Late Fall and Dormant Season Pest Management for Almonds

David Doll
Merced County UCCE
The Almond Growing Season

- Delayed Dormant
- Dormant
- Bloom
- Petal Fall: 2-5 weeks post petal fall
- Summer
- Hullsplit
- Harvest
- Post-Harvest Period
The Almond Growing Season

• Dormancy- Period of time from leaf fall until leaf out in the spring
  – December 1st until buds begin to swell, around February 1st, or so.

• Delayed Dormancy – Period of time of resumption of growth, indicated by bud swell until green tip.
Integrated Pest Management for Almonds

• Dormant Season Activities:
  – Count mummy nuts in the orchard
  – Remove, or knock, mummy nuts from trees
  – Let cover crop grow, and cut before bloom
  – Herbicide use for tree rows
  – Dormant spur sampling for scale and mites
  – Observe for other pests
Foliar Disease Management Strategies for Almond

1. Delayed Dormant
2. Bloom 2-5 weeks post petal fall
3. Petal Fall
4. Summer
5. Post-Harvest Period
6. Harvest

University of California
Agriculture and Natural Resources
Dormant/Delayed Dormant Treatments for Fungal Control

Possible treatments:
1. Shot-hole
2. Scab
3. Lichen
4. Maintenance

Recommended Options:
1. Copper and Oil
2. Liquid Limed-Sulfur
Bloom/Petal Fall Treatments for Fungal Control

Possible treatments:
1. Brown Rot
2. Anthracnose
3. Shot-Hole
4. Jacket Rot

Recommended Options:
1. Rotate FRAC group chemistries
2. Rovral, Scala, Vanguard, Bravo provide control
3. Save the Strobilurin for Scab/Rust
Post Petal Fall Treatments for Fungal Control

Early Diseases:
1. Scab
2. Anthracnose
3. Shot-Hole
Post Petal Fall Treatments for Fungal Control

Causes defoliation, weakens trees. Fritz, Carmel are highly susceptible. Twig Lesions serve as overwintering sites.
Fungicides for Scab

timing 2-5 weeks after petal fall

- Pristine (11/7)  medium  Strobilurin/Boscalid
- Flint / Gem (11)  high risk  Strobilurin
- Abound (11)  high risk  Strobilurin

- Captan (M4)  low risk  Phthalimide
- Ziram (M3)  low risk  Carbamate
- Bravo/Echo (M5)  low risk  Aromatic nitrile
- Topsin (1)  high risk  Benzimidazole

- Maneb (M3)  low risk  Carbamate
- Lime Sulfur  low risk
Summer Treatments for Fungal Control

Possible treatments:
1. Rust
2. Alternaria
3. Anthracnose

Recommended Options:
1. DMI’s (Quash, Bumber, Tilt)
2. Strobilurins
3. Pristine
Summer Treatments for Fungal Control

Why becoming problematic?

1. Planting Spacing
   - Humidity within canopy higher than ambient

2. Cutting corners on sprays, missed timings
Fungicides for Rust and Alternaria

Timing: 5 weeks after petal fall on

- Pristine (11/7)  medium  Strobilurin/Boscalid
- Flint / Gem (11)  high risk  Strobilurin
- Abound (11)  high risk  Strobilurin

**RUST ONLY**

- Maneb (M3)  low risk  Carbamate
- Sulfur  low risk  Inorganic
- Rovral (2)  low risk  Dicarboximide
Post- Harvest Fall Treatments for Fungal Control

Possible treatments:
1. Rust
2. Alternaria?

Recommended Options:
1. Zinc Sulfate 20-30 lbs per acre
   - Defoliate the trees to reduce overwintering populations
2. Clean up orchard by reducing leaf litter
Insect Pest Management Strategies for Almond

1. Delayed Dormant
2. Bloom 2-5 weeks post petal fall
3. Petal Fall Focus on Periods 1 and 2 for mites, scale, NOW, and PTB
4. Summer Hullsplit
   Post-Harvest Period

University of California
Agriculture and Natural Resources
Insect Pest Management Strategies for Almond

- Dormant/Delayed Dormant
- Scale and brown mite sampling
- Winter sanitation of varieties for NOW
- Decide on Treatment for PTB
Dormant Insect Management Strategies for Almond

- Sampling of spurs in late fall, early winter
  - 2-3 spurs off 35-50 trees
  - 20% infestation rate is threshold
  - Determine the need to treat with oil, Seize IGR
  - Guidelines @ ucipm.ucdavis.edu
Black caps of San Jose scale, *Diaspidiotus perniciosus*. San Jose scale nymphs.

**Identification tip:** The four round, dark scales in the center are the black cap stage, the most common overwintering form. The earlier white cap stage is to left.
European red mite eggs

**Identification tip:** Masses of eggs may be laid together. Each slightly flattened red egg has a long, spinelike projection, called a stipe, at the top that can be seen with a hand lens.
Dormant Spur Sampling of Almonds

Brown mite eggs

Identification tip: Brown mite eggs (shown here with adults) look like those of European red mite, but lack the stipe.
Dormant Spur Sampling of Almonds

European fruit lecanium

Identification tip: Look for legless, immobile, yellow insects on twigs. Older nymphs may have brown markings and a distinct center ridge.
Dormant Spur Sampling of Almonds

European fruit lecanium motile nymph and older nymphs, one parasitized.

Identification tip: Parasitized lecanium scales, such as the center one above, turn black.
Observations of Other Pests

Spider mites

**Identification tip:** The overwintering female mites are red or orange colored and are found under rough almond bark, in ground litter, and on winter weeds. Adult males are not present in the winter.
Observations of Other Pests

Armillaria root rot (oak root fungus)

**Identification tip:** In the winter months, large fleshy mushrooms grow at the base of trees infected with oak root fungus.
Observations of Other Pests

American plum borer larvae bore in scaffold crotches of young trees.

Identification tip: Extensive gumming around scaffold crotches, at pruning wounds, or in crown galls may indicate the presence of this borer.
Observations of Other Pests

Vertebrate pests:

Pocket gopher mounds:
Generally crescent shaped with a plugged opening

Vole Damage: Physical damage to tree and roots at or slightly above/below soil line
Pile of frass at entrance of peach twig borer hibernaculum.

**Identification tip:** Overwintering larvae are sheltered in tiny cells (hibernacula) that they bore under the bark of limb crotches on 1- to 4-year-old wood or in bark cracks on larger limbs and the trunk.
Bloom Insect Management Strategies

Overwintering Peach Twig Borer

Dormant Spray for PTB - 2009

Average Strikes/Tree

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Strikes/Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>12</td>
</tr>
<tr>
<td>Delegate (3 oz)</td>
<td>1</td>
</tr>
<tr>
<td>Belt (4 oz)</td>
<td>1</td>
</tr>
<tr>
<td>Lorsban EC (0.5 gal)</td>
<td>1</td>
</tr>
<tr>
<td>Asana (9.6 oz)</td>
<td>1</td>
</tr>
<tr>
<td>Lorsban Advanced (0.5 gal)</td>
<td>1</td>
</tr>
</tbody>
</table>

F. Zalom, UC Davis
Dormant/Bloom Insect Management Strategies

Overwintering/Emerging Peach Twig Borer

Average Strikes/Tree

- Untreated
- Dimilin Dormant (16 oz, 1.5 gal oil)
- Dimilin Delayed Dormant (12 oz + 1 qt summer oil)
- Dimilin early bloom (12 oz + 1 qt summer oil)
- Intrepid Early Bloom (10 oz)
- Intrepid Delayed Dormant (10 oz + 4 gal oil)

F. Zalom, UC Davis
Dormant Insect Management Strategies

Navel Orangeworm – Winter Sanitation

Count mummy nuts in the orchard
- If more than 2/tree, remove nuts from tree.
- Reduces overwintering larvae of Navel Orange Worm
- Flail mow by March

Research has shown importance for Pistachio!
Dormant Insect Management Strategies

Navel Orangeworm – Winter Sanitation

<table>
<thead>
<tr>
<th>AVERAGE # MUMMIES PER TREE</th>
<th># GROWERS</th>
<th>AVERAGE % NOW INFESTATION AT HARVEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 (0 - 1.9)</td>
<td>15</td>
<td>1.69 (0 - 5)</td>
</tr>
<tr>
<td>&gt;2 (2.6 - 177)</td>
<td>21</td>
<td>3.53 (0.2 - 14)</td>
</tr>
</tbody>
</table>
Dormant Insect Management Strategies

Navel Orangeworm – Over-wintering flight

<table>
<thead>
<tr>
<th>Variety</th>
<th>Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fritz</td>
<td>6.92% A</td>
</tr>
<tr>
<td>Nonpareil</td>
<td>10.00% B</td>
</tr>
<tr>
<td>Monterey</td>
<td>13.00% B</td>
</tr>
<tr>
<td>Butte</td>
<td>18.00% C</td>
</tr>
<tr>
<td>Padre</td>
<td>32.09% D</td>
</tr>
</tbody>
</table>

J. Siegel, USDA-ARS
Navel Orangeworm – Over-wintering flight

Madera 2009

Eggs

Degree Days

July 17

Pisachios A
Pistachios B
Pistachios C
Almonds A
Almonds B
Almonds C

J. Siegel, USDA-ARS

University of California
Agriculture and Natural Resources
Weed Management Strategies for Almonds

1. **Delayed Dormant**
   - Focus on Period 1 for Pre-emergent use

2. **Bloom**
   - 2-5 weeks post petal fall

3. **Summer**
   - Hullsplit

4. **Post-Harvest Period**
   - Harvest

---

University of California
Agriculture and Natural Resources
Weed Management Strategies for Almonds

Herbicide use for young almond orchards:

A good pre-emergent program to control most of annual broadleaves:

<table>
<thead>
<tr>
<th>Oct-Dec:</th>
<th>Matrix FNV (4 oz) + Prowl H₂O (5 pt) ± Postemergent(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>then</td>
</tr>
<tr>
<td>Jan-Mar:</td>
<td>Chateau (12 oz) + Prowl H₂O (5 pt) ± Postemergent(s)</td>
</tr>
</tbody>
</table>

If application of pre-emergents only want to be made in late winter, then:

<table>
<thead>
<tr>
<th>Oct-Dec:</th>
<th>Postemergents (2,4-D amine, RU, Rely, etc.) need to go on young weeds (no bigger than a silver dollar)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>then</td>
</tr>
<tr>
<td>Jan-Mar:</td>
<td>Chateau (12 oz) + Prowl H₂O (5 pt) ± postemergent(s)</td>
</tr>
<tr>
<td></td>
<td>or</td>
</tr>
<tr>
<td></td>
<td>Matrix FNV (4 oz)</td>
</tr>
</tbody>
</table>

K. Hembree, UCCE
Weed Control – Pre-emergents

Weed density at 120 DAT

- Untreated
- Glyphosate + glufosinate
- Glyphosate + chateau (12 oz)
- Pindar GT (2 pt)
- Alian (5 oz)
- Trellis (1.33 lb)
- Princep (2.0 lb)

B. Hanson, A. Johnson, UC Davis
Comparison of glyphosate vs glufosinate with residual partners

B. Hanson, A. Johnson, UC Davis
# Weed Control – Susceptibility Tables

**Website:** search “UC IPM” or UCIPM.UCDAVIS.EDU

## Susceptibility of Winter Weeds to Herbicide Control

<table>
<thead>
<tr>
<th>ANNUAL WEEDS</th>
<th>PREEMERGENCE</th>
<th>POSTEMERGENCE</th>
<th>COMBINATIONS</th>
<th>ANNUAL WEEDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FLM</td>
<td>ISO</td>
<td>NAP</td>
<td>NOR</td>
</tr>
<tr>
<td>Barley, Hare</td>
<td>N</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Bluegrass, Annual</td>
<td>N</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Bromegrasses</td>
<td>N</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Closures</td>
<td>C</td>
<td>P</td>
<td>P</td>
<td>N</td>
</tr>
<tr>
<td>Cudweeds</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>N</td>
</tr>
<tr>
<td>Filarees</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Groundsel, Common</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>P</td>
</tr>
<tr>
<td>Henbit</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>P</td>
</tr>
<tr>
<td>Mallow, Little</td>
<td>C</td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>Mustards</td>
<td>C</td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>Nettle, Burning</td>
<td>C</td>
<td>C</td>
<td>N</td>
<td>C</td>
</tr>
<tr>
<td>Oat, Wild</td>
<td>C</td>
<td>N</td>
<td>C</td>
<td>P</td>
</tr>
<tr>
<td>Radish, Wild</td>
<td>C</td>
<td>N</td>
<td>C</td>
<td>P</td>
</tr>
<tr>
<td>Redmaids (Desert Rockpurslane)</td>
<td>N</td>
<td>C</td>
<td>N</td>
<td>C</td>
</tr>
<tr>
<td>Rocket, London</td>
<td>C</td>
<td>P</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Ryegrasses</td>
<td>N</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>Shepherd’s-Purse</td>
<td>C</td>
<td>C</td>
<td>N</td>
<td>C</td>
</tr>
</tbody>
</table>

*Note: The table above lists the susceptibility of various winter weeds to different herbicide combinations. Each cell represents the susceptibility level, with options including 'C' for common, 'P' for poor, and 'N' for non-susceptible. Additional combinations and annual weeds are also provided.*
Conclusions

1. When it comes to pesticides, rotate, rotate, rotate
2. Brown rot is a concern, but summer foliar diseases should be emphasized
3. Tight spacing equals higher yields, they also equal more foliar diseases due to canopy micro-climate
4. If the orchard is infested with rust, apply zinc sulfate to defoliate the trees. Schedule spray for next year.
5. In regards to insects – a clean orchard is a happier orchard – winter sanitize all trees
6. New insecticides and herbicides provide more treatment options
GLYPHOSATE-RESISTANT WEEDS IN ORCHARDS - RECENT UC IPM PUBLICATIONS

 Posted by Brad Hanson / October 29, 2012 / Posted in Almond, General, Orchard Floor Management, Pest Management, Pistachio, Walnut / No Comments

Last winter, I participated in a series of seven half-day workshops in California, Oregon, and Washington on herbicide-resistant weeds. These workshops were organized by Kassim Al-Khatib from the University of California Integrated Pest Management (IPM) Program and had a special focus on glyphosate-resistant weeds in tree and vine crops.

In preparation for these workshops, we wrote a series of extension publications that I wanted to share today. The publications and resulting presentations were prepared by weed scientists from various Universities, Cooperative Extension, and USDA-ARS and included various aspects of herbicide resistance in permanent crops. Even as someone who thinks about herbicide resistance every day, I found the bulletins and presentations to be tremendously informative. These included:

Selection Pressure, Shifting Populations, and Herbicide Resistance and Tolerance by Brad Hanson, Albert Fischer, Anil Shrestha, Marie Jasieniuk, Ed Peachey, Rick Boydston, Tim Miller, Kassim Al-Khatib...
Questions?

Thank you for your attention!