

Managing Navel Orangeworm (NOW) in Walnuts



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“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



CM

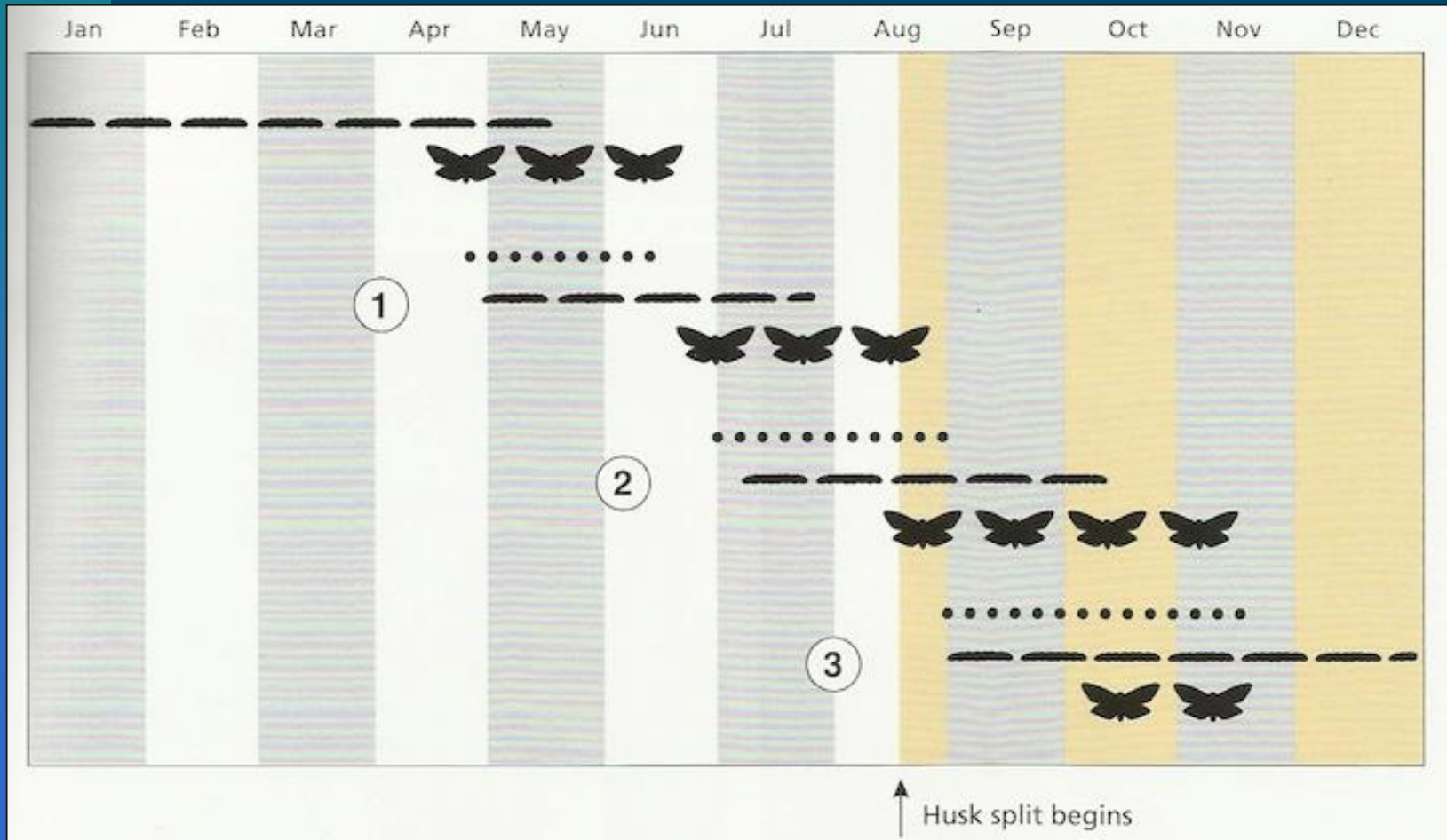


NOW

NOW management

understanding NOW life cycle
is key to management

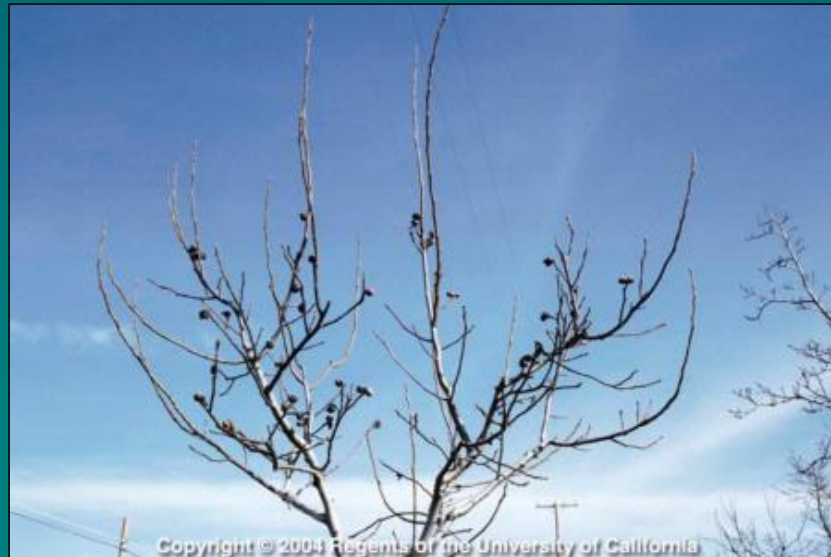
seasonal pattern in walnut



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



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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



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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

mummy nut treatment	1990-1991	1991-1992
on bare berm	63.3 a	11.8 a
in weeds	8.8 b	9.0 a
shredded	0.0 b	0.3 c
double disced	2.3 b	3.8 b

4 - point management program

2. control pests and diseases throughout the season

CM

blight

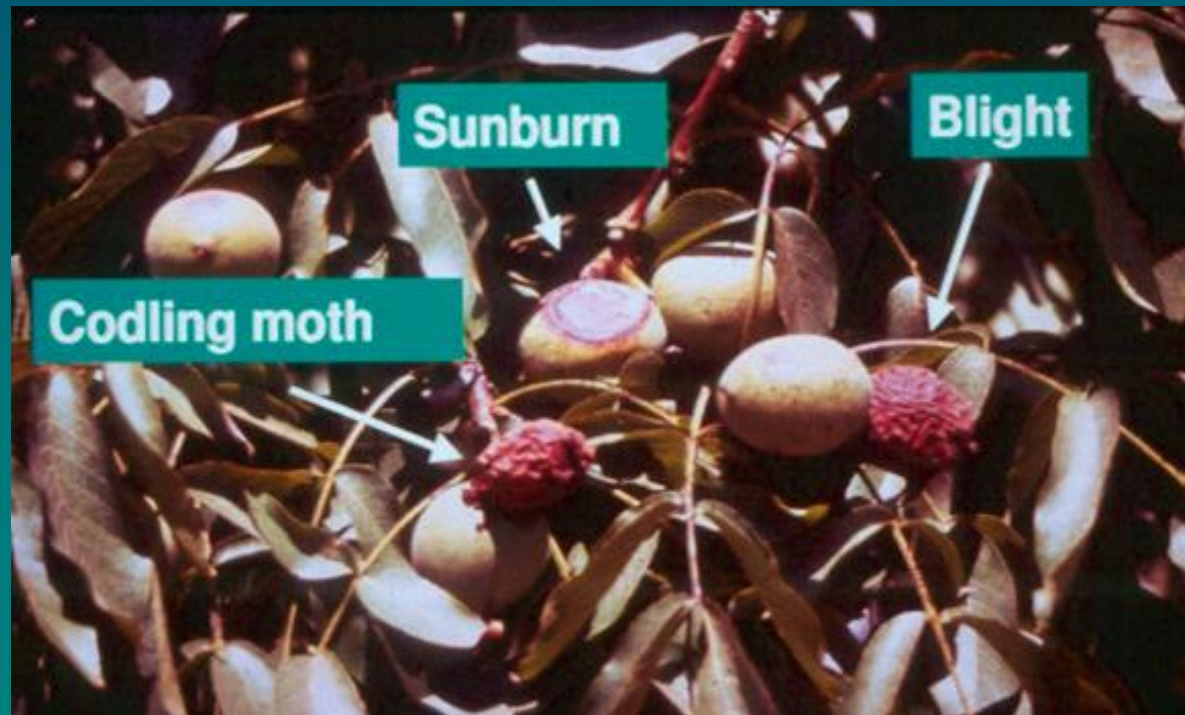
sunburn

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

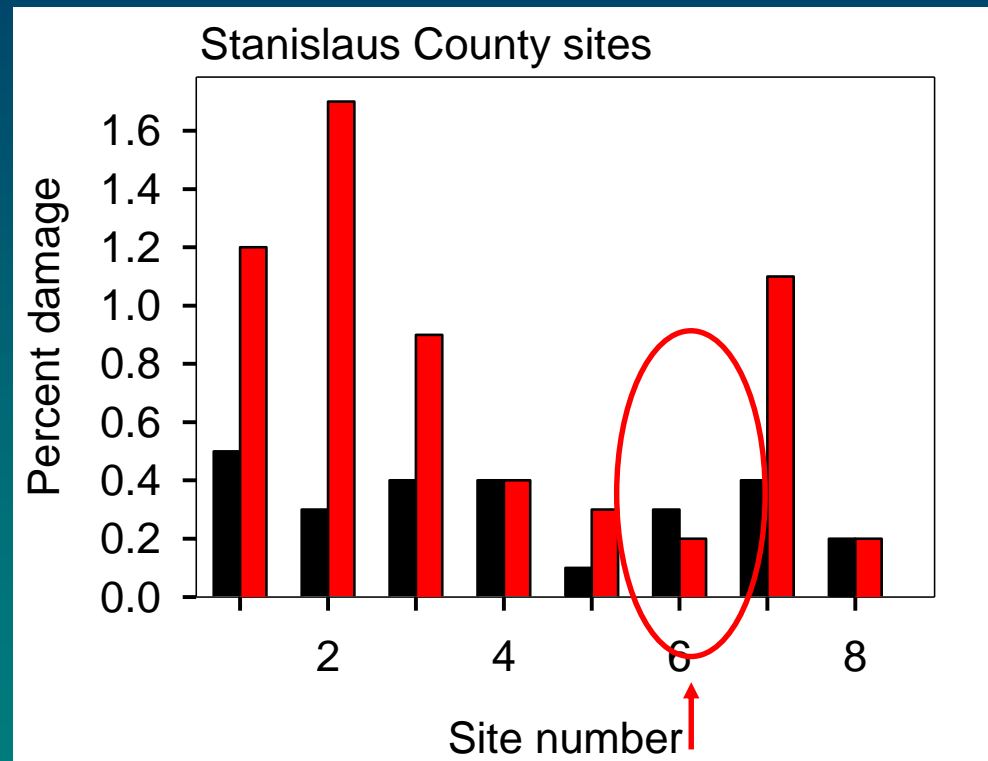
second shake

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



~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



wing trap

delta trap



pheromone traps

- monitor male moth population
- Sutterra 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?

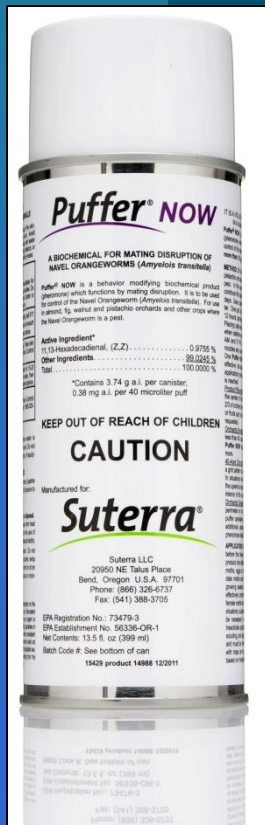


management options

- 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

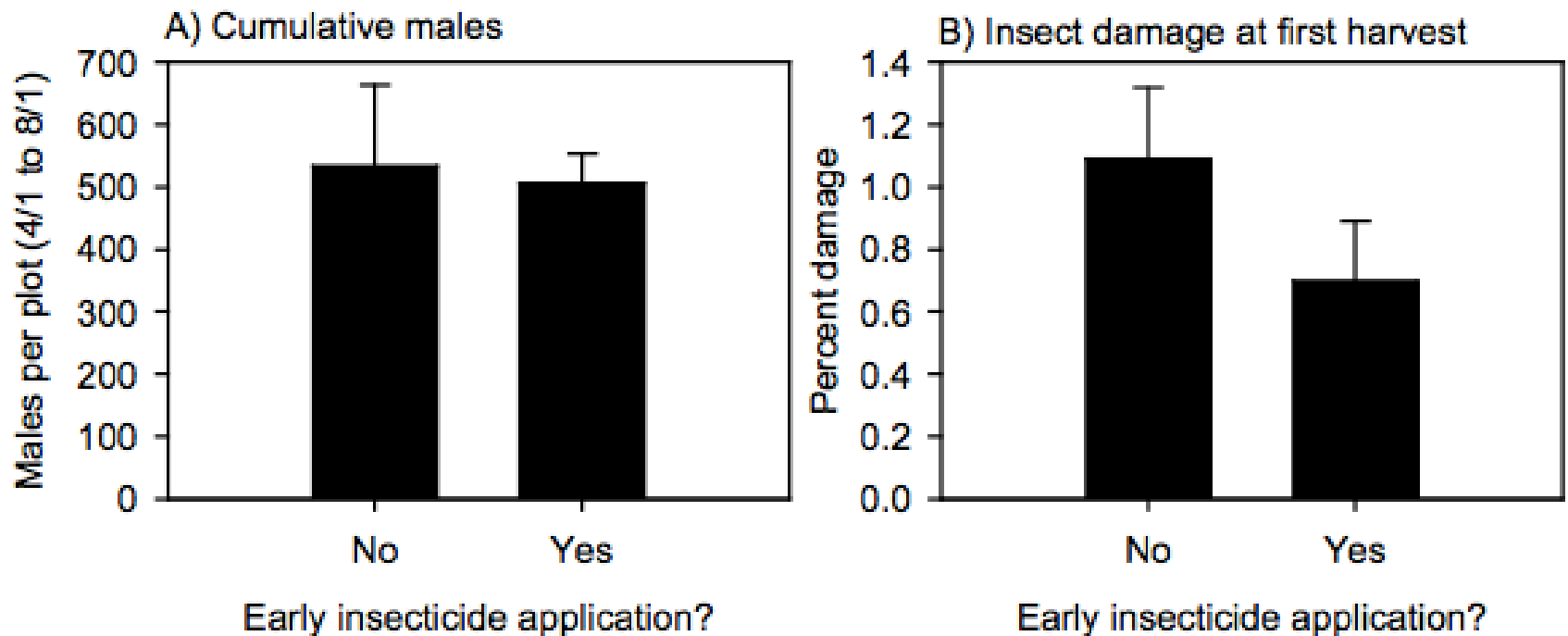
- impact on harvest damage less clear
- damage $>10\%$ in some orchards even with grower sprays

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**



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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

bottom line

“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