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Pest Management Update

Bob Curtis, ABC (Moderator)

David Haviland, UCCE, Kern County

Kris Tollerup, UCCE IPM Advisor

Emily Symmes, UCCE IPM Advisor

Brad Hanson, UC Davis

Jim Adaskaveg, UC Riverside

David Haviland
UCCE, Kern County

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Pest Management Update and Sampling: Insects, Weeds and Diseases

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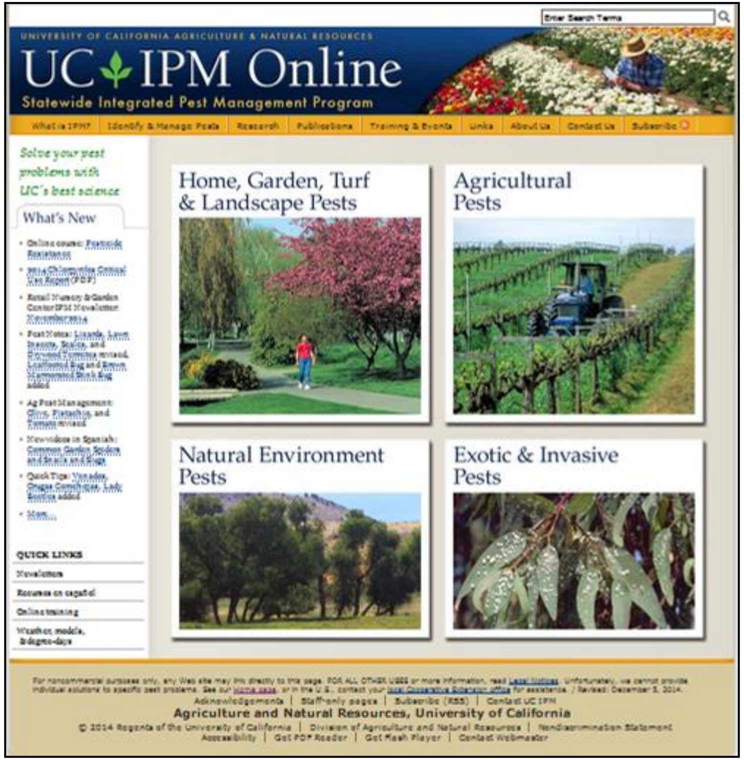
Integrated Pest Management in Almonds

- Information is readily available
  - UC Statewide IPM program, Farm Advisors, Almond Board
- The toolbox has never been so full
  - Sampling methods
  - Pheromone traps
  - Economic injury levels
  - Cultural controls
  - Biological controls
- When insecticides are needed
  - Numerous insecticides representing many modes of action
  - Multiple options available for nearly all situations
  - Mating disruption



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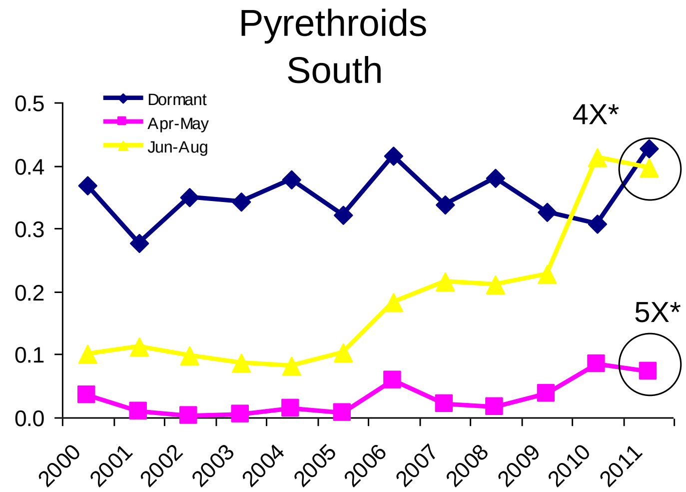
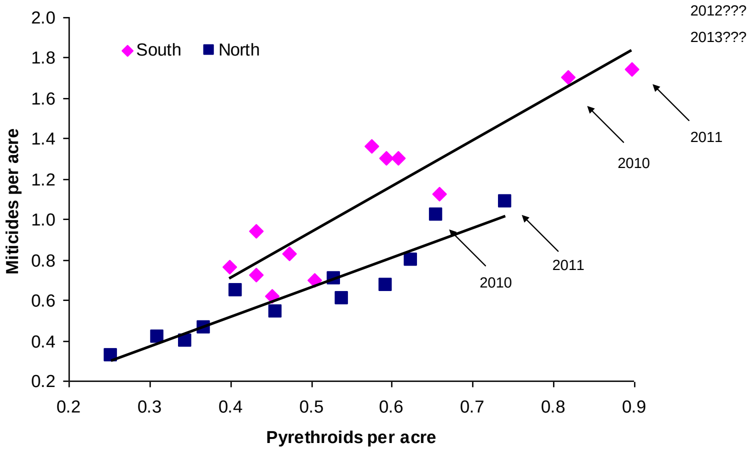
Pesticide Use Trends- Insecticides

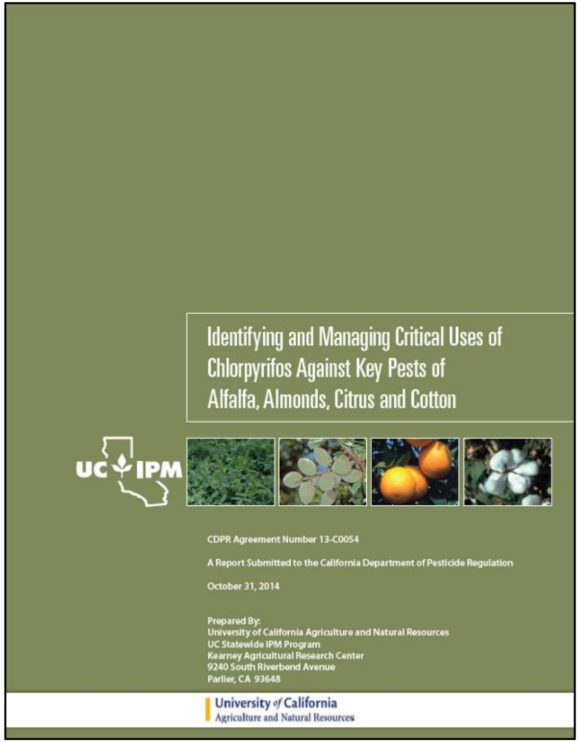
- Increasing annually due to increased acreage
- Increasing annually on a per acre basis
- Cotton is no longer king… almonds are
  - This puts a target on the back of the industry
- Pesticide use needs to be based on sampling and thresholds when other control options are exhausted





Chlorpyrifos Use in Almonds

- Functionally it is the last broad spectrum insecticide available to almond growers that is not an pyrethroid
- Off-site movement is a concern
  - Dormant treatments and water
  - Found in regional monitoring efforts
  - High emitter of VOCs
- DPR under pressure to restrict use
- Critical Uses Plan was developed (ABC/University/DPR)
  - Collaborative effort by ABC, Univ. of California, and CDPR
  - Goal of identifying prudent uses
  - Goal to maintain availability
- Chlorpyrifos now a restricted material
  - Has to be on permit, requires PCA recommendation, requires NOI
- Proposed air quality regulations
  - Low-VOC formulation required after May 1



Crop Team Leaders- Bob Curtis, Gabriele Ludwig

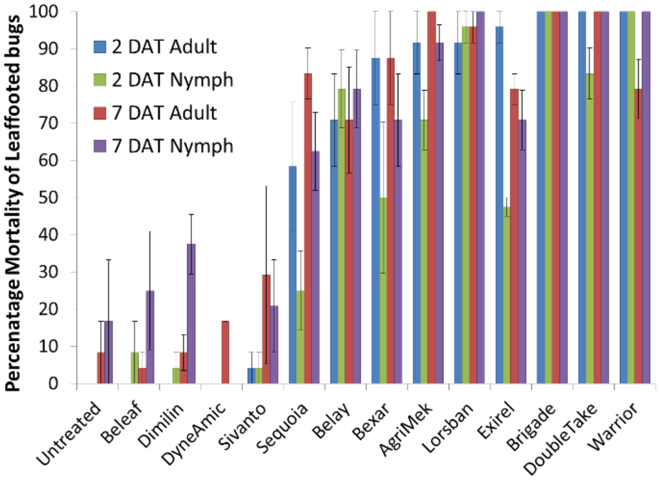
Members- Art Bowman, Mike Strmiska, David Haviland, Brad Higbee, Rob Kiss, Mel Machado, Jay Payne, Kris Tollerup, Danielle Veenstra

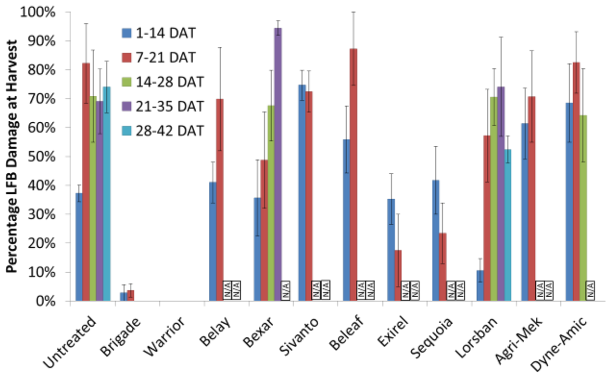
Leaffooted bug update

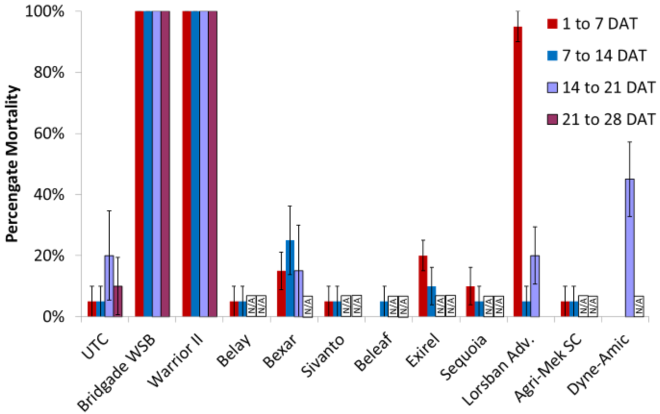
- WARNING: Leaffooted bug populations in the southern San Joaquin Valley are at all-time highs
  - LFB completed an extra generation this year
  - Populations are comparable or higher than fall 2005
- Appropriate winter response
  - If you find an aggregation, don't kill it. Monitor it
  - Watch weather. A good freeze could solve all potential problems
  - A mild winter could lead to a repeat of 2006
- Spring treatments should be based on monitoring (avoid overreacting)
  - Primary concern is March to May
  - Bugs in trees- pole sampling
  - Gummosis on nuts
  - Nut drop

Insecticides for leaffooted bug

- Lorsban- industry standard
  - Excellent on contact, residual of 1 week
- Pyrethroids- Brigade and Warrior II
  - Excellent on contact, residual of 4+ weeks
- Abamectin- Agri-mek and others
  - Excellent on contact, no residual activity
- Belay, Bexar, Sivanto, Beleaf, Exirel, Sequoia
  - Some contact activity, no residual activity







Proposed air quality regulations

Pesticides make up about 6% of VOC emissions

- Biggest almond contributions are Brigade, Agri-Mek, Fujimite, Lorsban, Onager, Goal

Use restrictions apply to:

- High-VOC products containing abamectin, chlorpyrifos, gibberellins, or oxyfluorfen
- SJV between May 1 and October 31
- To alfalfa, almonds, citrus, cotton, grapes, pistachios, or walnuts.

Almond grower adaptation to new regulations

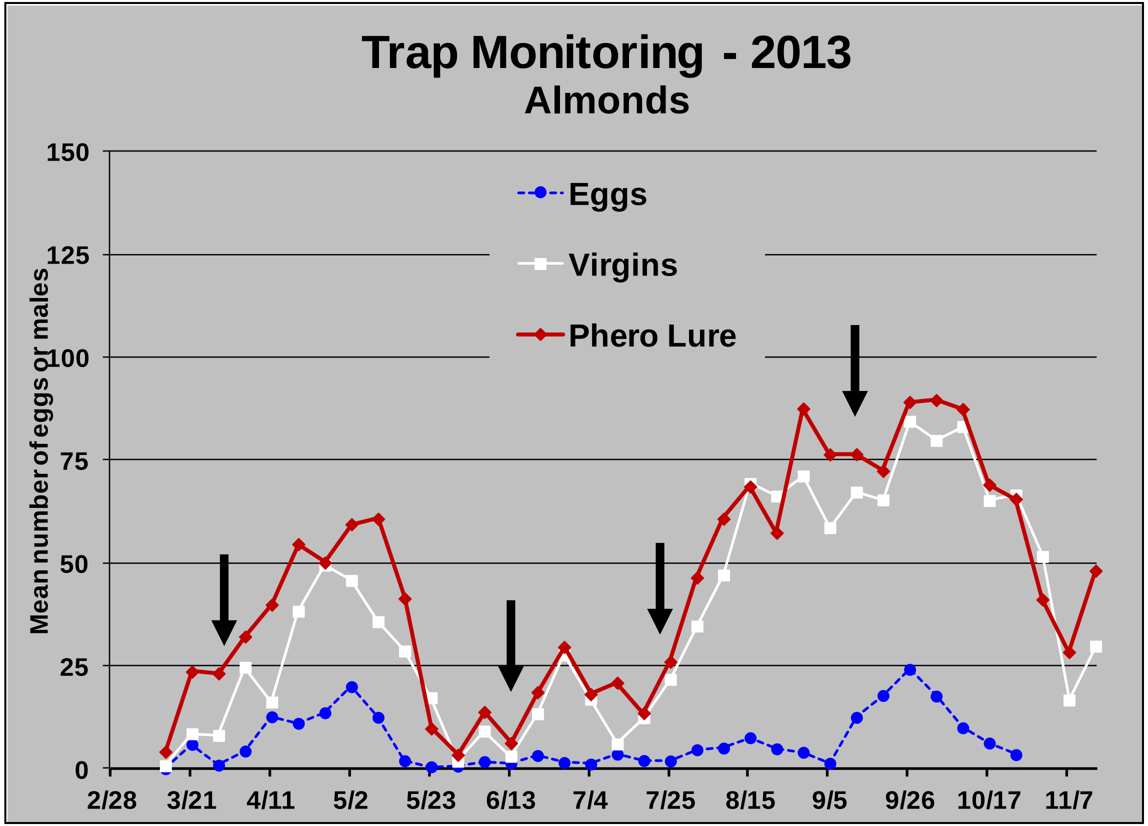
- Switch to low-VOC abamectin and chlorpyrifos
  - Agri-Mek SC and Lorsban Advanced are excellent
- Voluntarily minimize use of high-VOC bifenthrin, fenpyroximate, hexythiazox
  - efficacy of low-VOC formulations debatable

Navel orangeworm trapping and management

- Options improving each year
- Mating disruption more practical
- Egg traps still available
- Pheromone trap knowledge increases annually
- Reasons for trapping
  - Improved application timing
  - Treatment thresholds
  - Evaluate insecticide efficacy
  - Confirm trap shutdown in Mating Disruption blocks
  - Determine moth sources (internal or external)
  - Compare pest density across seasons

NOW traps

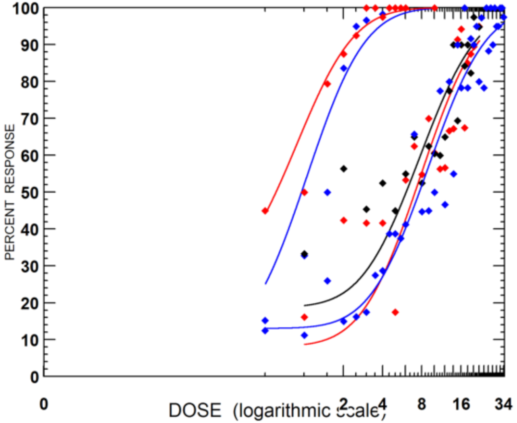
- Egg traps still valuable
  - Degree-day models are still based on egg traps
- Pheromone traps are available
  - Use in thresholds not established
  - May provide assistance with treatment timing
  - Better resolution than egg traps in $2^{nd}/3^{rd}$ flights
  - Creative uses
    - Residual effects of insecticides that kill adults
    - Document shut-down in mating disruption orchards



Source: Brad Higbee, Paramount Farming Company

NOW Pyrethroid Resistance

B. Higbee, Paramount Farming Co.



RF=Resistance factor = LC_{50} of field strain/LC_{50} of USDA strain

Bifenthrin is evaluated as a surrogate for all pyrethroids (Brigade, other bifenthrin products, Danitol, Warrior II, Voliam XPress, Pounce, Ambush, other permethrins)

48 hr mortality tables

	Low or no bifenthrin					High bifenthrin			
	LC50		RF			LC50		RF	
Year	**Male**	**Female**	**Male**	**Female**	**Year**	**Male**	**Female**	**Male**	**Female**
2009	**0.7**	**0.5**	**1.3**	**0.8**	**2009**	**0.3**	**0.5**	**0.6**	**0.8**
2010	**2.1**	**2.1**	**2**	**2**	**2010**	**1.35**	**1.8**	**1.3**	**1.65**
2011	**1**	**1.1**	**0.7**	**0.75**	**2011**	**1.7**	**2.1**	**1.2**	**1.5**
2012	**1.8**	**2.35**	**2.4**	**3.5**	**2012**	**2.4**	**2.5**	**3.1**	**3.8**
2013	**5.4/5.3**	**6.6/6.1**	**4.0/3.9**	**4.8/4.5**	**2013**	**7.9**	**8.8**	**5.8**	**6.5**
2014	**6.3/7.2**	**6.4/7.9**	**6.4/7.3**	**7.8/9.6**	**2014**	**10.6-13.8**	**10-13.9**	**10.8-14**	**12.1-17**

RF=Resistance factor = LC_{50} of field strain/LC_{50} of USDA strain

Monitoring for spider mites

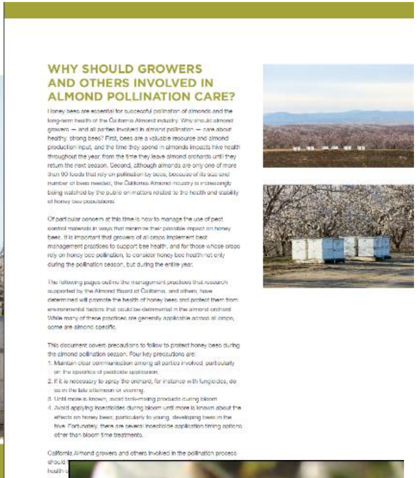
- Tolerate low mite population early in the season
- Biological control organisms get established
- Monitor mite densities (presence/absence on leaves)
- If less than 1/3 of leaves are infested, do not treat, mites will increase slowly and biocontrol can keep up
- If more than 1/3 of leaves are infested, mite growth turns geometric and biocontrol cannot keep up, treat with a miticide that kills mites but maintains biocontrol organisms
- Miticide controls most of the mites, predators eat up any mites that survive
- Predator/prey ratios typically remain balanced for the rest of the season

Southern SJV experience of PCAs using monitoring and thresholds

- Spring 2013- Lots of mites and few beneficial organisms suggested that an aggressive approach to mite management was needed to prevent defoliation. Multiple miticide applications were made
- Summer 2013- Lack of mites and presence of beneficials led many growers to skip mite sprays at hull split
- Late winter 2014- Many growers concerned about mites again in 2014, especially due to dry winter, early heat, and tree stress from lack of irrigation
- Spring 2014- Monitoring showed elevated biological control, no need to treat
- Summer 2014- PCAs using monitoring and thresholds averaged one miticide application for the season

Pollinator safety

- Almond growers rely on bees for production
- Protection of bees during bloom has always been a priority of almond growers
- Pesticide labels include specific guidelines related to bee safety and must be followed
- On rare occasions, insecticides used legally at bloom in combination with fungicides have resulted in reduced brood health
- The ABC and Univ. of CA have revised PTB guidelines to recommend that management, if needed, be done in the dormant season or during ‘May sprays’



Kris Tollerup
UCCE IPM Advisor

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Sampling: The “How” for Navel Orangeworm and Leaffooted Bug

Kris Tollerup, University of California Cooperative Extension Advisor, IPM, Kearney Agricultural Research and Extension Center

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Sampling: The How for Navel Orangeworm

- Egg traps constructed from modified 50-dram vial filled 50% with almond meal plus 10% wt/wt crude almond oil. HOWEVER, food-grade almond meal works well.
  - Begin 1st week of April.
  - One trap / 10 acres or minimum of 4 / orchard.
    - Divide large acreage into sprayable blocks.
  - Hang traps at head-height
    - North side of tree (non-Pareil) & 1 to 3 ft inside canopy.
    - Avoid water hazard.
  - Check 2x / week until biofix
    - First of two consecutive dates on which eggs increase on 75% of traps.

Sampling: The How for Navel Orangeworm

- Continue monitoring traps, remove eggs as you continue.
- Replace bait each 4 weeks.
- Eggs are flat, laid primarily on ridges of trap
  - Eggs white when first laid then turn orange-red prior to hatching.
- Graph egg numbers on monitoring form provided by UC Pest Guidelines (http://www.ipm.ucanr.edu/PMG/C003/almond-orngwrmeggtrap.pdf.)
  - Biofix: Begin accumulation of degree-days.
  - Data provides information when new generation begins egg-laying.
  - Use data to verify degree-day calculation.

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Sampling: The How for Navel Orangeworm

- Pheromone traps: Delta or white wing sticky trap baited with female synthetic sex pheromone.
- Hang in orchard mid-March
  - Use in conjunction with egg traps.
- Hang in tree at approximately head height.
- Count moths at least once per week.
- Change lure ~ 4 to 6 weeks.
- Change sticky card when “saturated”.
- Careful not to confuse meal moth for NOW.
- **Understanding of male NOW capture in progress**

Sampling: The How for Leaffooted Bug

Sampling: The How for Leaffooted Bug

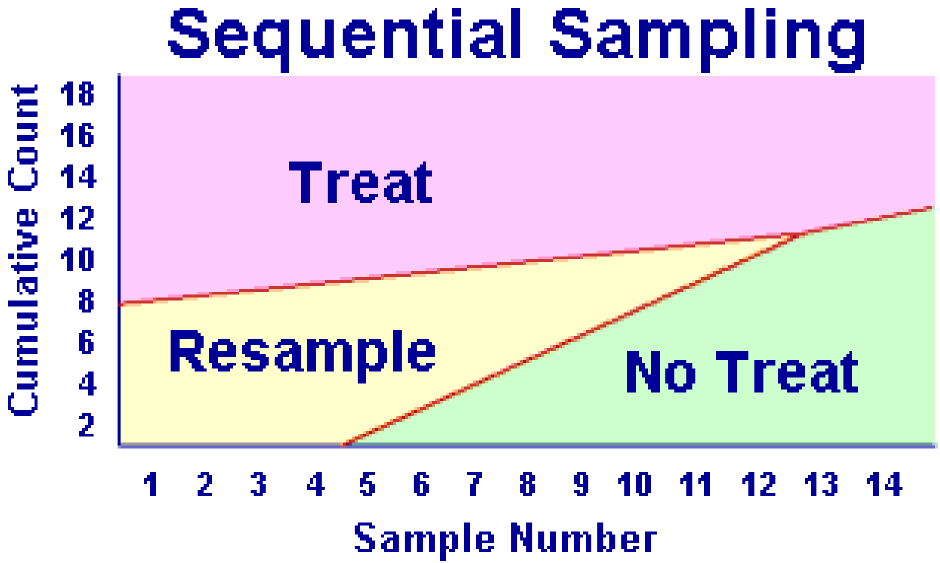
- Beat trays
  - Easy to detect species in canopy.
  - Immediate information.
- Poles
  - 8-ft pole used to strike upper limbs
    - Count the number of LFB which fly.
- Damaged nuts, in tree and on ground
  - Indicates presences of LFB.
  - Can estimate percentage of damage nuts.
  - Confirm damage by cutting across damage area.
- Critical period to sample
  - March and April.
- Overwintering aggregations.

Sampling: The How for Leaffooted Bug

- Limiting issues
  - No economic injury level.
    - Small population can cause substantial damage.
  - Pheromone not yet understood.
  - LFB part of large-bug complex.
    - Species change over the season.
    - Shell hardness differs; affects damage.
  - LFB is long-lived with 3 and a partial 4th generation per season.
- **Work to improve sampling is in progress.**

Sampling: The How for Spider Mites

- Sequential binomial sampling plan
  - Weekly, May through August.
  - Prior to July, focus on hot-spots.
  - Minimum of 5 trees/sampling area, 15 leaves/tree.
  - Examine leaves for spider mite adults, eggs, and natural enemies.
  - Note number of leaves with mites/eggs and with natural enemies.
  - Post 1 July, monitor whole orchard
    - Separate orchard into units that can be sprayed separately.



Sampling: The How for Spider Mites

					Predators absent		predators present	
Tree number	Total leaves sampled	No. leaves W/mites/tree	Cumulative no. leaves W/mites	No. leaves w/predatory mites/six spotted thrips	Don't treat (if total leavs w/mites is)	Treat (if total leavs w/mites is)	Don't treat (if total leavs w/mites is)	Treat (if total leavs w/mites is)
1	15	5	5	0				
2	30	2	7	0				
3	45	5	12	0				
4	60	5	17	0				
5	75	11	28	0	≤27	≥40	≤12	≥24
6	90	10	38	0	≤33	≥48	≤15	≥28
7	105	7	45	0	≤39	≥55	≤18	≥31
8	120	12	57	0	≤45	≥62	≤21	≥35
9	135	11	68	0	≤51	≥69	≤23	≥43
10	150	15	83	0	≤57	≥76	≤26	≥46

Emily Symmes
UCCE IPM Advisor

Pest Management Update & Sampling:

Peach Twig Borer and San Jose Scale

Emily J. Symmes, PhD
Area IPM Advisor, Sacramento Valley
University of California Cooperative Extension
University of California Statewide IPM Program

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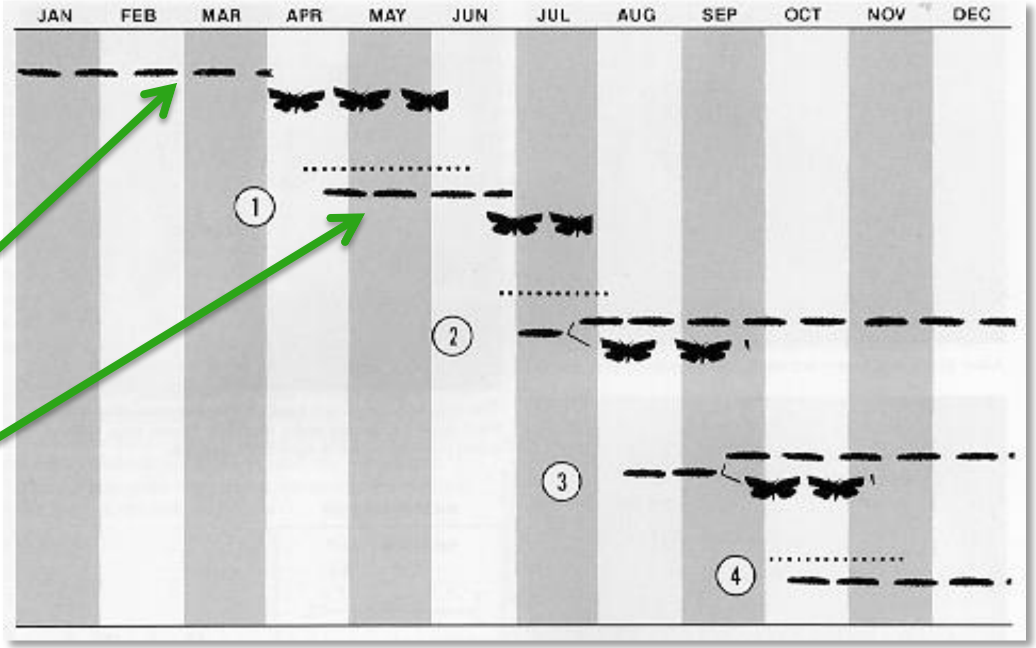
Peach Twig Borer

<u>Treatment Options</u>:

Dormant treatment

Bloom Bt treatment

Spring treatment



PTB Bloom Monitoring – Hibernacula

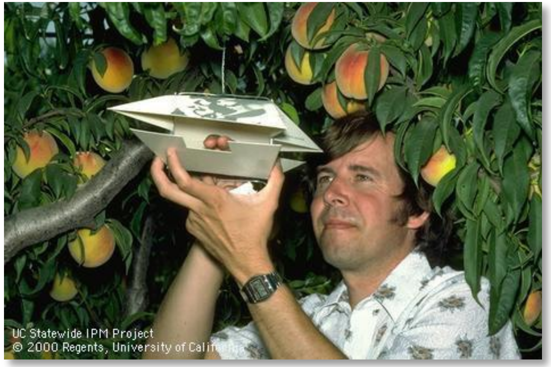
- Weekly beginning at popcorn stage
- Examine 10 hibernacula per orchard
  - Limb crotches or bark cracks, especially 2-3 year old wood
  - Cut small wedges of bark around hibernacula
  - Pinch bark to open hibernacula looking for presence of larva
- Bt treatments for moderate to high PTB populations
  - 20-40% larval emergence
  - 7-10 days later or 80-100% larval emergence
  - Third possible at 80-100% if emergence is spread out

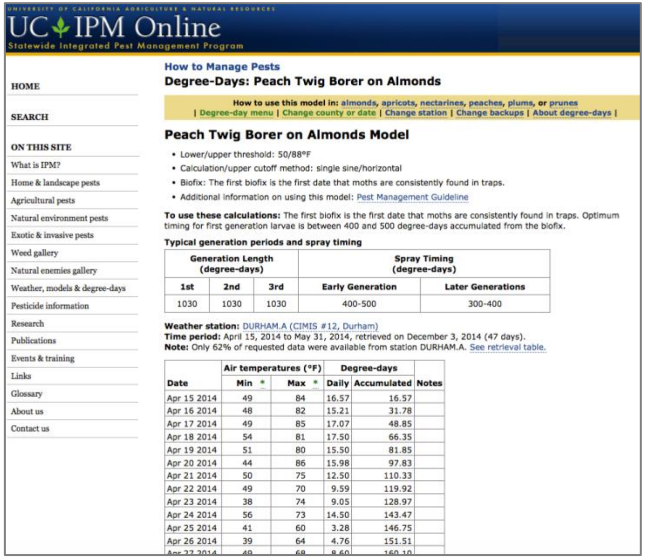
PTB Spring Monitoring – Shoot Strikes

- Weekly beginning mid April
- Walk through orchard and cut down any shoot strikes
- Slice into shoot strikes to determine PTB or OFM
- Threshold
  - 4 or more shoot strikes per tree in mature orchard

PTB – Spring Monitoring for Treatment Timing

- Pheromone traps
- Hang by March 20 (south) and April 1 (north)
- 1 trap/20 acres, minimum 2/orchard
  - Uniform
  - Additional traps in hot spots
  - Shade
  - 6-8 ft high
  - 1-3 ft inside canopy
  - North tree quadrant
  - Minimum 5 trees from edge
- Check 2x/week until biofix
  - First date moths are consistently caught
- If shoot strike monitoring indicates treatment, begin accumulating DD and treat accordingly depending on material

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How to Manage Pests
Degree-Days: Peach Twig Borer on Almonds

How to use this model in: almonds, apricots, nectarines, peaches, plums, or prunes
| Degree-day menu | Change county or date | Change station | Change backups | About degree-days |

Peach Twig Borer on Almonds Model

- Lower/upper threshold: 50/88°F
- Calculation/upper cutoff method: single sine/horizontal
- Biofix: The first biofix is the first date that moths are consistently found in traps.
- Additional information on using this model: Pest Management Guideline

To use these calculations: The first biofix is the first date that moths are consistently found in traps. Optimum timing for first generation larvae is between 400 and 500 degree-days accumulated from the biofix.

Typical generation periods and spray timing

Generation Length (degree-days)			Spray Timing (degree-days)	
1st	2nd	3rd	Early Generation	Later Generations
1030	1030	1030	400-500	300-400

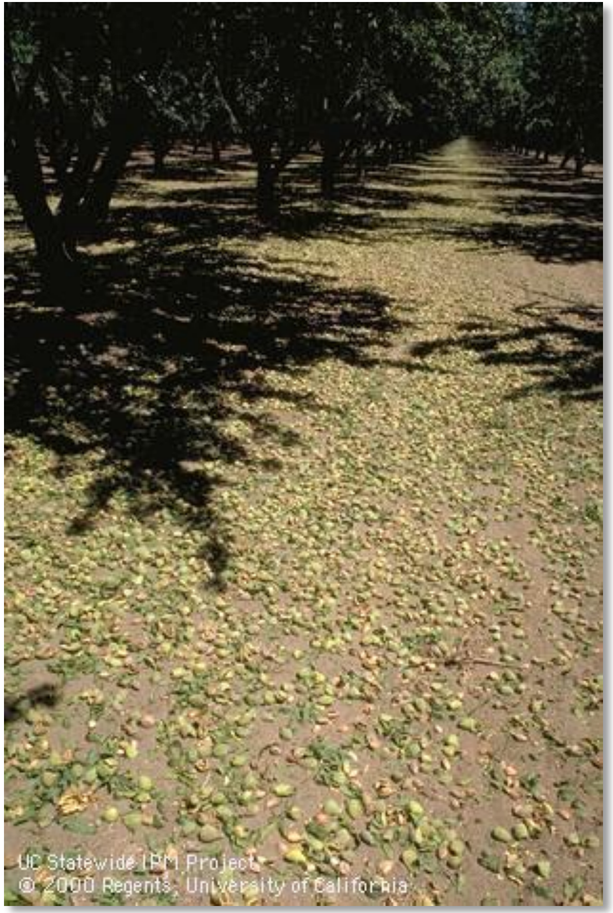
Weather station: DURHAM.A (CIMIS #12, Durham)
Time period: April 15, 2014 to May 31, 2014, retrieved on December 3, 2014 (47 days).
Note: Only 62% of requested data were available from station DURHAM.A. See retrieval table.

Date	Air temperatures (°F)		Degree-days		Notes
	Min *	Max *	Daily	Accumulated	
Apr 15 2014	49	84	16.57	16.57	
Apr 16 2014	48	82	15.21	31.78	
Apr 17 2014	49	85	17.07	48.85	
Apr 18 2014	54	81	17.50	66.35	
Apr 19 2014	51	80	15.50	81.85	
Apr 20 2014	44	86	15.98	97.83	
Apr 21 2014	50	75	12.50	110.33	
Apr 22 2014	49	70	9.59	119.92	
Apr 23 2014	38	74	9.05	128.97	
Apr 24 2014	56	73	14.50	143.47	
Apr 25 2014	41	60	3.28	146.75	
Apr 26 2014	39	64	4.76	151.51	

PTB – Harvest Samples

- Establish orchard history to help inform treatment decisions
- Check efficacy of management program

- Collect & crack out 500 nuts per block
- Identify pest infestation



PTB – Harvest Samples




	PTB	OFM	NOW	ANT
Kernel	Shallow channels & surface groove on kernels	Shallow channels & surface groove on kernels	Deep chewing in nut	Scraping or peeling of kernel skin, deep hollowing of nut, “sawdust” present
Frass	None	Reddish brown; very little	White; often a lot	No
Webbing	No	No	Yes	No
Boring	No	No	Yes	Hollowing

San Jose Scale – Dormant Spur Sampling

- 1X/year
- 35-50 trees (random) per orchard or plot
- 100 spurs total
  - 2-3 spurs (random) from inside of each tree canopy near main scaffold
- Clip spur off at base
  - Include old spur wood along with past season's growth
- Sequential sample
- Examine 20 spurs at a time
  - Count live SJS
  - Note level of parasitization

SJS black cap stage

Parasitized SJS

SJS – Dormant Spur Sampling Thresholds

# of Spurs	# of SJS infested spurs (not parasitized)
20	0: Stop sampling – no treatment necessary 1-3: Examine 20 more spurs ≥ 4: Stop sampling – treatment recommended
40	1: Stop sampling – no treatment necessary 2-5: Examine 20 more spurs ≥ 6: Stop sampling – treatment recommended
60	≤ 3: Stop sampling – no treatment necessary 4-7: Examine 20 more spurs ≥ 8: Stop sampling – treatment recommended
80	≤ 5: Stop sampling – no treatment necessary 6-8: Examine 20 more spurs ≥ 9: Stop sampling – treatment recommended
100	< 10: No treatment necessary ≥ 10: Treatment recommended

SJS – Dormant Spur Sampling Form

www.ipm.ucdavis.edu

Almonds—Dormant Spur Sampling

Supplement to UC IPM Pest Management Guidelines: Example Form

Directions:

1. To monitor for San Jose scale (SJS), European fruit lecanium (EFL), and mites, clip off 2 to 3 spurs randomly from each of 35 to 50 trees in the orchard, for a total of 100 spurs.
2. Using a hand lens or microscope, examine spurs for scales and mite eggs.
3. On the form below, note presence or absence of each pest on each spur for the first 20 spurs. Add up totals after every 20 spurs (including previous samples) and compare to treatment decision guidelines below. Continue as needed using page 2.

Grower/Orchard:_______________________________ **Date**______________________

Spur number	Live SJS	Parasitized SJS	EFL	Mite eggs
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
Total				
Treatment threshold	4 or more	Information only	4 or more	

Treatment decisions:

- If either SJS- or EFL- infested spurs are less than 4 but more than 0, examine another 20 spurs and record on chart to the right.
- If 4 or more unparasitized scales of one species are found, treat.
- If no samples with scale are found, stop sampling.
- Treat for mites if 20% or more spurs are infested.

Spur number	Live SJS	Parasitized SJS	EFL	Mite eggs
Totals from prior sample				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
Total				
Treatment threshold	8 or more	Information only	6 or more	

Treatment decisions:

- If grand total of SJS- or EFL-infested spurs is less than 6 but more than 1, look at another 20 spurs and record on the chart to the right.
- If 6 or higher, stop sampling and treat.
- If 1, stop sampling.
- Treat for mites if 20% or more spurs are infested.

Spur number	Live SJS	Parasitized SJS	EFL	Mite eggs
Totals from prior sample				
41				
42				
43				
44				
45				
46				
47				
48				
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				
Total				
Treatment threshold	12 or more	Information only	8 or more	

Treatment decisions:

- If grand total of SJS- or EFL-infested spurs is less than 8 but more than 3, look at another 20 spurs and record on the chart on page 2.
- If 8 or higher, stop sampling and treat.
- If 3 or less, stop sampling.
- Treat for mites if 20% or more spurs are infested.

(rev. 23 March 2009) Print copies of this form at www.ipm.ucdavis.edu/FORMS/ *Produced by the UC Statewide IPM Program*

Grower/Orchard___________________________________ **Date**____________________

Almond—Dormant Spur Sampling (continued)

Spur number	Live SJS	Parasitized SJS	EFL	Mite eggs
Totals from prior sample				
61				
62				
63				
64				
65				
26				
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
Total				
Treatment threshold	16 or more	Information only	9 or more	

Treatment decisions:

- If grand total of either SJS- or EFL-infested spurs is less than 9 but more than 5, look at another 20 spurs and record on chart to the right.
- If 9 or higher, stop sampling and treat.
- If 5 or less, stop sampling.
- Treat for mites if 20% or more spurs are infested.

Spur number	Live SJS	Parasitized SJS	EFL	Mite eggs
Totals from prior sample				
81				
82				
83				
84				
85				
86				
87				
88				
89				
90				
91				
92				
93				
94				
95				
96				
97				
98				
99				
100				
Total				
Treatment threshold	20 or more	Information only	10 or more	

Treatment decisions:

- If grand total of either SJS- or EFL-infested spurs is 10 or more, treat.
- If less than 10, no treatment is recommended.
- Treat for mites if 20% or more spurs are infested.

(rev.23 March 2009) Print copies of this form at www.ipm.ucdavis.edu/FORMS/ *Produced by the UC Statewide IPM Program*

SJS – Spring Monitoring for Treatment Timing

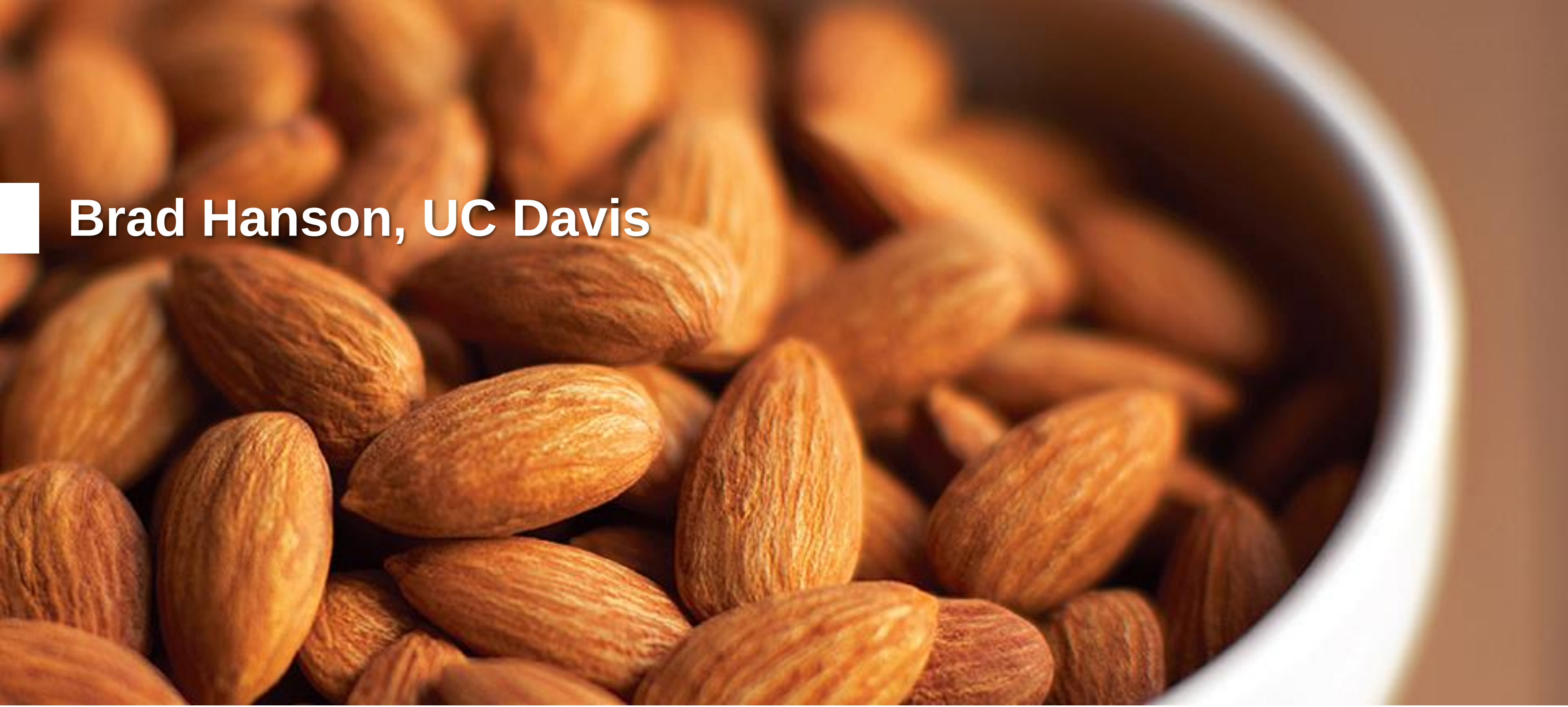
- Pheromone traps
  - Detect male emergence
  - Detect presence of parasitoids
- 3-4 traps/block
- Hang by February 25 (south) & March 15 (north)
  - Uniform
  - Additional traps in hot spots
  - Shade
  - 6-7 ft high
  - North or east tree quadrant
  - Minimum 5 trees from edge
- Check 2X/week until biofix
  - First date males are consistently caught
- If spur samples indicated treatment, begin accumulating DD and treat accordingly depending on material

SJS – Spring Monitoring for Treatment Timing

- Sticky tape
  - Monitor crawler emergence to time treatments if warranted
- Wrap clear plastic tape around scaffold limbs
- If spur samples indicated treatment, begin accumulating DD and treat accordingly depending on material

Thank you & Questions?

Brad Hanson, UC Davis



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Pest Management Update - Weeds

Brad Hanson

UC Davis Weed Science Program

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T&V weed science team

- Brad Hanson – Weed Extension Specialist
  - Chemical weed control, herbicide resistance, herbicide fate
- Lynn Sosnoskie - Project Scientist
  - Weed biology, ecology and resistance management
- Bahar Kutman – Postdoctoral Researcher
  - Glyphosate and micronutrient interactions
- Sarah Morran– Postdoctoral Researcher
  - Genetics and physiology of glyphosate resistance
- Seth Watkins – Staff Research Associate
  - Orchard and vineyard herbicide efficacy and crop safety evaluations
- Marcelo Moretti - PhD Student
  - Mechanisms of resistance in glyphosate- and paraquat-resistant Conyza
- Caio Brunharo – PhD Student
  - Glyphosate and glufosinate resistance in ryegrass
- Mariano Galla – PhD Student
  - Herbicide drift injury on walnut and other crops

Weed challenges in T&V

- Old favorites:
  - Normal mix of annual grasses and broadleaves
  - Challenge with perennial weeds, especially in new orchards or crops with fewer herbicide options
- New weed problems
  - Most of the “new” issues seem to be related to glyphosate resistance and/or shifting populations to tolerant species
- Changing control options
  - Less tillage, some new herbicides,
    water quantity-quality-delivery issues

Confirmed glyphosate resistance

(grouped by genus)	USA	CA	WA	OR
Palmer amaranth and com. waterhemp	✓ ✓	✚		
Giant and common ragweed	✓ ✓			
Australian fingergrass				
Hairy fleabane and horseweed	✓ ✓	✓ ✓		
Sourgrass				
Junglerice	✓	✓		
Goosegrass		✚		
Wild poinsettia				
Italian and rigid ryegrass	✓ ✓	✓ ✓		✓
Ragweed parthenium				
Annual bluegrass	✓	✓		
Buckhorn plantain				
Johnsongrass	✓			
Liverseedgrass				

Current T&V herbicide registration status

Herbicide Registration on California Tree and Vine Crops -*(updated February 2014 - UC Weed Science)*

	Herbicide-Common Name *(example trade name)*	Site of Action Group[1]	Almond	Pecan	Pistachio	Walnut	Apple	Pear	Apricot	Cherry	Nectarine	Peach	Plum / Prune	Avocado	Citrus	Date	Fig	Grape	Kiwi	Olive	Pomegranate
			----- tree nut -------				- pome -		---------stone fruit ---------												
Preemergence	dichlobenil *(Casoron)*	L / 20	N	N	N	N	R	R	N	R	N	N	N	N	N	N	N	R	N	N	N
Preemergence	diuron *(Karmex, Diurex)*	C2 / 7	N	R	N	R	R	R	N	N	N	R	N	N	R	N	N	R	N	R	N
Preemergence	EPTC *(Eptam)*	N / 8	R	N	N	R	N	N	N	N	N	N	N	N	R	N	N	N	N	N	N
Preemergence	flazasulfuron *(Mission)*	B / 2	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	R	N	N	N
Preemergence	flumioxazin *(Chateau)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	NB	NB	N	NB	R	N	R	R
Preemergence	indaziflam *(Alion)*	L / 29	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	N
Preemergence	isoxaben *(Trellis)*	L / 21	R	R	R	R	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	NB	R	NB	NB	NB
Preemergence	napropamide *(Devrinol)*	K3 / 15	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	R	R	N	N
Preemergence	norflurazon *(Solicam)*	F1 / 12	R	R	N	R	R	R	R	R	R	R	R	R	R	N	N	R	N	N	N
Preemergence	oryzalin *(Surflan)*	K1 / 3	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R
Preemergence	oxyfluorfen *(Goal, GoalTender)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	R	NB	R	R	R	R	R	R
Preemergence	pendimethalin *(Prowl H2O)*	K1 / 3	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	R	R
Preemergence	penoxsulam *(Pindar GT)*	B / 2	R	R	R	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Preemergence	pronamide *(Kerb)*	K1 / 3	N	N	N	N	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N
Preemergence	rimsulfuron *(Matrix)*	B / 2	R	R	R	R	R	R	R	R	R	R	R	N	R	N	N	R	N	N	N
Preemergence	sulfentrazone *(Zeus)*	E / 14	N	N	R	R	N	N	N	N	N	N	N	N	R	N	N	R	N	N	N
Preemergence	simazine *(Princep, Caliber 90)*	C1 / 5	R	R	N	R	R	R	N	R[+]	R	R	N	R	R	N	N	R	N	R	N
Postemergence	carfentrazone *(Shark)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Postemergence	clethodim *(SelectMax)*	A / 1	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	N	R	N	N	NB	N	NB	N
Postemergence	clove oil *(Matratec)*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Postemergence	2,4-D *(Clean-crop, Orchard Master)*	O / 4	R	R	R	R	R	R	R	R	R	R	R	N	N	N	N	R	N	N	N
Postemergence	diquat *(Diquat)*	D / 22	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB	NB
Postemergence	d-limonene *(GreenMatch)*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	N	R	N	R	R	R	N	N
Postemergence	fluazifop-p-butyl *(Fusilade)*	A / 1	NB	R	NB	NB	NB	NB	R	R	R	R	R	NB	R	NB	NB	R	N	NB	NB
Postemergence	glyphosate *(Roundup)*	G / 9	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Postemergence	glufosinate *(Rely 280)*	H / 10	R	R	R	R	R	N	N	N	N	N	N	N	N	N	N	R	N	N	N
Postemergence	halosulfuron *(Sandea)*	B / 2	N	R	R	R	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Postemergence	paraquat *(Gramoxone)*	D / 22	R	R	R	R	R	R	R	R	R	R	R	R	R	N	R	R	R	R	R
Postemergence	pelargonic acid *(Scythe)*	NC[3]	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	N
Postemergence	pyraflufen *(Venue)*	E / 14	R	R	R	R	R	R	R	R	R	R	R	N	N	R	R	R	R	R	R
Postemergence	saflufenacil *(Treevix)*	E / 14	R	N	R	R	R	R	N	N	N	N	N	N	R	N	N	N	N	N	N
Postemergence	sethoxydim *(Poast)*	A / 1	R	R	R	R	R	R	R	R	R	R	NB	NB	R	NB	NB	R	N	NB	NB

New glufosinate herbicides

- Glufosinate herbicides
  - Have be short in recent years, now off-patent
- Rely 280, Reckon 280, Glufosinate 280SL, Forfeit 280, Refer 280SL, Lifeline, (Cheetah – pending DPR)
  - Mostly same registrations as Rely 280 – minor exceptions due to differences between master/package label
    - Similar recommendations for adjuvants/surfactant
  - Group 10 herbicide. POST activity only. Broadleaf and grass activity. Small amount of translocation.
  - In our testing, performance has been similar among brands
  - Recall that glufosinate can injury young almond trees

Alion – major label changes

- Several key changes
  - Modified use pattern in tree nuts, grape, stonefruit, pome fruit, olive
    - Citrus label not changed
  - Do not use in flood-irrigated systems
  - Age changes: almond/walnut/pistachio (1yr), grape (5yr), pome/stone/olive (3yr), citrus (1yr)
  - Soil OM rate restriction
    - <1% - max rate 3.5 fl oz/A
    - 1-3% - rate 3.5 to 5 fl oz/A (5 oz max for grape if above 1%)
    - >3% - rate 5 to 6.5 fl oz/A
  - Avoid spring applications for best performance

  - Will impact almond growers and PCAs

Important oxyfluorfen use change

- VOC regulations will affect use of Goal 2XL and similar herbicides in summer
  - Several high VOC pesticides have been under consideration for additional regulation during the summer (May-Oct) “ozone” season
  - The trigger was hit in 2014 so additional restrictions will be implemented
  - Max use rate of EC formulations of oxyfluorfen will be limited to 0.125 lb ai/A (1 pt of a 2lb product)
    - Does not affect rates Nov-April
    - Does not affect SC formulations (eg GoalTender)
  - Will impact almond growers and PCAs

In other T&V crops, may hear about:

- Sulfentrazone (Zeus)
  - Group 14 herbicide. PPO inhibitor
    - PRE and POST activity
  - Registered in early 2014 in CA
    - Grape, lemon, orange, pistachio, walnut (3 yrs or older)
  - Recommended rate 10-12 fl oz/A
  - Primarily broadleaf weed control, good suppression of nutsedge
    - Good efficacy on GR conyza in a Parlier trial
    - Suppression of nutsedge 6 MAT in an Atwater trial
  - Best as part of a integrated program
  - Not likely to be registered in almond or stonefruit any time soon

In other T&V crops, may hear about:

- Flazasulfuron (Mission)
  - Group 2 herbicide, ALS inhibitor
- CA registrations on grape (3 yrs), citrus (5 yrs)
  - PRE and POST activity
  - Rate range 2.14-2.85 oz/A. Needs NIS for POST
  - Activity on some grasses and some broadleaves. Good suppression of sedges and kyllinga
  - Not registered in CA almond, future prospects not known?

Alion rates and tankmixes

Table 4. Selected weed control evaluations from 2013-14 comparison of Alion and other preemergence tankmix partners in an almond orchard near Wasco, CA. All treatments included a high rate of Rely 280 and Roundup Powermax to ensure good control of existing weeds. (Watkins, Moretti, and Hanson)

				61 DAT-A				125 DAT-A		
				Annual bluegrass	Shepherds-purse	Hairy fleabane	Overall	Junglerice	Hairy fleabane	Overall
	Treatment	Rate		% control						
1	Untreated Check			0	0	0	0	0	0	0
2	Alion	2.5	oz/a	100	100	88	97	97	97	97
3	Alion	3.5	oz/a	100	100	88	97	98	92	92
4	Alion	5	oz/a	100	100	40	85	99	69	76
5	Chateau	10	oz wt/a	100	100	70	94	75	57	77
6	Matrix	4	oz wt/a	100	85	83	95	58	40	40
7	Pindar GT	2.5	pt/a	92	100	93	97	87	96	92
8	Goaltender	4	pt/a	99	100	100	100	98	98	97
9	Alion Chateau	5 6	oz/a oz wt/a	100	100	90	97	100	97	97
10	Alion Matrix	5 2	oz/a oz wt/a	100	100	93	98	100	100	100
11	Alion Pindar GT	5 1.5	oz/a pt/a	100	100	65	95	99	86	96
12	Alion Goaltender	5 2	oz/a pt/a	100	100	88	97	100	98	97
LSD (P=.05)				***6***	***7***	***31***	***9***	***24***	***34***	***25***

Treatments applied on January 16, 2014. All treatments included Roundup Powermax at 2 qt/A, Rely 280 at 2 qt/A, and AMS at 2 qt/100 gal spray solution.

Table 6. Selected weed control evaluations from 2013-14 comparison of Alion and other preemergence tankmix and sequential partners in an almond orchard near Escalon, CA. All treatments included a high rate of Rely 280 and Roundup Powermax to ensure good control of existing weeds. (Watkins and Hanson)

	Treatment	Rate			3 spike goose-grass	Crab-grass	Sow-thistle	Hairy fleabane	Spotted spurge	Overall	Overall	Overall
					------ 122 DAT-A				------		164 DAT	196 DAT
					------ % control							------
1	Untreated Check				0	0	0	0	0	0	0	10
2	Alion	2.5	oz/a	A	45	100	100	88	100	80	70	55
3	Alion	3.5	oz/a	A	45	100	93	100	100	86	78	68
4	Alion	5	oz/a	A	70	100	100	98	100	92	85	83
5	Chateau	10	oz wt/a	A	38	38	55	93	50	73	43	33
6	Matrix	4	oz wt/a	A	38	50	43	98	0	73	50	28
7	Pindar GT	2.5	pt/a	A	18	25	15	78	0	65	8	13
8	Goaltender	4	pt/a	A	18	45	5	45	0	55	18	18
9	Alion Chateau	5 6	oz/a oz wt/a	A	58	100	95	93	100	85	86	73
10	Alion Matrix	5 2	oz/a oz wt/a	A	59	100	100	100	100	91	89	73
11	Alion Pindar GT	5 1.5	oz/a pt/a	A	55	100	100	100	100	89	86	80
12	Alion Goaltender	5 2	oz/a pt/a	A	90	100	98	98	100	94	91	84
13	Chateau Alion	10 3.5	oz wt/a oz/a	A B	60	100	100	98	100	94	93	84
14	Chateau Alion	12 5	oz wt/a oz/a	A B	75	98	100	100	100	98	94	91
15	Matrix Alion	4 5	oz wt/a oz/a	A B	63	100	100	100	100	97	94	84
16	Alion Alion	5 5	oz/a oz/a	A B	75	100	100	100	100	98	96	91
17	Alion	3.5	oz/a	B	50	100	100	78	100	92	71	60
18	Alion	5	oz/a	B	65	100	98	83	100	95	79	74
LSD (P=.05)					***32***	***34***	***20***	***22***	***14***	***11***	***17***	***18***

The 'A' timing was applied December 17, 2013 and the 'B' timing on March 19, 2014. All treatments at both timings included Roundup Powermax plus Rely 280 and AMS for control of emerged weeds.

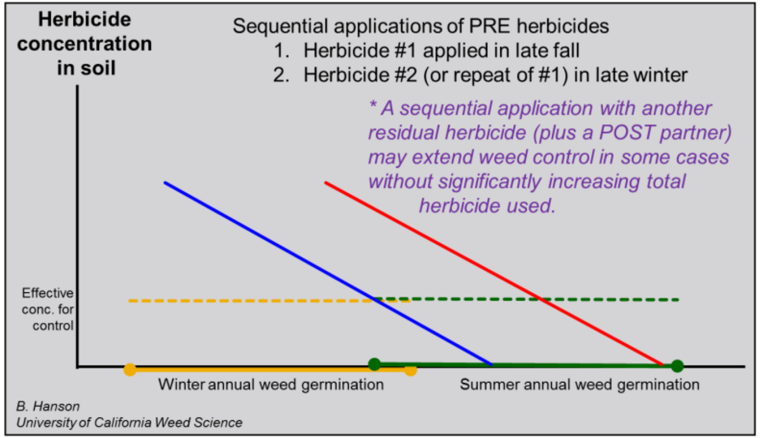
Table 7. Preemergence weed control with Matrix and Alion combinations and sequential treatments in a walnut orchard trial conducted near Chico, CA in 2014. (Watkins and Hanson)

				timing	Overall 64 DAT-A	Overall 124 DAT-A	Junglerice 160 DAT-A	Hairy fleabane 160 DAT-A	Overall 160 DAT-A
					%	%	%	%	%
1	Untreated Check				0	0	0	0	0
2	Matrix	4	oz wt/a	A	92	63	100	100	60
	Alion	5	fl oz/a	A					
3	Matrix	4	oz wt/a	AB	96	100	100	100	98
	Alion	2.5	fl oz/a	AB					
4	Matrix	4	oz wt/a	A	99	100	100	100	92
	Alion	2.5	fl oz/a	A					
	Matrix	2	oz wt/a	B					
	Treevix	1	oz wt/a	B					
5	Matrix	4	oz wt/a	A	96	97	95	100	76
	Alion	2.5	fl oz/a	A					
	Matrix	4	oz wt/a	B					
	Treevix	1	oz wt/a	B					
6	Matrix	4	oz wt/a	A	96	98	100	100	91
	Alion	2.5	fl oz/a	A					
	Matrix	2	oz wt/a	B					
	Prowl H2O	2	qt/a	B					
7	Matrix	4	oz wt/a	A	99	100	100	100	94
	Alion	2.5	fl oz/a	A					
	Matrix	4	oz wt/a	B					
	Prowl H2O	2	qt/a	B					
8	Matrix	4	oz wt/a	A	96	99	95	100	86
	Alion	2.5	fl oz/a	A					
	Matrix	2	oz wt/a	B					
	Alion	2.5	fl oz/a	B					
9	Matrix	4	oz wt/a	A	91	98	100	100	92
	Alion	2.5	fl oz/a	A					
	Matrix	4	oz wt/a	B					
	Alion	2.5	fl oz/a	B					
LSD (P=.05)					***8***	***19***	***6***	***0***	***18***

The 'A' timing was applied December 18, 2013 and the 'B' timing on March 20, 2014. The entire trial area was oversprayed with Roundup Powermax plus Rely 280 at the same time as the 'A' timing for control of emerged weeds.

A few random thoughts on almond weed management

- Think about your glyphosate formulations/rates – AI concentration and surfactant loads vary
- Consider PRE herbicide programs and mixes
- Consider sequential PRE applications to extend control into summer
- Think about weed control over several seasons - integrated weed management



Orchard Sampling Workshop – Weed Scouting Recap

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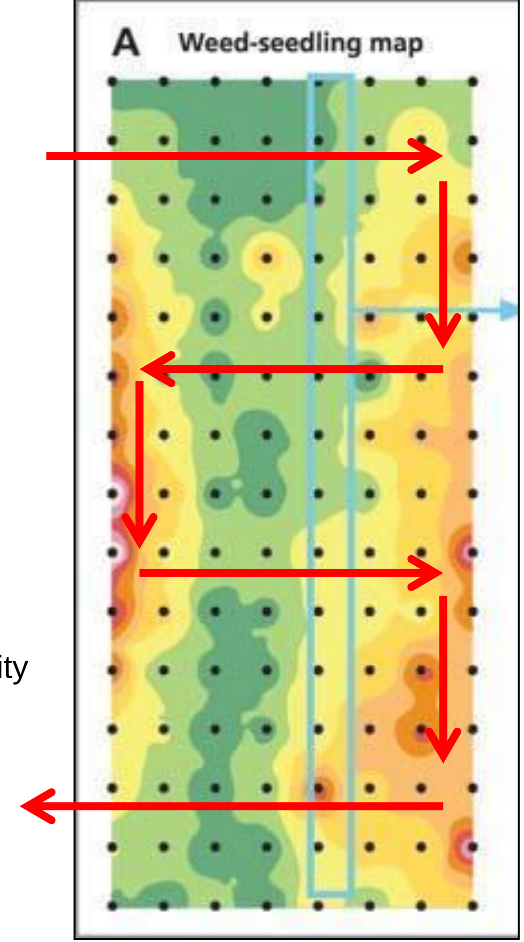
Why orchard scouting matters for weed managers

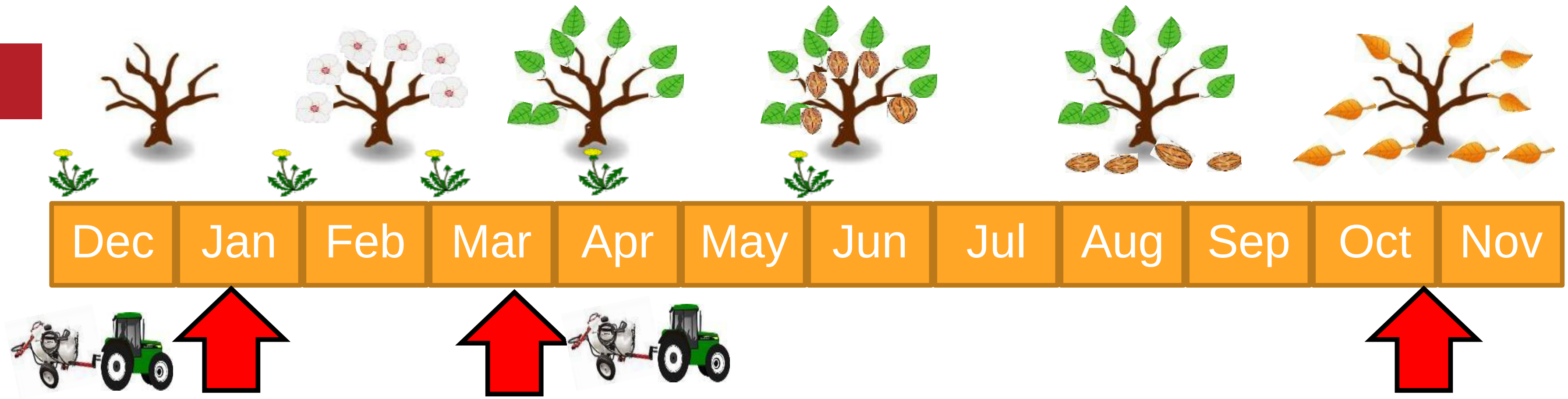
- Basing control decisions on actual weed problems
  - Control the weeds you KNOW you have (or will have)
- Avoid ineffective treatments
  - Using the wrong tool for the job wastes time and money
  - Will likely have to be retreated or controlled some other way
- Avoid overtreatment
  - Wastes money and time
  - Puts a higher than necessary load of pesticide in the environment
  - Crop safety concerns?
- 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

Spatial sampling

- Wide range of sampling intensities
  - Map illustrates a fairly intense grid sampling strategy
    - Probably a bit excessive in terms of precision needed
  - Could be a “drive by” observation from the truck or “ask the irrigator”
    - Probably a bit lax
- Take a walk or ride through each zone a few times each season
  - “zone” size may vary among operations due to scale
- Key points
  - Cross the top, middle, and bottom of the field to account for that variability
  - Don’t follow traffic patterns
  - Hit known “different” areas (soils, swales, historical use)
  - Note weed differences in middles vs rows



Modified from Koller and Lanini 2005 (Calif Agric 59:182)



- Key points:
  - Monitoring should begin after harvest.
    - Recall the techniques used last year and consider how they worked. Adjust as needed.
    - Scout orchards to assess weed presence and size for fall treatments with PRE/POST tankmixes
  - In late winter, assess the efficacy of the dormant season weed control program. Decide on spring program needs.
  - In late spring, evaluate previous control efficacy and determine pre-harvest weed control program.
  - At harvest, note how well the yearly program worked.

Orchard weed scouting

- Get a good representation of the weeds throughout the orchard management zone
- Scout several times per year to catch multiple weed flushes at sizes that can be controlled
- Choose the right tool for the job
  - Avoid economic and environmental problems with over- or under-treating
  - May need to consider rows and middles separately
- Keep records and compare year-over-year
  - Identify new weed problems and weed control failures and address at early stages
- Use scouting results to reevaluate and refine your weed management program
  - Should be an iterative process and something to consider throughout the year

www.beyondthebell.org

Brad Hanson
bhanson@ucdavis.edu
530 752 8115
http://ucanr.org/brad.hanson

UC Davis Weed Research and Information Center

http://wric.ucdavis.edu/
http://ucanr.org/blogs/UCDWeedScience/
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Jim Adaskaveg, UC Riverside

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Disease Management Update and Optimum Fungicide Usage Based on Host Phenology and Disease Monitoring

Dr. J. E. Adaskaveg
Department of Plant Pathology
University of California, Riverside

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Foliar and fruit diseases of almond in California


Brown rot blossom blight

Green fruit rot/Jacket rot

Shot hole


Bacterial spot

Anthracnose

Scab

Alternaria leaf spot

Rust


Hull rot

Fungicides for Managing Almond Diseases

Inorganics and Conventional Synthetics

Inorganics — M1&2 — Copper, Sulfur — 1960s

Dithiocarbamates — M3 — Ziram, Manzate, Dithane? — 1940s

Phthalimides — M4 — Captan — 1950s

Isophthalonitriles — M5 — Bravo, Echo, Equus — 1960s

Guanidines — U12 — Syllit — 1960s

Benzimidazoles — 1 — Topsin-M, T-Methyl — 1970s

Dicarboximides — 2 — Rovral, Iprodione, Nevado, Meteor — 1980s

Sterol inhibitors (DMIs) — 3 — Elite, Rally, Indar, Tilt, Bumper, Quash, Inspire, Tebucon, Toledo — 1970s - 1980s

SDHIs — 7 — Xemium, Luna Privilege, Fontelis — 1960s

Anilinopyrimidines — 9 — Vangard, Scala — 1990s

QoIs — 11 — Abound, Gem, Headline — 1990s

Hydroxyanilides — 17 — Elevate — 1990s

Polyoxins — 19 — Ph-D — 1960s

Phosphonates — 33 — ProPhyt, K-Phite, Fungi-phite, *Aliette*, *Linebacker* *(non-bearing)* — 1980s

Pre-Mixtures

- 3+9 — Inspire Super
- 3+11 — Quadris Top, Quilt Xcel,
- 7+11 — Pristine, Luna Sensation, Merivon
- 3+7 — Luna Experience
- 3+33 — Viathon

New: Luna Products & Merivon (2014), Syllit (2014), Viathon (2015), & new products continue to be evaluated

Why disease monitoring and risk assessment?

- Determine pathogen population size
- Determine possibility of disease outbreaks or increases in disease intensity based on general weather forecasts
- Assess if, when, and where disease management has to be implemented
- Optimize disease management - effective and economical

Optimum timing for implementing management practices

Inoculum-based

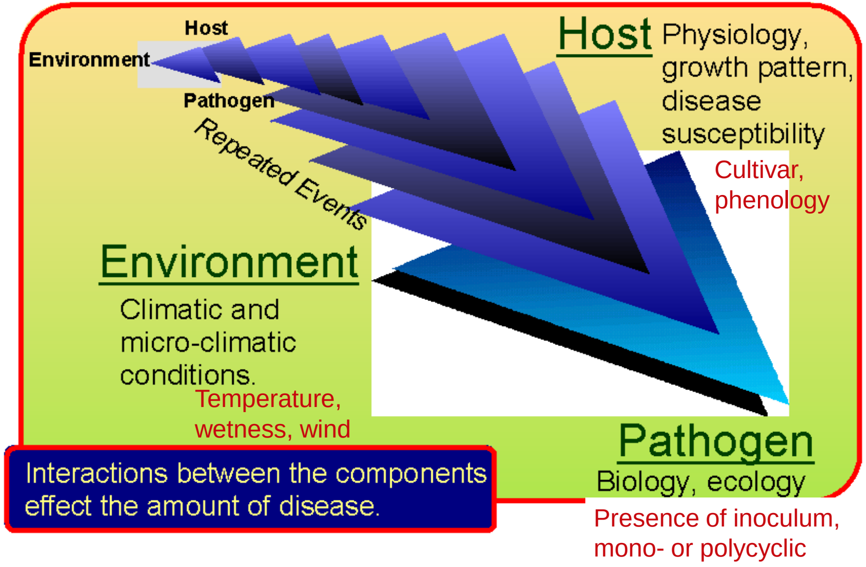
- Inoculum (disease) levels in the current and previous seasons are indicators for risk.
- Inoculum may not be present at high levels and disease progress can be monitored.
- Once inoculum is found, management practices can be implemented.
- Examples: shot hole, scab, rust, bacterial spot

Host phenology-based

- Disease occurs on specific host tissues during a limited time in the season
- Inoculum is commonly present
- Examples: blossom blight, Rhizopus hull rot

Microclimate-based

- Pathogen inoculum is commonly present.
- Climatic conditions determine disease progress.
- Examples: Alternaria, anthracnose, bacterial spot



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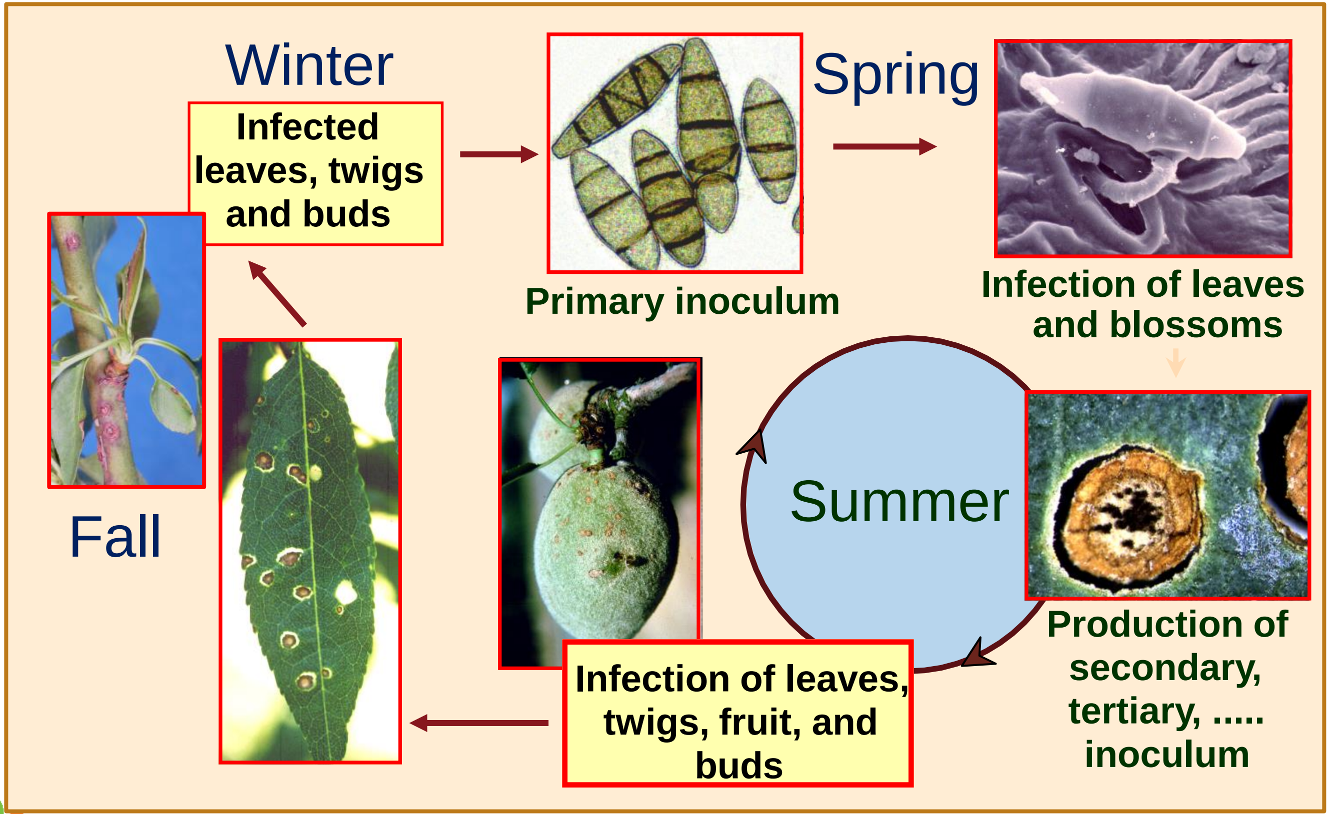
Examples of diseases where management is based primarily on amount of pathogen inoculum

Shot hole

Scab

Rust

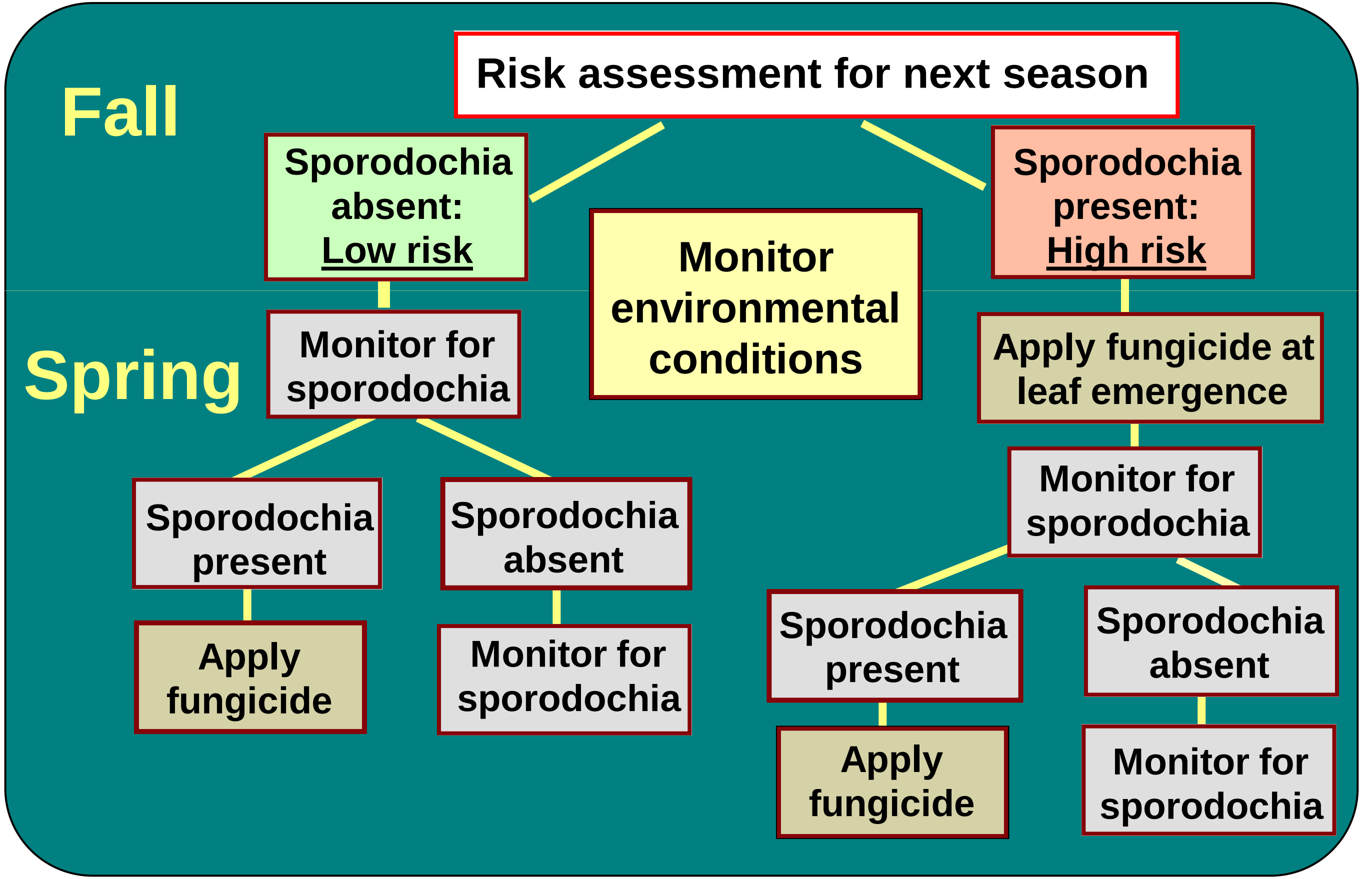
Shot hole of almond - Disease cycle in California



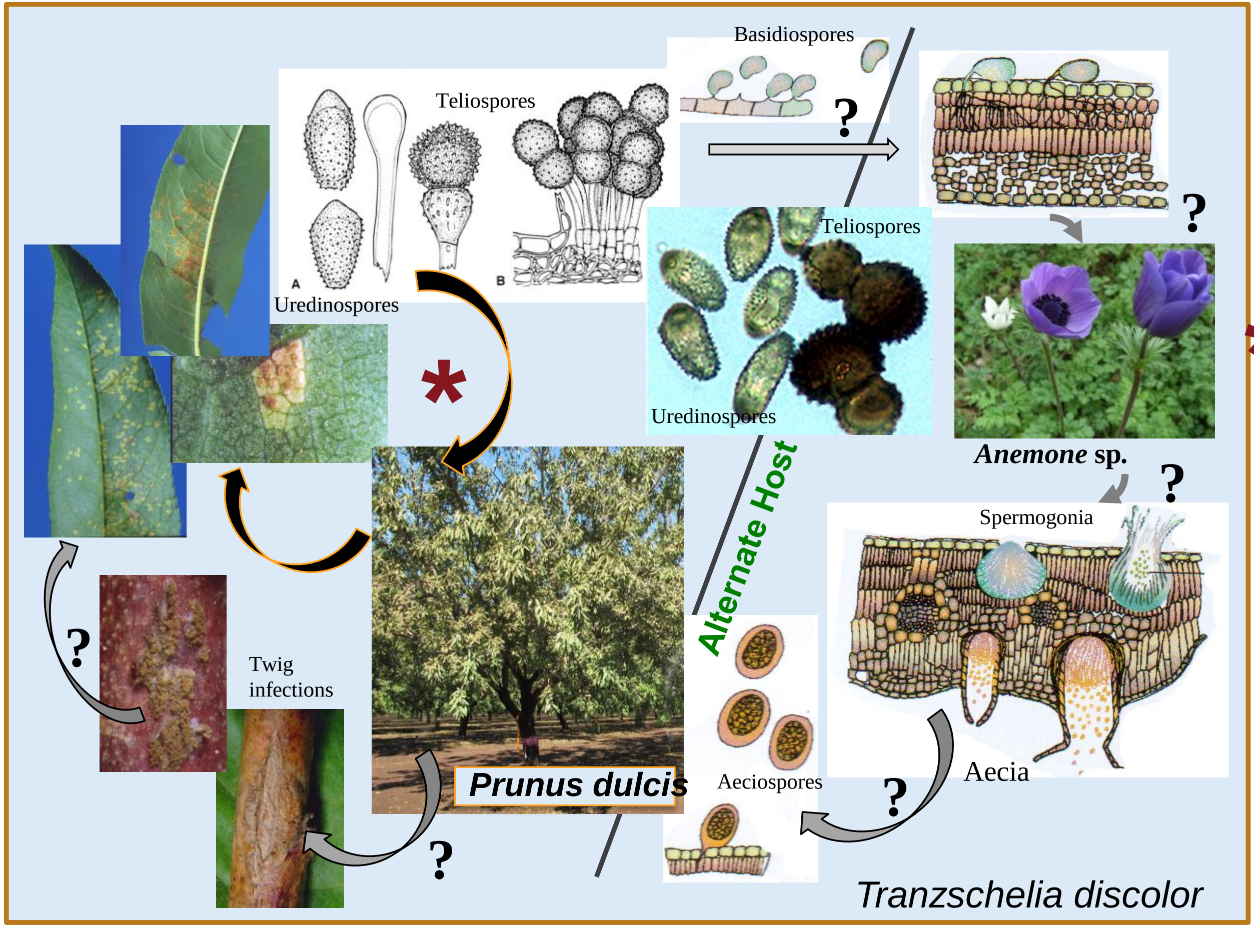
Wilsonomyces carpophilus

If inoculum is present at critical levels in the previous season and at leaf emergence in the spring, climatic conditions determine disease progress.

Shot hole management program for almond



Monitor for sporodochia in the previous fall and in the spring of current season



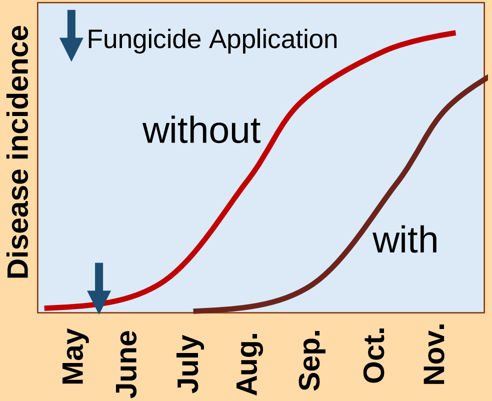
Almond Rust Disease Cycle

* Repeating stage: re-infection of new host tissue from secondary, tertiary, ….. inoculum.

Driven by environ-mental conditions and host susceptibility.

Management of almond rust with properly timed fungicides

- Biweekly monitoring is needed in the spring.
- Start applications with first detections of rust on leaves (angular yellow flecks) at 1% incidence and continue prior to forecasted rains.
- The goal is to shift the disease progress curve by 8-12 weeks.
- Fall defoliation before epidemics reduces overwintering inoculum



Disease progress curves of rust without and with fungicide applications starting at first detection in the spring. With fungicide applications, the progress curve is shifted so that defoliation from disease occurs late in the season.

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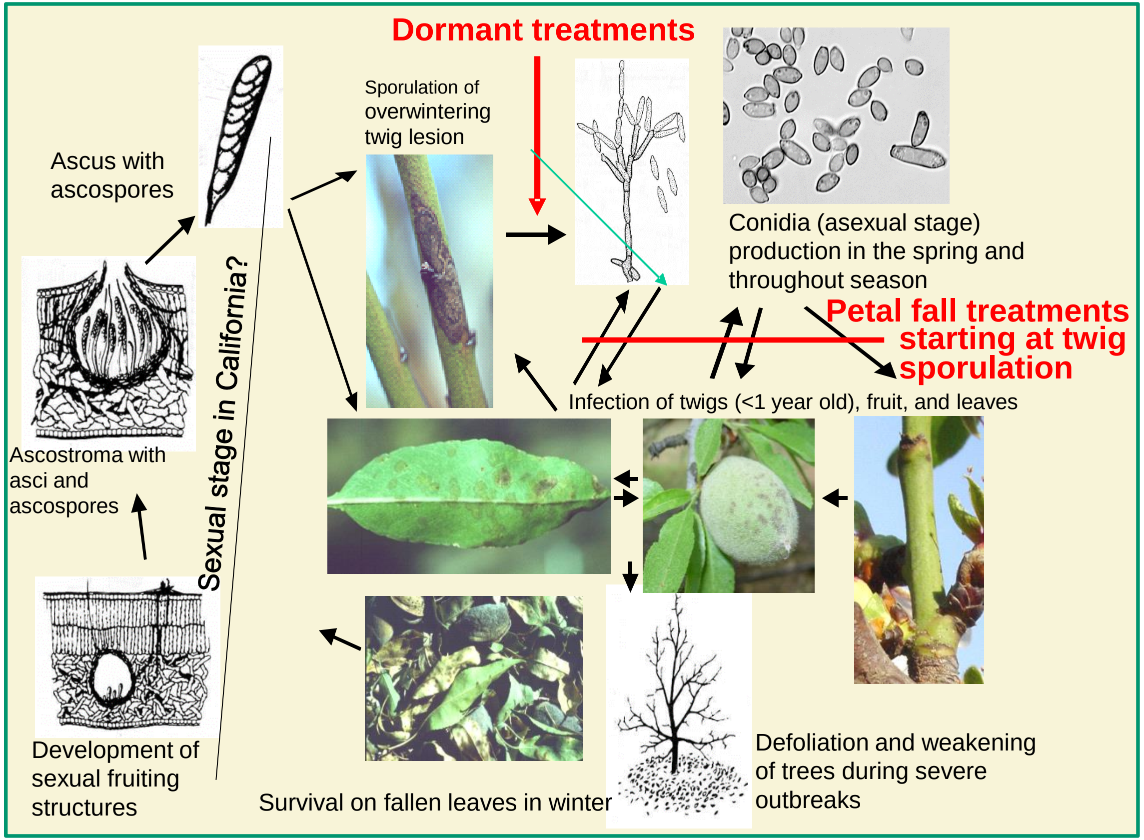
Management of almond rust with properly timed fungicides

- Start in-season treatments with multi-site material: mancozeb or chlorothalonil.
- Second and third applications: use single-site materials as premixtures: QoI (FRAC 11) SDHI (FRAC 7), and DMI (FRAC 3) compounds. Sulfur and chlorothalonil are also effective. Dormant treatments are ineffective.
- Azoxystrobin or propiconazole have post-infection activity (applied 1-2 days after rainfall) because they are locally systemic.

Disease cycle of almond scab and management strategies using dormant and after petal fall in-season treatments

Fusicladium carpophilum

Disease epidemiology determines most effective timings of fungicide applications.



Almond scab in California

- Scab has become a common disease at many locations in recent years and the disease has to be managed.
- Effective management requires
  - Knowledge of the disease history of the orchard
  - Application of dormant treatments to delay twig sporulation
  - Monitoring for twig sporulation in the spring
  - Fungicide application at the beginning of twig sporulation

Twig lesions non-sporulating (top) and sporulating (bottom)

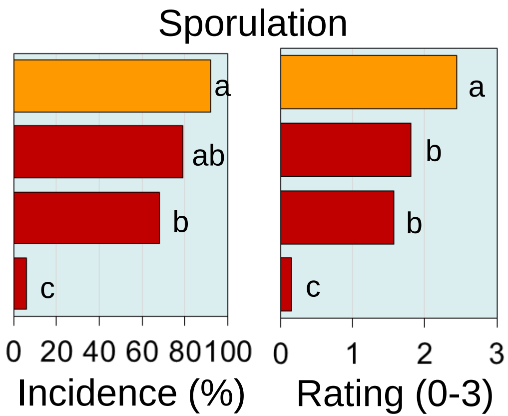
Management of Scab: Dormant applications to reduce inoculum in the spring

Control Bravo

cv. Carmel, Butte Co.
Application: Jan 2014, Evaluation: April 23.

2014

Treatment
Control
Manzate ProStick 6 lb + Oil 3.5 gal
Captan 80WDG 5 lb + Oil 3.5 gal
Bravo 6 pts + Oil 3.5 gal



- Chlorothalonil-oil is highly effective in delaying sporulation of twig lesions into late spring – copper-oil less effective, captan-oil or mancozeb-oil have little efficacy.
- Chlorothalonil is effective by itself, but oil increases effectiveness.
- Applications in mid-Dec. similarly effective as in mid-Jan.

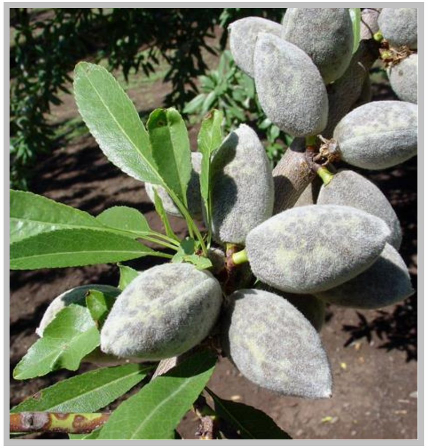
Dormant treatments to reduce scab inoculum in the spring

- Bravo WeatherStik received a Section 2(ee) registration for dormant application between Dec. 1 and Jan. 10, or before bud swell using the 4-pt rate.
- Full registration planned through IR-4 to change PHI to 60 days and rate to 6 pts/A.
- Benefits: Inoculum reduction, delay onset of epidemic, and synchronize scab with Alternaria treatments

Treatment timing for scab and Alternaria

		Bloom			Spring		Summer	
Disease	Dormant	Pink bud	Full bloom	Petal fall	Two week	Five week	May	June
Scab	++	-	-	+	+++	+++	+/-	+/-
Scab Dormant Chlorothalonil+oil	++	-	-	-	-	+++	+++	+/-
Alternaria	-	-	-	-	-	+++	+++	+++

Management of Scab - Summary



- At locations with high disease levels, a dormant application should be done.
- An effective 3-spray program includes dormant and two applications after twig infection sporulation.
- Multi-site fungicides with low resistance potential (chlorothalonil, possibly mancozeb, captan, ziram) should be in rotations with the newer single-site and pre-mix fungicides.

<u>Most effective newer fungicides:</u>

Single: Quash, Ph-D, Syllit, EXP-1
Pre-mixtures: Quadris Top, Inspire Super, Luna Sensation, Merivon
Rotations: including Catamaran/Viathon.

Examples of diseases where management is based primarily on host phenology

Brown rot blossom blight

Hull rot

Brown rot blossom blight

- Infection period is well defined – bloom period of 7 to 14 days for each variety in an orchard
- Risk of infection is determined by environmental conditions
    - Temperatures above 58F
    - Wetness
- Multiple highly effective fungicides are available

Timing of bloom applications

Determining factors	Delayed bloom application (30-40% bloom)	PB (5% bloom) <u>and</u> FB (80% bloom) applications
Environmental conditions (rain)	Less favorable	Highly favorable
Fungicide properties	Locally systemic action	With or without locally systemic action

- Many of the newer brown rot fungicides have some locally systemic activity and subsequently pre- and some post-infection activity.
- During less favorable environments **a single application at delayed bloom** (20-40% bloom) is sufficient for good disease control.
- During highly favorable conditions, a 2-spray program with applications at pink bud and full bloom is recommended.

Almond Hull Rot

- Caused by *Rhizopus stolonifer* or by *Monilinia fructicola*
- Both pathogens infect fruit and cause dieback

R. stolonifer (left), *M. fructicola* (right)

- Inoculum of *Rhizopus stolonifer* is omnipresent (soil)
- Inoculum of *Monilinia fructicola* originates from other stone fruits (peaches, cherries) or almond. Blossom blight can be caused by *M. laxa* (North) and *M. fructicola* (South regions).
- The two pathogens require different management strategies

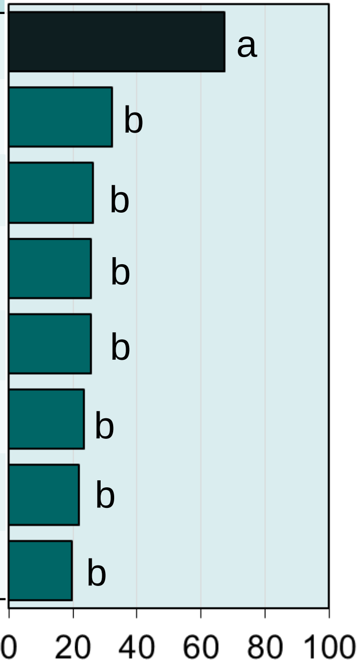
Effective hull rot treatments are available

Numerous effective treatments available: FG 3, 7, 19, 3/7, 3/11, 7/11. Reduction of disease up to 70%.

cv. Nonpareil, San Joaquin Co. 2014,
Hull rot mainly caused by *R. stolonifer*

Treatment	Rate (/A) (oz/fl oz)	Applic. 6-5	Applic. 7-10
Control	-----	-----	-----
Quash + S2200	3.36 + 3.36	@	@
Luna Experience	8	@	@
Ph-D + Tebucon*	6.2 + 8 + 8	@	@
Inspire Super*	20 + 16	@	@
Quadris Top*	14 + 16	@	@
Ph-D + Quash*	6.2 + 3 + 8	@	@
Luna Sensation	5	@	@

Hull rot counts

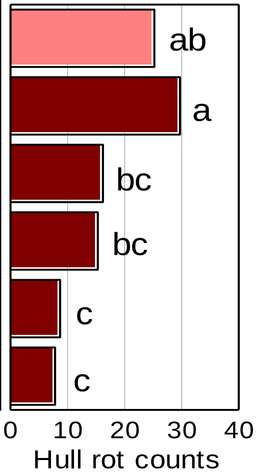


* Added DyneAmic or NuFilm-P

Timing of hull rot treatments

Hull Rot caused mainly by *M. fructicola* 2012 trial

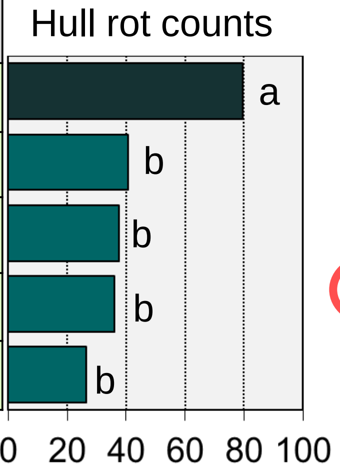
4-4	4-25	6-6	7-13
---	---	---	---
---	---	---	@
@	---	---	---
---	@	---	---
---	---	@	---
@	@	@	---



Precip. 9.5 mm

Hull Rot caused mainly by *R. stolonifer* 2014 trial

6/10	6/24	7/10	7/23
---	---	---	---
@	---	---	@
---	@	---	@
---	---	@	@
@	@	@	@



Critical timings

Pathogen = *M. fructicola*: Pre-hull split applications (early/mid June)

Pathogen = *R. stolonifer*: Early to late hull split applications but earlier applications at pre-hull split also help to manage the disease.

Both pathogens: Applications in early/mid June <u>and</u> at early hull split.

Examples of diseases where management is based primarily on environmental conditions

Alternaria leaf spot

Alternaria alternata, A. arborescens, A. tenuissima

Anthracnose

Colletotrichum acutatum

Bacterial spot

Xanthomonas arboricola pv. *pruni*

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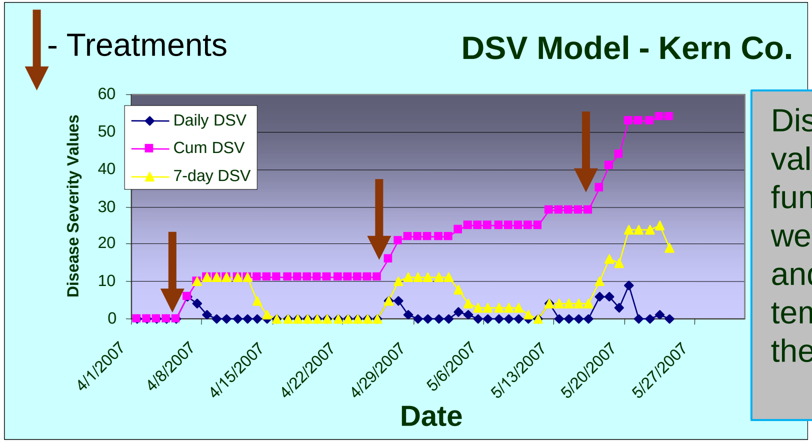
Timing of Alternaria leaf spot treatments

- Inoculum is omnipresent in orchards.
- Alternaria leaf spot is greatly influenced by microclimatic conditions within orchards.
- The DSV (Disease Severity Value) Model was originally developed for forecasting black mold of tomato caused by *A. alternata.*
- We evaluated the model for forecasting the disease on almond and adapted the temperature parameters.

The modified DSV model

Mean temperature (C) during wetness	Leaf wetness duration (hours)				
15 - 17	0 - 6	7 - 15	16 - 20	21	---
17.1 - 20	0 - 3	4 - 8	9 - 15	16 - 22	23+
20.1 - 25	0 - 2	3 - 5	6 - 12	13 - 20	21+
25.1 - 29	0 - 3	4 - 8	9 - 15	16 - 20	23+
DSV	0	1	2	3	4



Disease severity values (DSV) as a function of leaf wetness duration and average air temperature during the wetness period.

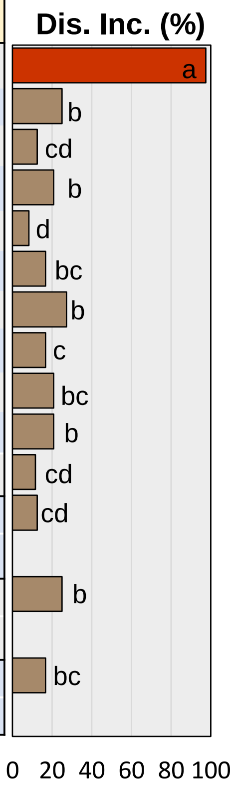
Efficacy of Alternaria leaf spot treatments - 2014

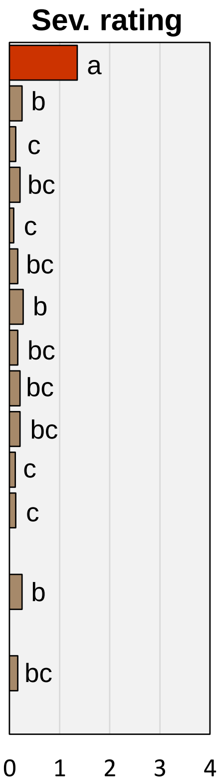
Treatment	Rate (oz/fl oz)	5/14	6/4	6/25
Control	---	---	---	---
Isofetamid	17	@	@	@
EXP-1	5.14	@	@	@
EXP-1 + Headline	3.43 + 5.48	@	@	@
EXP-1 + EXP-2	3.43 + 4.57	@	@	@
Isofetamid + IB18111	10.3 + 5.57	@	@	@
Ph-D + Tebucon	6.2 + 8	@	@	@
Fontelis + Tebucon	14 + 8	@	@	@
Luna Experience	6	@	@	@
Luna Sensation	5	@	@	@
Merivon	6.5	@	@	@
Inspire Super*	20	@	---	@
Quadris Top*	14	---	@	---
Bravo Weather-Stick	64	@	---	---
Quadris Top*	14 + 16	---	@	@
Ph-D*	6	@	---	@
Tebucon	8	---	@	---

Rotations

cv. Monterey, Kern Co. 2014

* Used with NIS





Summary

- Two to three applications in late spring based on a DSV-model threshold (e.g., increases of 6-10 values of the 7-day index).
- Most effective materials: FRAC 7/11 combinations; FRAC 3+7, 3/9, 3/11, and 3+19 combinations.
- Rotations and mixtures of FRAC Groups successful - ***No detections of new resistance***

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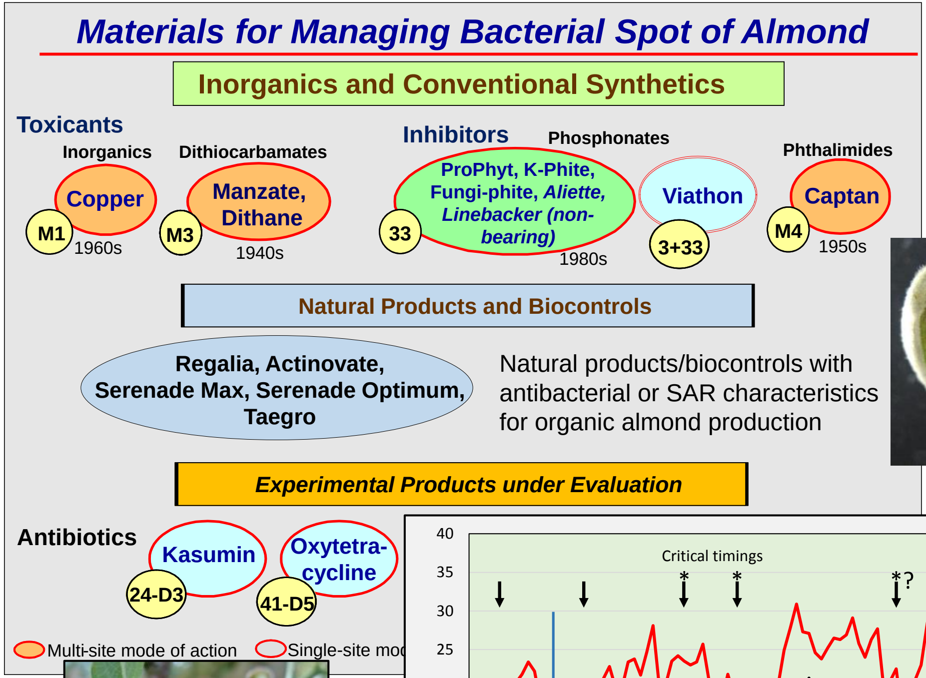
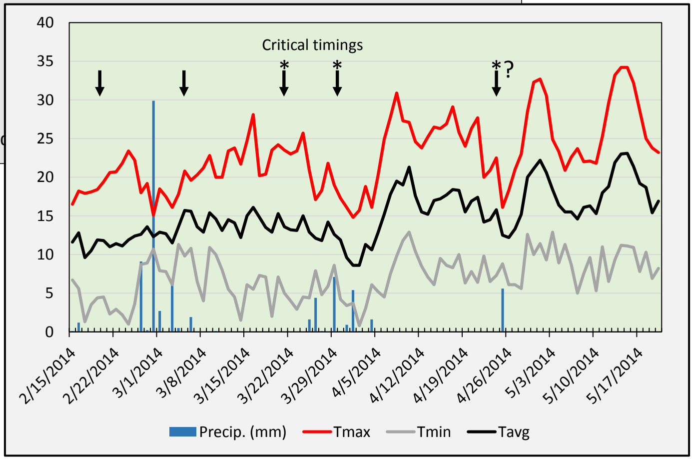




Bacterial Spot

The pathogen *Xanthomonas arboricola* pv. *pruni* overwinters in fruit mummies on the tree. Isolates evaluated to date were all copper-sensitive.

Late dormant treatments with copper, copper-mancozeb, or copper-mancozeb-captan significantly reduced the disease.

In-season treatments in the weeks following petal fall were most effective when timed around rain events and before temperatures started to rise.

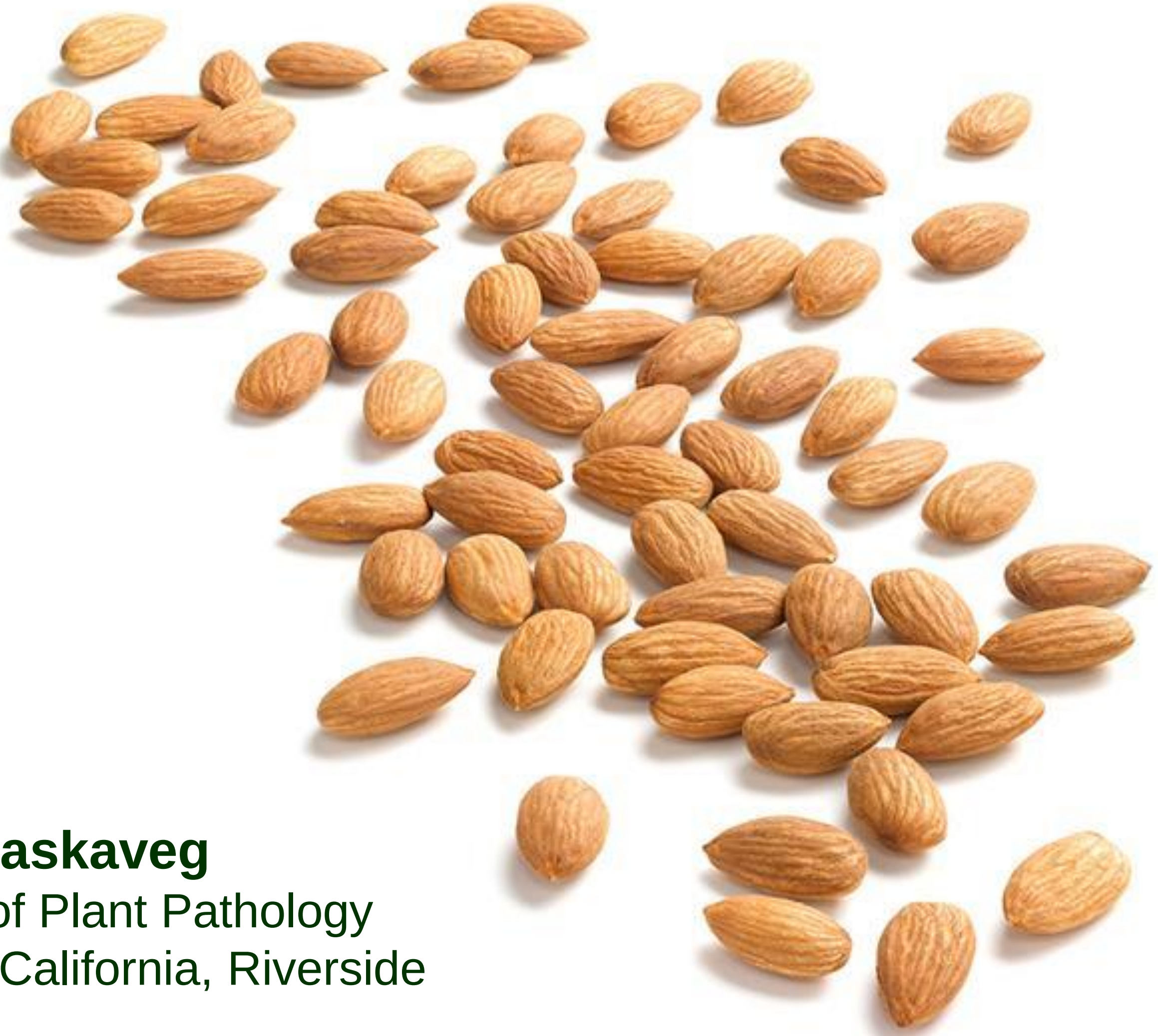
All copper products significantly reduced disease. Kasumin (accepted in IR-4), Fireline/Mycoshield, and Serenade Optiva were also effective.

The most effective management program:

1) A late dormant application to reduce inoculum;
2) At least one or two in-season applications around rainfall events and rising temperatures to prevent new infections.

(*see poster for details*)

Thank you
Danke
Gracias
Merci
Cheers
谢谢
ありがとう
धन्यवाद
спасибо
شكرا



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Dr. J. E. Adaskaveg
Department of Plant Pathology
University of California, Riverside

Thank You

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