Anaerobic soil disinfestation as preplant soil treatment for perennial crop nurseries

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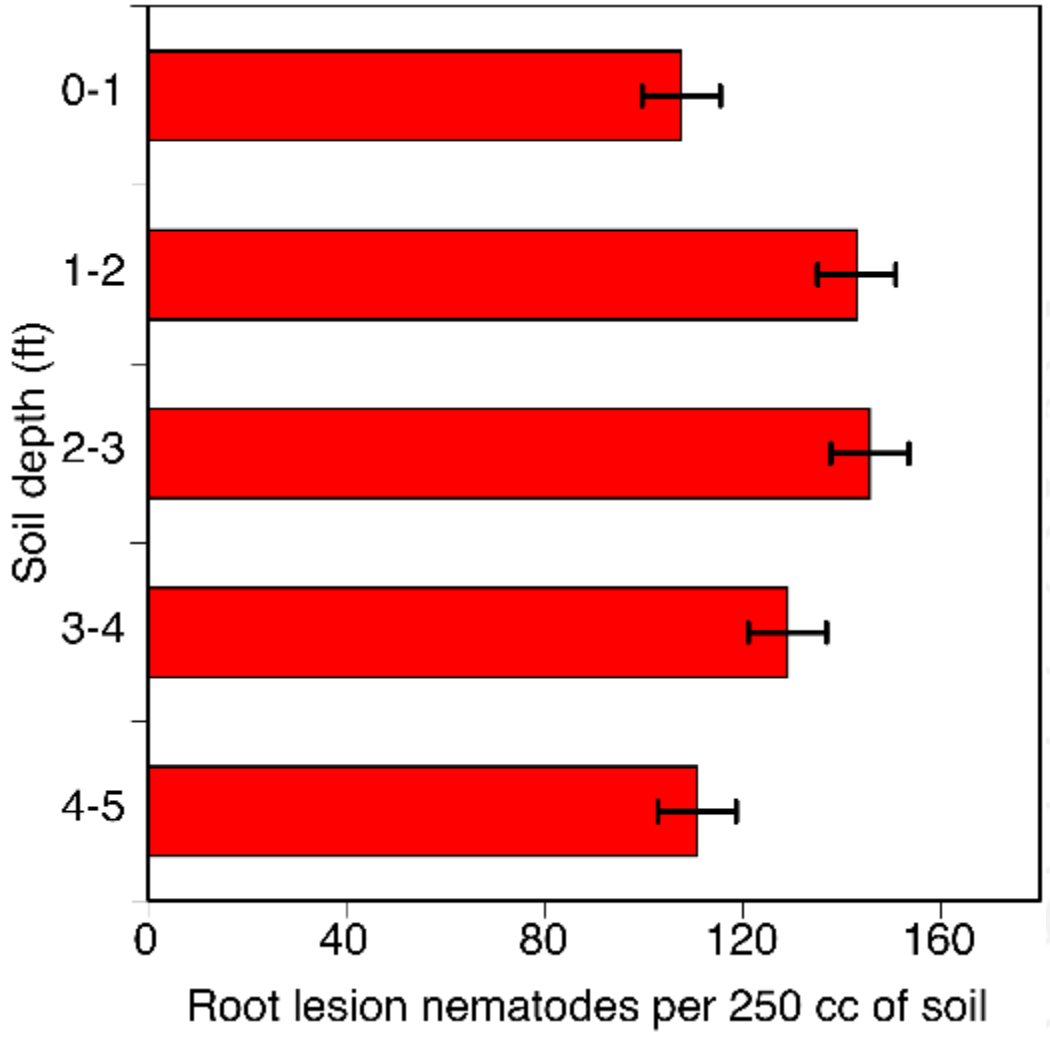
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Outline

- What is anaerobic soil disinfestation (ASD)?
- What are efficacy limitations?
- Are there alternative substrate sources?
- Are there alternative application methods?

Root lesion nematode population density distribution



The process of anaerobic soil disinfestation (ASD)

- Apply carbon-rich substrate
- Incorporate with a rototiller
- Install irrigation lines, cover soil with TIF add water (6 inch; 150 L/m^2)
- Keep moist for one month (1 inch, 25 L/m^2 every other day)
- Remove TIF film, allow for aeration, and plant crop

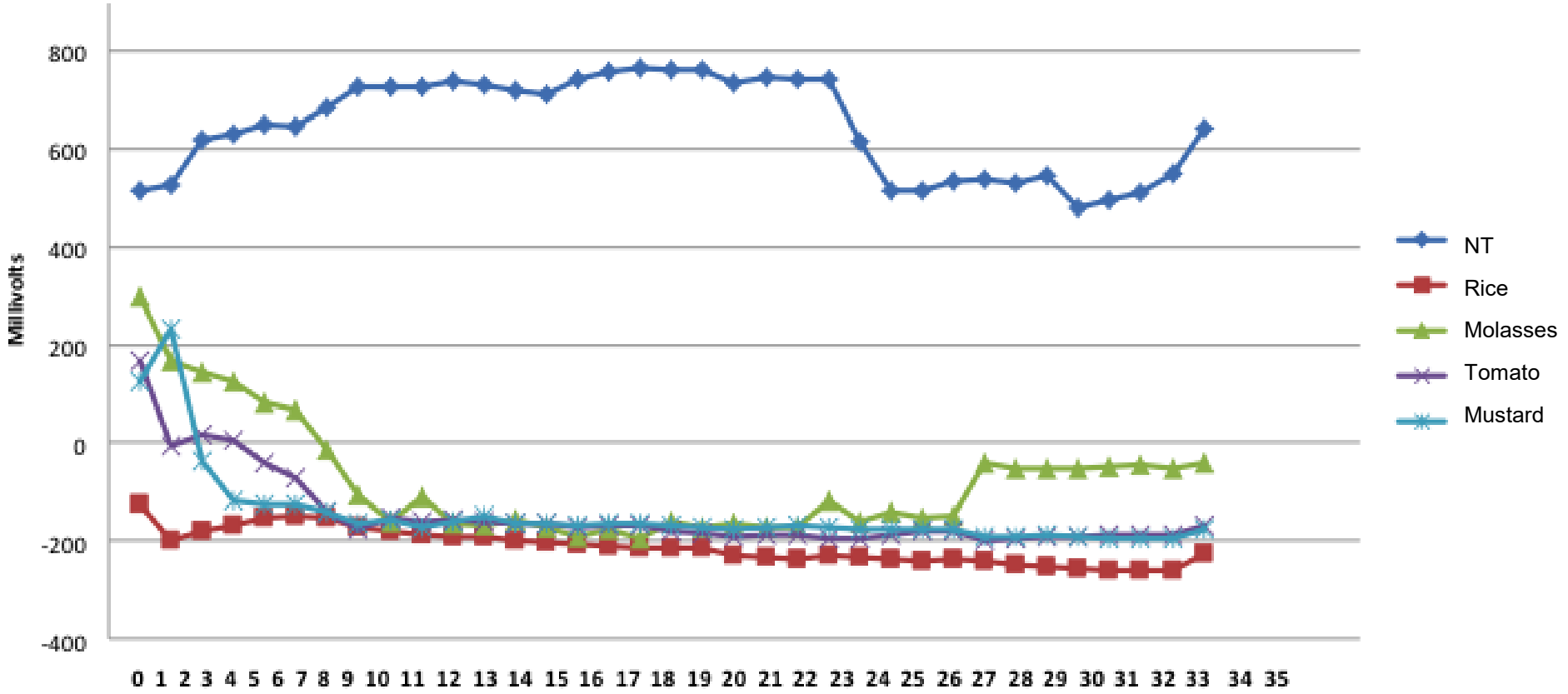
Substrates used for ASD

(typical application rates: 9 ton/acre; 20.2 ton/ha)

- Rice bran
- Molasses
- Tomato pomace
- Mustard seed meal

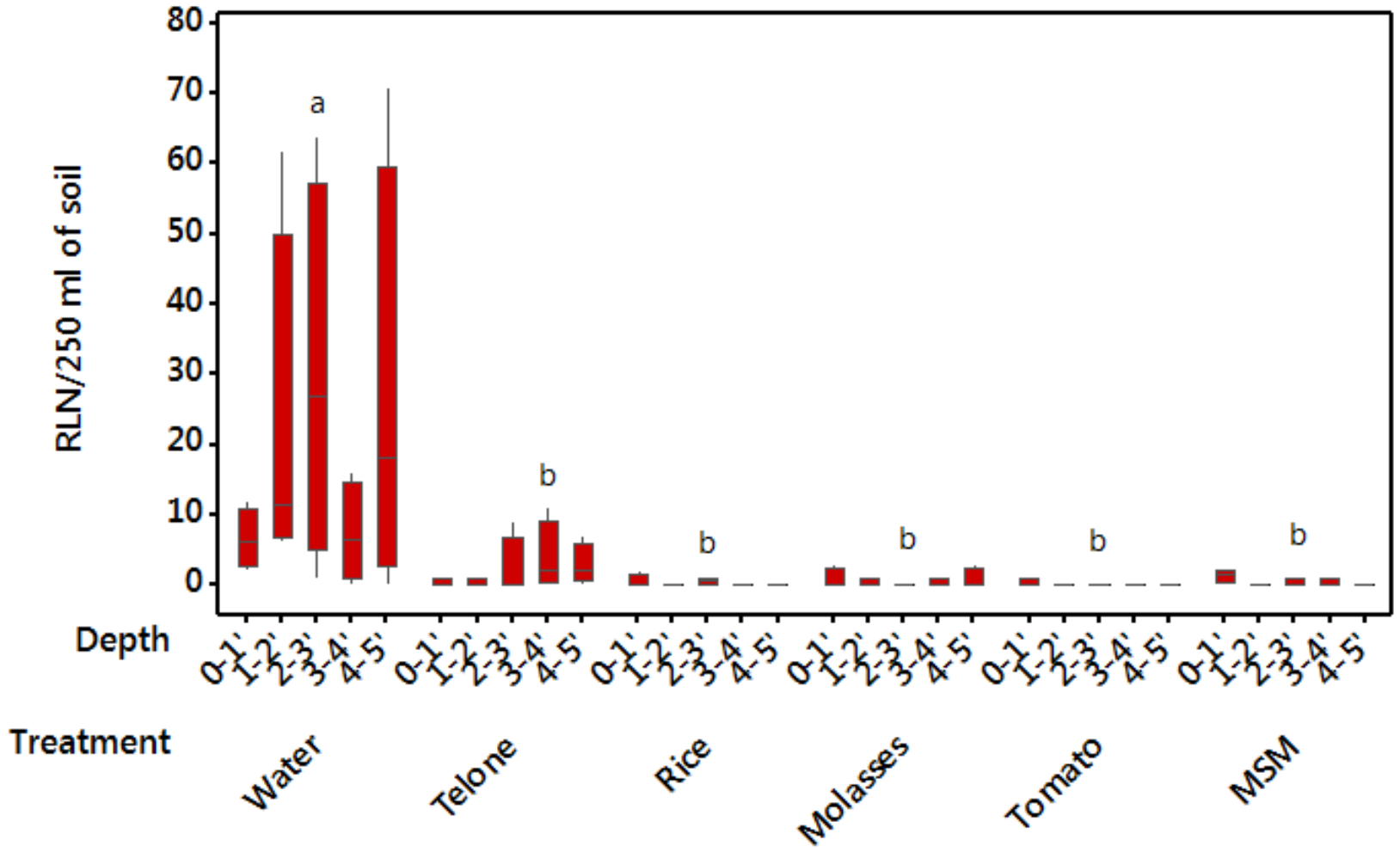
Soil anaerobic conditions during ASD incubation

(18-inch deep)



Incubation time under plastic (days)

Soil populations at planting of 'Nemaguard' seeds post treatment by ASD



Root infection of ‘Nemaguard’ rootstock in *Pratylenchus vulnus*-infested soil winter (15 months)

The number of *Pratylenchus vulnus* in roots was as low after ASD treatments as after soil fumigation.

Field experiments for scaled-up applications (summer 2018)

#			METHOD
1	Water	Water	Surface continuous
2	Telone II	N/A	shank
3	Methyl bromide	N/A	shank
4	ASD	Water	Surface continuous

Plant seeds of peach rootstock ‘Nemaguard’ (one year) and ‘Paradox” walnut rootstocks (two years)

Soil population densities of *Pratylenchus vulnus* after soil treatments Trial 1

After treatment, nematode population densities were close to the detection level after Telone II fumigation, and non-detectable after methyl bromide fumigation and ASD in the upper 5 ft of soil.

Pratylenchus vulnus in walnut roots after soil preplant treatments plus Salibro postplant (2nd year)

Nematode numbers in the roots were low under Telone II, methyl bromide, and ASD.

Limitations



Efficacy of ASD in soil with different sources of root-knot nematode infestation

When different sources of RKN inoculum (grape soil, Prunus roots, grape roots) were used to infest microplots root-knot nematodes in grape roots were not reduced after ASD whereas soil fumigation with Telone EC suppressed populations.

Anaerobic soil disinfestation



A person standing next to sudangrass cover crop



A tractor pulling a moldboard plow



An injection machine on a trailer

(Westphal)

Alternative substrates



Biomass from cover crops

A person standing next to sudangrass planting



Sudangrass biomass after mowing held by a person



Walnut ‘Livermore’ on “PH’ at replant site (sandy loam) after preplant treatments (2020): RLN August 2021

Population densities of *Pratylenchus vulnus* after ASD with cover crops as substrate were on similarly low levels as after soil fumigation

Application procedure:

Methods?

Simplifying ASD application protocols in almond

Rice bran can be incorporated into the soil with a moldboard plow. When ASD is initiated by the described irrigation schedule, almonds planted after these treatments grow much more vigorously than in non-treated soil.

Walnut ‘Chandler’ grafted to ‘Vlach’ in nematode-infested soil. Planted winter 2024, measurements, winter 2026

Plow in method with sudangrass biomass similar as the traditional ASD.

Cost estimates

		Trad.	Plow	Inject.	Cover
Substrate	$3,000	X	X	X	1/2
Compost spreader	$200	X	X	-	-
Rototiller	$30	X	-	-	(X)
Mowing	$50	-	-	-	X
Injecting	$200	-	-	X	-
Tarp	$1,000	X	-	-	-
Irrigation lines	$1,000	X	1/2	1/2	1/2
Plastic laying	$500	X	-	-	-
Plowing, rolling	$80	-	X	-	1/4
Irrigation water	variable				
TOTAL		**$5,730**	**$3,780**	**$3,700**	**$2,100**

Results and Conclusions

- Anaerobic soil disinfestation was as effective as soil fumigation in RLN-infested ground.
- Efficacy of nematode suppression was similar when ASD was initiated in July to October.
- Substrate and water amount plus schedule are critical for consistent efficacy.
- Grape roots may allow survival of RKN.
- Using at-site produced biomass of nematode-antagonistic crops has potential to expand substrate selection.
- Using moldboard incorporation of substrate eliminated the need for plastic mulch.

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