Pest Management Update and Sampling: Insects and Weeds

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Pest Management Update and Sampling: Insects and Weeds
IPM for Almonds- making management decisions

“There will be a time when we must choose between what is easy and what is right”

Dumbledore
Harry Potter and the Goblet of Fire
Monitoring programs are the basis for making treatment decisions

- Determine pest presence/population
- Determine beneficial organism presence/population
- Evaluate population growth/decline
- Determine the need to treat (treatment thresholds)
- Assist with treatment timing
- Assess treatment efficacy and need to retreat
- Compare populations from year to year

The vast majority of monitoring activities result in an informal ‘do not treat’ recommendation
 Written recommendations require certification that monitoring was done and that treatments are warranted

- “I hereby certify that alternatives and mitigation measures that would substantially lessen any significant adverse impact on the environment have been considered and, if feasible, adopted.”

- Criteria for determining need for treatment:
  - Sweep net counts
  - Field observations
  - Pheromone or other trap counts
  - Presence of pest above treatment threshold
  - Pest levels increasing, no evidence of beneficials
  - Etc.
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 destructor
*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
Treatment decisions

- Nine trials, six years
- In 8 out of 9 cases mites reached treatable levels within 1 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
Kris Tollerup, UCCE IPM Advisor
Sampling for Navel Orangeworm and Leaffooted Bug: The What, Why, and How

Kris Tollerup, UnivLeafersity of California Cooperative Extension Advisor, IPM, Kearney Agricultural Research and Extension Center
Sampling: The What

- Bioeconomics: Relationships between pest number, host response to injury, and resultant economic loss.
  - Basic biology and ecology.
  - Sampling and identification
Sampling: The Why

- Identification of pest and associated damage.
- Provides estimation of pest population density.
- Provides decision-making tool i.e. treat / not treat information
  - Economic injury level
    - Some level of pest/damage is tolerated i.e. below on economic injury level.
    - Pest and crop dependent.
    - Can decrease as crop value increases.
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-orngwrmeggttrap.pdf.)
  – Biofix: Begin accumulation of degree-days.
  – Data provides information when new generation begins egg-laying.
  – Use data to verify degree-day calculation.
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 (For Now).
• 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.
Any Questions?
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
Peach Twig Borer

Treatment Options:

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
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

<table>
<thead>
<tr>
<th></th>
<th>PTB</th>
<th>OFM</th>
<th>NOW</th>
<th>ANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kernel</td>
<td>Shallow channels &amp; surface groove on kernels</td>
<td>Shallow channels &amp; surface groove on kernels</td>
<td>Deep chewing in nut</td>
<td>Scraping or peeling of kernel skin, deep hollowing of nut, “sawdust” present</td>
</tr>
<tr>
<td>Frass</td>
<td>None</td>
<td>Reddish brown; very little</td>
<td>White; often a lot</td>
<td>No</td>
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<tr>
<td>Webbing</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Boring</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Hollowing</td>
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</tbody>
</table>
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 – Dormant Spur Sampling Thresholds

<table>
<thead>
<tr>
<th># of Spurs</th>
<th># of SJS infested spurs (not parasitized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>0: Stop sampling – no treatment necessary</td>
</tr>
<tr>
<td></td>
<td>1-3: Examine 20 more spurs</td>
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<td></td>
<td>≥ 4: Stop sampling – treatment recommended</td>
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<tr>
<td>40</td>
<td>1: Stop sampling – no treatment necessary</td>
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<td>2-5: Examine 20 more spurs</td>
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<td></td>
<td>≥ 6: Stop sampling – treatment recommended</td>
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<tr>
<td>60</td>
<td>≤ 3: Stop sampling – no treatment necessary</td>
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<td></td>
<td>4-7: Examine 20 more spurs</td>
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<td></td>
<td>≥ 8: Stop sampling – treatment recommended</td>
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<tr>
<td>80</td>
<td>≤ 5: Stop sampling – no treatment necessary</td>
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<td></td>
<td>6-8: Examine 20 more spurs</td>
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<td></td>
<td>≥ 9: Stop sampling – treatment recommended</td>
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<tr>
<td>100</td>
<td>&lt; 10: No treatment necessary</td>
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<tr>
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<td>≥ 10: Treatment recommended</td>
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</table>
### Almonds – Dormant Spur Sampling

**Supplement to UC IPM Pest Management Guidelines: Example Form**

**Directions:**
1. To monitor for San Jose scale (SJS), European fruit leaftier (EFL), and mites, clip off 2 to 3 spurs randomly from each of 36 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 3.

**Grower/Orchard:**

<table>
<thead>
<tr>
<th>Date</th>
</tr>
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<table>
<thead>
<tr>
<th>Spur number</th>
<th>Live SJS</th>
<th>Paralyzed SJS</th>
<th>EFL</th>
<th>Mite eggs</th>
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</thead>
<tbody>
<tr>
<td>1</td>
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| Treatment 
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<tr>
<td>4 or more</td>
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<tr>
<td>3 or more</td>
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<td>2 or more</td>
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<tr>
<td>1 or less</td>
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<tr>
<td>0</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Treatment decisions:</th>
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<tbody>
<tr>
<td>If overall SJS or EFL-infested spurs is less than 8 but more than 1, look at another 20 spurs and record on chart to the right.</td>
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<tr>
<td>If fewer than 20 spurs, stop sampling and treat.</td>
</tr>
<tr>
<td>If 10 or less, stop sampling and treat.</td>
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</table>

**Total:**

| Treatment 
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<tbody>
<tr>
<td>14 or more</td>
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<tr>
<td>9 or more</td>
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</tbody>
</table>

**Treatment decisions:**

- If grand total of either SJS or EFL-infested spurs is less than 8 but more than 1, look at another 20 spurs and record on chart to the right.
- If fewer than 20 spurs, stop sampling and treat.
- If 10 or less, stop sampling and treat.
- Treat for mites if 20% or more spurs are infested.

**Printed 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
Orchard Sampling for Pest Management - Weeds

Brad Hanson
UC Davis Weed Science Program
Orchard weed scouting

- Helps us select the right tools for the job at hand
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
  – Escapes will likely have to be retreated or controlled in 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
Orchard weed scouting practices

- Weed identification
- Keeping records and mapping
- Scouting within a field
- Scouting several times per season
- Comparing records over several years
- Evaluate, adjust, and refine weed management programs
Weed identification

• Unknown weeds cannot be properly managed
  – No technique controls all weed species
  – Not all weeds cause equal damage (thresholds)
  – Species respond differently to control strategies
    • Even variants within a species (i.e. herbicide resistant biotypes)

A number of weed ID books are available. Also many pamphlets and extension publications from public and private sources.
Weed ID - Software

• Several available
• I currently use a software from XID Services
  – Available from UC Davis, WSSA, WSWS, and others
Online Weed ID Resources

A few online (FREE) resources are available:

UC Davis Weed Research and Information Center
www.wric.ucdavis.edu
Keeping records

• Note recent weed control tactics
  – What, when?
• Note weed species present
• Density
  – Scattered, patchy, dense, OMG!
• Where they are located
  – in-row, middles, field edges, openings?
• Comment on potential changes for weed management in that block

Weed survey form example from UC IPM Online
Mapping

- Can be sophisticated (or not)

- **Key points:**
  - Mapping helps define the size and scope of a weed problem
  - May be able to focus efforts on portions of the orchard
  - Allows comparison over years – look for trends

From Wiles, 2005 (Weed Sci 53:228)
Spatial sampling

• Weeds are usually not uniformly distributed in a field
  – Sampling strategies need to take this into account
  • A single observation made in a “clean” part of the field could lead to undertreating the site, while an observation made in a patch could lead to overtreating the majority of the field

From Koller and Lanini 2005 (Calif Agric 59:182)
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)
Sampling over the course of the season

• Weed scouting should not be a “once and done” operation
• Different weed species emerge over the course of the year
  – winter annuals, spring annuals, perennial weeds, summer-hardy species
• At a minimum, assess each field prior to a weed management operation
  – Better yet, monitor both before and a few weeks after to determine how you did
• 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.
Record keeping: comparing weed scouting reports over several years

• Like any other orchard performance evaluations, look for weed trends over time

• Compare several year’s records to evaluate changes
  – Look for new species
  – Are patches expanding or moving?
  – Failures on the same weed in the same area – could be early stages of resistance

• Compare weed management programs
  – Are there multiple strategies (integrated weed management) being used?
  – Are multiple herbicide modes of action being used within and among years?
  – Document and consider weed control successes and failures
  – Could varying levels of intensity be used in different parts of the orchard?
    • May save money while controlling weed patches

• Refine and fine-tune weed management program as needed
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
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UC Davis Weed Research and Information Center
http://wric.ucdavis.edu/
http://ucanr.org/blogs/UCDWeedScience/
@UCWeedScience on Twitter