California Almonds and Honey Bees

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The Scope of the Almond Growing in California

- Spanning 500 miles throughout the Central Valley
- 100% of U.S. production
- ~ 6,500+ growers, 100 “handlers”
  - 50% of growers have 50 A or less
  - 90%+ are family owned & run
- Approximately 80% of worldwide production
- Top U.S. horticultural crop in export value

ABC is a grower-enacted “Federal Marketing Order” established in 1950
  - Represents growers and handlers (processors)
- Operates under supervision of USDA

2012 Farm value
Approximately $4 Billion
Almond varieties are self-incompatible (pollen of one variety doesn’t pollinate itself)

Each orchard is planted with two, typically 3, different varieties of almonds to allow cross-pollination

Rely on bees to move the pollen from one variety to another, so not just move pollen within flower

Need pollination services mid-February through mid-March
Pollination Supply vs. Demand: Supply Stable

Source: USDA NASS Honey Production Report
Pollination Supply vs. Demand: Overwinter Colony Loss
Average 30.6% vs. Acceptable 15%

Source: Apiary Inspectors of America and USDA-ARS Beltsville Lab
Almond Acreage: Pollination Supply vs. Demand

~ 2 colonies/ac = 1.62 million colonies vs. 2.62 in US and ~30% winter loss

Source: USDA Agricultural Statistics Service, Pacific Region (NASS/PR) 2012 Acreage Report
Honey Bees and Almond Production

• Grower perspective: sufficient supply to date despite honey bee health challenges
• Beekeeper perspective: might not be in business without almond pollination

Cultural costs
San Joaquin Valley (2011)
$1,978 per acre (w/o harvest, overhead, taxes, etc)
Almonds need Fungicides and Pollination Services at the same time

### Fungicide Treatment Timing in Almonds

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

<table>
<thead>
<tr>
<th>Disease</th>
<th>Dormant</th>
<th>Bloom</th>
<th>Spring&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Pink bud</td>
<td>Full bloom</td>
<td>Petal fall</td>
</tr>
<tr>
<td>Alternaria</td>
<td>----</td>
<td>----</td>
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<td>----</td>
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<tr>
<td>Anthracnose&lt;sup&gt;2&lt;/sup&gt;</td>
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<td>++</td>
<td>+++</td>
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<tr>
<td>Brown rot</td>
<td>----</td>
<td>++</td>
<td>+++</td>
<td>+</td>
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<tr>
<td>Green fruit rot</td>
<td>----</td>
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<td>+++</td>
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<tr>
<td>Hull rot&lt;sup&gt;2&lt;/sup&gt;</td>
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<tr>
<td>Leaf blight</td>
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<td>+++</td>
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<tr>
<td>Scab&lt;sup&gt;3&lt;/sup&gt;</td>
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<tr>
<td>Shot hole&lt;sup&gt;4&lt;/sup&gt;</td>
<td>+&lt;sup&gt;5&lt;/sup&gt;</td>
<td>+</td>
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<td>+++</td>
</tr>
<tr>
<td>Rust</td>
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</table>

**Rating:** +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

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

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

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

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

<sup>5</sup> Dormant treatment provides a degree of control of anthracnose that is beneficial to many of this year's new, but not always to follow-up applications.

<sup>6</sup> Dormant treatment controlled Hull rot and other infection to levels of this year's effect but did not control by fall application.
Trends in Fungicide Application During Almond Bloom
Usage from February 16–March 15

Total Acres Treated

Source: CDPR-PUR
Fungicides during Almond Bloom – What Strategies to Mitigate?

1) **Can bloom sprays be avoided? Not really.**
   - Fungal diseases at critical time affect nut set/embryo differentiation. Some diseases cause early leaf drop, which affects the energy for tree.
   - Fungal spores like mild temps and wet/moist conditions. Bloom is during rainy season and there is enough dew for sporulation to occur.
   - Most fungicides only work if applied prior to the fungal sporulation
     (is that prophylactic tmnt when research says rain/dew & right temps present?)

2) **Can sprays be applied to avoid honey bee foraging in almonds? Yes**
   - Almond pollen is released in the morning and bees forage the pollen fairly quickly.
   - Apply fungicides in late afternoon/evening (but need time for it to dry)
   - Recent preliminary research also found that wet stigma inhibits pollen germination and pollen tube formation.
     ➔ Additional incentive for growers to delay fungicide sprays to later in the day
BMP Outreach to Almond Growers

California Almond Outlook (print & eNews)
Western Farm Press
AgNet West Radio
The Almond Conference
AlmondBoard.com
UC Extension

BMP Messages include:

• Minimize exposure of bees and pollen to fungicides by spraying after mid-afternoon and at night
• Applications of insecticides during bloom should be avoided until more is known about impact on bee larvae
• Provide supplemental nutrition by planting plants to feed bees both before and after almond pollination (Project Apis m, CURES, Syngenta, Monsanto, UC-Davis, etc). Still assessing what works
• Communicate with your beekeeper!
What has else the ABC done?
Almond Grower Research Investment into Bee Health

ABC has funded research in pollination since 1976, investing some $2.2 million of almond grower dollars

• Largest, most sustained of any commodity organization
• Honey bee health has been a focus since 1995 – nutrition, stock improvement, pest/disease management, impact of pesticides - $1.3 million spent
• Since 2000, 70 projects with key researchers throughout the United States

Partnering with beekeepers (e.g., Project Apis m. and CSBA) and research institutions across the US
Almond (and Other Key Players)  
Priorities for Improving Honey Bee Health

Research Priorities:

1. Improving honey bee nutrition and forage throughout the year*
2. Varroa mite (and other bee pests) control – breeding, new materials, and management techniques*  
3. Germplasm importation, preservation, and stock improvement (disease and pest resistance)  
4. Balancing the need for pest control materials, both in crops and in the hive vs. possible effects on hive health  
• “Successful beekeepers Top 2 list: Mite management and providing good nutrition.”

Extension Priorities: Need both beekeeper and grower BMPs  
1. Cooperative extension apiculturists  
2. Fee for service Bee “Pest Control Advisors” and Tech Transfer Teams
Policy Issues in Honey Bee Health from an Almond Grower Perspective

1) How to balance the need for pest control tools with the simultaneous need for pollination services?

2) How to ensure necessary food supply for bees and other pollinators exists both nationally as well as before and after almond bloom in California

3) How to ensure appropriate research exists to develop real solutions?

4) How to ensure almond pollination is attractive to beekeepers and yet at a price that is reasonable for almond growers
Questions?

Thank You!