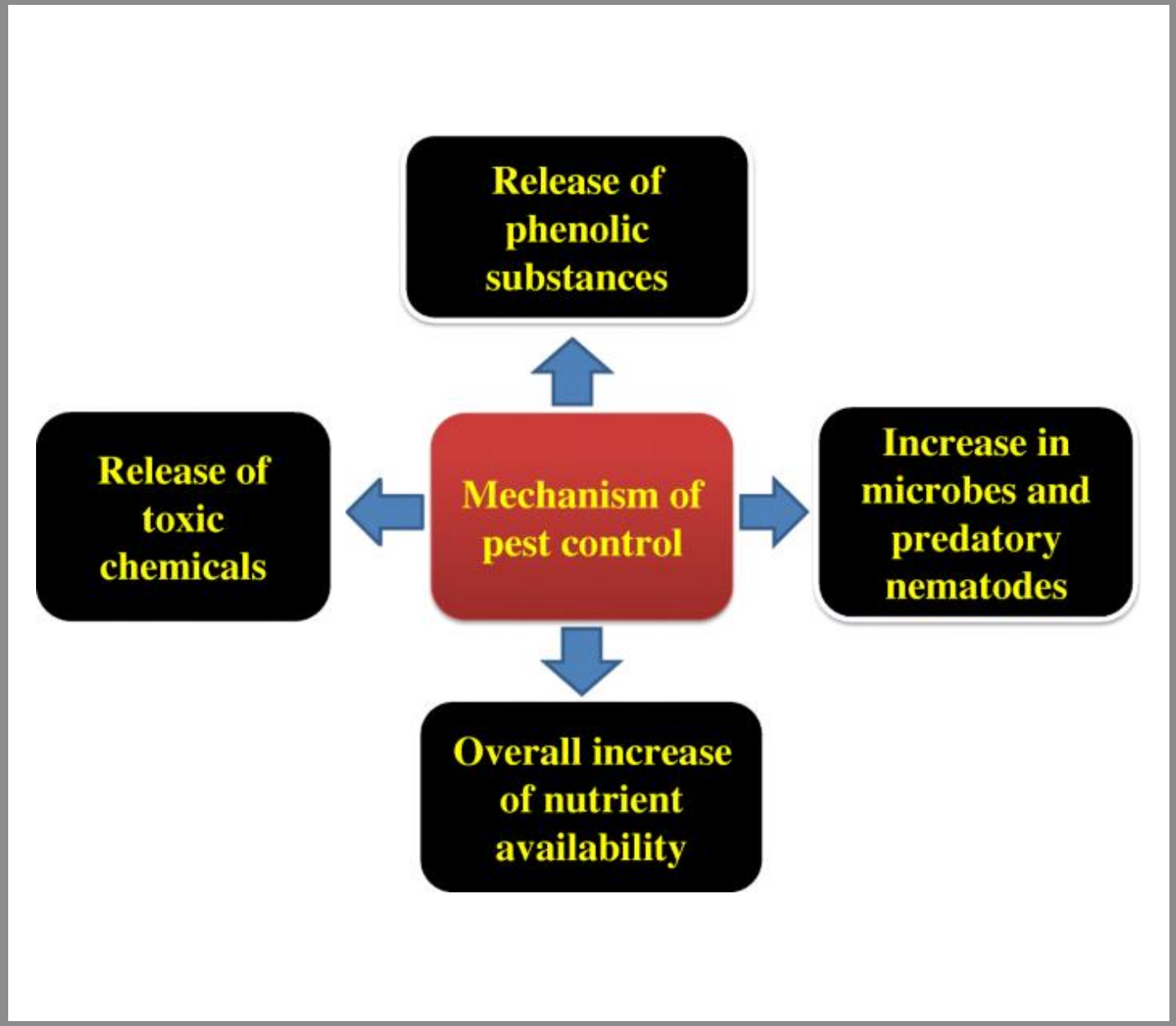




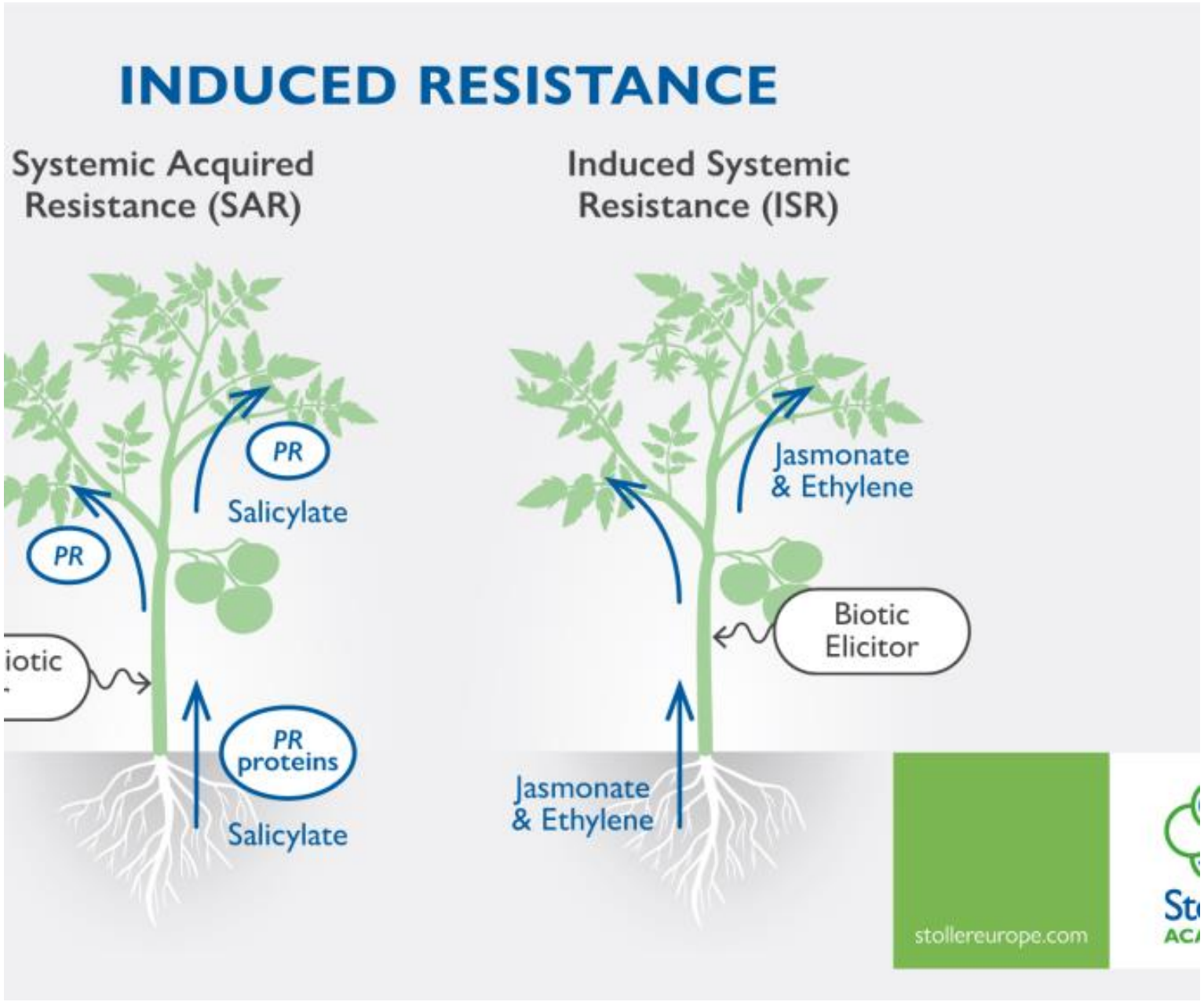


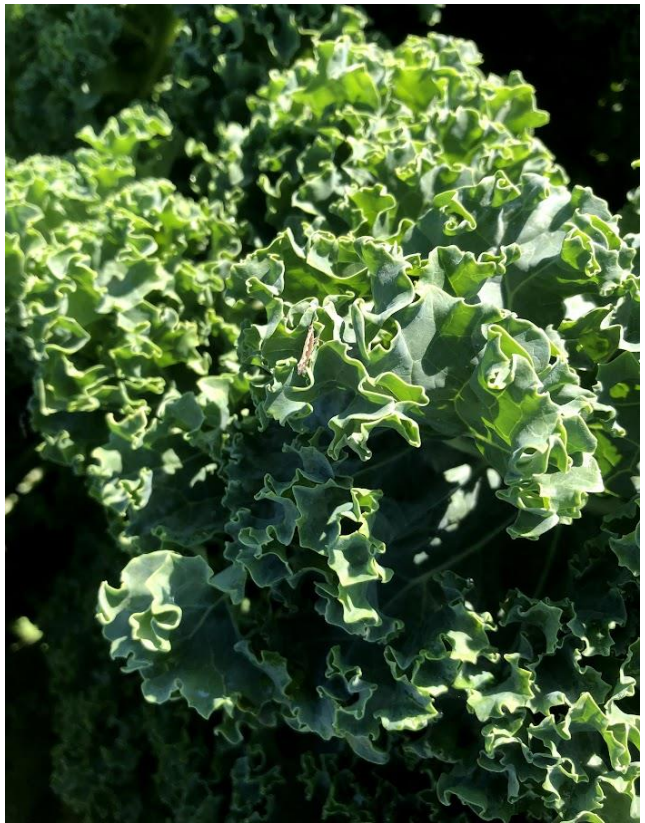
Waisen, 2023 [Imperial County AgBriefs. 26(1): 133–137]

4. Vermicompost Tea (Project in the pipeline)



Vermicompost/Vermicast Tea Another Organic Control Option for Nematode Control





Others:

Entomopathogenic nematode as biocontrol for Lepidopteran Pests(diamondback moth, beet armyworm, cabbage looper) on Cole Crops

Thank You

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