WASHINGTON STATE UNIVERSITY

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Is Preplant Fumigation The Way To Go For Nematode Control in Vineyards?

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Many Factors to Consider When Planting a Vineyard …

… Decline Due to Soil-borne Pests Adds Risk to Vineyard Success

A vine can only carry so much stress

Why Do Nematodes Add to Risk? Because They Add To Vine Stress

Productive vine

Non-productive vine

A young vine

Slide modified from Dr. Katherine East, USDA-ARS

What Does Nematode-Risk Look Like?

New Vineyards

Chronic Decline

- Plant parasitic build up on the vine root systems
  - Own rooted vines – fast build up
  - Rootstocks – variable build up
- Build up of additional stressors over time?
- Reduces overall lifespan?

Vineyard Replant

Acute (and Chronic?) Decline

- High pre-existing nematode populations can quickly overtake a small root system
- If you start off behind, can you ever catch up?
- Severely reduces overall lifespan

Current "Strategies" To Reduce Risk Due to Nematodes

- **Rootstocks**
  - Not all rootstocks are resistant – some are tolerant
  - Not all rootstocks are the same relative to different nematode species
- **Pre-Planting Fumigation**
  - "Tried and true"
  - Used in other systems for a variety of replant disorders
- *Post-Planting Options*
  - *Chemical applications – not much efficacy*
  - *Cover crops – Suppression? Control? Effort to maintain?*

Rootstocks Aren't a Foolproof Option – Resistance vs. Tolerance

Own-rooted *V. vinifera*	Reproduction Factor (R_f)
Chardonnay	45.1 a
Riesling	27.6 b
Cabernet Sauvignon	18.2 bc
Syrah	7.9 c
Merlot	9.5 c

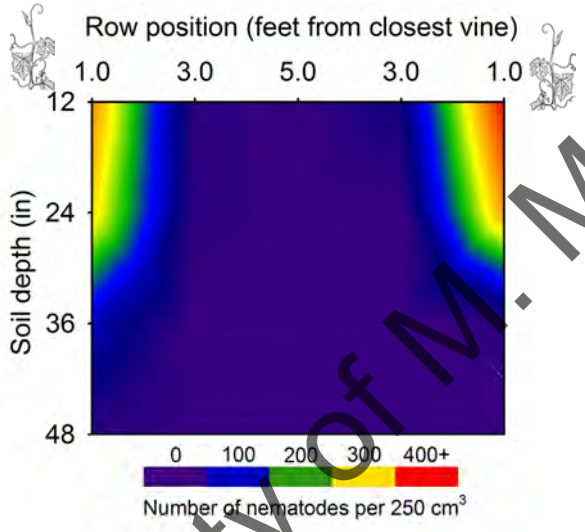
Work done by I. Zasada at USDA-ARS, Corvallis, OR

Rootstock	*M. hapla* R_f	*M. incognita* R_f	*Ms. xenoplax* R_f
Chardonnay	134.69 a	55.64 a	1.33 ab
5 BB	0.10 b	0.02 b	1.40 ab
SO4	2.50 b	0.04 b	0.70 ab
44-53	34.78 b	2.66 b	0.73 ab
140 RU	0.00 b	2.49 b	1.77 a
1616 C	0.00 b	0.00 b	0.17 b
Schwarzman	0.04 b	1.18 b	0.28 b
1103 P	0.04 b	0.00 b	0.98 ab

Work done by I. Zasada at USDA-ARS, Corvallis, OR; and M. Moyer, WSU - Prosser

Reproduction Factor (R_f) – If greater than 1, the host is susceptible

Pre-Plant Fumigation is Tried. But is it "True"?



- **Where is RKN?**
  - Concentrated near vine rows
  - In upper 24 inches of the soil profile
- **Where does fumigant go?**
  - Drip applied – Coverage? Timing?
  - Shanked - How low did it go (likely not to 24 inches!)?

East, Moyer, Madden, Zasada. 2019. How Low Can They Go? Plant-Parasitic Nematode Distribution in a Washington Vineyard. Catalyst 3: 31-36.

Is Pre-Planting Fumigation Actually Worth It?

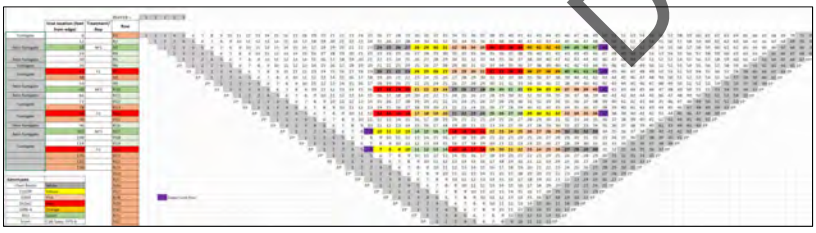
- **Does it reduce RKN?**
- **Does it improve vigor or yield?**

Case Study 1

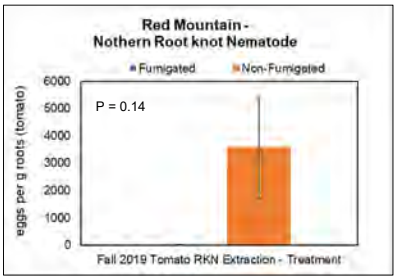
Short – Term Nematode Tracking
Red Mountain AVA

Case Study 1 - The Site / Experiment

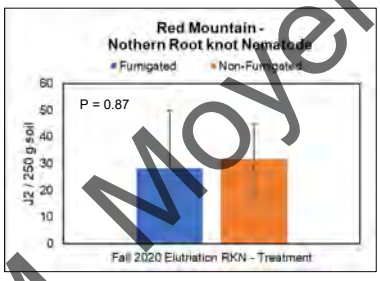
- Old vines removed Dec 2018
- Soil prepped Mar / Apr 2019
- **Shanked fumigated** (11' swaths) Apr 2019
  - Telone II (1,3-dichloropropene)
  - Rate: 35 GPA
- Vineyard planted Aug 2019
- Nematode Sampling – Fall (Sept – Oct)



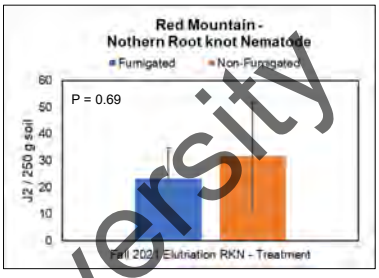
Fumigation Effects – Telone II (shanked)



6 months after treatment, 1 month after planting



18 months after treatment, 1 full growing season

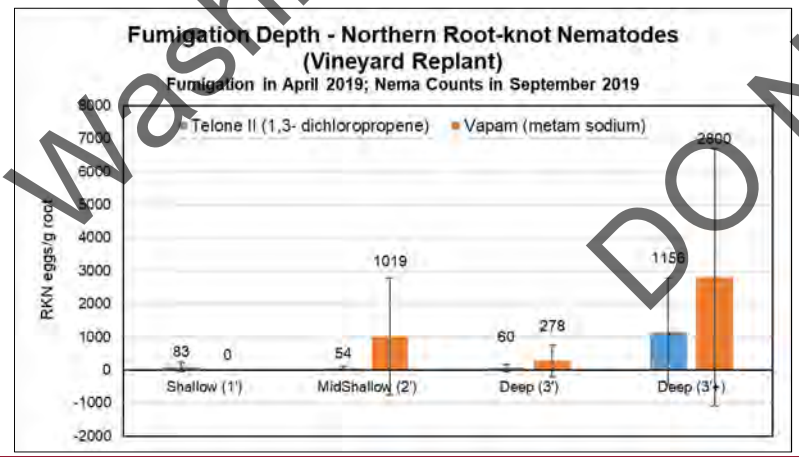


30 months after treatment, 2 full growing seasons

Did pre-plant fumigation reduce RKN?

Fumigation Really Doesn't Go That Deep

Side project: Deep-core nematode populations. We did both Telone II and Vapam



- Fumigants only go as deep as you can put them
- Nematodes are mobile
- Fumigation is only a temporary "clean slate"

Case Study 2

Long – Term Nematode Tracking
Horse Heaven Hills AVA

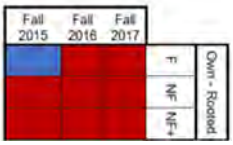
Winner of the 2022 AJEV Best Viticulture Paper
"Field Performance of Winegrape Rootstocks and Fumigation during Establishment of a Chardonnay Vineyard in Washington"

Case Study 2 - The Site / Experiment

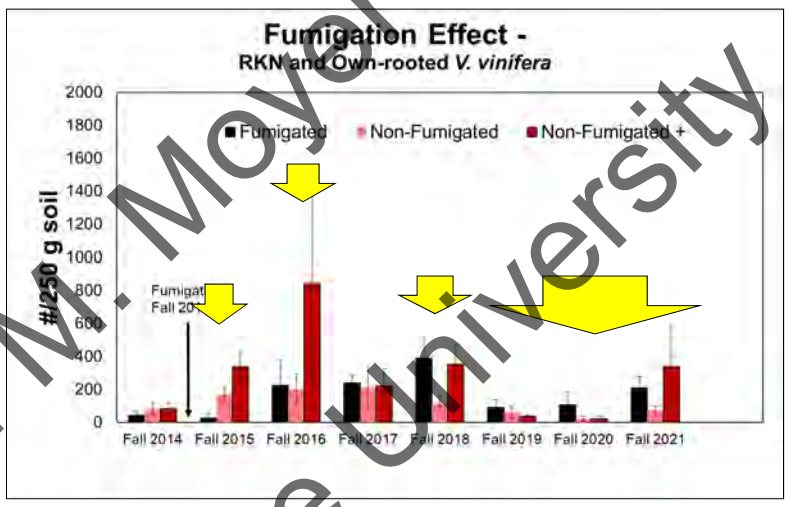
- Fall 2014 – Old block treated with foliar glyphosate
- Fall 2014 – Fumigated with Vapam through existing driplines
  - Half rows were fumigated
  - Sections of fumigated and non-fumigated alternating across the block
- Vines removed winter / spring (2014/2015)
- Site planted in Spring 2015 (May)

Did pre-plant fumigation reduce RKN?

Short and Long-Term Impacts



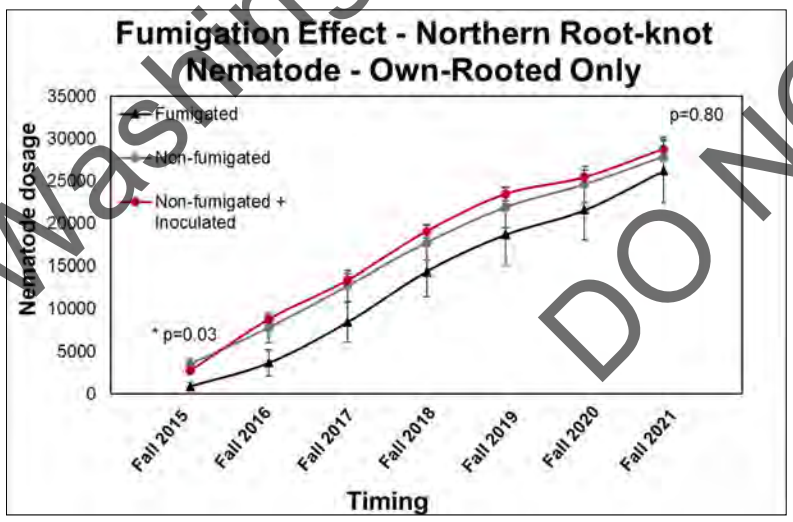
Populations tend to plateau to a "soil + host" threshold – regardless of starting populations



East, Zasada, Tarara, and Moyer. 2020. AJEV DOI: 10.5344/ajev.2020.20023

Did pre-plant fumigation reduce RKN?

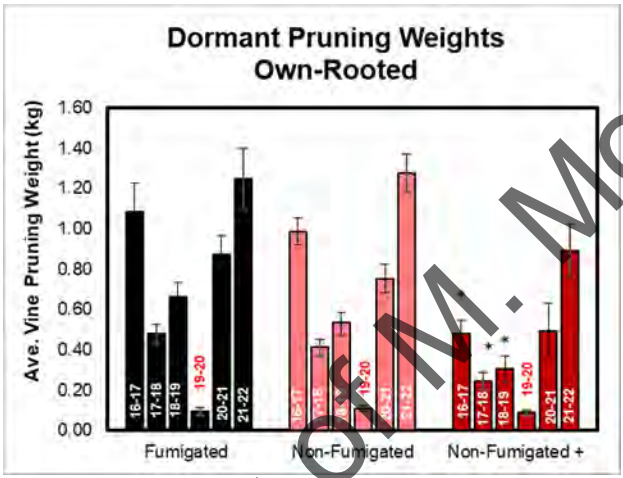
Nematode Pressure Over Time



- Nematode dosage – build up of nematodes over time
- Build-up equalizes by second year
- Interpretation: The potential "effects" of feeding pressure were equalized by the second year – fumigation didn't matter

Did pre-planting fumigation improve vigor?

Tracking "Vigor" – Did Fumigation Help Vine Establishment?

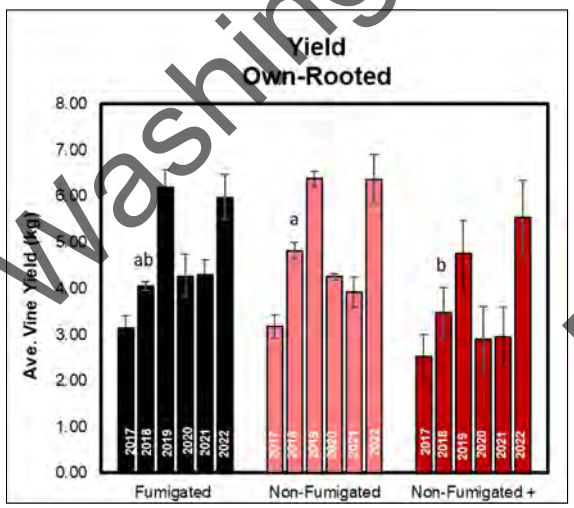


June 2021

2019-2020 – Block mechanically pre-pruned prior to pruning weight collection

Did pre-planting fumigation improve yield / productivity?

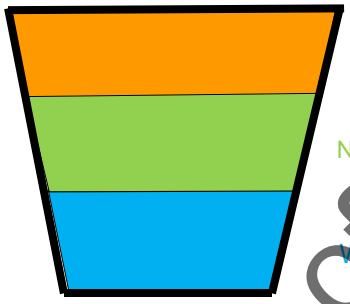
Tracking Yield – Heavily Manipulated By Cultural Practices



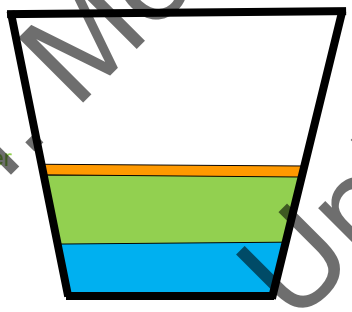
- Remember: By bearing age, no real difference in nematode density in soil between treatments
- Fumigated and nonfumigated – no difference in yield over the years
- Non-fumigated + additional nematodes – A lot more variable yield!

Can Fumigation Be Effective Long-term? Maybe with Rootstocks!

Own-Rooted Vine
Within 6 months of fumigation?



Resistant Rootstock
Within 6 months of fumigation?



Resistant Rootstocks

Make fumigation effect last longer if R_0 less than 1?

Reduce other stressors to improve productivity?

Long-Term Projects Mean A Lot of People!

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Provided Vines and Grafting

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Moyer Lab (WSU) – Past and Present
- Maria Mireles
- Dr. Charlotte Oliver
- Dr. Katherine East
- Dr. Margaret McCoy
- Lexie McDaniel
- Bernie Gagnier
- Polet Torres

Zasada Lab (USDA) – Past and Present
- Catie Wram

QUESTIONS?

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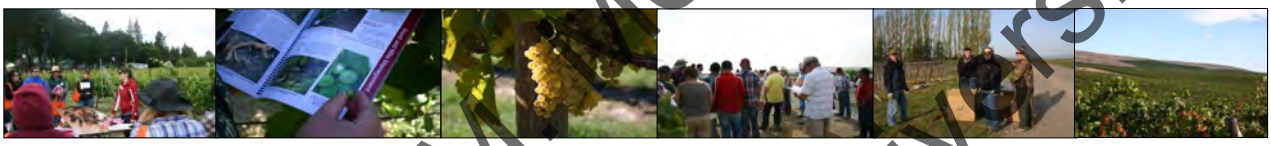

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