IPM for leaffooted bugs, navel orangeworm and spider mites

David Haviland

UC Cooperative Extension, Kern County

for

Almond Sustainability Project Grower Meetings

Bakersfield 3/18/15 and Visalia 3/19/15

Managing Leaffooted Bugs in Almonds

David Haviland
Entomology Farm Advisor
UC Cooperative Extension, Kern Co.

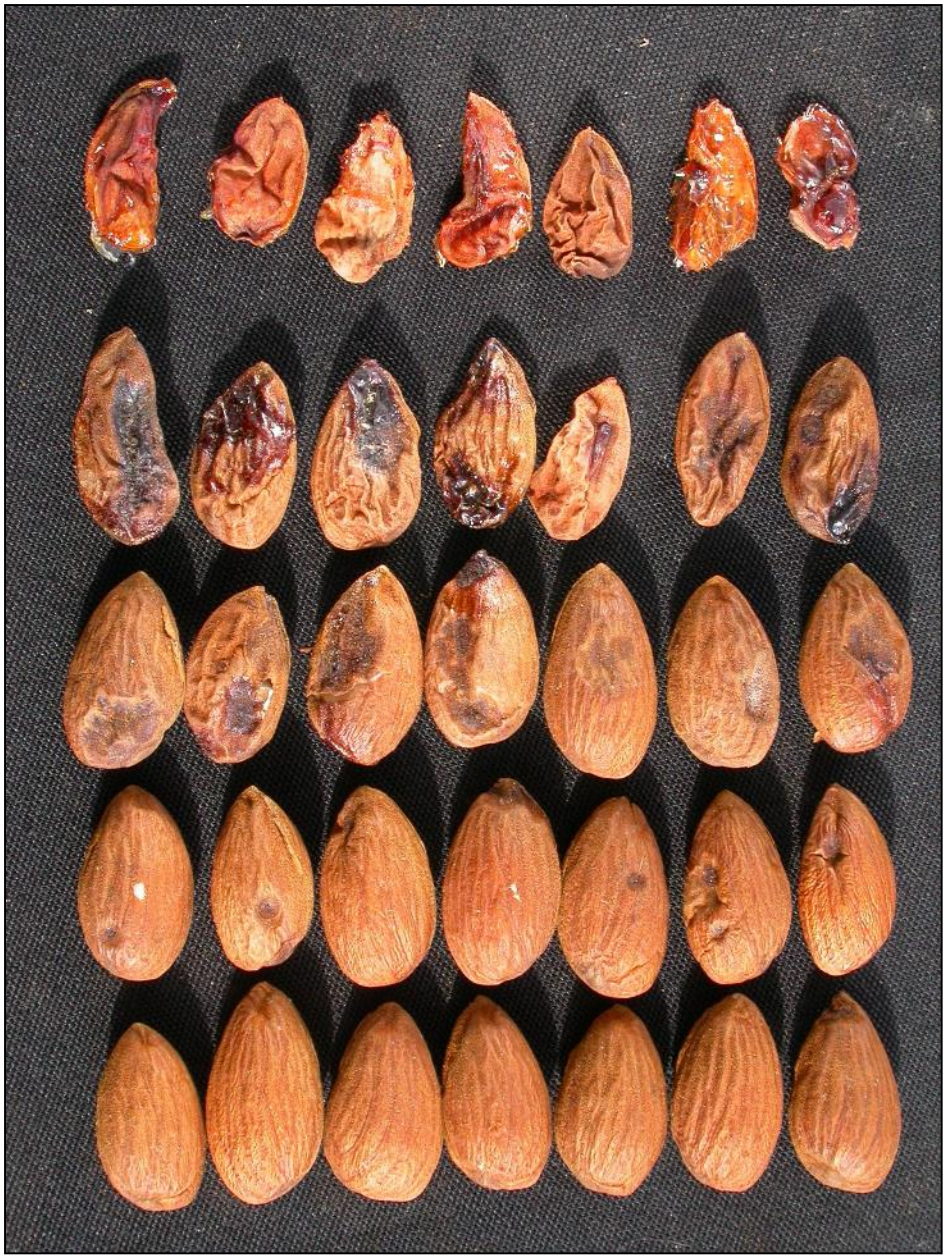
Leaffooted bug intro

- Large mouthparts
- Prefers to feed on seeds
  - Almonds in the spring
  - Pistachios in the summer
  - Pomegranates in the fall
- First recognized as major pest in 2006
  - 2005- Kern County Lorsban = 14,456 acres in almonds
  - 2006- Kern County Lorsban = 89,430 acres of almonds
  - Hard frost 06-07, problem went away

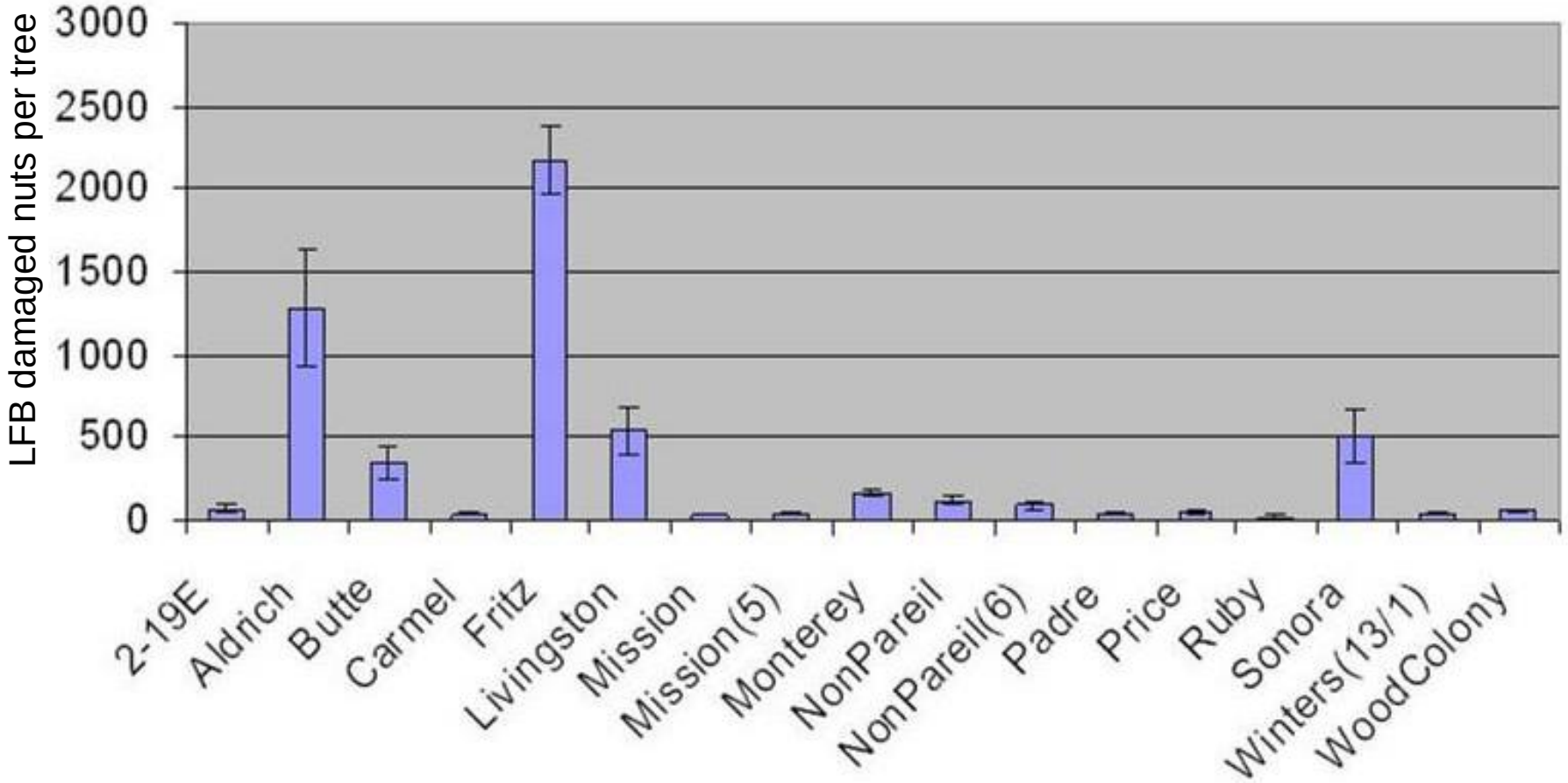
Damage to almonds

Damage to Almonds

- LFB penetrates into kernel while feeding
- Kernel becomes damaged
- Early season causes abortion or kernel
- Later in the season kernel remains on the tree
- Offgraded as inedible at harvest
- Can be associated with *Eremothycium coryli*

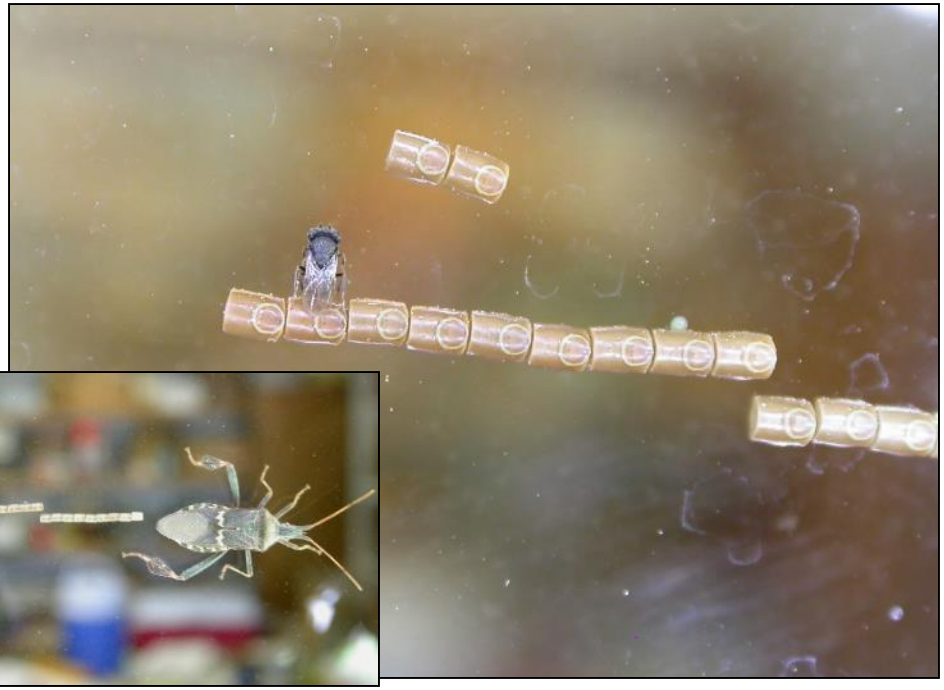


Varietal susceptibility to yield damage



Biological Control

- *Gyron pennsylvanicum*
- Egg parasitoid
- Can reduce LFB in the summer
- No benefit against overwintering adults that migrate to almonds



How to proceed this year

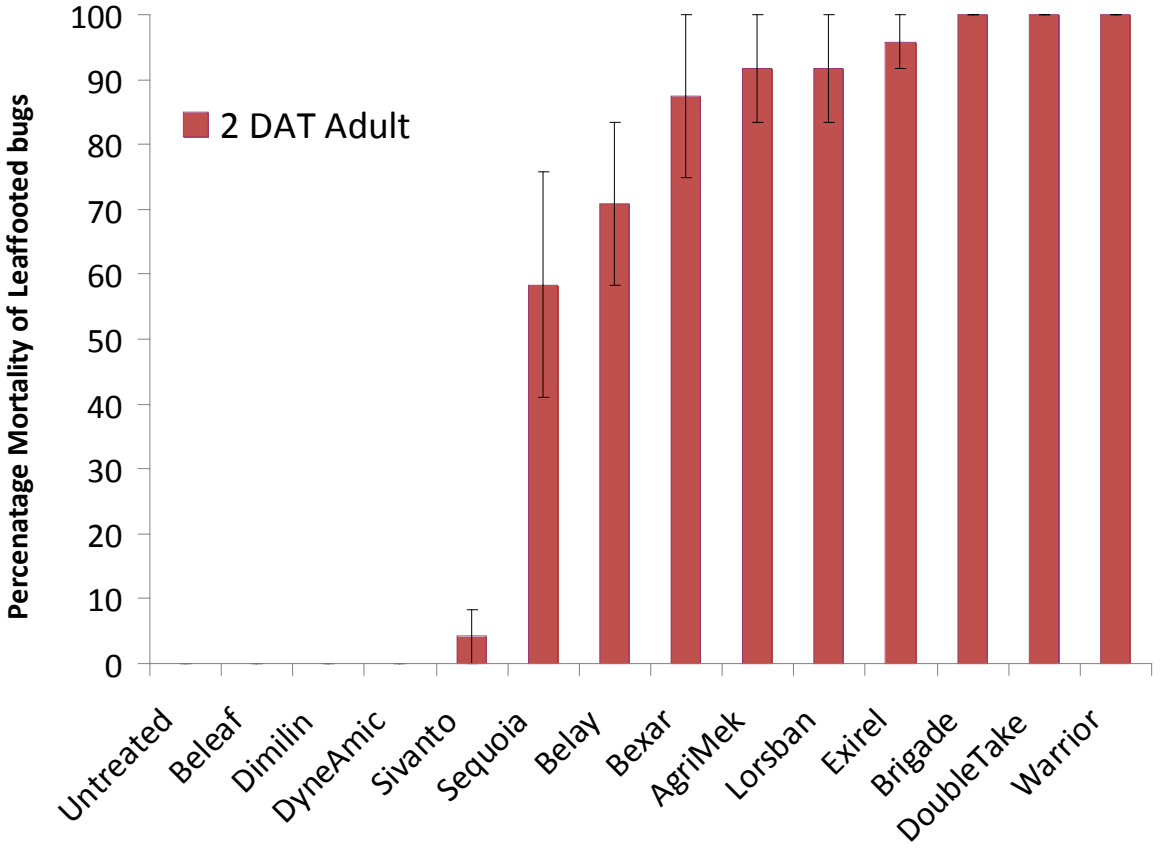
- Monitoring
  - Pole sampling to find bugs visually
  - Pole sampling to hear bugs (bumble-bee sound)
  - Look for gummosis on nuts
  - Inspect aborted nuts for gummosis
- Treatments
  - Not too early, but not too late
  - Beware unintended consequences of treatments

Leaffooted bug vs. Bacterial spot

Insecticide contact toxicity

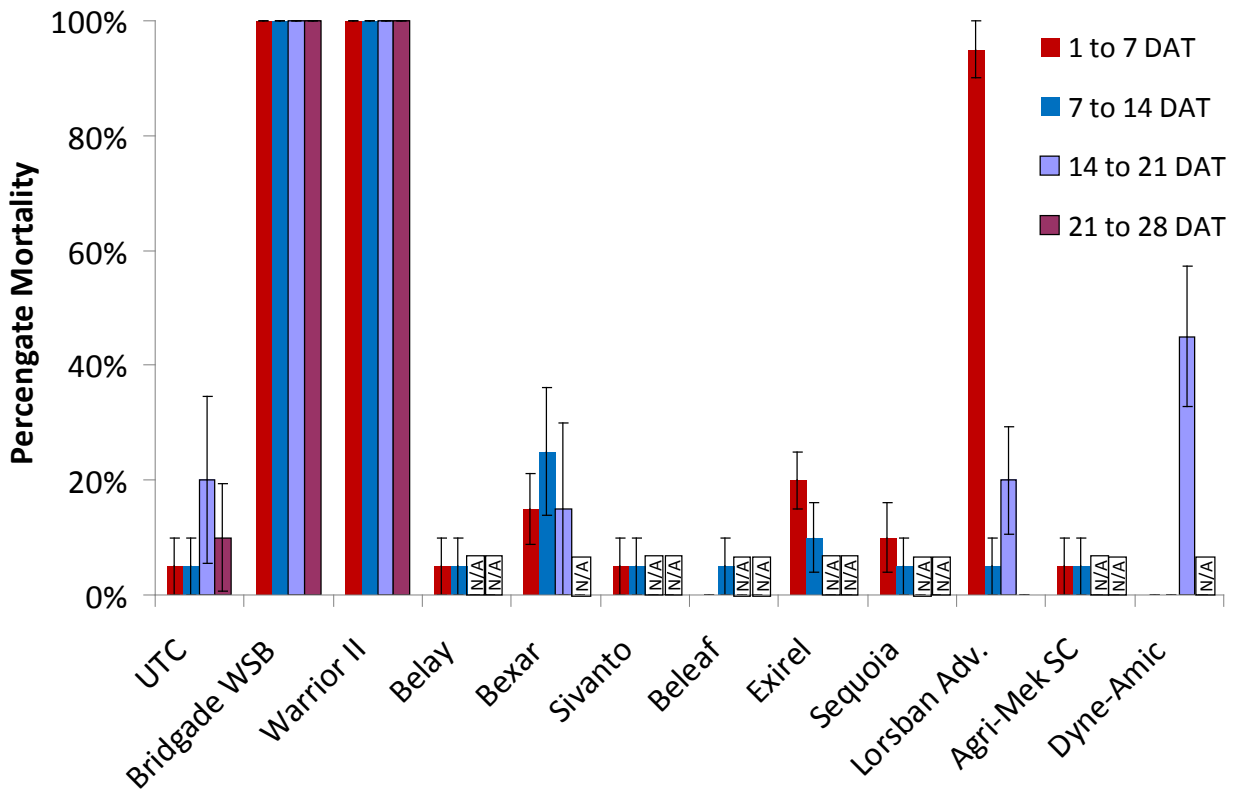
Trial methods

- Adults and nymphs
- Spray bugs directly
- Place on clean petri dish with carrot and bean
- Evaluate mortality



Insecticide residue toxicity

- Sprayed trees
- Caged adult bugs onto trees at weekly intervals for 5 weeks
- Evaluated mortality at 1 and 2 weeks after introduction
- Removed bugs after 2 weeks
- Evaluated nuts from cages at harvest



Insecticide conclusions

- 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

Navel Orangeworm Management in Almonds

NOW Management

(sanitation + three questions)

- Sanitation
  - Removal and destruction of mummies
  - Tree vs. ground mummies, min of 2 per tree
- How many sprays do I need?
  - Based on orchard history, neighbors, sanitation level, trap captures, harvest date
- When do I spray?
  - Based on phenology models, trap captures, harvest date, PHIs
- What do I spray?
  - Efficacy, mode of action, resistance mgt., incorporation of mating disruption

Seasonal development

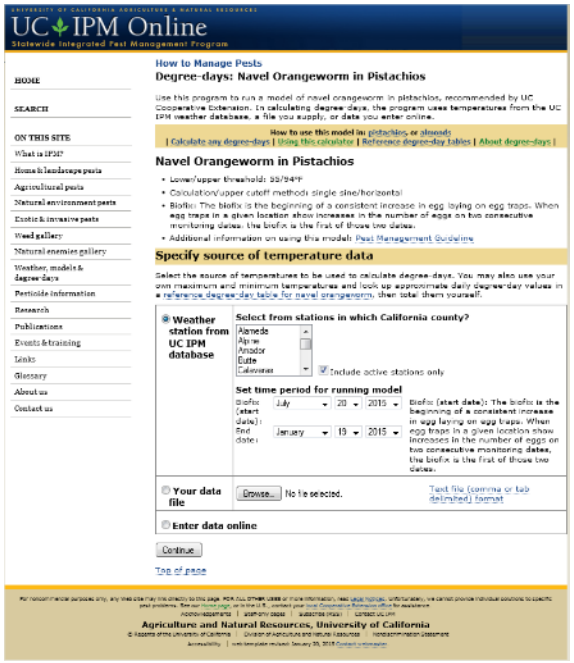
- 1st flight from March to May
  - Eggs laid on mummies
- 2nd flight in late June to July
  - Eggs laid on new crop at hull split
- 3rd flight mostly in August
  - Eggs laid around the time of nonpareil harvest
- 4th flight mostly in September
  - Eggs laid on new crop and new mummies
- Dev time in each stage dependent on host quality (1050DD in mummies, ~700DD in fresh almonds, ~500-600DD in fresh pistachios)

Monitoring

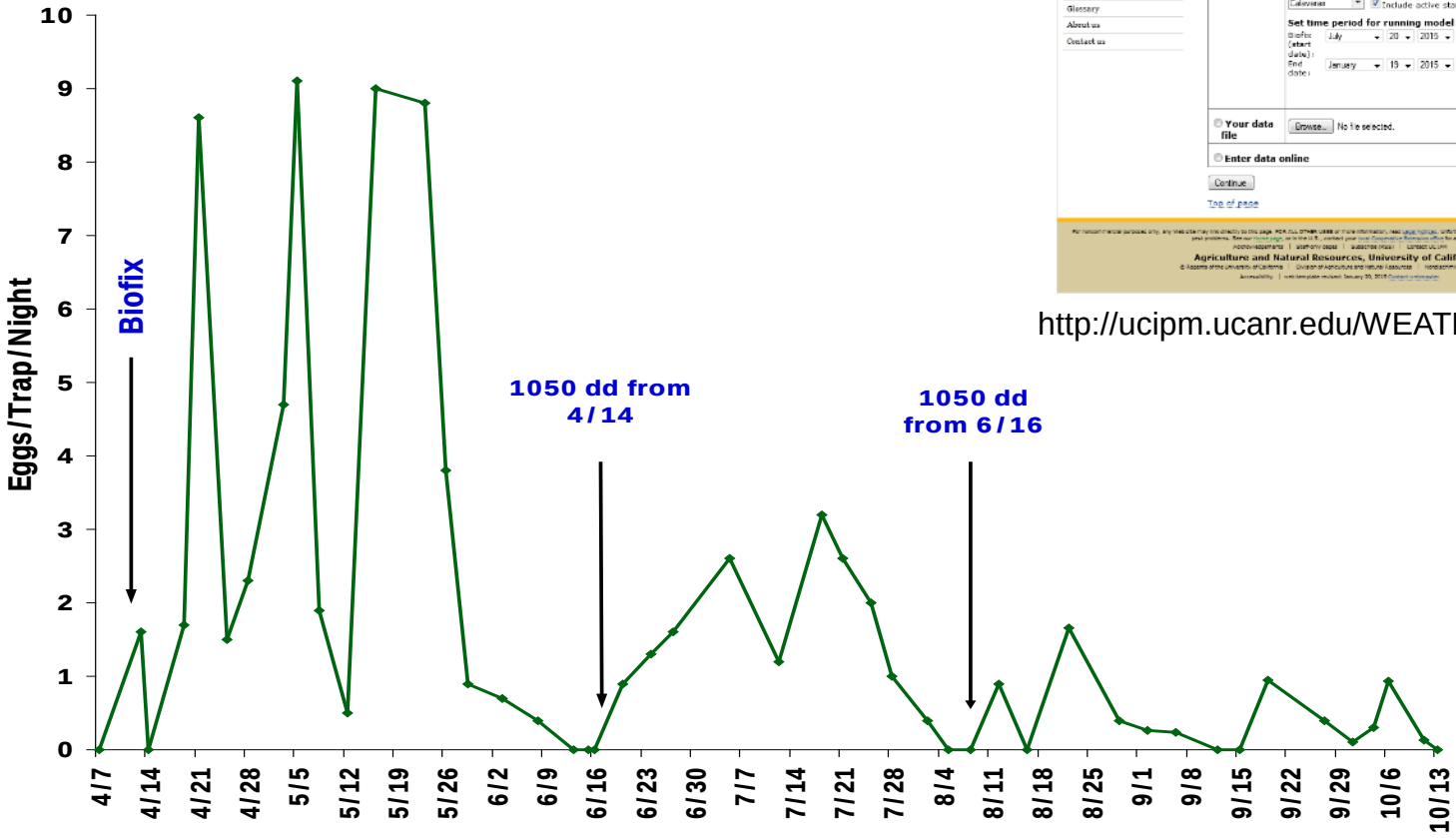
- Egg traps
  - Almond meal and oil
  - Start in March
  - Identify egg-laying of first flight for degree-day models
  - Not effective after June
- Pheromone traps
  - Start in March or April
  - Difficult to interpret before June
  - Better that egg traps after June

NOW Egg traps

- For setting a biofix during the 1st flight
- Difficult to use when pressure is low
- UC recommends 1 trap per 5 acres
- Check traps 2x per week
- Trapping period of a few weeks



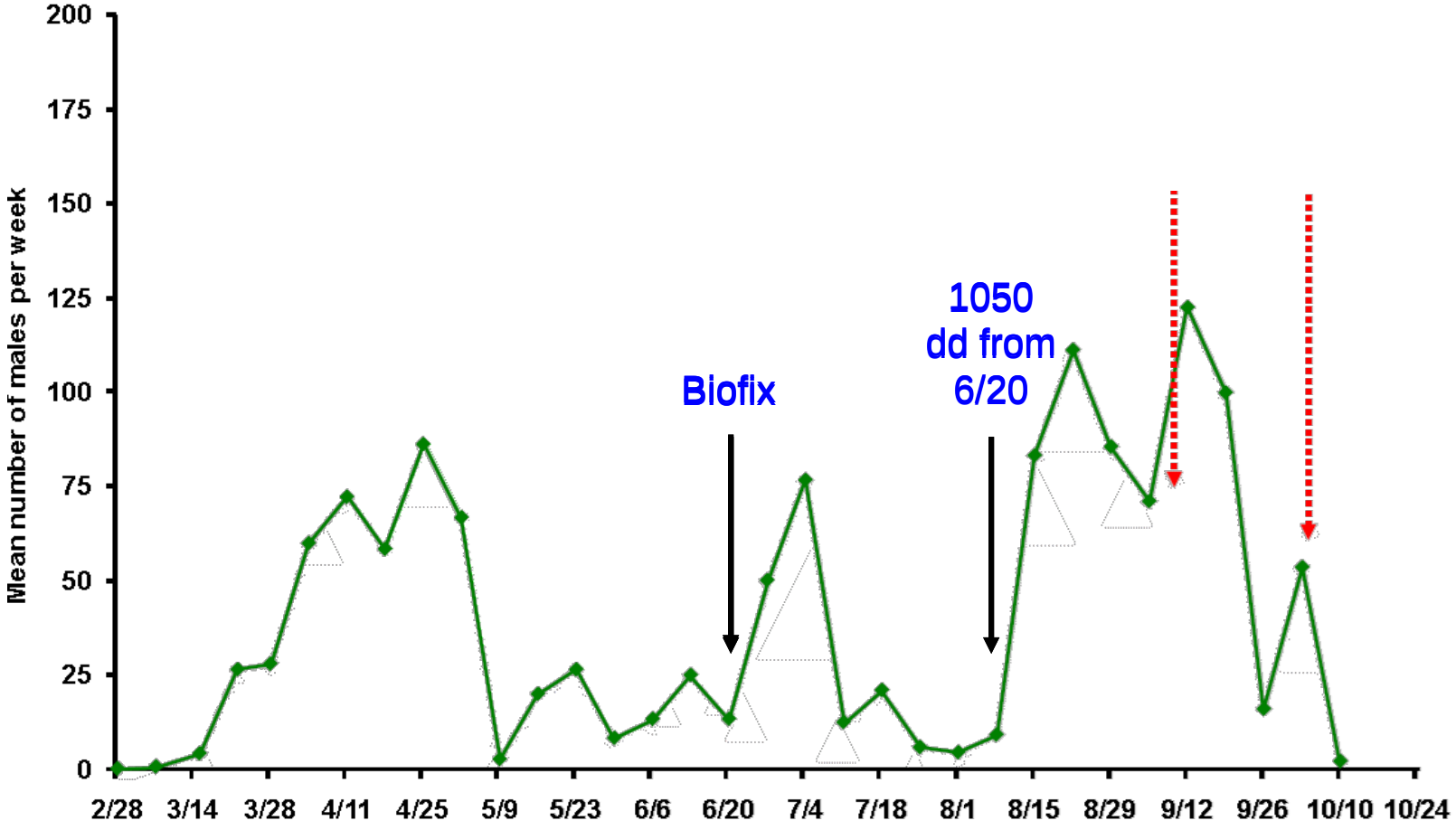
http://ucipm.ucanr.edu/WEATHER/index.html



Data from Dudley Ridge, Kern Co.

Pheromone traps (for adult males)

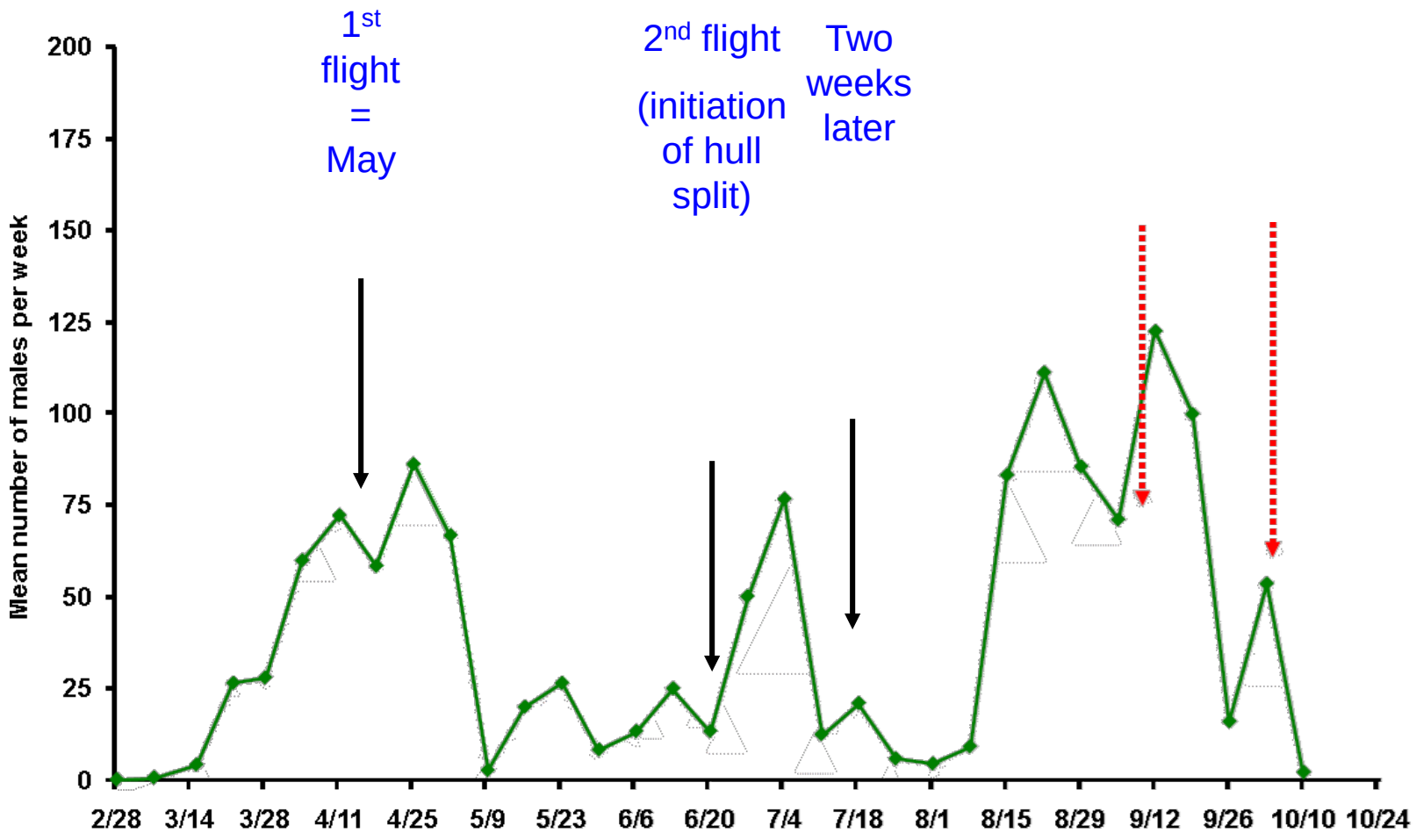
- Effective when egg traps stop working
- Can be used to improve spray timing
- Poor understanding of what numbers mean



Data source: Brad Higbee, Pistachio, 2007

Possible treatment timings

(each with pros and cons)



Data source: Brad Higbee, Pistachio, 2007

Possible insecticide timings

Timing	Pri-ority	Goal	Comments
1st flight (late Apr-May)	3	Prevent oviposition into mummies	No ideal application date (long flight); application typically made at PTB timing
2nd flight (late June, July)	1	Prevent oviposition into splitting nonpareils	Typical timing in almonds
2 weeks later	2	Maintain coverage on nonpareils (now 100% split) as well as splitting pollinators at the time that hull split spray residues are degrading.	Treatment based on weeks since hull split, monitoring fruit, weeks until harvest, pheromone trap captures
3rd flight and beyond	4	Save pollinators from damage in fields with high nonpareil damage	Timing often impractical due to pre-harvest intervals

Monitoring for spider mites

- Goal is management of mites through biological control supplemented by insecticides
- The goal is NOT to manage spider mites through miticides supplemented by biological control

Monitoring for spider mites

- Prior to July 1, focus on hot spots
  - Edges, crotches of the tree
- Leaves should be random
- 15 leaves per tree
- At least 5 trees
  - More is better
- +/- for mites
- +/- for predators

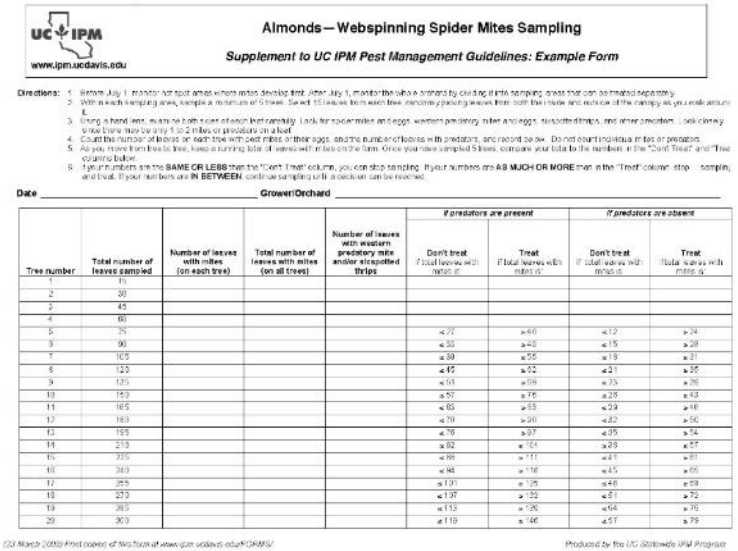
Sixspotted thrips
Scolothrips sexmaculatus

Spider mite destroyer
Stethorus picipes

Minute Pirate Bug
Geocoris sp.

Treatment decisions

- Based on presence/absence sampling
  - Accounts for biological control
- If predators are present
  - Treat if 50% leaves infested
  - Don't treat if <30% infested
- If no predators are present
  - Treat if 26% infested
  - Don't treat if <20% infested



UC IPM
www.ipm.ucdavis.edu

Almonds—Webspinning Spider Mites Sampling

Supplement to UC IPM Pest Management Guidelines: Example Form

Directions: 1. Before July 1, monitor hot spot areas where mites develop first. After July 1, monitor the whole orchard by dividing it into sampling areas that can be treated separately.
2. Within each sampling area, sample a minimum of 5 trees. Select 10 leaves from each tree, randomly picking leaves from both the inside and outside of the canopy as you walk around it.
3. Using a hand lens, examine both upper and lower leaf surfaces. Look for spider mites and eggs, western predatory mites and eggs, six-spotted thrips, and other predators. Look closely since there may be only 1 to 2 mites or predators on a leaf.
4. Count the number of leaves on each tree with pest mites or their eggs, and the number of leaves with predators, and record below. Do not count individual mites or predators.
5. As you move from tree to tree, keep a running total of leaves with mites on the form. Once you have sampled 5 trees, compare your total to the numbers in the "Don't Treat" and "Treat" columns below.
6. If your numbers are the **SAME OR LESS** than the "Don't Treat" column, you can stop sampling. If your numbers are **AS MUCH OR MORE** than in the "Treat" column, stop sampling, and treat. If your numbers are **IN BETWEEN**, continue sampling until a decision can be reached.

Date _____ Grower/Orchard _____

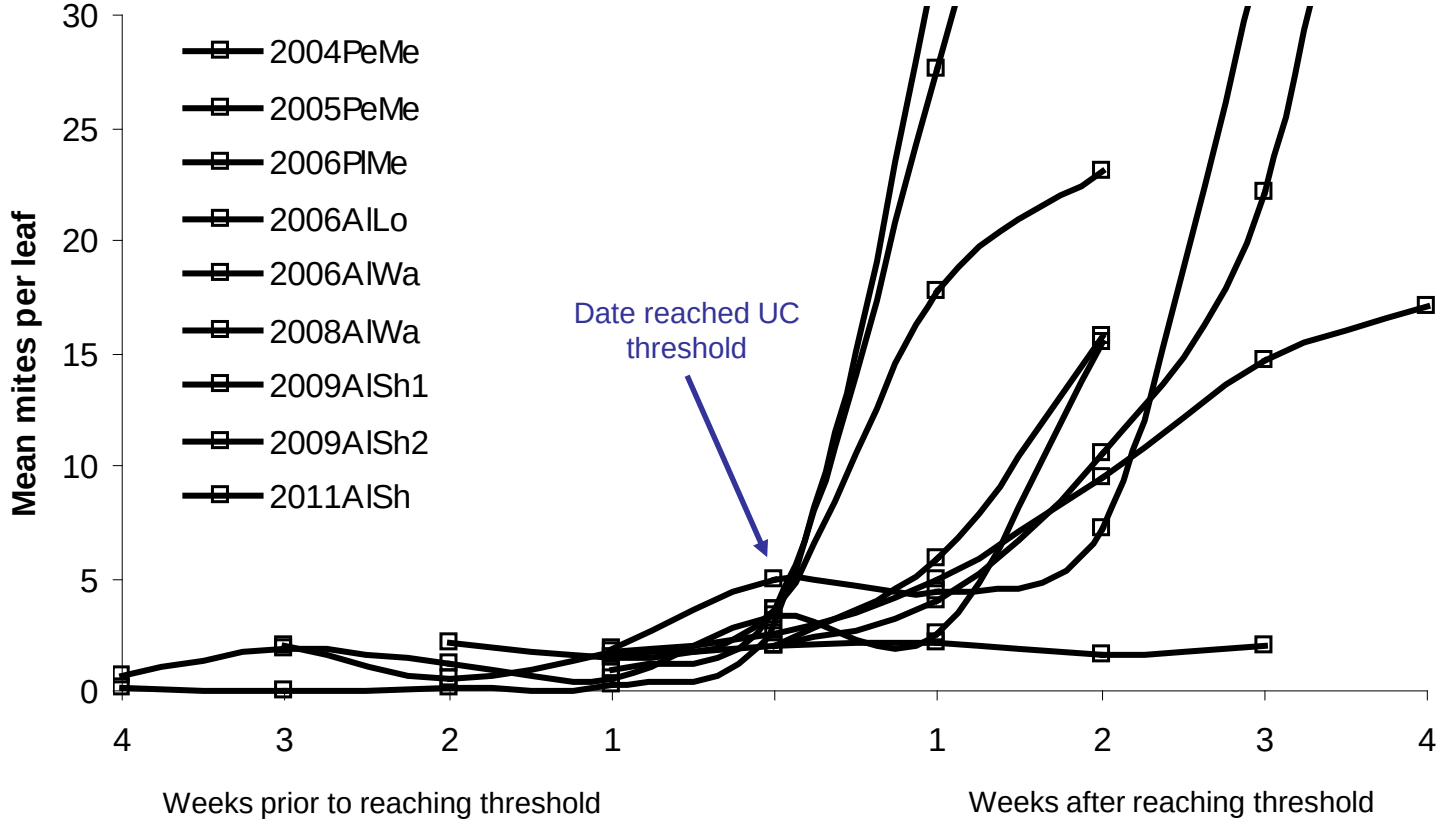
Tree number	Total number of leaves sampled	Number of leaves with mites (on each tree)	Total number of leaves with mites (on all trees)	Number of leaves with western predatory mite and/or six-spotted thrips	If predators are present		If predators are absent	
					Don't treat if total leaves with mites is:	Treat if total leaves with mites is:	Don't treat if total leaves with mites is:	Treat if total leaves with mites is:
1	15							
2	30							
3	45							
4	60							
5	75				≤ 27	≥ 40	≤ 12	≥ 24
6	90				≤ 33	≥ 48	≤ 15	≥ 28
7	105				≤ 39	≥ 56	≤ 18	≥ 31
8	120				≤ 45	≥ 63	≤ 21	≥ 35
9	135				≤ 51	≥ 71	≤ 23	≥ 39
10	150				≤ 57	≥ 79	≤ 26	≥ 43
11	165				≤ 63	≥ 87	≤ 29	≥ 46
12	180				≤ 70	≥ 95	≤ 32	≥ 50
13	195				≤ 76	≥ 103	≤ 35	≥ 54
14	210				≤ 82	≥ 111	≤ 38	≥ 57
15	225				≤ 88	≥ 119	≤ 41	≥ 61
16	240				≤ 94	≥ 128	≤ 43	≥ 65
17	255				≤ 100	≥ 136	≤ 46	≥ 68
18	270				≤ 107	≥ 144	≤ 51	≥ 72
19	285				≤ 113	≥ 152	≤ 54	≥ 76
20	300				≤ 119	≥ 160	≤ 57	≥ 79

(3 March 2009) Print copies of this form at www.ipm.ucdavis.edu/PDMG/

Produced by the UC Statewide IPM Program

Treatment decisions

- Nine trials, six years
- In 8 out of 9 cases mites reached treatable levels within1 to 2 weeks after the threshold was reached
- Data suggest mite presence on 25% of leaves justifies a treatment



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, biocontrol was excellent