Managing Navel Orangeworm (NOW) in Walnuts

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Stanislaus County
“worm” infestation

Know your enemy

• to manage infestations effectively

distinguish between NOW

and codling moth (CM)
NOW

CM
NOW nut infestation:
webbing, frass, multiple larvae

NOW

CM
NOW has crescent-shaped mark behind head
NOW management

understanding NOW life cycle is key to management
seasonal pattern in walnut
NOW life cycle

overwinter

- as larvae in mummy nuts on tree and ground
- trash nuts around bins, hullers
NOW life cycle

pupation

March to May
NOW life cycle

moth emergence
April-May
first moth emergence

• OW adults start emerging in April

• peak emergence usually late April to mid-May
  (depends on season and locality)
NOW

adults lay eggs on injured nuts
where larvae then develop
NOW

• cultivar

• history
  ✓ grade sheets*
  ✓ harvest crackout

• mummy nuts
NOW

4-point management program

- season-long
- multi-tactic strategy
4 - point management program

1. destroy mummy nuts
mummy nuts

initial source of NOW population for the season
NOW: high reproductive capacity, low survival

- survival probably under 10% under most field circumstance

- a small increase in survival can result in a large increase in abundance!

- destroy mummy nuts before moth emergence in April
- flail mow to break mummy nuts apart
# mummy nut destruction vs. adult emergence

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>on bare berm</td>
<td>63.3 a</td>
<td>11.8 a</td>
</tr>
<tr>
<td>in weeds</td>
<td>8.8 b</td>
<td>9.0 a</td>
</tr>
<tr>
<td>shredded</td>
<td>0.0 b</td>
<td>0.3 c</td>
</tr>
<tr>
<td>double disced</td>
<td>2.3 b</td>
<td>3.8 b</td>
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</table>
4 - point management program

2. control pests and diseases throughout the season

CM
blight
sunburn
CM, blight, sunburn

- in-season “bridge” from mummy nuts to hullsplit
- allow NOW population to survive and increase
NOW damaged hulls allow NOW to develop throughout the season
4 - point management program

3. timely harvest
quality benefits of timely harvest

- less NOW
- lighter kernels
- less mold
easy NOW access
NOW infestation

after hullsplit

especially coinciding with NOW egg laying period

the number of infested nuts increases substantially with harvest delays
2-shake harvest

**first shake**
80% of the nuts can be removed and 95% of those nuts are hullable

**second shake**
harvest the remaining 20% 10 to 14 days later
ethephon

- first shake: economic harvest 14 days after application
- harvest 7 to 10 days earlier when applied at packing tissue brown
- reduces the amount of time the nuts are exposed to NOW infestation
insect damage in husk split and first harvest samples

Stanislaus County sites

<table>
<thead>
<tr>
<th>Site number</th>
<th>Percent damage</th>
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<tbody>
<tr>
<td>2</td>
<td>0.0</td>
</tr>
<tr>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td>6</td>
<td>0.4</td>
</tr>
<tr>
<td>8</td>
<td>0.6</td>
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~50% CM

Burks, Fichtner, Anderson - 2014
Q. Is NOW a secondary pest entering through CM, other damage?

A. Yes, BUT may be primary
Do I need to treat NOW?

- **history**
- **monitoring**
  - egg traps
  - pheromone traps
  - kairomone traps
  - crop phenology and egg laying
- **Thresholds?**
egg traps

bait with ground almond press cake plus 3% - 10% crude almond oil
egg traps

- very variable
- gives spring biofix date – useful?
- more eggs earlier in season
- Are they cost effective to monitor and maintain?
- need 8-12 traps / orchard unit
- more useful in almonds/pistachios right now
Usefulness in walnuts?

- undetermined

- Detect eggs at hullsplit?
  maybe but strong competition with split nuts
change bait as needed

moldy, compressed bait after rain
pheromone traps

delta trap

wing trap
pheromone traps

- monitor male moth population
- Suterra Biolure®, others coming
- hang early March
- count weekly
- What do the numbers mean?
  - don’t know
- need research
be careful with interpretation
don’t confuse with meal moth in traps
kairomone traps

Peterson traps
Mass trapping?
management options

- mating disruption
- chemical control
NOW mating disruption

Suterra® has registered product
NOW mating disruption

- less research in walnuts
- near complete trap shut down
- few eggs in nearby traps

BUT

- impact on harvest damage less clear
- damage >10% in some orchards even with grower sprays
chemical control

- about 50% effective at best – coverage issue
- time at husk split – monitor egg laying on nuts
- benefit from CM sprays
- IPM guidelines
  (www.ipm.ucdavis.edu)
impact of early April spray -NS
treat eggs & new larvae from overwintering generation

Burks, Fichtner, Anderson - 2014
Where is NOW coming from?

Q: Source of NOW – resident or immigrant?

A: Can be either - highest in fall

✓ implications for area wide control

overwintered is in-orchard from mummy nuts
“Improvement is needed in all aspects of IPM for NOW”

C. Burks
summary

4 - point management program

1. destroy mummy nuts*

2. control pests/diseases throughout the season

3. timely harvest*

4. insecticides