PUR and the Economics of Walnut Pest Management Strategies using Pheromone

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Project Team Acknowledgements

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Agricultural Impacts on the Environment
To Understand the Economic and Environmental Tradeoffs behind Different Pest Management Strategies in order to:

1. Minimize environmental impact to a safe threshold for all non-targeted groups
2. Maintain agricultural economic viability
Case Study

99% of all American walnut production is in California

2006

- ≈215,000 bearing acres
- ≈314,000 metric tons
- ≈$550 million value

Top 20 Ag Commodities for California

≈ 33% of world supply
Case Study

Arthropod Pests

Codling Moth (*Cydia pomonella*)

Walnut Husk Fly (*Rhagoletis completa*)

Aphid (*Chromaphis juglandicola*)

Spider Mites (*Tetranychus sp.*)

Arthropod Pesticides

2006, San Joaquin County

≈ 127,000 lbs of active ingredients used

Over 60% are probable impairments to water quality

Organophosphates

Pyrethroids
Low Risk Pest Control Products

- Pheromone Mating Disruption
- Insect Growth Regulators
- Microbial Controls
- Biological Control
### Data Sources: Current Pest Management Practices

**Pesticide Use Reports (PUR) Database**
California Department of Pesticide Regulation

- Grower Identification
- Commodity
- Location
- Acres Treated
- Total Acres Planted
- Product and Active Ingredient
- Use Rate
- Number of Applications
- Date of Application
- Method of Application
**Overview of Analysis**

Compare grower’s current costs to the cost of hypothetical, alternative pheromone-based pest management strategies

- to determine the % of growers finding an alternative strategy economically feasible
Overview of Analysis

6 Steps:

1. Derive costs of current pest management strategies practiced by growers, as reported in the PUR database
2. Consider limitations of PUR data and assumptions needed
3. Derive costs of hypothetical low risk strategies based on each grower's target pests and codling moth pressure
4. Compare current cost to alternative cost to determine economic feasibility of alternative pest management strategies
5. Analyze how biological control effectiveness affects economic feasibility
6. Calculate % of growers finding the alternative strategy economically feasible
Step1: Grower’s Pest Management Strategy Costs

**Pest Management Strategy** =

All arthropod pest controls used throughout the season by a grower
### Step 2: PUR Data Limitations

Through product choice and timing, we can tell if a grower treated for:
- Codling Moth (April 15th to the end of July)
- Walnut Husk Fly (applied with bait)
- Mites (miticide)

We cannot tell:
- If a grower treated for Aphid
- If a grower had high or low Codling Moth pressure

We therefore:
- Assumed *all* growers treated for **Aphid**
- Ran 2 separate analyses assuming:
  - 1\textsuperscript{st}: *All* growers have *low/moderate* pressure
  - 2\textsuperscript{nd}: *All* growers have *high* pressure
Step 3: Hypothetical Alternative Pest Management Strategy Costs

Growers are split into 2 groups:

- **Group 1**:
  - Codling Moth, Aphid: Pheromone Alone
  - Cost: $108/acre
  - Success + Bait
  - Cost: $164/acre

- **Group 2**:
  - Codling Moth, Aphid, and Walnut Husk Fly: Pheromone + Intrepid
  - Cost: $193/acre
  - Success + Bait
  - Cost: $248/acre
An alternative strategy is economically feasible if

1. The cost of an alternative strategy is \( \leq \) to a grower’s current costs
2. Equivalent efficacy
3 Levels Evaluated in relation to Miticide Costs

- Effective: $0 miticide costs added to alternative strategy costs
- Moderate: ½ PUR-reported miticide costs added to alternative strategy costs
- Ineffective: Full PUR-reported miticide costs added to alternative strategy costs

Step 5: Biological Control

Effectiveness

Organophosphates

Pyrethroids
### Step 6: Economic Feasibility of Alternative Strategies

**CM Pressure:** Low/Moderate

<table>
<thead>
<tr>
<th>Biological Control</th>
<th>Effective</th>
<th>Moderate</th>
<th>Ineffective</th>
</tr>
</thead>
<tbody>
<tr>
<td>OP</td>
<td>52%</td>
<td>31%</td>
<td>16%</td>
</tr>
<tr>
<td>Pyrethroid</td>
<td>12%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>Combination</td>
<td>62%</td>
<td>48%</td>
<td>25%</td>
</tr>
<tr>
<td>Entire Sample</td>
<td>53%</td>
<td>36%</td>
<td>19%</td>
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</tbody>
</table>
Step 6: Economic Feasibility of Alternative Strategies

<table>
<thead>
<tr>
<th>CM Pressure: High</th>
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</thead>
<tbody>
<tr>
<td>Biological Control:</td>
</tr>
<tr>
<td>Effective</td>
</tr>
<tr>
<td>OP: 7%</td>
</tr>
<tr>
<td>Pyrethroid: 2%</td>
</tr>
<tr>
<td>Combination: 19%</td>
</tr>
<tr>
<td>Entire Sample: 12%</td>
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</tbody>
</table>
Summary

Biological Control:
Ineffective → Effective

Low/Codling Moth Pressure:
- Combination: 12 to 53%
- OP: 16 to 52%
- Pyrethroid: 04 to 12%

High Codling Moth Pressure:
- Combination: 25 to 162%

Effective

Ineffective
Conclusions

• Recent studies show pheromone may be effective without supplement – therefore the higher % (19-53%) may be more reflective of the region

• We assumed that all growers need to treat for aphid every year. Softening this assumption would ↑%

• Growers may choose alternative strategies even if more costly to reduce risk, which would ↑%
Conclusions

• Alternative pheromone based low risk pest management strategies hold promise both economically and environmentally

• High risk pesticide use per acre could be reduced 6-43%, dependent on biological control effectiveness and codling moth pressure

• Organophosphate or combination of organophosphate and pyrethroid
Thank You

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