2018 | THE ALMOND CONFERENCE

IPM TOOLS YOU CAN USE

ROOM 308-309 | DECEMBER 6, 2018

california almonds
Almond Board of California

growing ADVANTAGE
The Almond Conference

AGENDA

- **Bob Curtis,** Consultant to ABC, moderator
- **Jim Farrar**, UC IPM
- **Brad Hanson**, UC Davis
- **David Haviland**, UCCE Kern
- **Mohammad Yaghmour**, UCCE Kern

IPM Tools You Can Use

Jim Farrar
Director, UC IPM

UC IPM | University of California Agriculture and Natural Resources | Integrated Pest Management Program

What is IPM?

- Science-based decision-making strategy
- Integrates multiple tools
- System agnostic
- Goal to reduce economic, human-health, and environmental impacts of pests and pest management practices
- Already widely practiced in California almond production

Steps in an IPM Program

- Pest identification
- Monitoring and assessing pest numbers and damage, including weather data
- Guidelines for when management action is needed
- Preventing pest problems
- Using a combination of biological, cultural, physical/mechanical and chemical management tools
- After action is taken, assessing the effect of pest management

Why Use IPM?

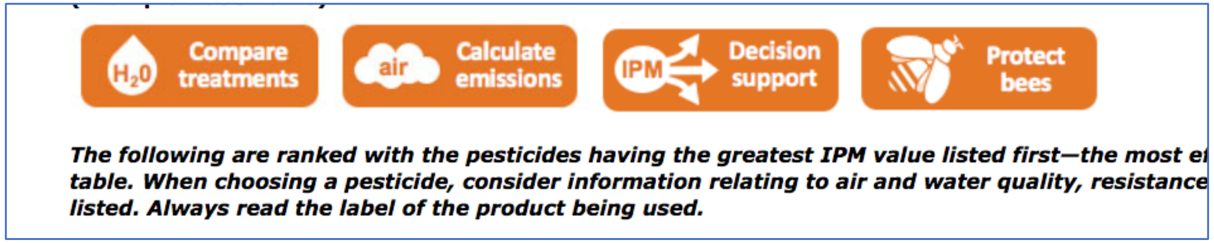
- Effective pest management based on your goals
- Avoid input costs when not effective
- Reliance on any single method eventually fails
- Societal expectations -
  - high product quality
  - low residues
  - low environmental impact

UC IPM Tools

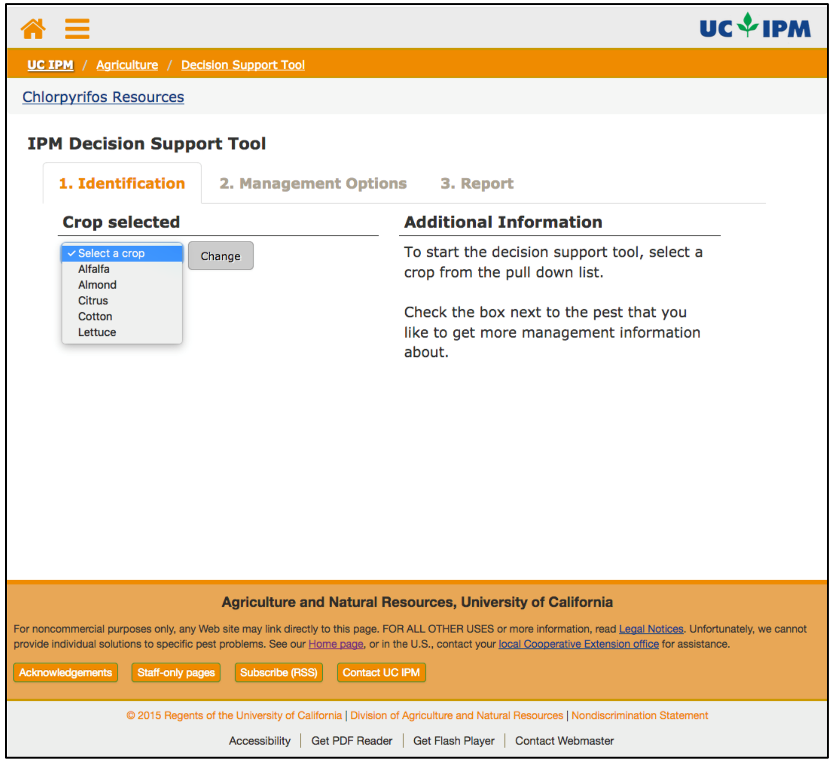
- Almond Pest Management Guidelines
- Year-round IPM Program for Almonds
- Weather-based models
- Monitoring and treatment guidelines for individual pests
- Fungicide efficacy information
- Weed susceptibility to herbicides

UC IPM Tools

- UC IPM how-to videos (year-round plan, BMSB ID, gopher trapping)
- On-line CEUs for licensing (laws & regs and other)
- Bee and natural enemies information
- Water and air resources information

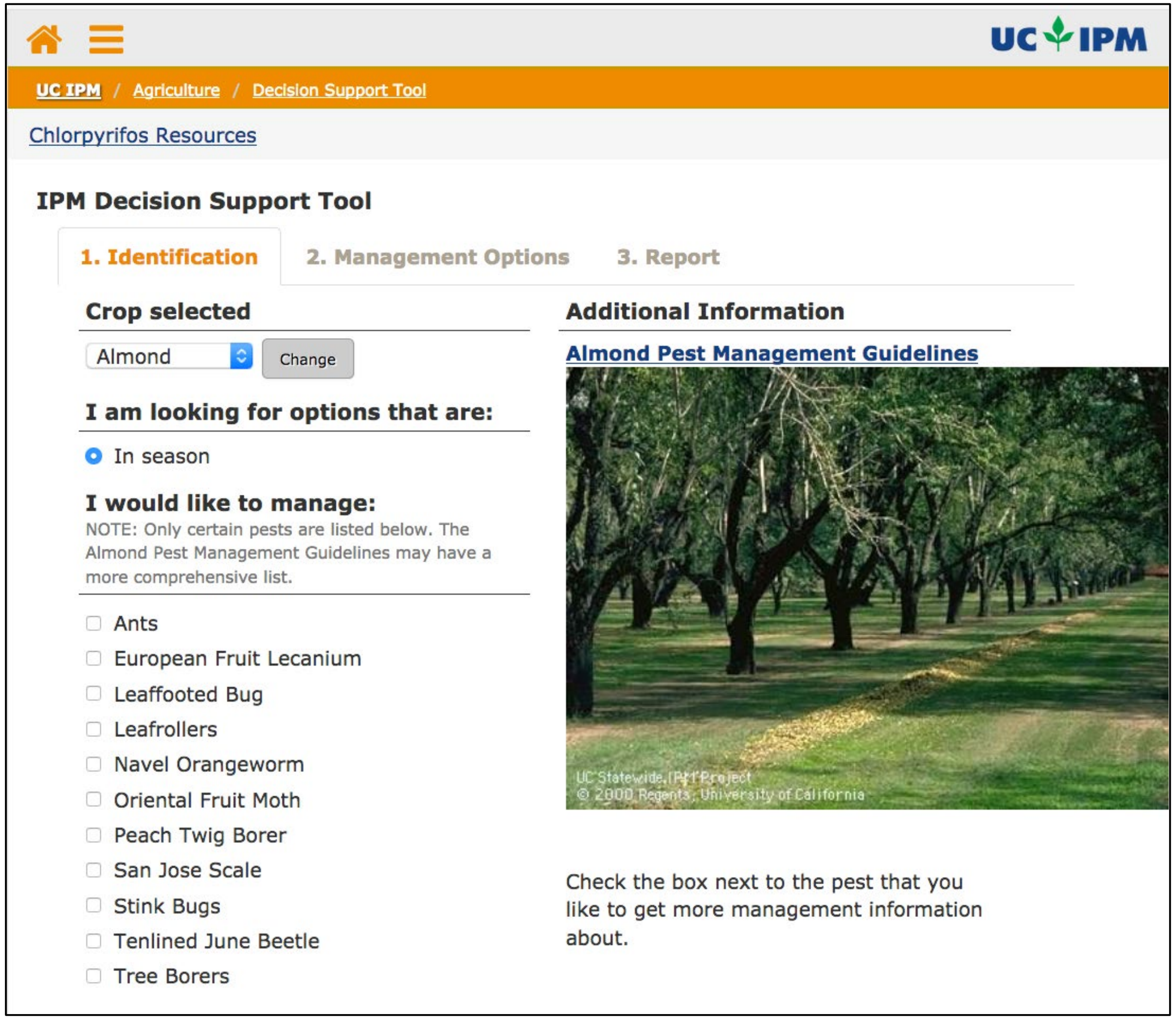


- IPM Decision-support tool
  - Derived from chlorpyrifos critical uses project



IPM Decision-support tool

- Eleven insect pests
- Quick or detailed sampling for each
- Seven potential management options, including 25 specific pesticides under chemical option
- User selected insect pests and management options to consider
- Output is a comparison table which can be downloaded as a pdf



ipm.ucanr.edu

UC IPM

University of California
Agriculture and Natural Resources

Integrated Pest Management Program

IPM Tools You Can Use: Weed Control

Brad Hanson, UC Cooperative Extension Weed Specialist, UC Davis

University of California
Agriculture and Natural Resources

UC DAVIS
DEPARTMENT OF PLANT SCIENCES
College of Agricultural and Environmental Sciences

Why IPM for weeds?

- Increasing/maintaining efficacy
- Maintaining/reducing costs (short/long term)
- Reducing environmental impacts and subsequent regulatory constraints
- Minimizing crop injury issues

Three common weed management issues:

Not making an appropriate plan or implementing it poorly

Not properly identifying or understanding the problem

Over-treating. Challenges: economics, sustainability, crop safety

- The right tools, used well, and at the right time, make orchard weed management a much easier, cheaper, and effective proposition

Manage “your” weeds

- Weed management is an annual concern and production cost that must be considered in a local context
- No “one size fits all” solution for all orchards. A program that works for other growers or in other blocks may not be the best one for all other growers/blocks
- The best integrated weed management plan for a giving situation will depend on:
  - knowledge of the weeds (species, density, locations), soils, orchard age, cultural practices, vegetation management goals, etc.

Glyphosate-paraquat-resistant fleabane treated a total of 4 times with glyphosate or paraquat

Implement your plan well

- The best weed management program can fail if:
  - Implemented at the wrong time
    - Too late/too early, weeds too big or not yet emerged
  - Herbicides applied poorly
    - Poorly calibrated or maintained equipment, insufficient overlap at tree row, poorly trained applicators
    - Inappropriate surfactants
    - Insufficient spray coverage (GPA)
    - Excessive plant debris or large plants present

Hairy fleabane treated with glufosinate at a late growth stage.

Use the right tool for the job

- Effective Integrated Weed Management is predicated on the grower or PCA understanding the problem at hand, considering it in the context of the management goals and site-specific constraints, and then designing an appropriate management strategy
  - An appropriate rate of an appropriate herbicide is more likely to be successful and sustainable than an extreme rate or another or another application of a less-than-ideal herbicide
  - Or, to put it another way, "more herbicide is not necessarily the answer" (even if economically feasible)

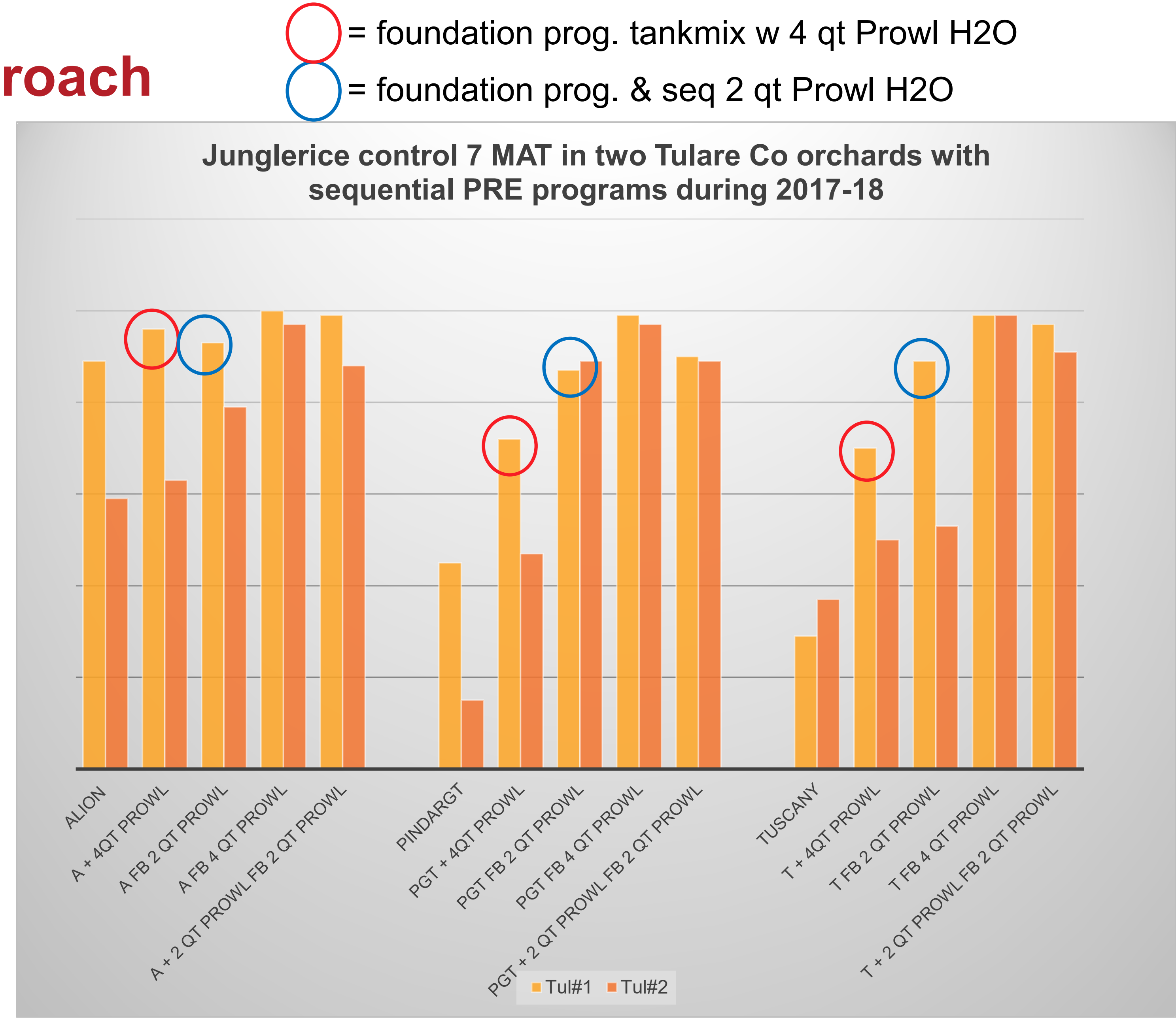
Treatments aimed at annual weeds often fail if the site is also infested with perennial weeds.

Over treatment

- Some examples of excessive weed control programs:
  - Ultra-high expectations (eg. 12 months of "moonscape")
    - Expensive, sustainability challenge, regulatory scrutiny
  - Poorly considered sequential programs
    - Expensive, not-necessarily effective, can push crop safety envelope
- "You can only kill one weed one time – it won't get deader"
- This can also be an expensive way to learn about soil type differences across a field!

Overly "aggressive" herbicide programs or inconsistent applications can sometimes lead to expensive lessons.

Example of a sequential approach



- **Goal:**
- 1. control of winter weed complex
- 2. *and* control of summer-emerging grasses

- **Evaluated:**
- Sequential approach using a targeted PRE
- Alion, PindarGT, and Tuscany as foundation
- Added Prowl to help with grasses
  - 4 qt in winter with foundation
  - 2 qt in March
  - 4 qt in March
  - 2 qt in winter + 2 qt in spring

-junglerice emerges ~May-Aug
-pendimethalin is effective on many grasses, but a high rate of pendimethalin in Dec is needed for it to "last" until July

? Can we use a lower rate but apply it later to achieve the same outcome (with economic and environmental benefits)?

IWM starts with effective field scouting

- Basing control decisions on actual weed problems
  - Control the weeds you KNOW you have (or will have)
- Identify new weed problems when they are small
  - New invasive species, resistant biotypes, etc.
  - Can use more intensive control strategies on the pockets that need it rather than field-wide
- Avoid ineffective treatments
  - Using the wrong tool for the job wastes time and money
  - Will likely have to be retreated or controlled some other way
- Avoid overtreatment
  - Wastes money and time
  - Puts a higher than necessary load of pesticide in the environment (+ regulatory burden)
  - Increases crop safety concerns

Integrated weed management

Make a good plan and implement it well

Understand the problem and goals, then use the right tool for the job

Use the right tool and right amount to reduce excessive or unnecessary treatments

- The right tools, used well, and at the right time, make orchard weed management a much easier, cheaper, and effective proposition

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College of Agricultural and Environmental Sciences

Thank you

Brad Hanson, UC Cooperative
Extension Weed Specialists, UC Davis

http://hanson.ucdavis.edu

http://wric.ucdavis.edu

IPM Tools You Can Use: Disease Management

David Haviland, UCCE Kern County

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Almond Orchard 2025 Goals - Entomology

By 2025, the California almond community commits to…

- Increase adoption of environmentally-friendly pest management tools by 25%
- "Environmentally Friendly" is defined as using an integrated pest management approach that focuses on prevention, monitoring, and only applying the appropriate pesticides when necessary.

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Examples of “Environmentally Friendly Pest Management”

Southern Fire Ant

- 15 years ago
  - Chlorpyrifos on the ground prior to harvest
- Today
  - Applications based on
    - Monitoring
    - Ant identification
    - Thresholds
  - Environmentally-safe ant baits

San Jose Scale

- 15 years ago
  - Annual dormant organophosphate w/ oil
- Today
  - Primary reliance on parasitoids
  - Applications based on
    - Dormant spur sampling and biocontrol
    - Thresholds
  - If needed (the exception), application of oil or an IGR

Areas of Opportunity for increased integration (ABC BOD)

Spider mites

- Monitoring
- Increased reliance on biocontrol
- Avoid prophylactic treatments
- Resistance management

Navel orangeworm

- Winter sanitation
- Monitoring
- Mating disruption
- Early harvest
- Pesticide choice (avoid pyrethroids)
- Resistance management

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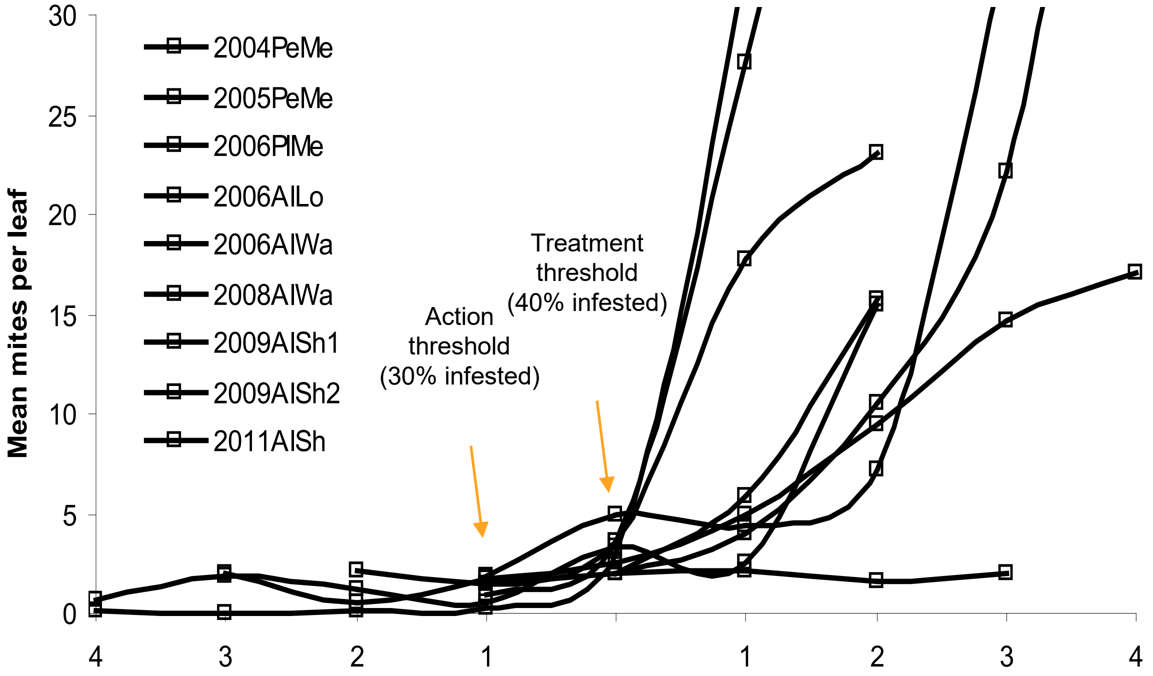
Spider mites - monitoring and thresholds

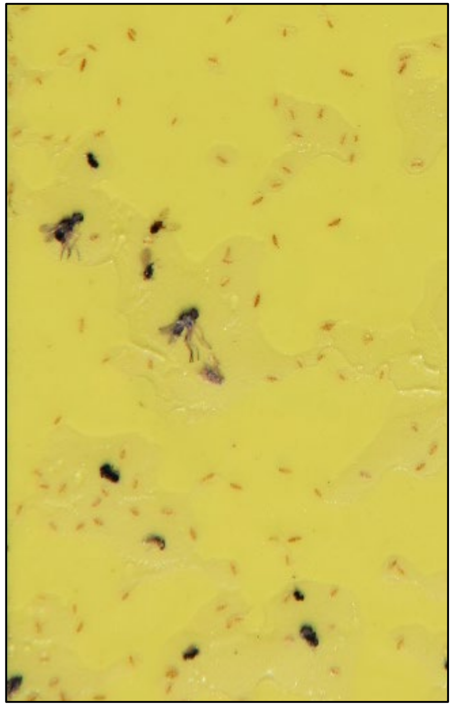
- Monitoring
  - Weekly
  - Presence-absence sampling
  - Also look for predators on leaves
- Thresholds
  - Treat too early = starve predators
  - Treat too late = defoliation (sometimes)
  - 30-40% of leaves infested
- Monitoring for sixspotted thrips
  - Sticky cards

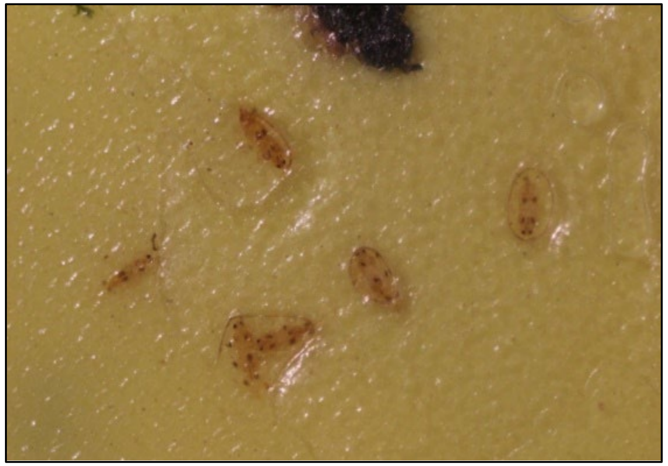


Monitoring - sixspotted thrips

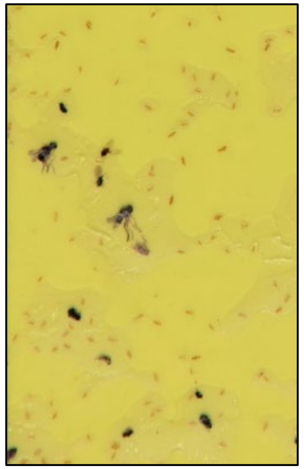
- Yellow strip trap
- 3” x 5”
- Great Lakes IPM
- Case of 1,000 for $260

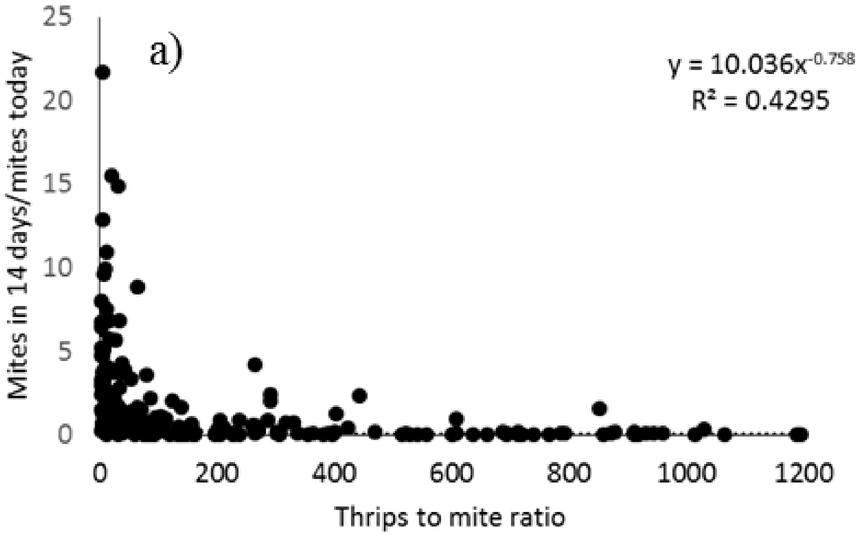
- Hang from tree using binder clip and large uncoiled paper clip
- Place near NOW or PTB traps traps





Thrips: mite ratios can predict change in mite density





- As thrips approach zero, mites increase exponentially
- As thrips approach infinity, mites decrease exponentially

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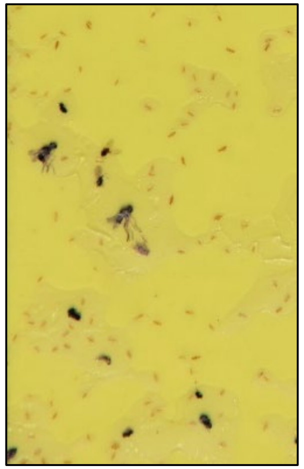

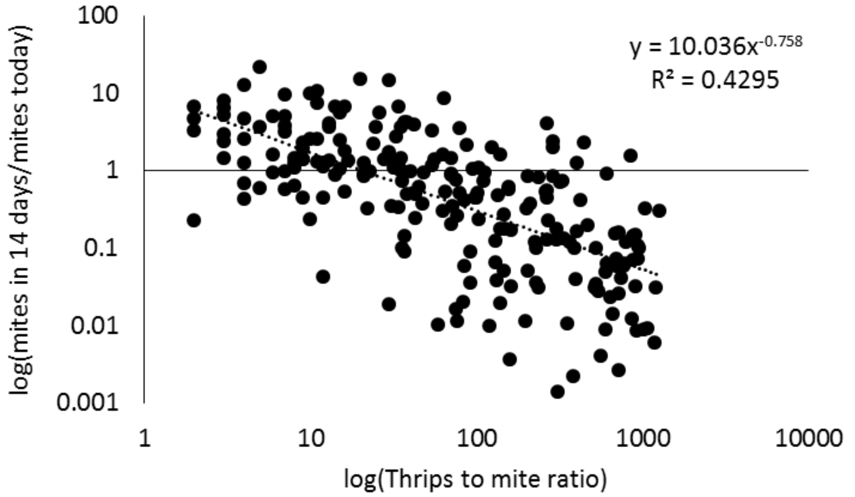

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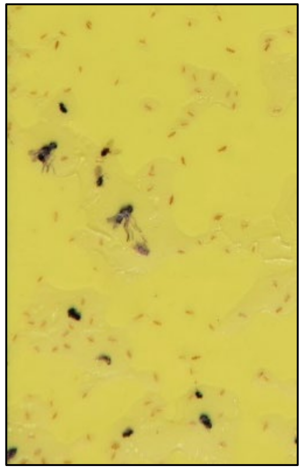

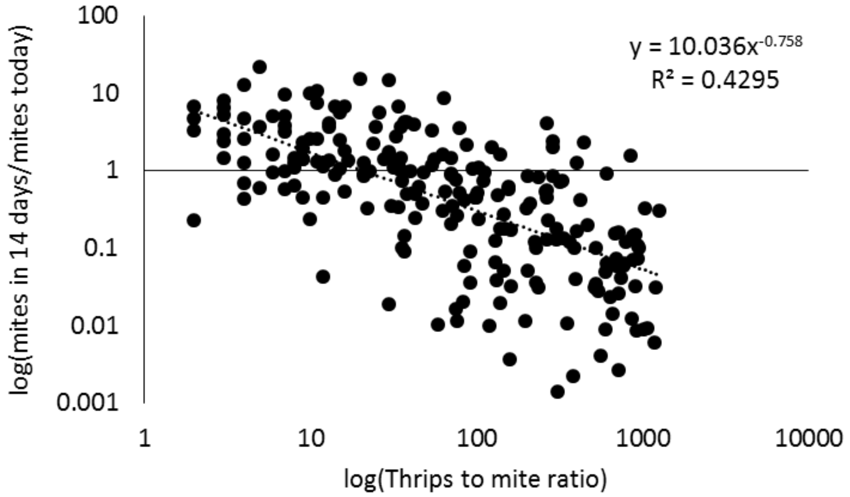

- As thrips approach zero, mites increase exponentially
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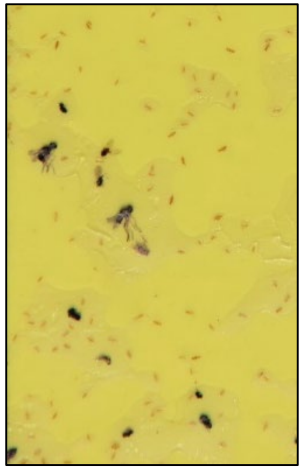
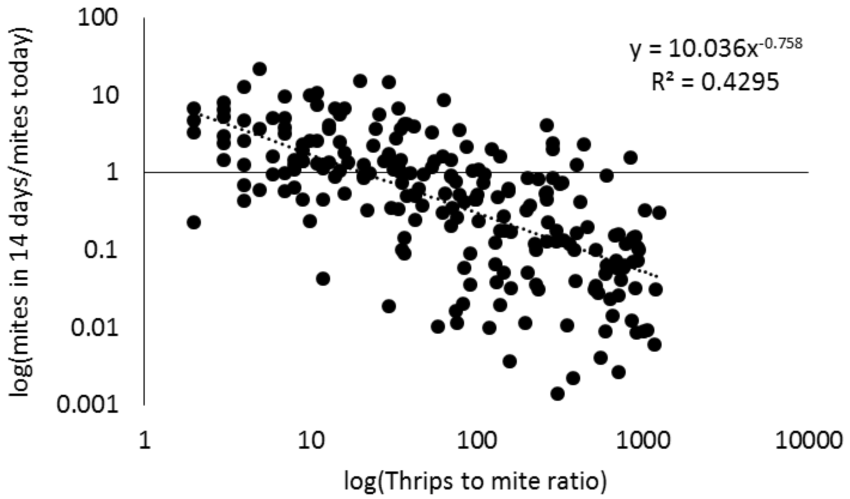
- 2.6 thrips/card/week for every 1 mite/leaf equals no change in mites 7 days later
  - Spring implication - If 1 mite per 3 leaves, 1 thrips on a card is all you need

Thrips: mite ratios can predict change in mite density





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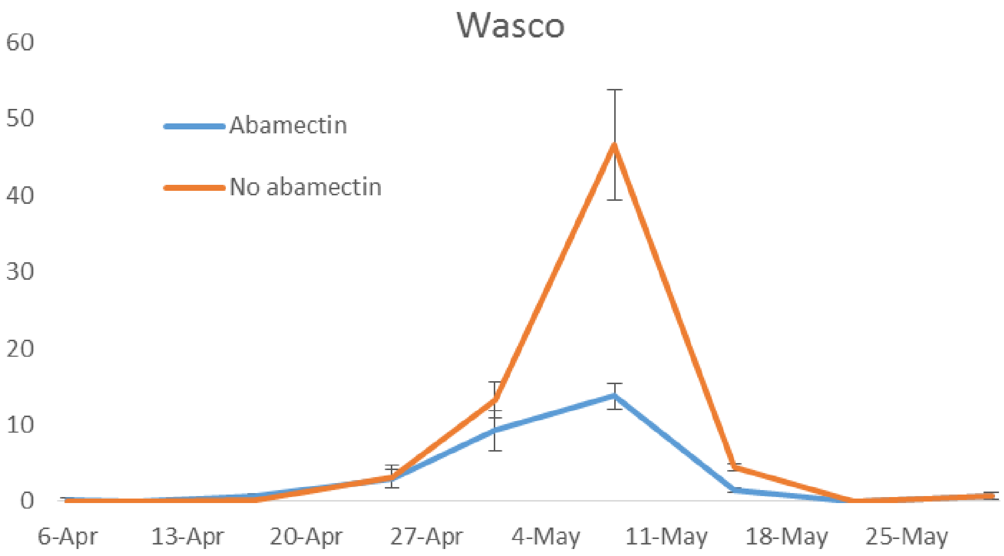
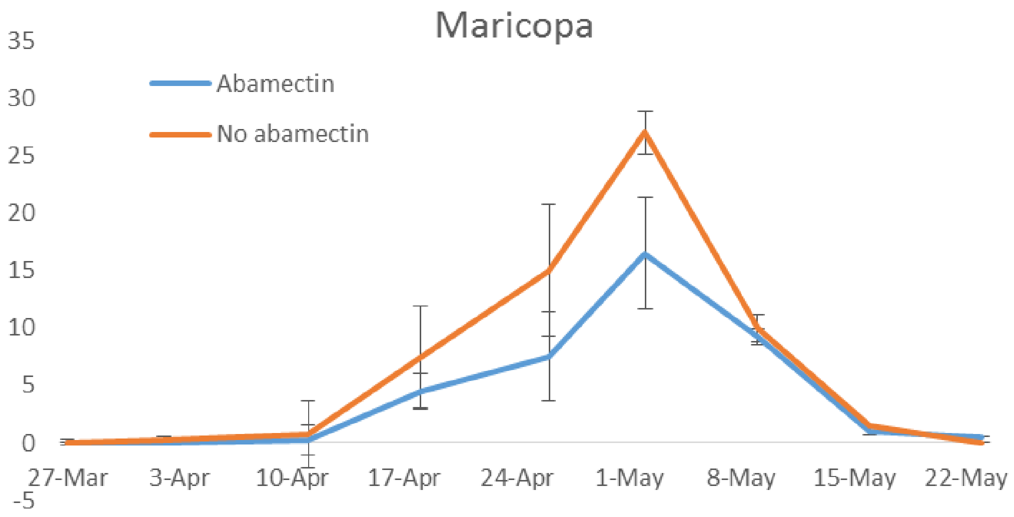
- 2.6 thrips/card/week for every 1 mite/leaf equals no change in mites 7 days later
  - Spring implication- If 1 mite per 3 leaves, 1 thrips on a card is all you need
- Simplified version for mid-season to hull split
  - 3 thrips/trap/week = break even
    - 50% chance mites will be the same or lower in 14 days
  - 6 thrips/trap week = walk away
    - 72.7% chance mites will decrease in 7d, 96.6% chance mites will decrease in 14d

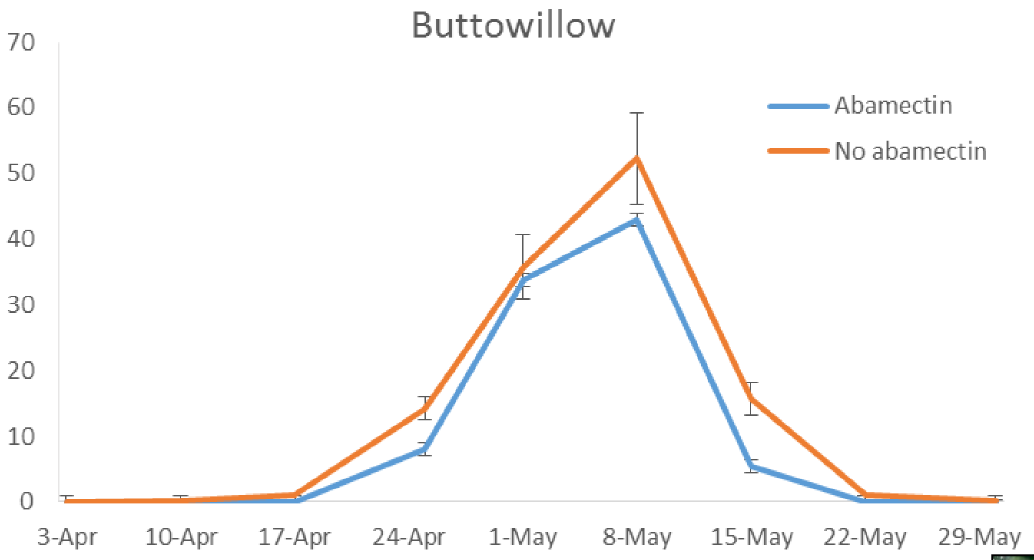
Avoid prophylactic treatments

- May sprays for mites becoming obsolete
- See charts
    - Nine orchards (9/9) all look the same
- Miticides should never be used in May without monitoring for spider mites and thrips
- If a treatment is justified, avoid products that kill thrips

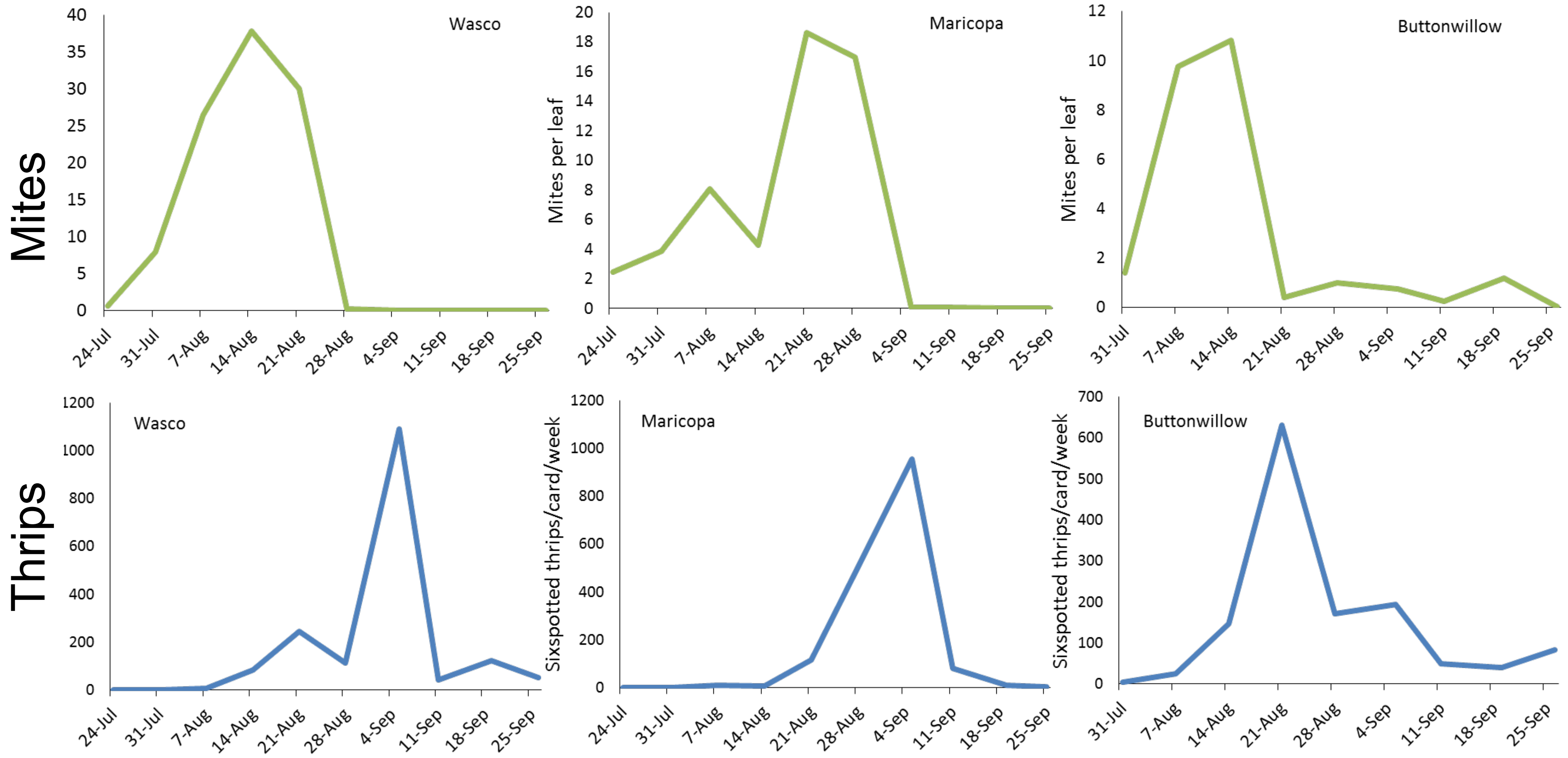
Sixspotted thrips/card/week







Spider mite biocontrol



- Mites flare up
- 2-week delay, thrips respond
- Thrips double population every 3.4 days
- Mites crash

Areas of Opportunity for increased integration (ABC BOD)

Spider mites

- Monitoring
- Increased reliance on biocontrol
- Avoid prophylactic treatments
- Resistance management

Navel orangeworm

- Winter sanitation
- Monitoring
- Mating disruption
- Early harvest
- Pesticide choice (avoid pyrethroids)
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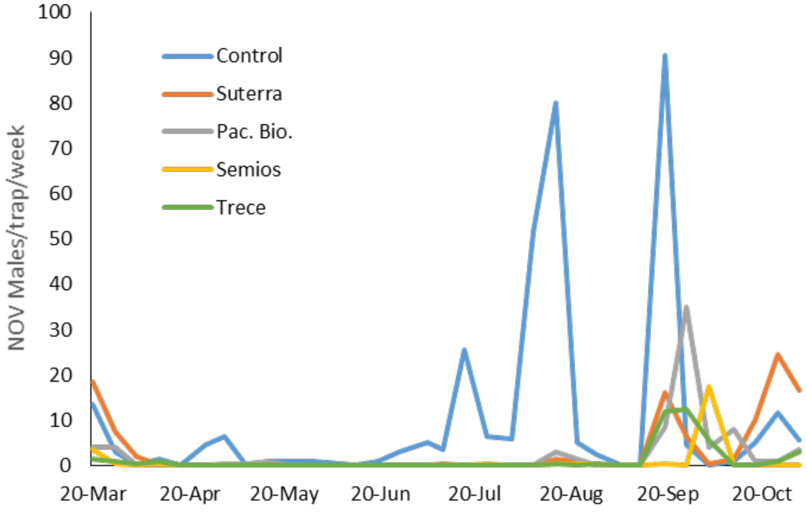
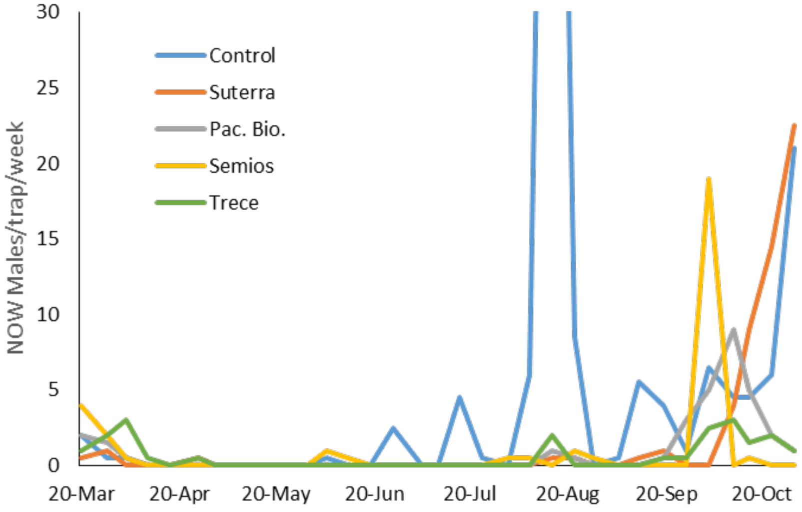
Mating Disruption Products

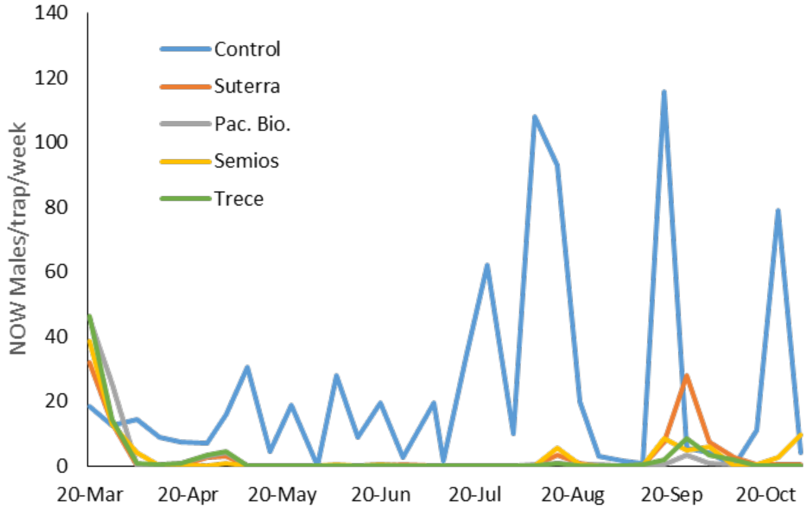
Trade Name	Manu-facturer	Dispen-sers per acre	Type	Release rate	Other perks/ costs	Organic
Puffer NOW	Suterra® Wonderful	2	Aerosol	Static Nightly	No	No
Semios NOW	semios	1	Aerosol	Variable	Yes	No
Isomate NOW	Pacific Biocontrol	1	Aerosol	Static nightly	No	No
Cidetrak NOW Meso	TRÉCÉ® INCORPORATED	20 (15-28)	Passive	Static 24/7	No	Yes

Pheromone trap captures - Southern SJV

Haviland Almond Board Project, 2017





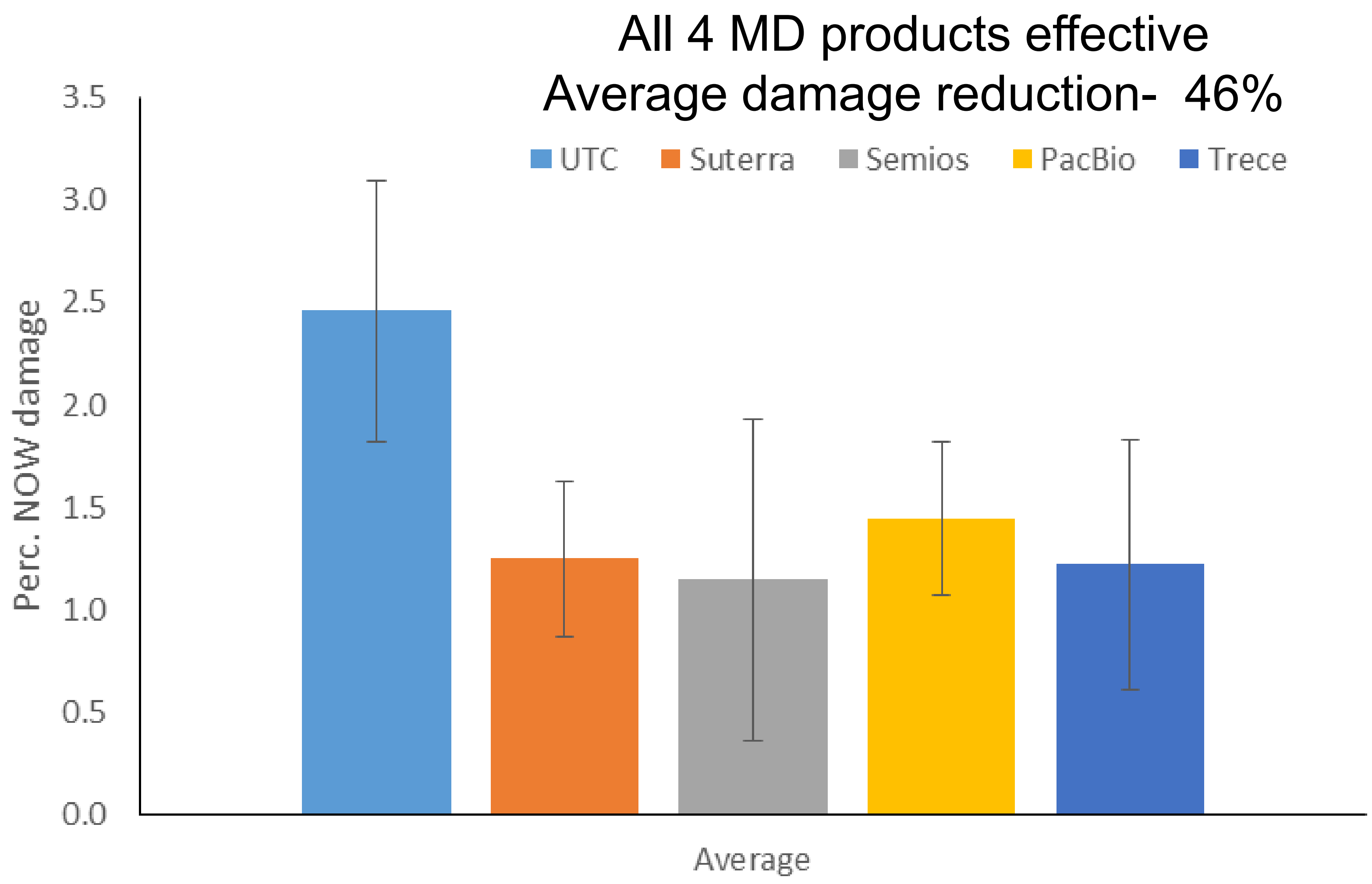


Reductions in trap captures

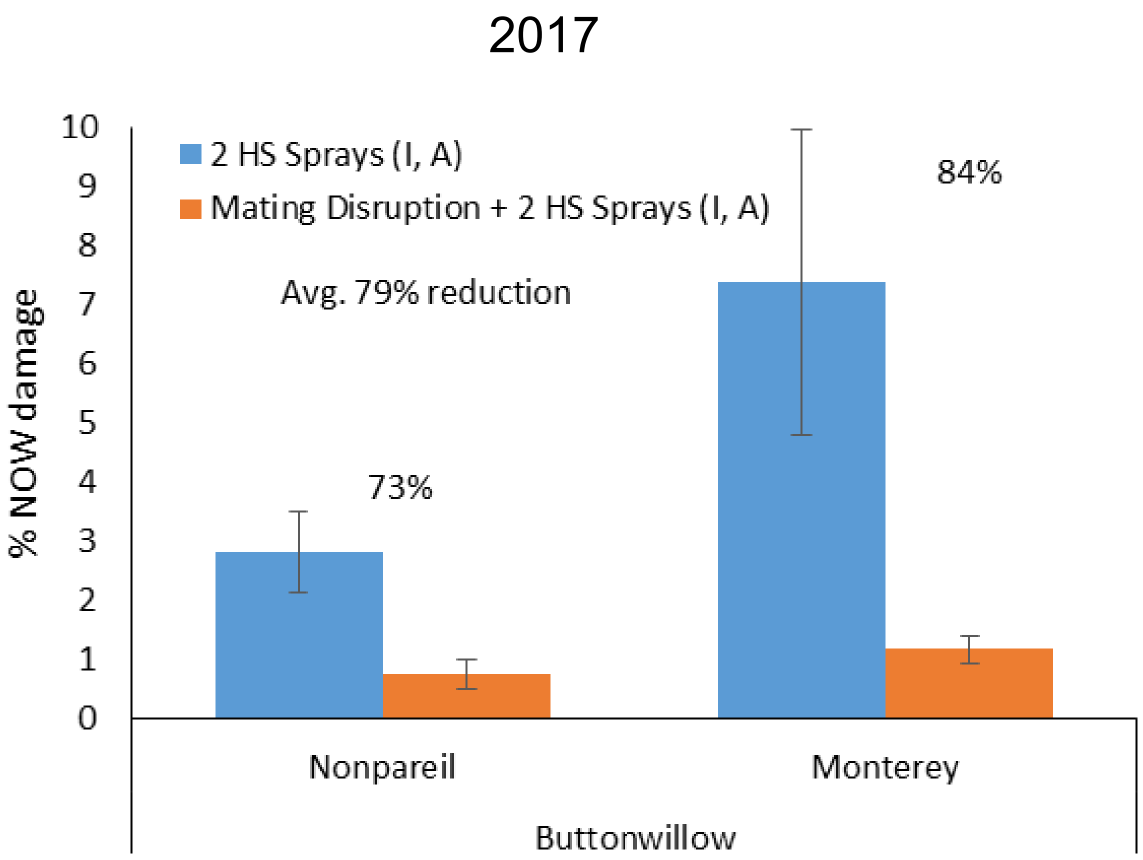
ABC 2017	PMA 2017	PMA 2018
89%	97%	100%
95%	93%	97%
91%	94%	99%

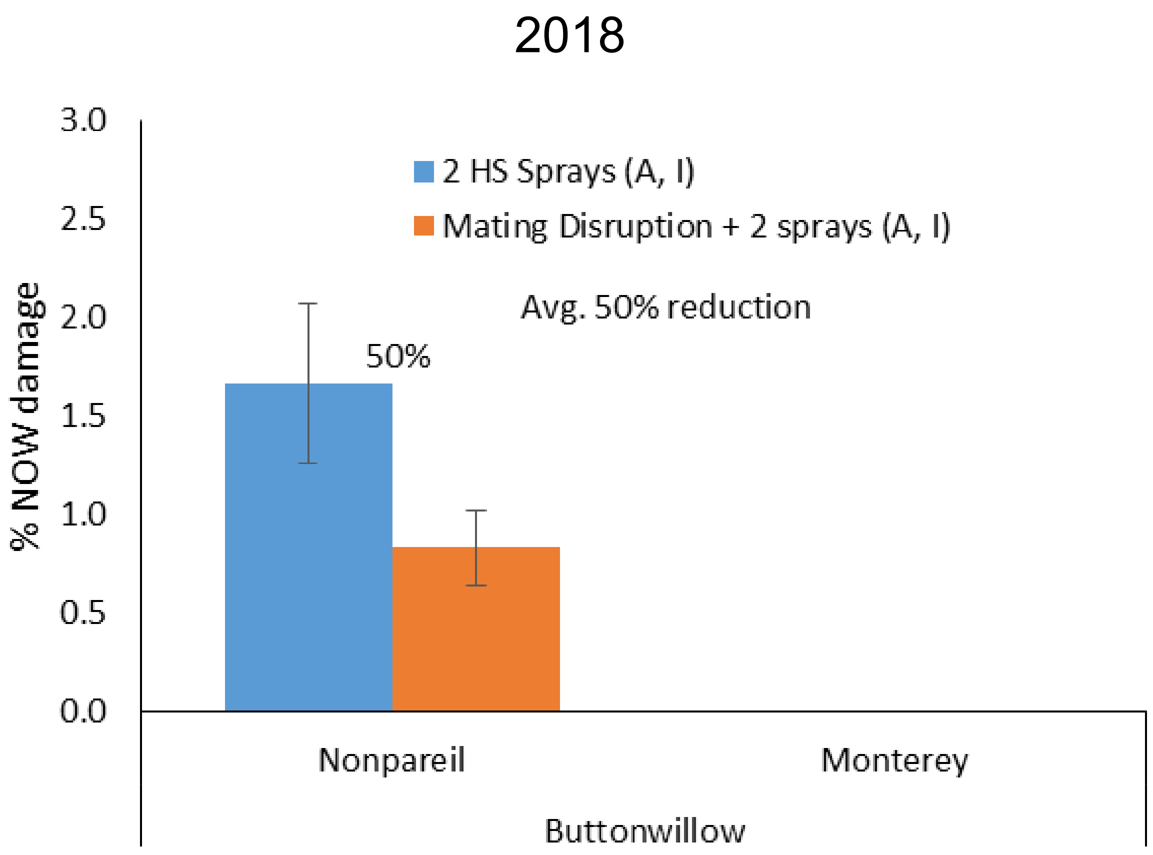
NOW damage at harvest - Southern SJV

Haviland Almond Board Project, 2017



PMA Site - Lost Hills

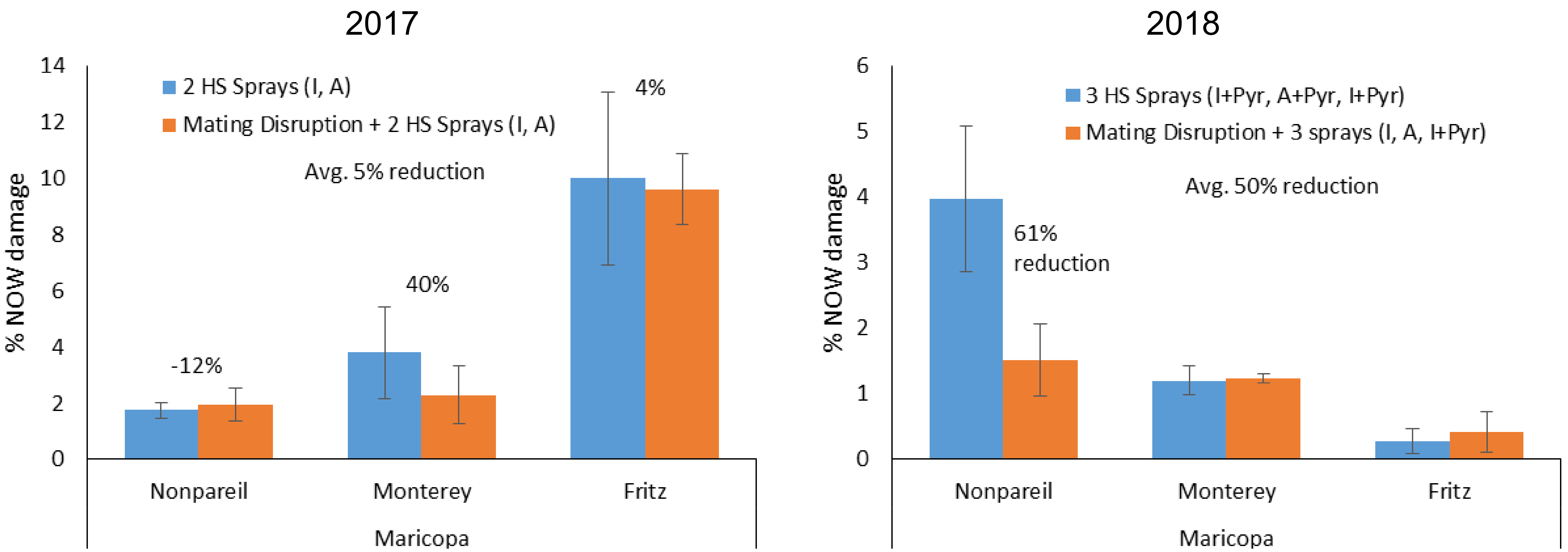




- Two sprays w/ or w/o MD

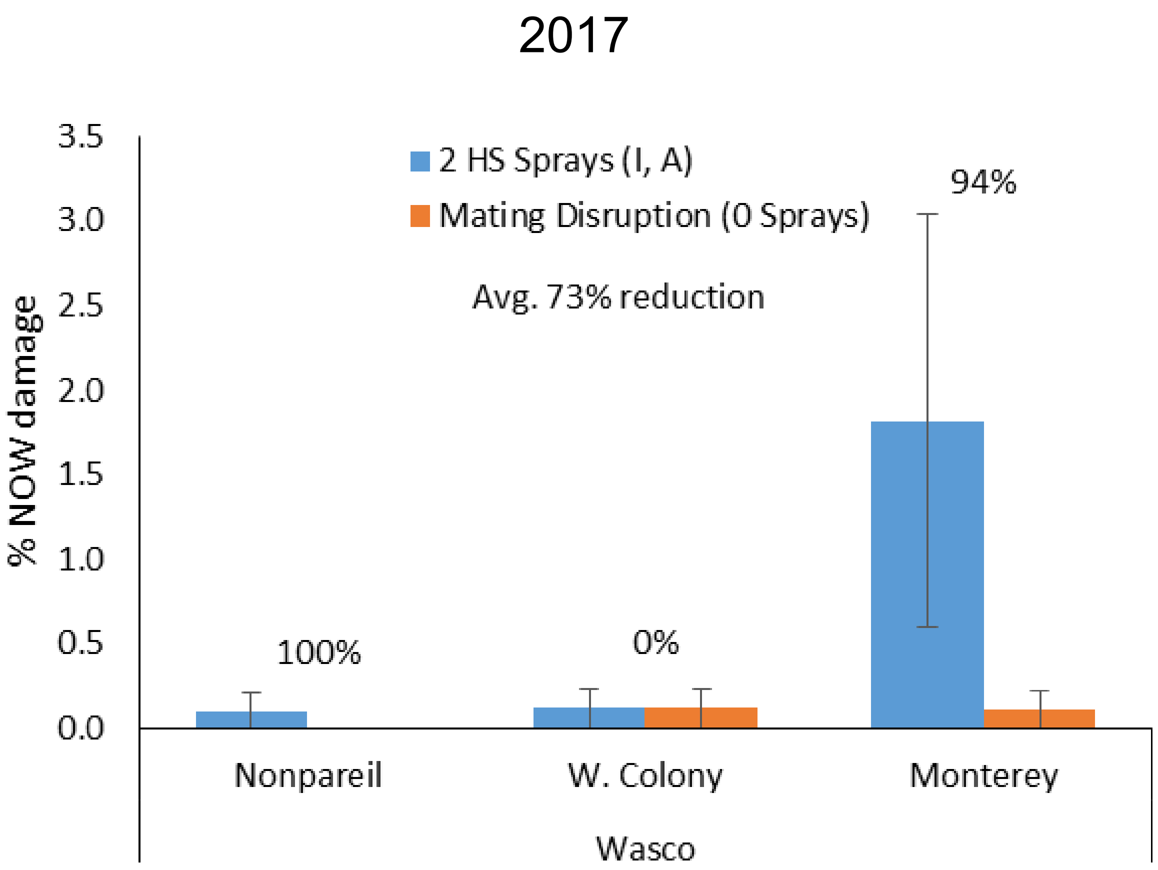
- Two-year damage ↓ 49%
- Net grower return ↑ $84/yr/acre

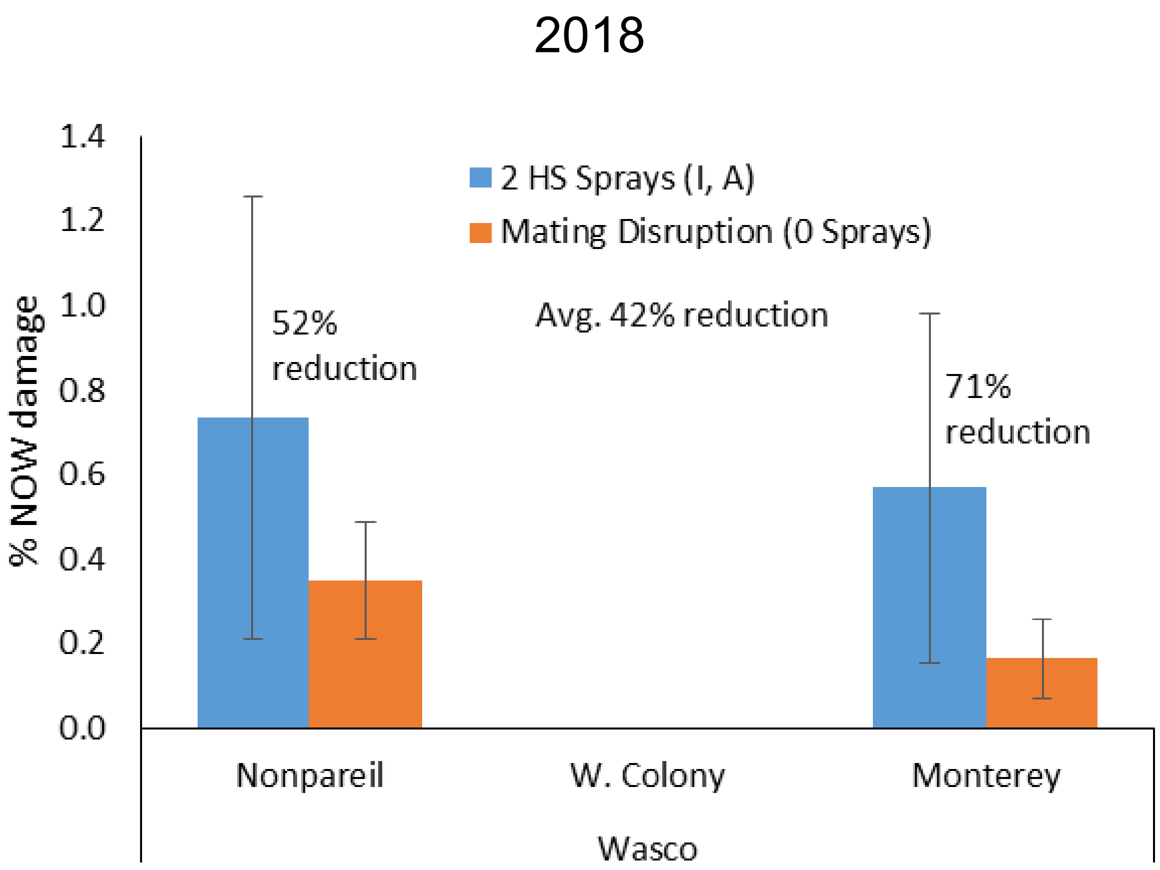
PMA Site - Maricopa



- 100ac triangle vs. 200ac square
- 2-3 sprays w/ or w/o MD
- Two-year damage ↓ 28%
- Net grower return ↑ $28/yr/acre

PMA Site - Wasco





- Low pressure
- MD replaced two sprays

- Two-year damage ↓ 58%
- Net grower return ↑ $36/yr/acre

Take-home messages

Almond industry has made great shifts towards sustainability…
but room for improvement still exists. 2025 goals are very attainable.

- Spider mites
  - Monitor mites and beneficials
    - Including sticky cards
  - Use thresholds
    - Presence-absence, and thrips
- Navel orangeworm
  - Continue sanitation, early harvest efforts
  - Make decisions based on monitoring
  - Increase adoption of mating disruption

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IPM Tools You Can Use: Disease Management

Mohammad Yaghmour, UC ANR
UCCE Kern County

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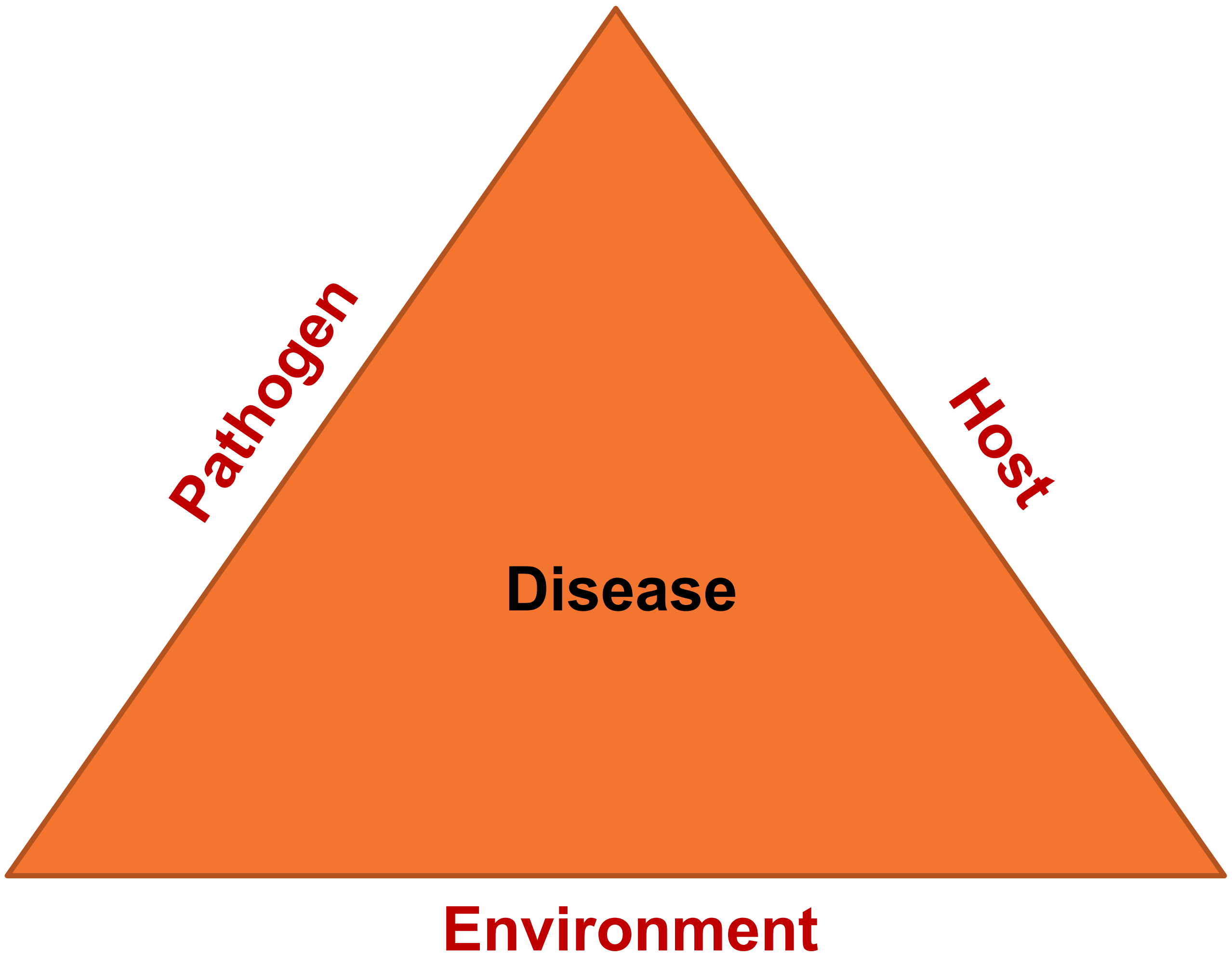
Disease Triangle

- What are the major factors in disease development?
  - Susceptible almond tree (Rootstock, and/or scion)
  - Aggressive pathogen (Fungi, bacteria, virus)
  - Conducive Environmental conditions (Temperature, humidity, plant nutrition, etc)
- Understanding disease biology, and epidemiology is key for **disease management.**



Disease Causal Agents

- **First step is to have a correct identification of the causal agent**
- **This is the most important part in disease management.**
- **Symptoms can be confusing**





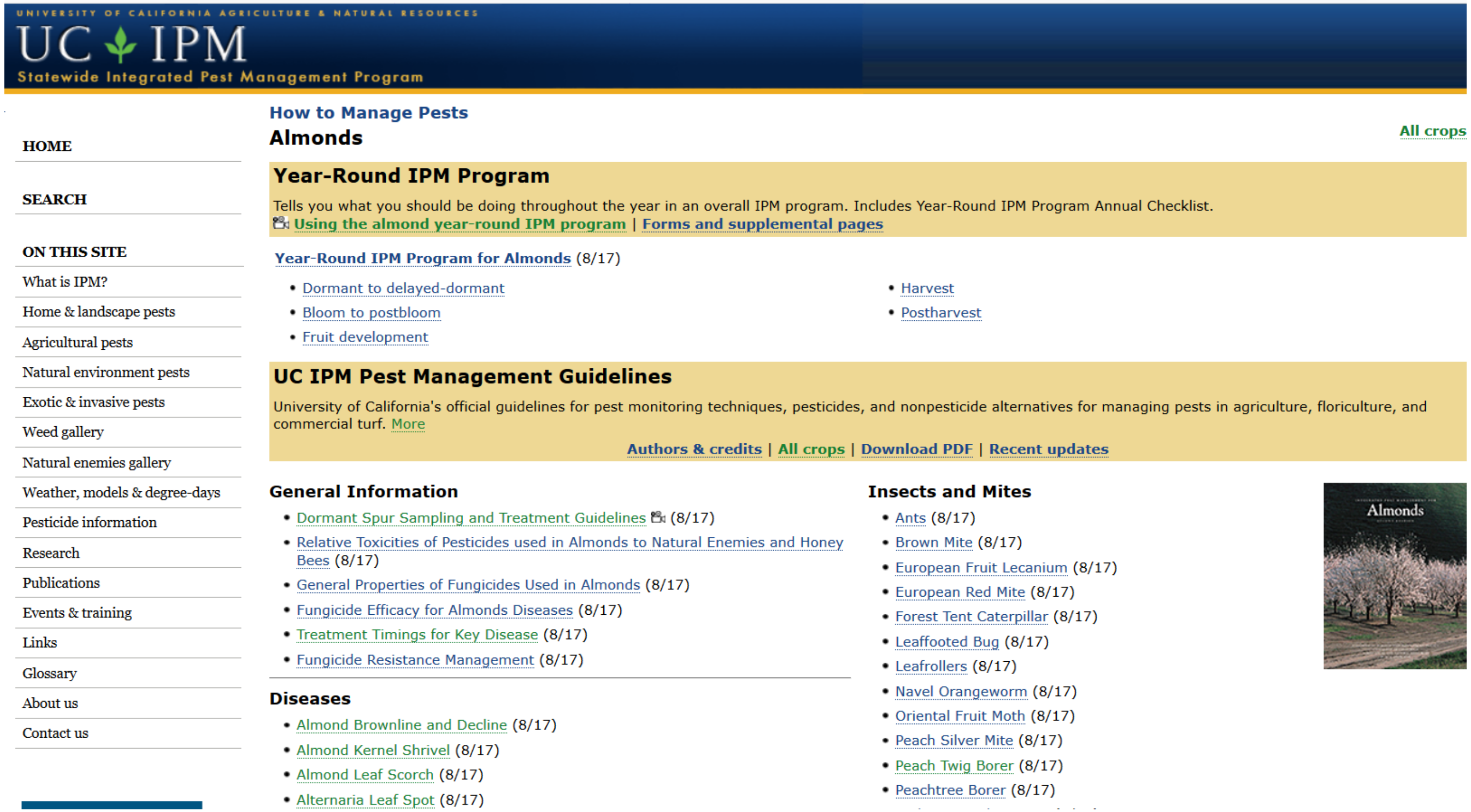
Integrated Pest Management in Disease Management

What is IPM in disease management?

It is the use a combination of different strategies to manage and combat plant diseases. This may include but not limited to:

- Resistant rootstocks and varieties
- Irrigation management
- Proper fertilization
- Disease models and forecasting
- Chemical control
- Disease-free trees
- Quarantines and Eradication

UC IPM website is an excellent source for Disease management options



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UC IPM
Statewide Integrated Pest Management Program

HOME
SEARCH
ON THIS SITE
What is IPM?
Home & landscape pests
Agricultural pests
Natural environment pests
Exotic & invasive pests
Weed gallery
Natural enemies gallery
Weather, models & degree-days
Pesticide information
Research
Publications
Events & training
Links
Glossary
About us
Contact us

How to Manage Pests
Almonds
All crops

Year-Round IPM Program
Tells you what you should be doing throughout the year in an overall IPM program. Includes Year-Round IPM Program Annual Checklist.
Using the almond year-round IPM program | Forms and supplemental pages

Year-Round IPM Program for Almonds (8/17)
- Dormant to delayed-dormant
- Bloom to postbloom
- Fruit development
- Harvest
- Postharvest

UC IPM Pest Management Guidelines
University of California's official guidelines for pest monitoring techniques, pesticides, and nonpesticide alternatives for managing pests in agriculture, floriculture, and commercial turf. More
Authors & credits | All crops | Download PDF | Recent updates

General Information
- Dormant Spur Sampling and Treatment Guidelines (8/17)
- Relative Toxicities of Pesticides used in Almonds to Natural Enemies and Honey Bees (8/17)
- General Properties of Fungicides Used in Almonds (8/17)
- Fungicide Efficacy for Almonds Diseases (8/17)
- Treatment Timings for Key Disease (8/17)
- Fungicide Resistance Management (8/17)

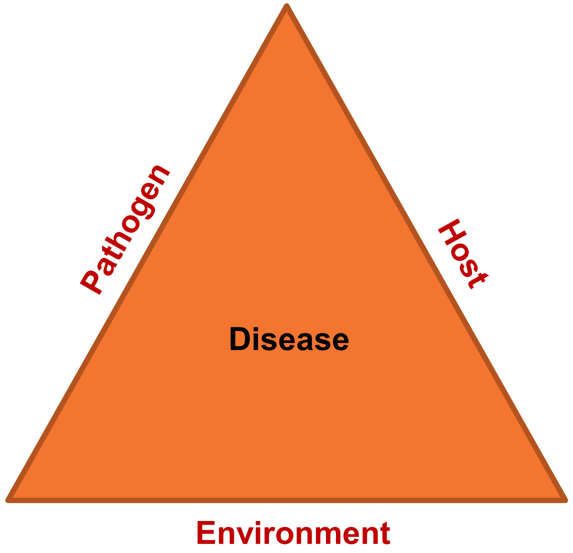
Diseases
- Almond Brownline and Decline (8/17)
- Almond Kernel Shrivel (8/17)
- Almond Leaf Scorch (8/17)
- Alternaria Leaf Spot (8/17)

Insects and Mites
- Ants (8/17)
- Brown Mite (8/17)
- European Fruit Lecanium (8/17)
- European Red Mite (8/17)
- Forest Tent Caterpillar (8/17)
- Leaffooted Bug (8/17)
- Leafrollers (8/17)
- Navel Orangeworm (8/17)
- Oriental Fruit Moth (8/17)
- Peach Silver Mite (8/17)
- Peach Twig Borer (8/17)
- Peachtree Borer (8/17)

Almonds

Strategies Used in IPM

- Avoidance: Mainly dealing with the environment component (Avoid planting in *Armillaria mellea* infested soil, or planting in a virgin soil to avoid prunus replant disease)
- Exclusion: focusing on the pathogen or the pest to keep it out of production areas, state, or country
  - Quarantine
  - Pathogen-Free planting material (Prunus necrotic ringspot virus (PNRSV))
- Eradication: Focusing on eliminating and removal of the primary inoculum (pathogen)
  - Removal and eradication of infected plants acting as a source of inoculum (Fumigation before planting, destroying)
- Protection



Protection

- Cultural practices
  - Planting on berms (e.g., Phytophthora root and crown rot)
  - Managing plant nutrition (e.g., nitrogen management for hull rot)
  - Water management (Important in soil borne diseases)
  - Row orientation (e.g., Alternaria leaf blight)
  - Proper scaffold selection (Canker diseases)
- Chemical control
  - Fungicides, Fumigation, etc
- Biological Control (AF36 to manage aflatoxin)
- Host Resistance
  - Use of resistant rootstocks (i.e soil borne disease, managing nematodes)
  - Varietal susceptibility and resistance

Examples of Using IPM in California Almond Orchards

- Bacterial Spot
- Hull Rot
- Alternaria Leaf Spot
- Invasive Species

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Bacterial Spot: *Xanthomonas arboricola* pv. *pruni*

- Fritz is very susceptible
- The bacterium overwinters on almond mummies
- Twig cankers can harbor the bacterium and may act as a source of inoculum

Cultural Control

- Improve air movement in the orchard to reduce relative humidity.
- Irrigation management.
- Good sanitation practices including dormant fruit mummy removal.
- Cleaning harvesting equipment carefully to prevent the movement of infected fruit between orchards.

Chemical Control

- Delayed dormant and in-season treatments using copper and mancozeb to protect immature, developing fruit.

Hull Rot

- Identify the causal agent
- Irrigation management and avoidance of standing water at hullsplit.
- Avoid excess nitrogen fertilizer.
- Chemical control
  - FRAC group 3 and 11 for *Rhizopus stolonifer* timed at hull split.

***Monilinia* spp.**

Sources of inoculum: Infected almond and stone fruit twigs, fruits, mummies, etc

Rhizopus stolonifer

Source of inoculum: Soil

Aspergillus niger

Fruit susceptibility to Hull Rot Pathogen *Rhizopus stolonifer*

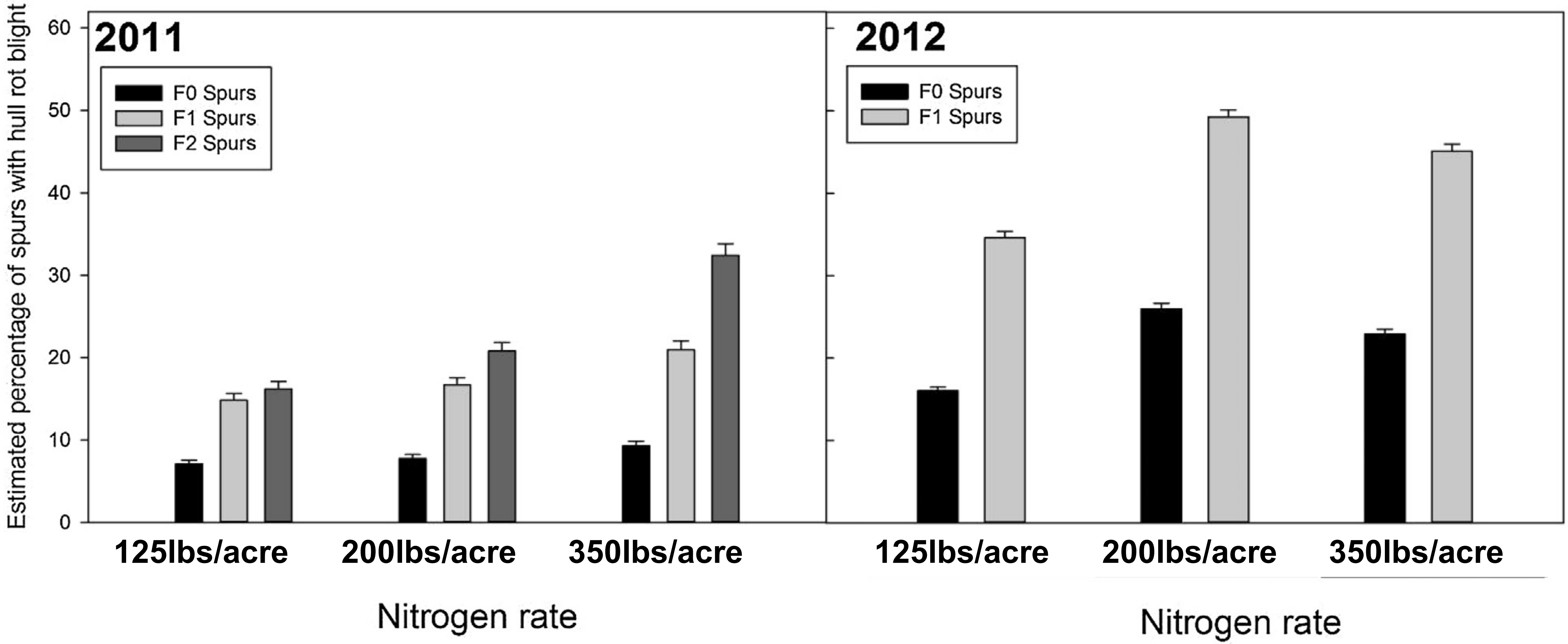
(b1) Initial separation-50% or more of a thin separation line visible

(b2) Deep V, is the most susceptible stage (source: Adaskaveg. 2010)

(b3) Deep V, split-a deep "V" in the suture, which is not yet visibly separated, but which can be squeezed open by pressing both ends of the hull

(c) Split, less than 3/8 inch

Hull Rot Incidence Increases with Increased Nitrogen Rate



Source: Saa et al. 2016.

Irrigation Management and Hull Rot

Deficit irrigation decreased incidence of hull rot, and regulated deficit irrigation was more effective than sustained deficit irrigation

Table 2. Effects of deficit irrigation on natural incidence of hull rot disease caused by *Rhizopus stolonifer* in almond trees cultivar Nonpareil, Kern County, CA

	Dead leaf clusters[y] (no. per tree)		Dead wood[y] (cm per tree)		Infected hulls[y] (%)	
Irrigation treatment[x]	**1994**	**1995**	**1994**	**1995**	**1994**	**1995**
100 (control)	20.1	23.1	28.4	49.2	26.5	24.2
85 sustained	18.0	35.2	32.8	66.6	35.0	24.5
85 regulated	6.1	13.5	8.2	22.1	24.2	14.5
70 sustained	7.1	15.5	8.4	17.2	21.5	14.2
70 regulated	4.7	5.4	2.2	2.2	35.8	18.8
Significance of F, P = [z]	0.032	0.001	0.001	0.002	0.010	0.036
Orthogonal contrasts						
100 versus deficits	0.005	0.022	0.006	0.068	NS	0.063
100 versus 85 sustained	NS	NS	NS	NS	0.072	NS
85 versus 70	0.030	0.007	0.003	0.003	NS	NS
Sustained versus regulated	0.027	0.002	0.003	0.009	NS	NS

[x] Irrigation deficits of 70 and 85% of potential evapotranspiration (ETc) were imposed at every irrigation (70 and 85 sustained) or by one preharvest reduction to 50% of ETc from 1 June to 31 July (70 regulated) or 1 to 15 July (85 regulated).

[y] Average of 12 trees per replication. Dead wood consisted of spurs, twigs, and small branches and was visually estimated. Data collected 11 and 18 August 1994 and 1995, respectively, 2 days after trees were shaken for harvest.

[z] Irrigation treatments were replicated six times and arranged in a randomized complete block design. NS = not significant, $P > 0.1000$. Means were separated by orthogonal contrasts.

Source: Teviotdale et al. 2001. Effects of deficit irrigation on hull rot disease of almond trees caused by *Monilinia fructicola* and *Rhizopus stolonifer.* Plant Dis. 85:399-403

Chemical Control of Hull Rot

- Hull rot caused by R. stolonifer can be managed by a single application at hullsplit (1-5% hullsplit), timed with the navel orangewo
- Hull rot ca

ALMOND: TREATMENT TIMING

Note: Not all indicated timings may be necessary for disease control.

Disease	Dormant	Bloom			Spring[1]		Summer	
		Pink bud	Full bloom	Petal fall	2 weeks	5 weeks	May	June
Alternaria leaf spot	—	—	—	—	—	++	+++	+++
Anthracnose[2]	—	++	+++	+++	+++	+++	+++	++
Bacterial spot	+	—	++	+++	+++	++	+	—
Brown rot blossom blight	—	++	+++	+	—	—	—	—
Green fruit rot	—	—	+++	++	—	—	—	—
Hull rot[7]	—	—	—	—	—	—	—	+++
Leaf blight	—	—	+++	++	+	—	—	—
Rust	—	—	—	—	—	+++	+++	+[6]
Scab[3]	++	—	—	++	+++	+++	+	—
Shot hole[4]	+[5]	+	++	+++	+++	++	—	—

Rating: +++ = most effective, ++ = moderately effective, + = least effective, and — = ineffective

[1] Two and five weeks after petal fall are general timings to represent early postbloom and the latest time that most fungicides can be applied. The exact timing is not critical but depends on the occurrence of rainfall.

[2] If anthracnose was damaging in previous years and temperatures are moderate (63°F or higher) during bloom, make the first application at pink bud. Otherwise treatment can begin at or shortly after petal fall. In all cases, app should be repeated at 7- to 10-day intervals when rains occur during periods of moderate temperatures. Treatment should, if possible, precede any late spring and early summer rains. Rotate fungicides, using different fungicid a resistance management strategy.

[3] Early treatments (during bloom) have minimal effect on scab; the 5-week treatment usually is most effective. Treatments after 5 weeks are useful in northern areas where late spring and early summer rains occur. Dormant tre liquid lime sulfur improves efficacy of spring control programs.

[4] If pathogen spores were found during fall leaf monitoring, apply a shot hole fungicide during bloom, preferably at petal fall or when young leaves first appear. Reapply when spores are found on new leaves, or if heavy, persiste rains occur. If pathogen spores were not present the previous fall, shot hole control may be delayed until spores are seen on new leaves in spring.

[5] Dormant copper treatment seldom reduces shot hole infection but may be useful in severely affected orchards and must be followed by a good spring program.

[6] Treatment in June is important only if late spring and early summer rains occur.

[7] Make application at 1-5% hull split to manage hull rot caused by *Rhizopus stolonifer*.

Alternaria Leaf Spot

- Caused by *Alternaria alternata, A. arborescens, A. tenuissima*, and require warm and humid environmental conditions.
- Susceptible varieties: Monterey, Carmel, Sonora, Butte, and Winters.
- Cultural Management:
  - Pruning to increase air flow and circulation
  - Resolving water infiltration problems and irrigation management to reduce humidity.
  - Plant orchard in north-south direction
- Chemical Control:
  - Scout and monitor the orchard starting April for disease signs, if detected, then start chemical treatment about mid-April and thereafter 2-3 weeks in orchards with a history of Alternaria leaf spot
  - Fungicides in groups 3, 7, 11, and 19

Alternaria Leaf Spot Disease Severity Value (DSV) Model

- Developed by Dr. Adaskaveg
- When DSV accumulates 10-12 units, apply fungicide.
- *Alternaria* sp. resistance to strobilurins, succinate dehydrogenase inhibitor (FRAC group 7 and 11) was detected.
  - The recommendation is not to use fungicides that belong to these groups in such orchards.

Mean temperature (F) during wetness	Leaf wetness duration (hours)				
59-63	0–6	7–15	16–20	21	-
63–68	0–3	4–8	9–15	16–22	23+
68–77	0–2	3–5	6–12	13–20	21+
77–82	0–3	4–8	9–15	16–20	23+
DSV	0	1	2	3	4

Day	Hours of Leaf wetness	Average temperatureduring leaf wetness (°F)	Daily DSV	7 Day DSV accumulation
1	8	55	0	0
2	10	61	1	1
3	10	64	2	3
4	2	65	0	3
5	10	62	1	4
6	11	63	1	5
7	12	58	0	5
8	12	57	0	4
9	12	60	1	5

Source: Franz Niederholzer. 2014. Alternaria season starts in the Sacramento Valley. The almond doctor blog

Resistance as a tool to manage diseases

- Genetic resistance is the best control option when available.

- Rootknot nematodes (RKN) :
- Lovel is susceptible to RKN
- Nemaguard, almond-Nemaguard hybrids (Hansen 536, Nickels, Cornerstone, Bright's and Titan), Viking, Krymsk 86, Atlas, Cadaman, are immune/resistant

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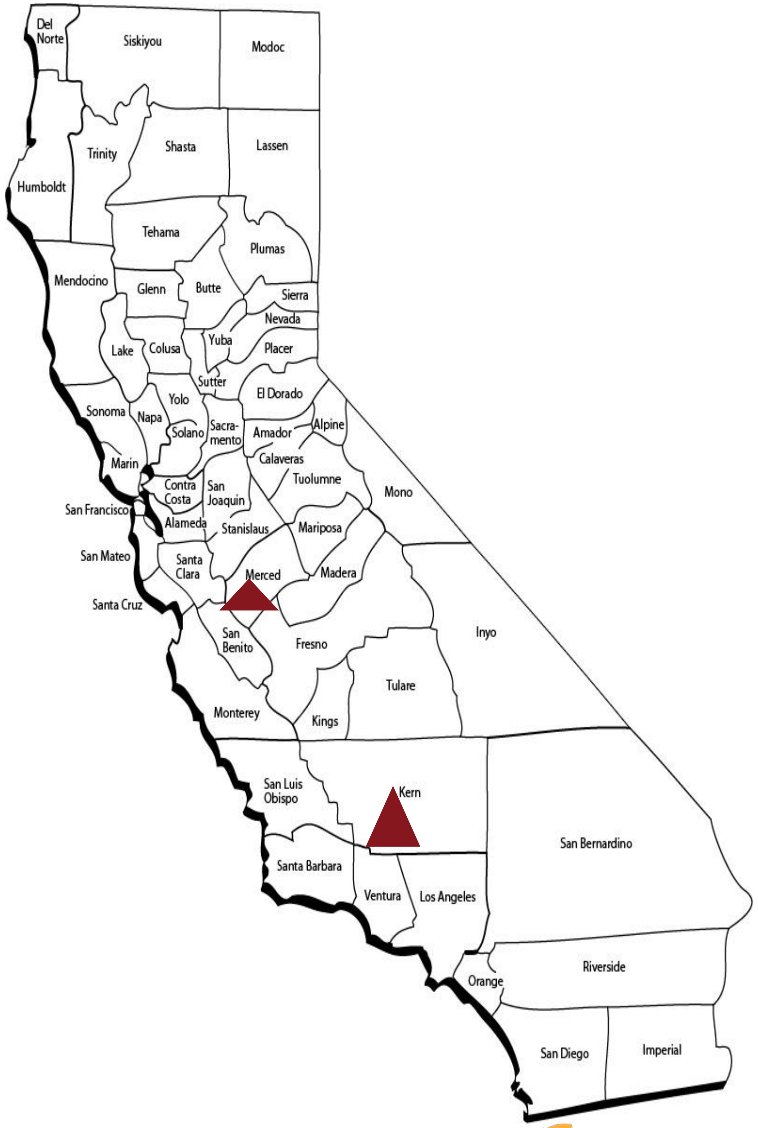
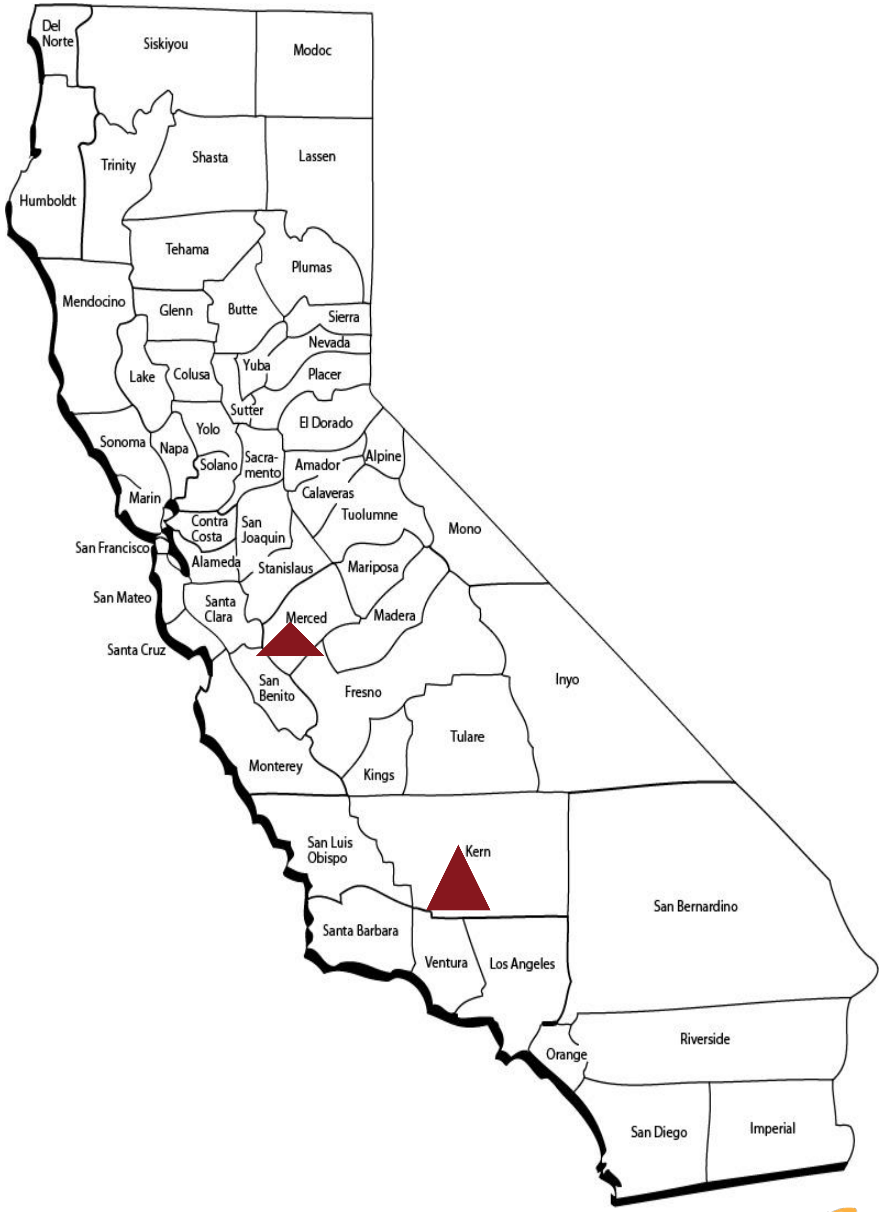
Peach Root knot Nematodes *(Meloidogyne floridensis)*

- Detected on Hansen and Nemaguard rootstocks in Merced County and found on Bright's Hybrid 5 in Kern County.
- The orchard in Kern County is a 3rd leaf planted in a sandy soil, and the infested trees appear stunted.
- *Meloidogyne floridensis* is "quarantine actionable" (regulatory issue) .



Possible Management Options

✓ Proper nematode ID (Diagnostics are very important)
- What is the distribution of this nematode in California?
- Eradication?
- Cultural and chemical control?
- Resistant rootstocks:
  – Flordagaurd (Good resistance)
  – Breeding and evaluation of different rootstocks under California conditions



Final Thoughts on Disease Management

- Before planting
  - Proper site selection
  - Proper rootstock selection
  - Soil preparation
  - Proper irrigation design
  - Sampling for nematodes
  - Fumigation or other alternatives (ASD)
- After planting
  - Identify the causal agent
  - Understand disease biology and epidemiology
  - Use Integrated Pest Management measures to protect the trees and reduce the effect of disease on tree health and productivity (site specific).
- Chemical control is only one tool among others

Thank You!

mayaghmour@ucanr.edu

661-646-6211

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Thank you!

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