WSGS 2022
17 November 2022

Cover Crop Alternatives for Nematode Management in Washington Vineyards

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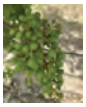


The Northern Root-Knot Nematode

Northern Root-Knot Nematode (*Meloidogyne hapla*)

- Soil-borne microscopic roundworm
- Adult *M. hapla* are sedentary endoparasites
- Second-stage juveniles are mobile in the soil

Second-Stage Juvenile *M. hapla*; root galls on *V. vinifera;* Adult *M. hapla*, stained red

Photo: UC Davis Nemaplex

Current Management Approaches

Pre-plant Strategies – Chemical Fumigation

- Environmental concerns
- Cost and labor intensive
- No lasting effects

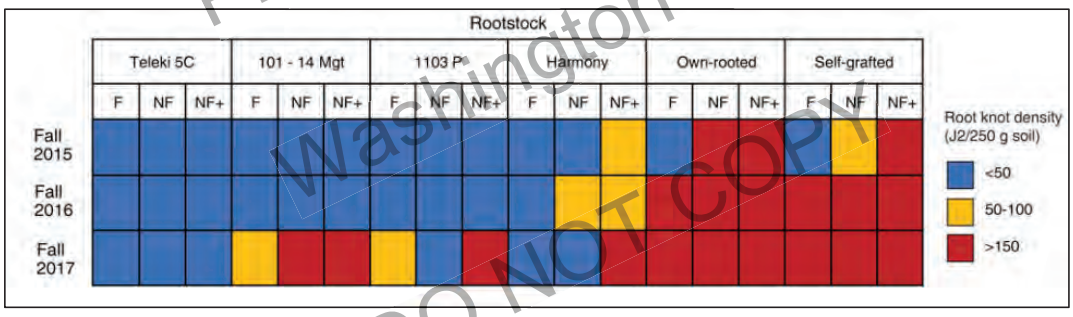
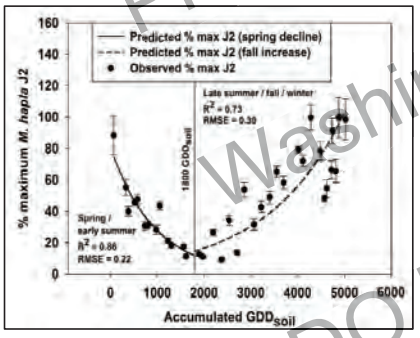


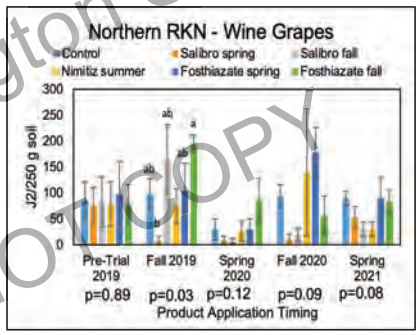
Photo: Michelle Moyer, Good Fruit Grower; East et al. 2021.

Current Management Approaches

Post Plant Strategies - Nematicides

- Require biological timing
- Short-term studies show no differences from untreated controls
- Environment and human applicator concerns





East et al. 2019. Plant Dis. 105:966-971; Moyer et al. 2021 Unpublished data; Photo: Katherine East

Pre-Plant Alternative Option : What is Litchi Tomato

Litchi tomato (*Solanum sisymbriifolium*)

- Contains root exudates that trigger hatching
- *M. hapla* cannot feed or establish a feeding site on its roots

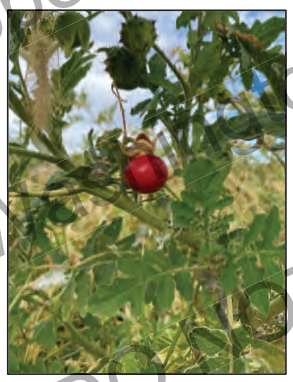



Photo Credit: (1) Michelle Mover

Pre-Plant Alternative Option : Why Litchi Tomato?

Trap crop exploration of a potato pest

- Biologically similar to RKN
- Successful results without the use of chemicals

Effect of litchi tomato on PCN reproduction in a subsequent potato crop

Treatment	PCN Cyst*
Potato after litchi tomato	1
Potato after fallow	271
Potato after potato	1021

* Average of six replicates

Photo: Tina Gresham USDA-APHIS; University of Idaho News-Pubs

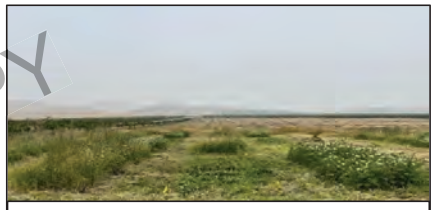
Pre-Plant Alternative Option : What We Did

Prep Plots

Irrigate (overhead)

Sample

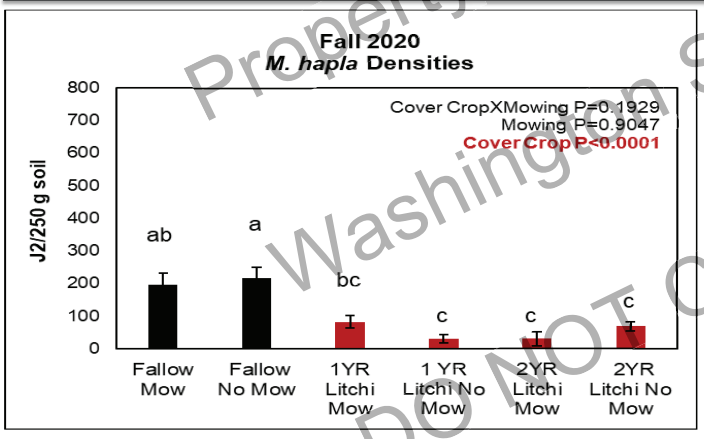
Seed Plots
(emergence)

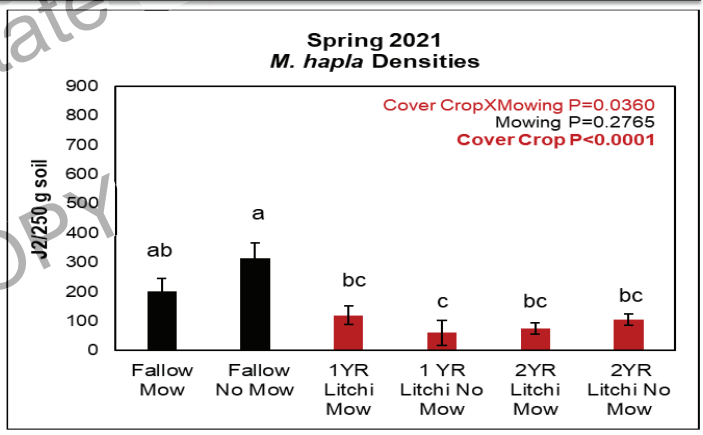


Mow Select Plots

Pre-Plant Alternative Option : What We are Seeing

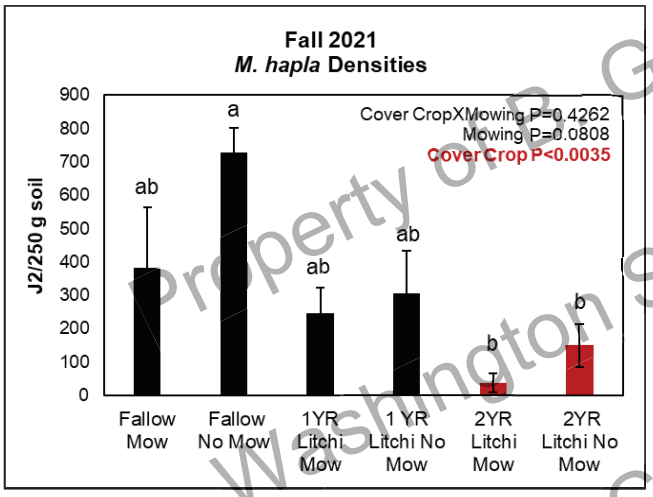
Pre-plant cover crop treatments		
Control	**One Year Litchi**	**Two Year Litchi**
Fallow No Mow	**1 YR No Mow**	**2 YR No Mow**
Fallow Mow	**1 YR Mow**	**2 YR Mow**

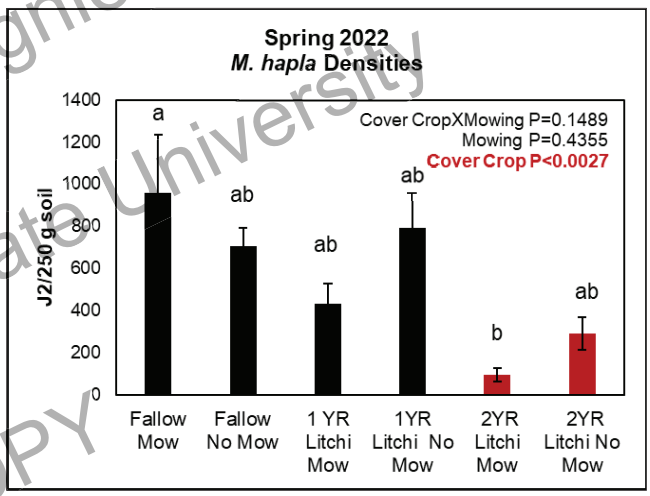




Statistics: JMP ANOVA and Tukeys HSD

Pre-Plant Alternative Option : What We are Seeing



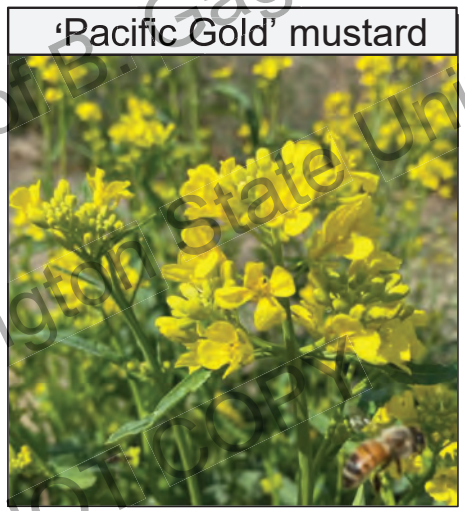


Litchi tomato is successful in reducing *M. hapla* relative to an untreated control

Statistics: JMP ANOVA and Tukeys HSD

Post Plant Alternative Option : Nematicide Replacement Cover Crops

Raphanus sativus var. oleiformis 'Dracula' (Trap Crop)



Brassica juncea (Biofumigant)

Trifolium repens (Non-host)

Dandurand et al. 2016. Anal App Bio. 169:180-189; Nemaplex http://nemaplex.ucdavis.edu; Hemayati et al. 2017. App Soil Eco. 119:192-196

Post Plant Alternative Option : Season 1

June 2020
Prepped plots planted 'Roma' tomatoes

July 2020
Inoculated 'Romas' with *M. hapla*

August 2020
Destructively harvested, roots remain

September 2020
Cover crops seeded

October 2020
Cover crops after germination

November 2020
Soil samples collected

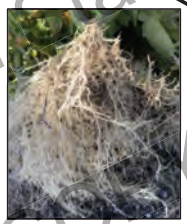
Post Plant Alternative Option : Season 2

April 2021
Mustard and radish incorporated

Spring soil samples collected

June 2021
Plots prepped and 'Romas' planted

July 2021
'Romas',no inoculation



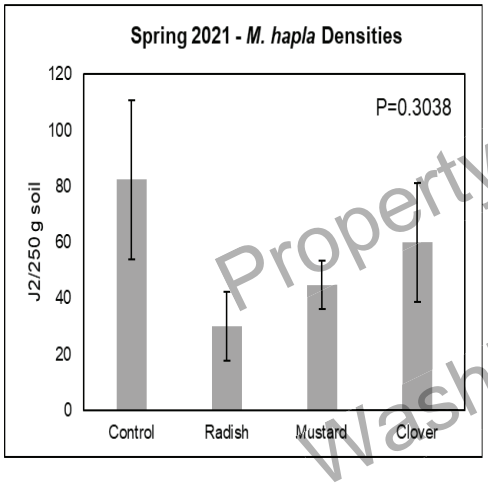
August 2021
'Roma' roots evaluated for eggs; cover crops seeded

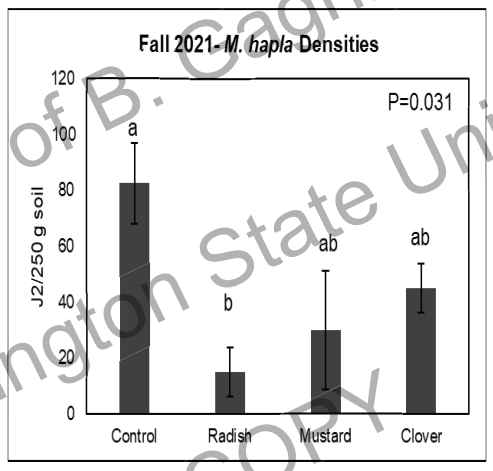
September 2021
Germinated cover crops

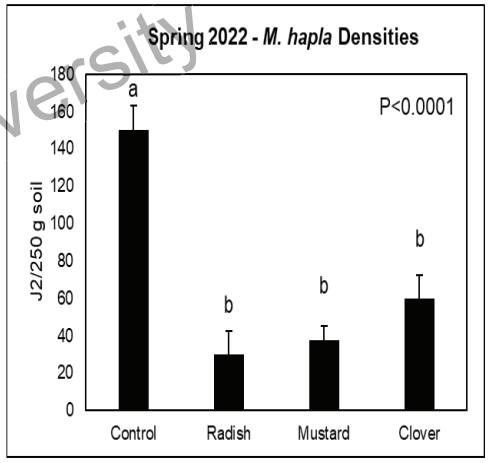
October 2021
Soil samples collected

April/May 2022
Soil samples collected

Post Plant Alternative Option : Results







Cover crops are a promising long-term, post plant option for *M. hapla* management in Washington vineyards

Statistics: JMP ANOVA and Tukeys HSD

Continuing Research

Expanding Cover Crop Experiments

- Litchi tomato maturation against *M. hapla*
- 'Image Nematode Control' radish experiment
- Cover crop host status greenhouse trial

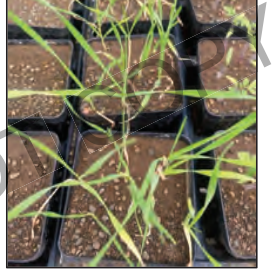
Litchi / Roma

Litchi / Roma

'Dracula' Radish

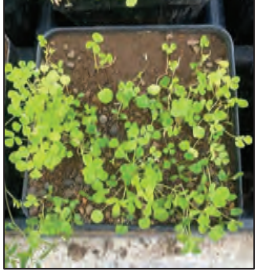
'Image' Radish

Triticale



Hairy Vetch

Pipolina



The Take Home

- Litchi tomato shows promise for reducing *M. hapla* in Washington State vineyards

  (**pre-plant or re-plant scenarios ONLY**)

- Cover crops have potential as long-term, post-plant options for *M. hapla* management in Washington vineyards

- An integrated management approach is the best defense for the management of *M. hapla*.

Acknowledgments

Advisor and Committee Members
- Dr. Michelle Moyer – WSU
- Dr. Inga Zasada – USDA
- Dr. Tom Collins – WSU
- Dr. Deirdre Griffin-Lahue – WSU
- Dr. Lisa Wasko DeVetter – WSU

Moyer Lab (WSU)
- Maria Mireles
- Lexie McDaniel
- Polet Torres

Zasada Lab (USDA)
- Amy Peetz
- Hannah Baker
- Lester Nunez Rodriguez
- Mckenna Platt

USDA
- Dr. Katherine East

Previous WSU/USDA
- Dr. Charlotte Oliver
- Dr. Margaret McCoy
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Questions?

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