

Considerations When Replanting or Planting an Almond Orchard

Cameron Zuber

January, 2025

Areas of Consideration

Areas of Consideration

- Plant-parasitic nematodes
- Aggressive pathogens and pests
- Soil Conditions
- Other Field Conditions

Learn from Previous Orchard or Crop



Google Earth

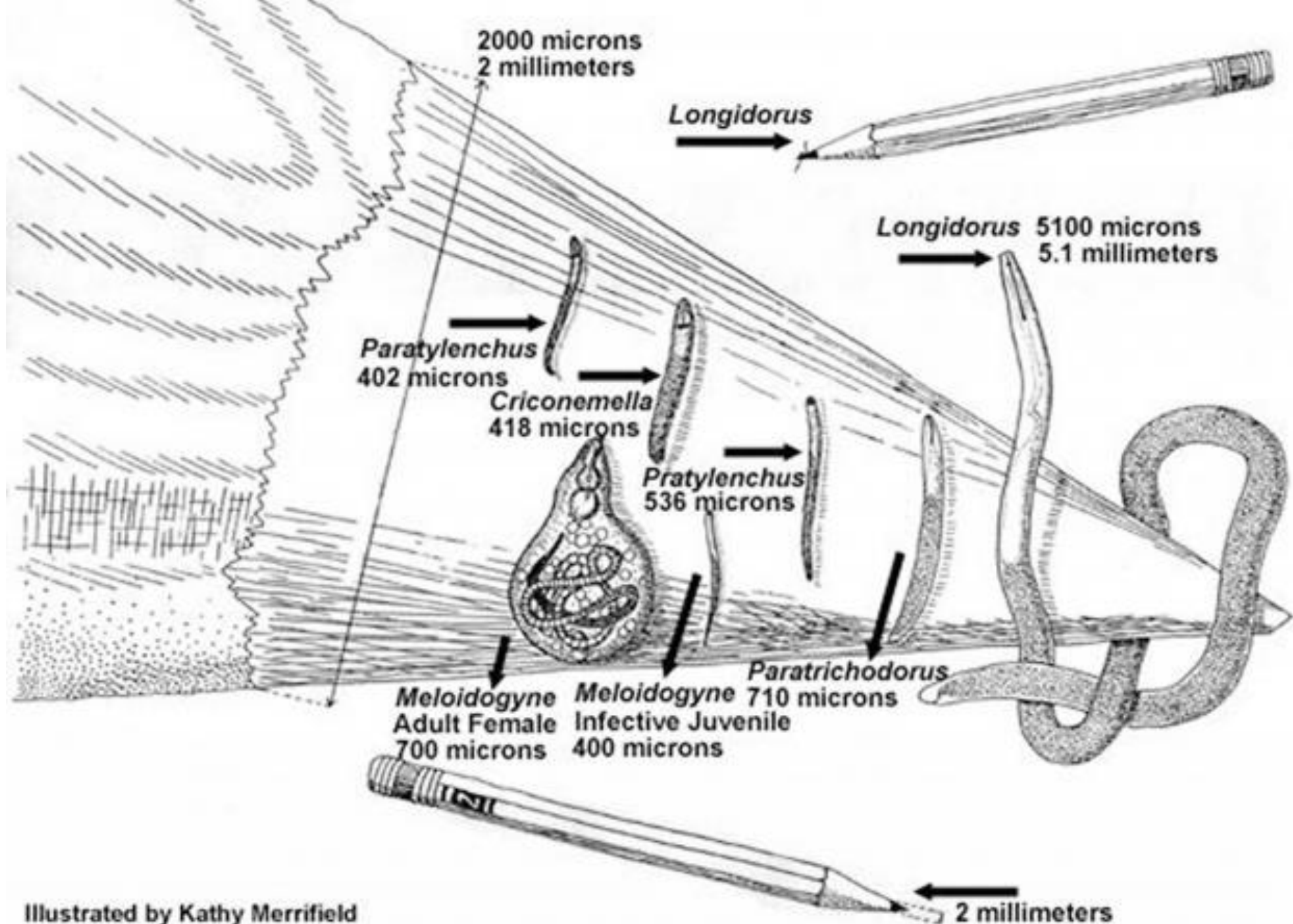


SOIL SURVEY

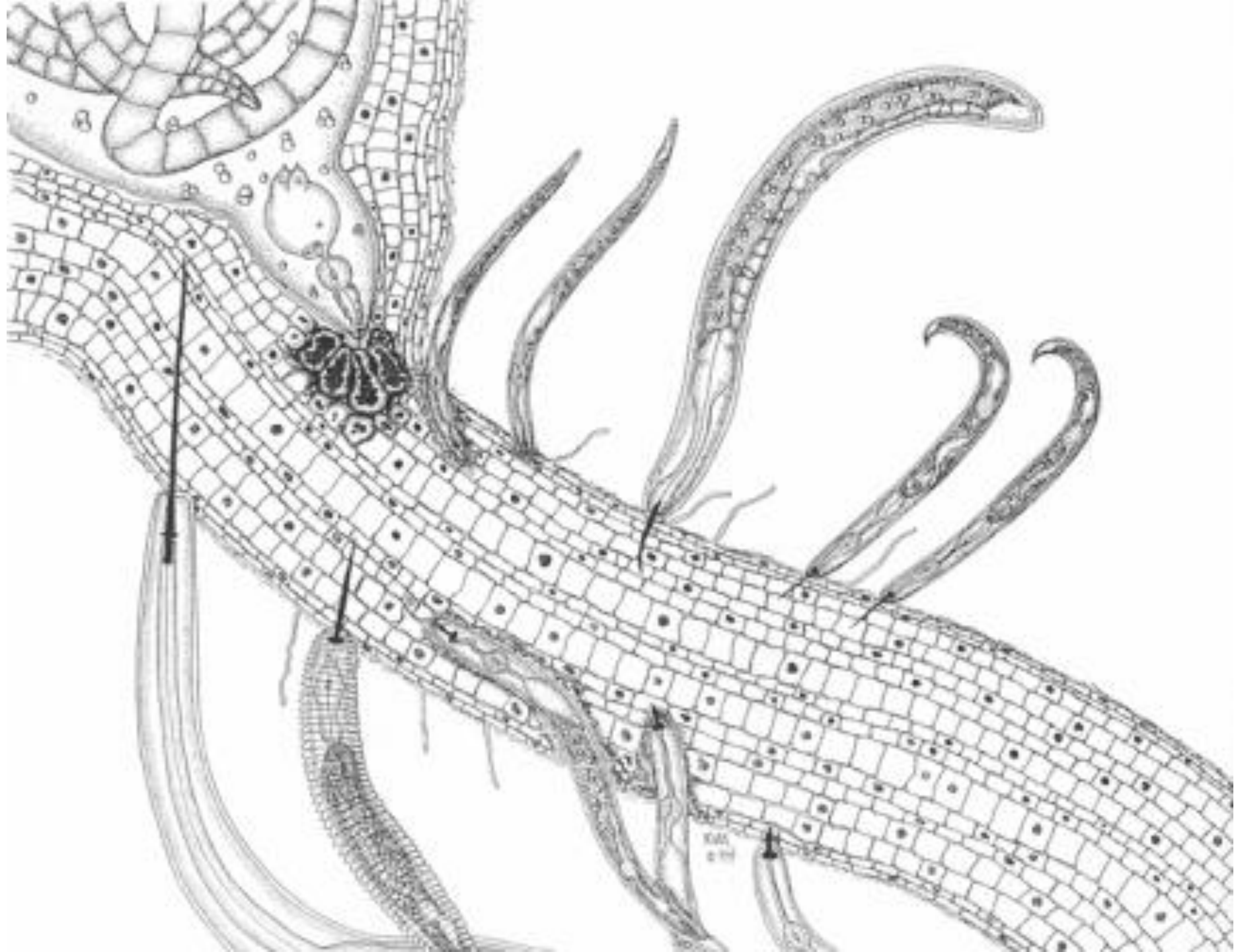
Our online soil survey can be used to access USDA-NCSS detailed soil survey data (SSURGO) for most of the United States.

Area of Consideration

Plant-parasitic nematodes

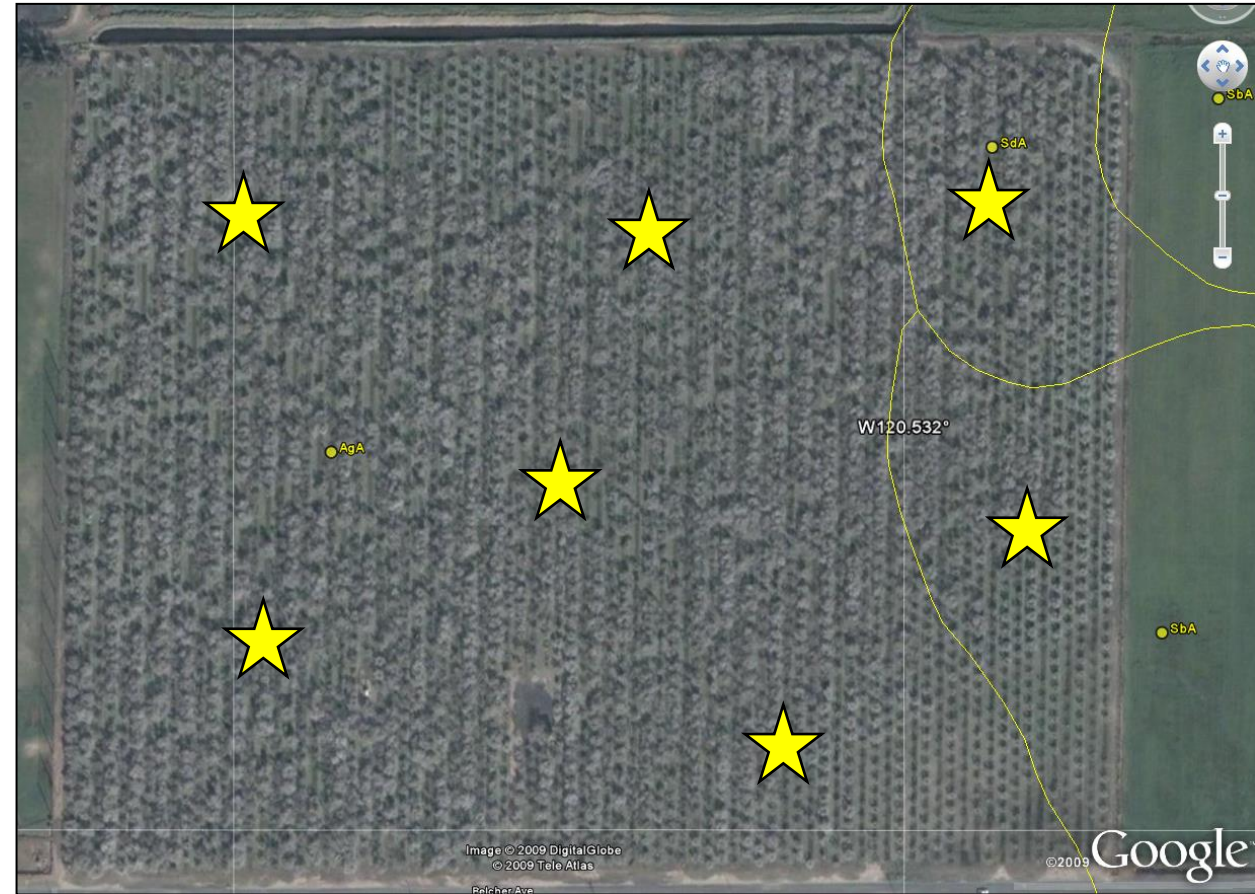


Illustrated by Kathy Merrifield



Plant-parasitic nematodes

- Timing: Fall is ideal
- Tools: Probe or auger
- Depth: 4" to 24"
- Multiple spots & combine
- Sanitize
- Mark properly
- Store in refrigerator or cooler



Plant-parasitic nematodes

SAMPLE		Root Knot	Ring	Lesion	Stubby Root	Pin	Free-Living
Site		Meloidogne	CX	PV	Paratrichodorus	Paratylenchus	Composite
1.		0	48	0	8	28	102
2.		0	0	0	2	0	512
3.		0	152	0	0	180	46
4.		0	40	0	0	0	5038
5.		0	584	0	6	24	64
6.		0	732	0	0	104	1124
7.		0	1136	0	0	204	102
8.		0	0	0	14	328	38
9.		0	96	0	0	52	2192
10.		0	1008	956	0	0	714
11.		0	316	0	0	50	118
12.		0	408	0	4	12	486
13.		0	808	0	0	496	228
14.		0	112	0	0	68	524

Plant-parasitic nematodes

1. Should I fumigate?
2. What fumigant should I use?
3. How should I apply the fumigant?
4. Should I use a tarp?
5. Rootstocks over fumigants?

SAMPLE		Root Knot	Ring	Lesion	Stubby Root	Pin	Free-Living
Site		Meloidogne	CX	PV	Paratrichodorus	Paratylenchus	Composite
4.		0	40	0	0	0	5038

Nematode	Low (<40/L)	Medium (40-150/L)	High (>150/L)	Rootstock
Rootknot		Cover Crop	Row Strip Fumigate	Nemaguard, Guardian (Most Hybrids)
Ring	Row Strip Fumigate, Cover Crop	Row Strip Fumigate, Cover Crop	Broadcast Fumigate, Cover Crop	Tolerant Rootstocks Avoid P/A Hybrids
Lesion	Cover Crop	Row Strip Fumigate, Cover Crop	Broadcast Fumigate, Cover Crop	Any Vigorous Rootstock (like P/A Hybrids)

P/A = peach/almond

SAMPLE	Root Knot	Ring	Lesion	Stubby Root	Pin	Free-Living
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Plant-parasitic nematodes

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Plant-parasitic nematodes

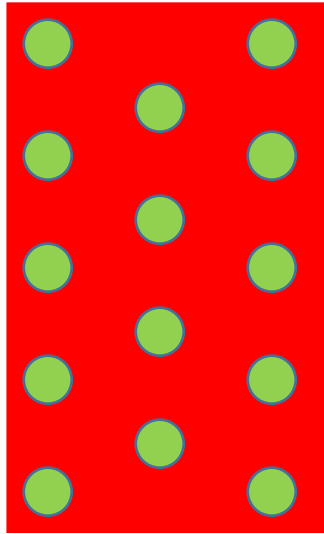
Fumigants with 1,3-dichloropropene and chloropicrin outperformed non-fumigated or allyl isothiocyanate treated areas...

... testing **only** these **three** fumigants in sites with high levels of **ring nematode**.
(context matters even with research)

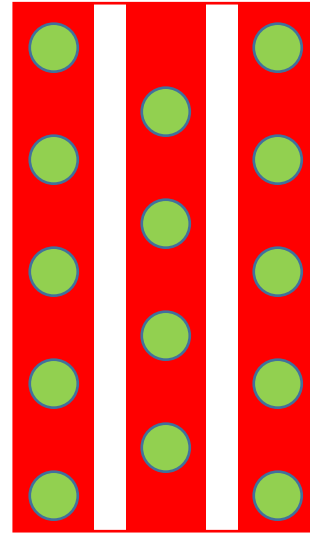
Plant-parasitic nematodes

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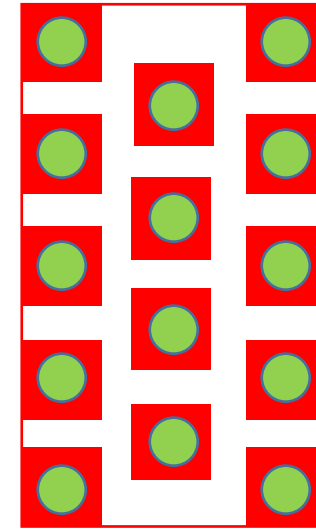
Plant-parasitic nematodes




Broadcast
100% of Orchard Area



Rowstrip – 11'
~50% of Orchard Area



Spot – 8'x8'
~20% of Orchard Area

- 
- Moderate (not high) nematode levels
 - Primarily ring nematode
 - Labor cost?
 - Time???
- ...context matters

All fumigation treatments had low symptoms from plant-parasitic nematodes

Plant-parasitic nematodes

1. Should I fumigate?
2. What fumigant should I use?
3. How should I apply the fumigant?
- 4. Should I use a tarp?**
5. Rootstocks over fumigation?

Plant-parasitic nematodes

- 100% Telone[®] C-35
- 66% Telone[®] C-35
- No fumigant

- Polyethylene tarp
- TIF tarp
- No tarp



Photo Source OpenPR

Plant-parasitic nematodes

TIF and No Tarp with Telone[®] C-35 treatments had positive but variable effects

TIF reduces emissions and
Polyethylene tarp does not

More a consideration when dealing with local limits or buffer zone reduction credits

Plant-parasitic nematodes

1. Should I fumigate?
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Plant-parasitic nematodes

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P/A = peach/almond

Plant-parasitic nematodes

Rootstock

- Hansen 536
- Empyrean-1
- Nemagaurd
- Viking
- Rootpac-R

Fumigant

- Row-strip
- No fumigation

Mitigation of Replant Problems

Post-plant chemical applications



UNIVERSITY OF CALIFORNIA
Agriculture and Natural Resources

Cooperative Extension

Post-Plant Chemical Applications

- Fumigant
- Fumigant with Movento[®] & Velum[®] 1
- Movento[®] & Velum[®] 1
- No fumigation, Movento[®], or Velum[®] 1

Post-Plant Chemical Applications



Movento® foliar spray
Spring and fall



Velum® 1 chemigation
Spring and summer

Post-Plant Chemical Applications

Change in trunk growth (inches)

Treatment	1 st year	2 nd year	3 rd year	4 th year	Total
Fumigant with Post-Plant Controls	1.63	1.43	2.32	1.18	6.56
Fumigant only	1.64	1.37	2.31	1.15	6.48
Post-Plant Controls only	1.23	1.45	2.17	1.02	5.86
Untreated	1.32	1.42	1.84	1.02	5.60



Post-Plant Chemical Applications



Treatment	Yield (kernel lbs/acre)		
	1 st harvest	2 nd harvest	Total
Fumigant with Post-Plant Controls	241 ^A	1585 ^A	1809 ^A
Fumigant only	224 ^A	1611 ^A	1773 ^A
Post-Plant Controls only	203 ^B	1050 ^B	1251 ^B
Untreated	169 ^B	879 ^C	1054 ^C

Post-Plant Chemical Applications

- Control

- Once with Salibro[®]

- Twice with Salibro[®]

- Velum[®] 1

- Planted 2011

- Study 2018-2020

- Sandy Soil

- Ballico, CA

- Primarily ring nematode

Label currently only for non-bearing almond

Post-Plant Chemical Applications

Movento[®] & Velum[®] 1

Young trees

Ring nematode

*Some efficacy
when no fumigation*

Salibro[®]

Other studies

Root lesion and root-knot

Good efficacy

Just Velum[®] 1

Older trees

Ring nematode

Some efficacy

Salibro[®]

Older trees

Ring nematode

Weak efficacy

Mitigation of Problems

Other controls for plant-parasitic nematodes

Non-Fumigant Controls

- “Starve and Switch” Method
 - Kill existing roots by spraying killing the trees prior to removal with herbicide
 - Replant using a different parentage of rootstock
- Work the soil thoroughly to remove roots
 - Backhoe, deep rip, etc.
- Anerobic Soil Disinfestation

Area of Consideration

Aggressive pathogens and pests



**Phytophthora
root rot**

Photo source UC IPM



**Armillaria
root rot**

Photo source UC IPM

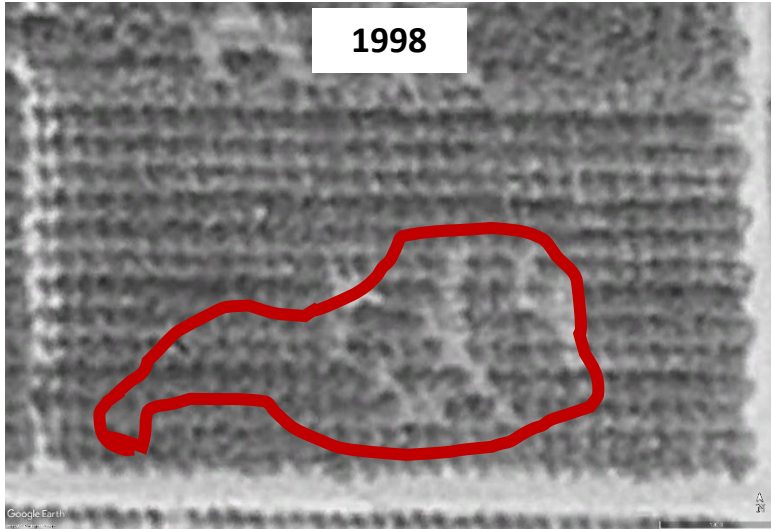


Verticillium wilt

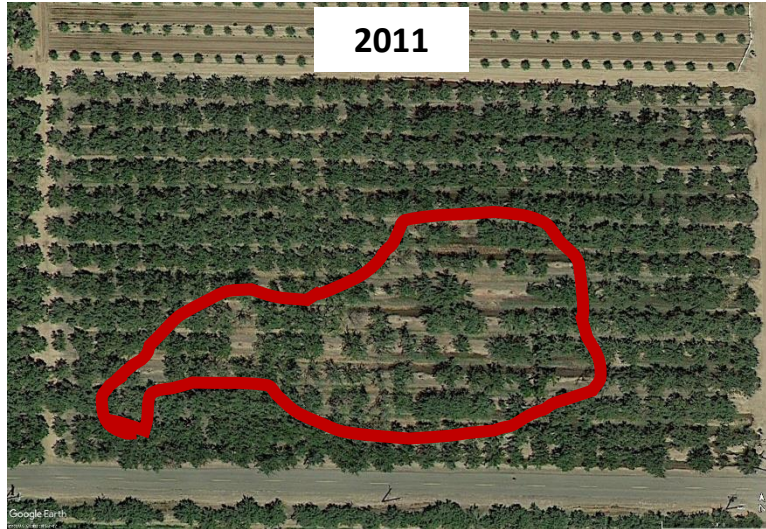
Photo source Almond Doctor

Aggressive Pathogen and Pests

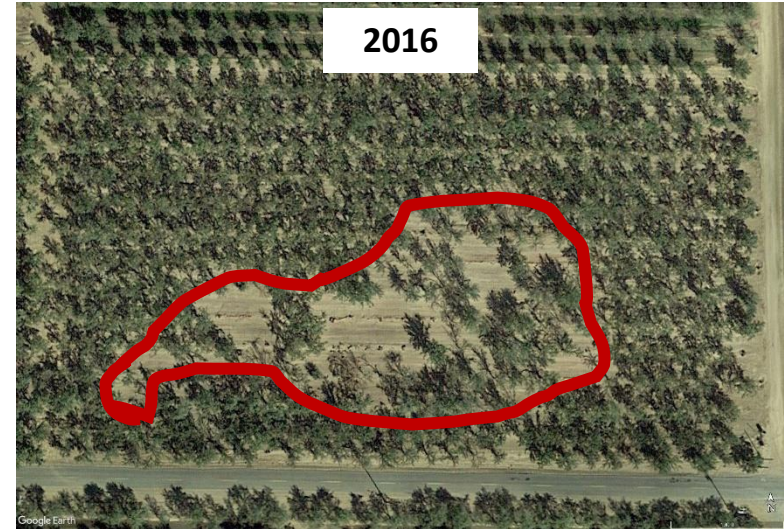
1998



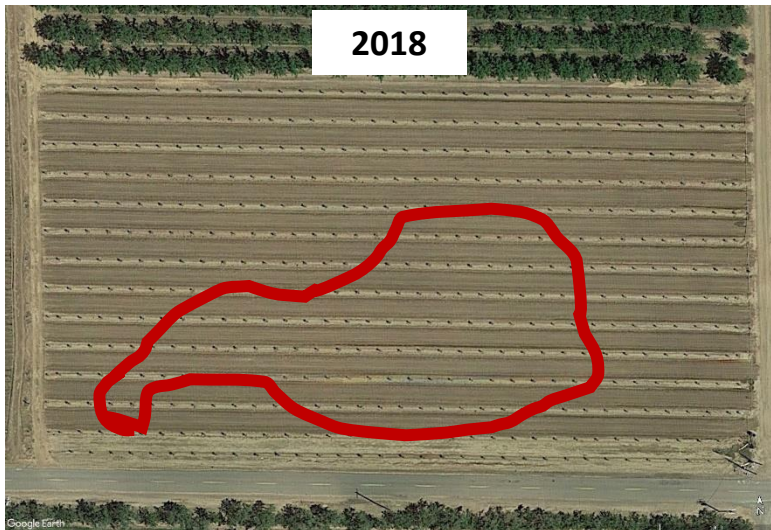
2011



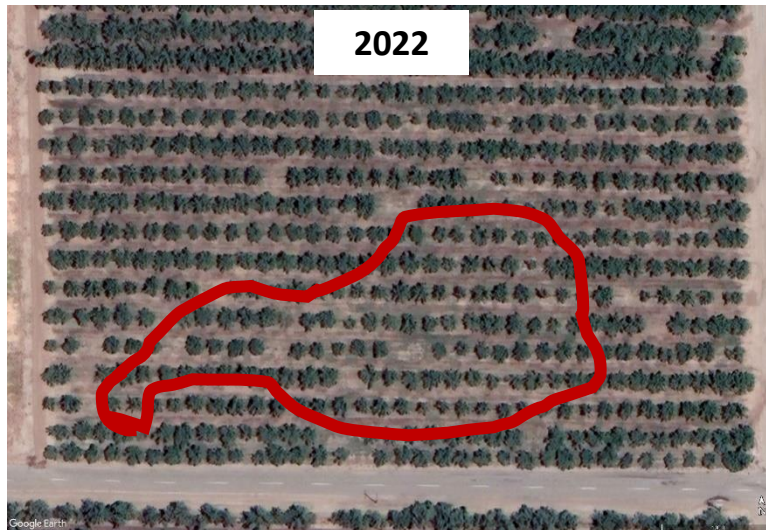
2016



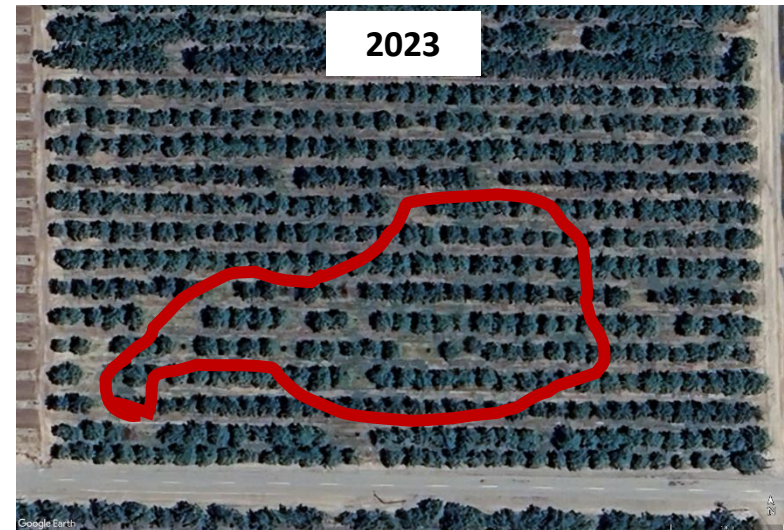
2018



2022



2023



Aggressive Pathogen and Pests



**Armillaria
root rot**

Photo source UC IPM

Area of Consideration

Soil Conditions

SSURGO | ca644.ca648 | 0.11 seconds | 0.8 cache ratio | BBOX:(-120.7999, 37.4646) (-120.7957, 37.4662) | 17 acres



HhA

DfA

Google Earth

©2016 Google



100 ft



More Thrifty

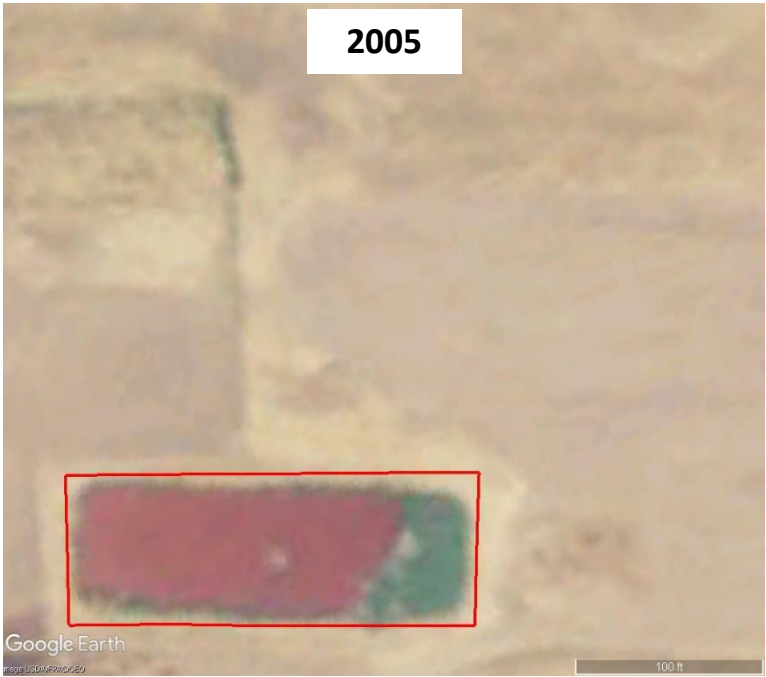
Less Thrifty

DfA

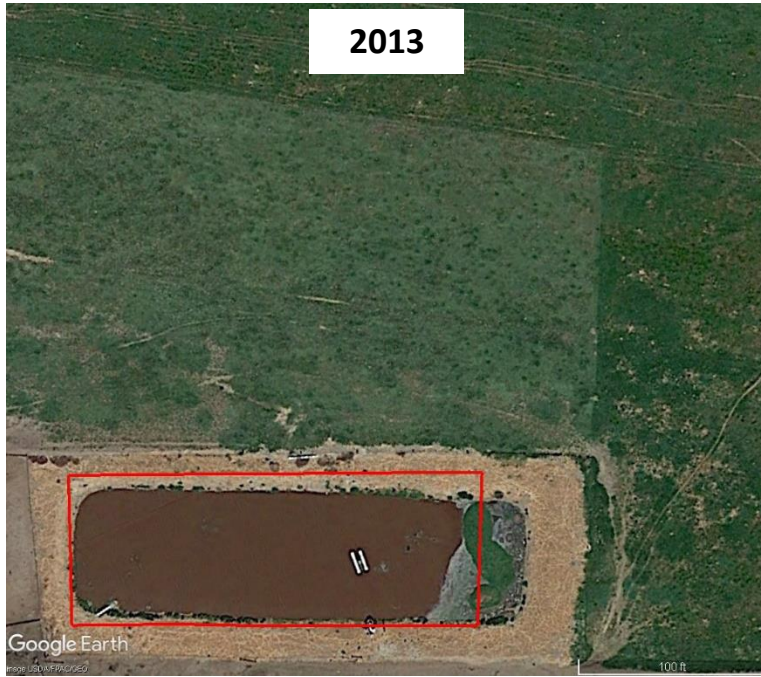
SSURGO | ca644.ca648 | 0.11 seconds | 0.8 cache ratio | BBOX:(-120.7999, 37.4646) (-120.7957, 37.4662) | 17 acres



2005



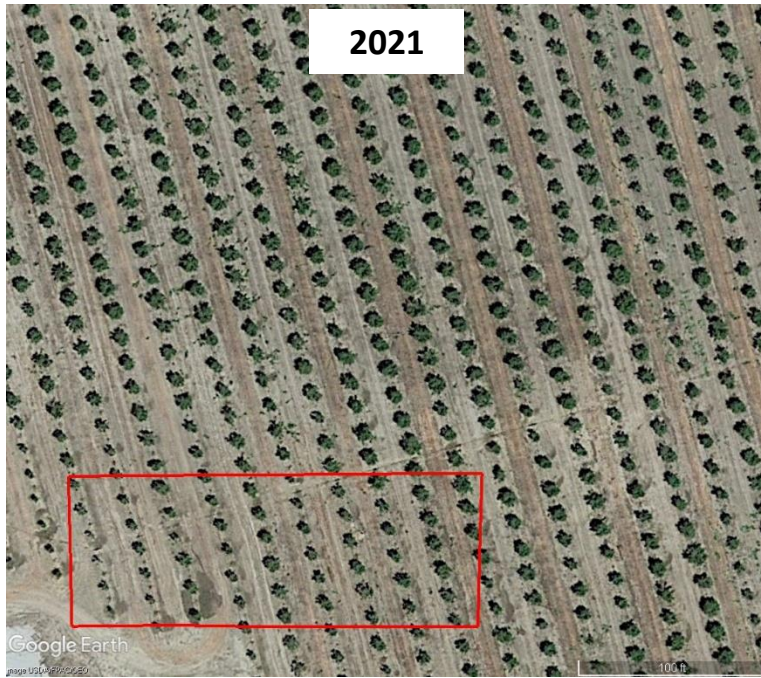
2013



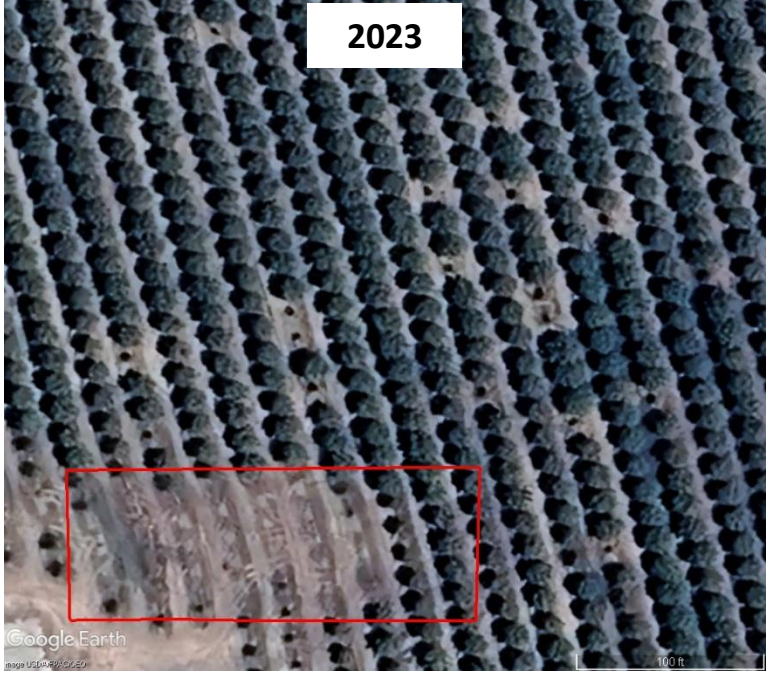
2020

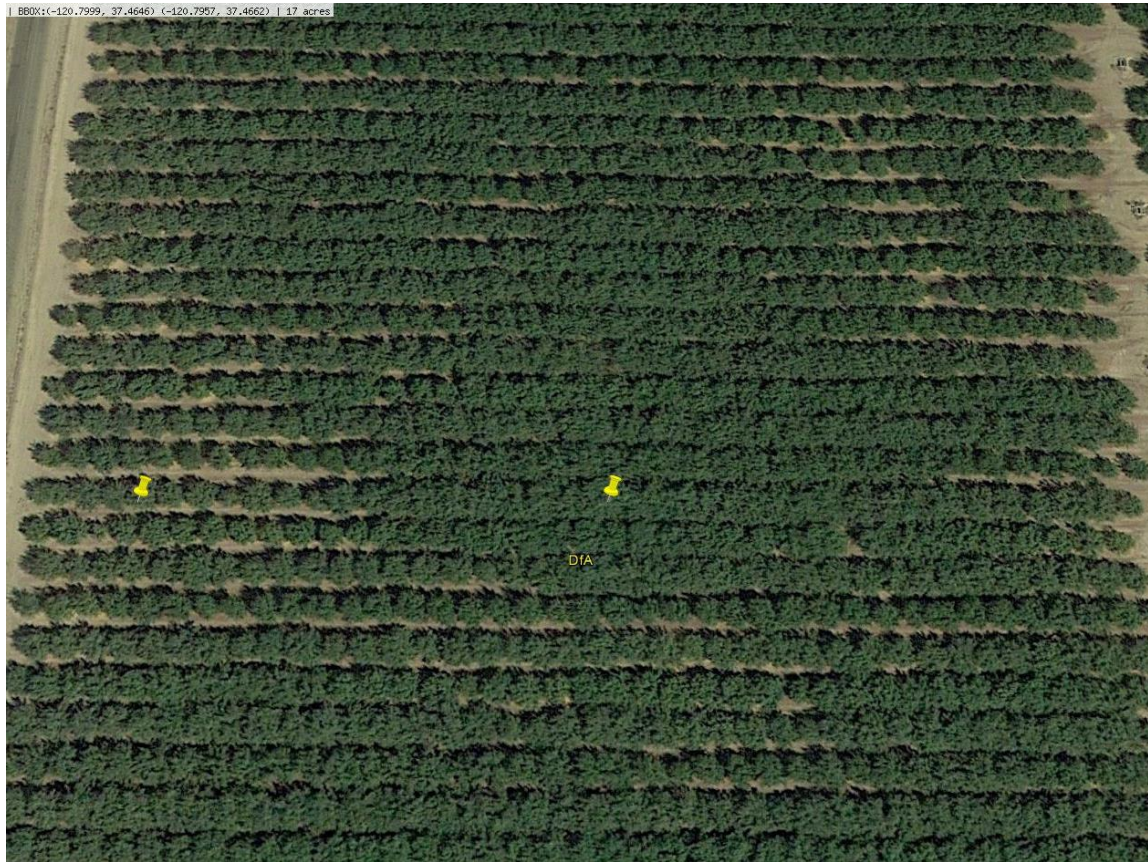


2021



2023





Deep rip?



Remediation?

Area of Consideration

Other Field Conditions

Other Field Conditions

- ‘Nonpareil’ on 13 rootstocks
- ‘Fritz’ and ‘Monterey’ on 6 rootstocks

Rootstocks planted on Nonpareil, Fritz, and Monterey	Rootstocks planted on Nonpareil only
Nemaguard®	Rootpac R®
Hansen 536®	TempoPac®
Brights 5®	Krymsk 86®
Viking®	Cornerstone®
Atlas®	Cadaman®
Empyrean 1®	BB 106®
	Floridaguard x Alnem®

Other Field Conditions

- Replants
- Diseased trees
Ceratocystis canker



Other Field Conditions

More Replants and Diseased Trees ↑

Nonpareil	
Atlas®	61%
Cadaman®	56%
Empyrean 1®	53%
Flordaguard x Alnem®	50%
Red Titan®	50%
Hansen 536®	47%
Cornerstone®	36%
TempoPac®	36%
BB 106®	31%
Brights 5®	28%
Viking®	25%
Nemaguard®	17%
Krymsk 86	17%
Rootpac R	11%

Monterey	
Empyrean 1®	69%
Red Titan®	58%
Atlas®	58%
Nemaguard®	56%
Hansen 536®	53%
Brights 5®	36%
Viking®	33%

Fritz	
Red Titan®	29%
Empyrean 1®	22%
Hansen 536®	22%
Nemaguard®	18%
Viking®	14%
Brights 5®	11%
Atlas®	6%

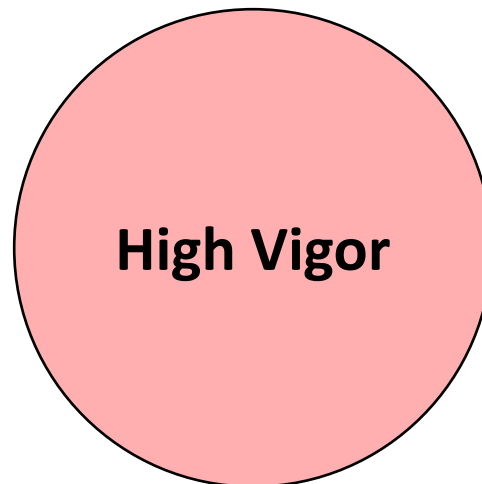
Other Field Conditions

Nonpareil

Atlas®	61%
Cadaman®	56%
Empyrean 1®	53%
Flordaguard x Alnem®	50%
Red Titan®	50%
Hansen 536®	47%
Cornerstone®	36%
TempoPac®	36%
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Brights 5®	28%
Viking®	25%
Nemaguard®	17%
Krymsk 86	17%
Rootpac R	11%

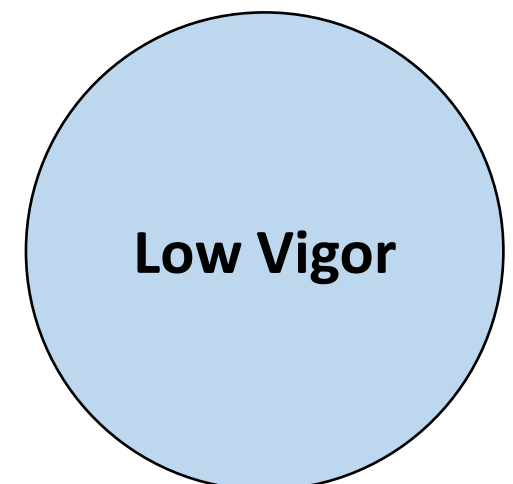
Monterey

Empyrean 1®	69%
Red Titan®	58%
Atlas®	58%
Nemaguard®	56%
Hansen 536®	53%
Brights 5®	36%
Viking®	33%



Fritz

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Viking®	14%
Brights 5®	11%
Atlas®	6%



Other Field Conditions

Nonpareil

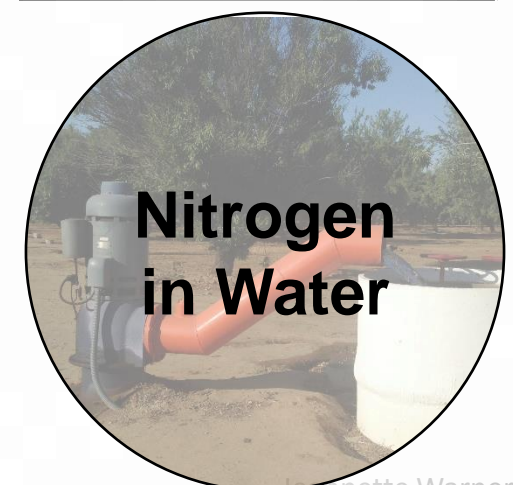
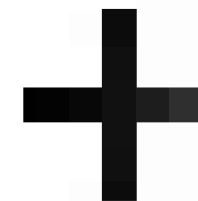
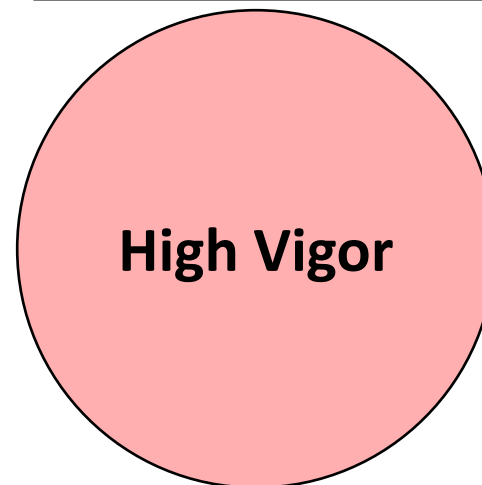
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Monterey

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Other Field Conditions



Areas of Consideration

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- Aggressive pathogens and pests
- Soil Conditions
- Other Field Conditions

Some Plugs Before Questions

Web Resource

TREE FRUIT NUTS VINEYARDS IPM
SOILS AND IRRIGATION NUTRITION GALLERY VIDEOS

UC San Joaquin Valley
CE Trees and Vines

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OTHER RESOURCES

www.sjvtandv.com



Figure 1. Application of NAA at full bloom

Sep 25, 2024

Yield benefits from a new strategy using naphthaleneacetic acid to manage olive crop load

Aug 14, 2024

Recording of the *Carpophilus truncatus* information session



Aug 7, 2024

New ANR publication: Olive production manual for oil



Jul 10, 2024

Building Your Own Tensiometer for Monitoring Soil Water Tension

Podcast

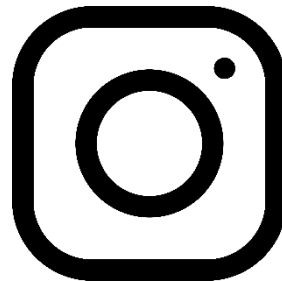
Growing the Valley



www.growingthevalleypodcast.com



LinkedIn

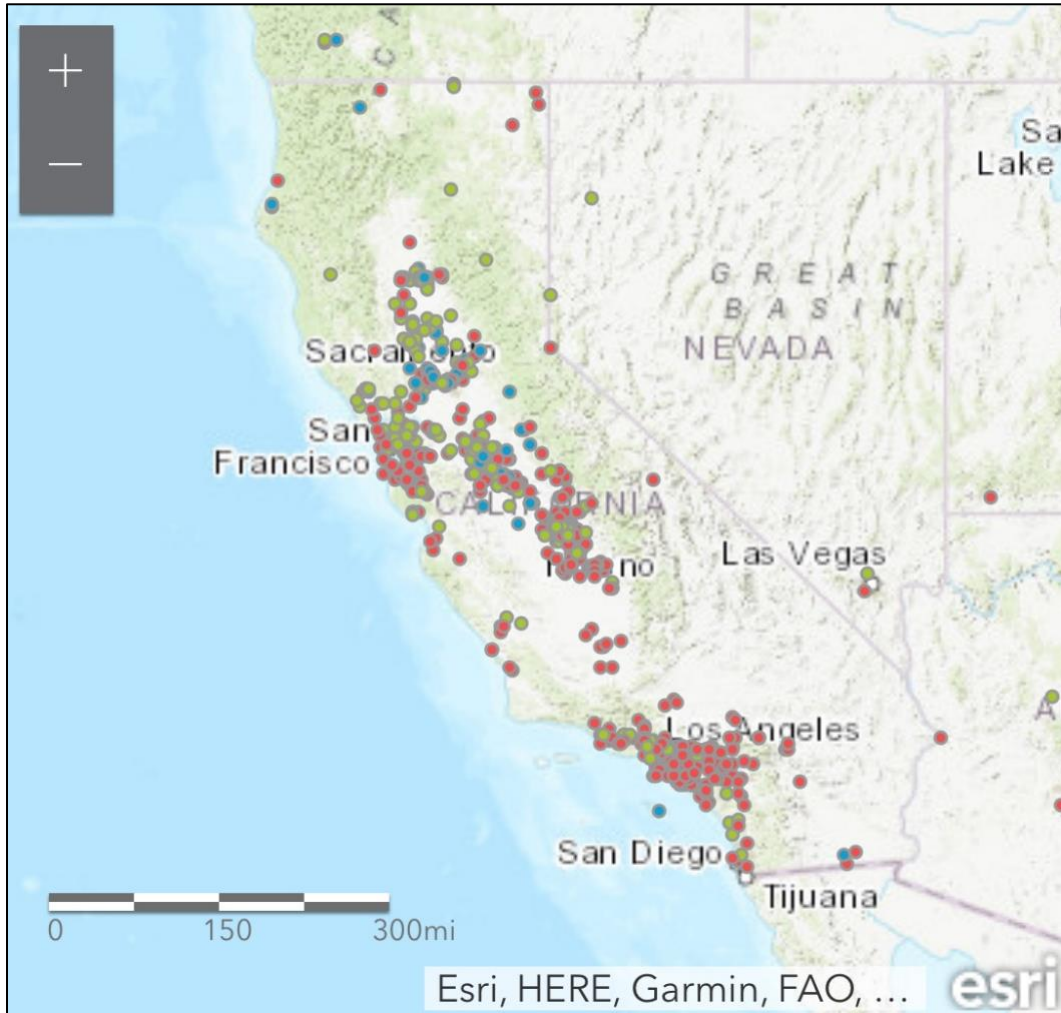


Instagram



Facebook

How Do You Say Almond?



Map as of October 2024

MAP LEGEND

- With the L (ALL-mund)
- Without the L (AH-mund)
- Both, it depends on the company I'm with

Visit the website at

www.ucanr.edu/sayalmond

to learn more about this project
and to see how people around
California say the word almond

While at the website take the
survey yourself and add your
pronunciation to the map

Cameron Zuber

Email: cazuber@ucanr.edu

Cell: (209) 201-2352

Office: (209) 385-7403

Most deciduous trees in Merced County
Almonds, walnuts, peach, prune, cherry, etc.

Just walnuts in Madera County



**Thank you to
collaborators, nurseries,
and funding sources
(too many to list)**



Questions?

