IPM Updates:
Walnut Scale & Navel Orangeworm

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Sacramento-Solano-Yolo Walnut Production Meeting

March 1st, 2017

Scale Pests of Walnut

Walnut scale

San Jose Scale

Italian Pear Scale

Scale Pests of Walnut

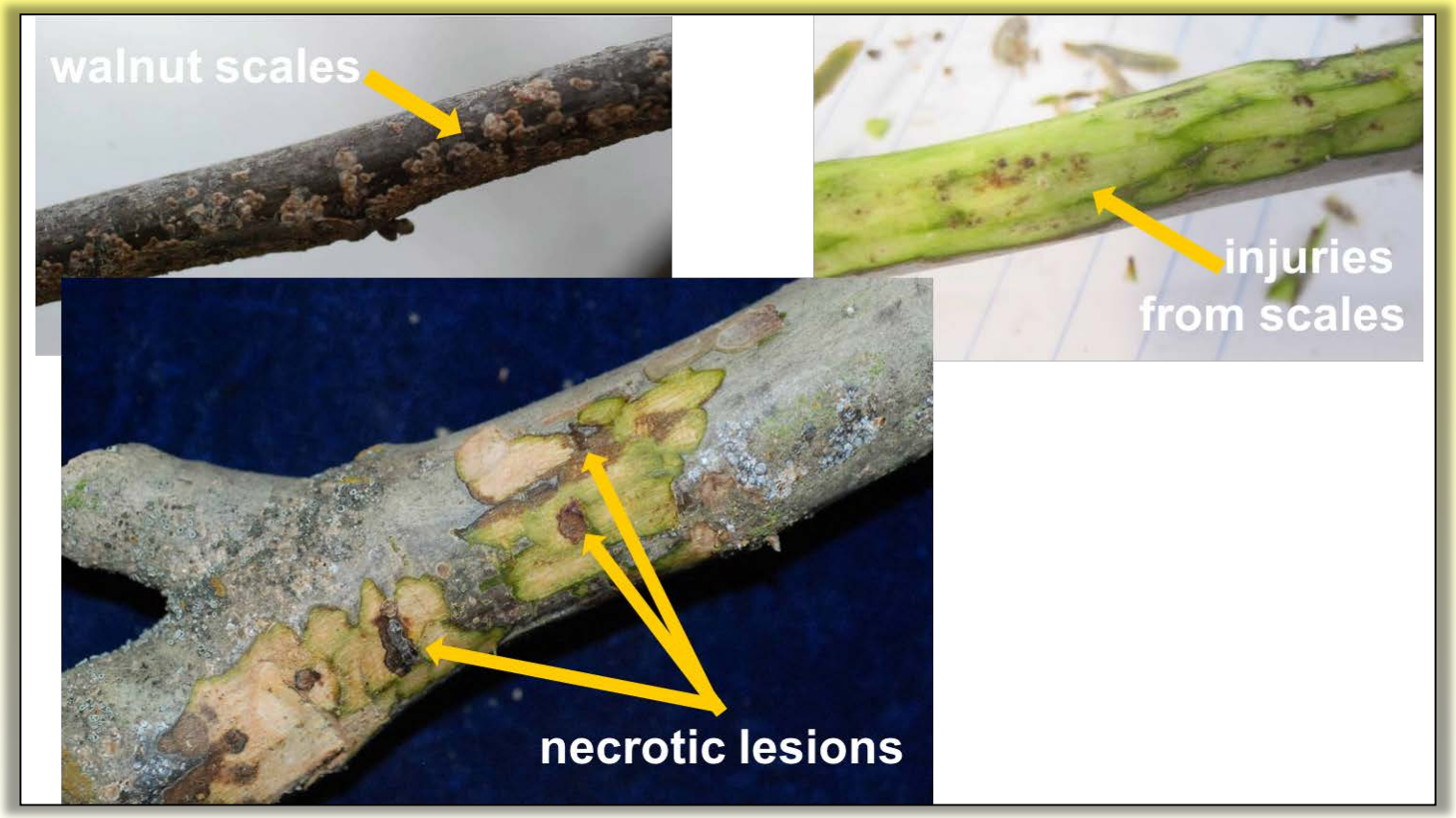
Frosted scale

European fruit lecanium

Walnut Scale Damage

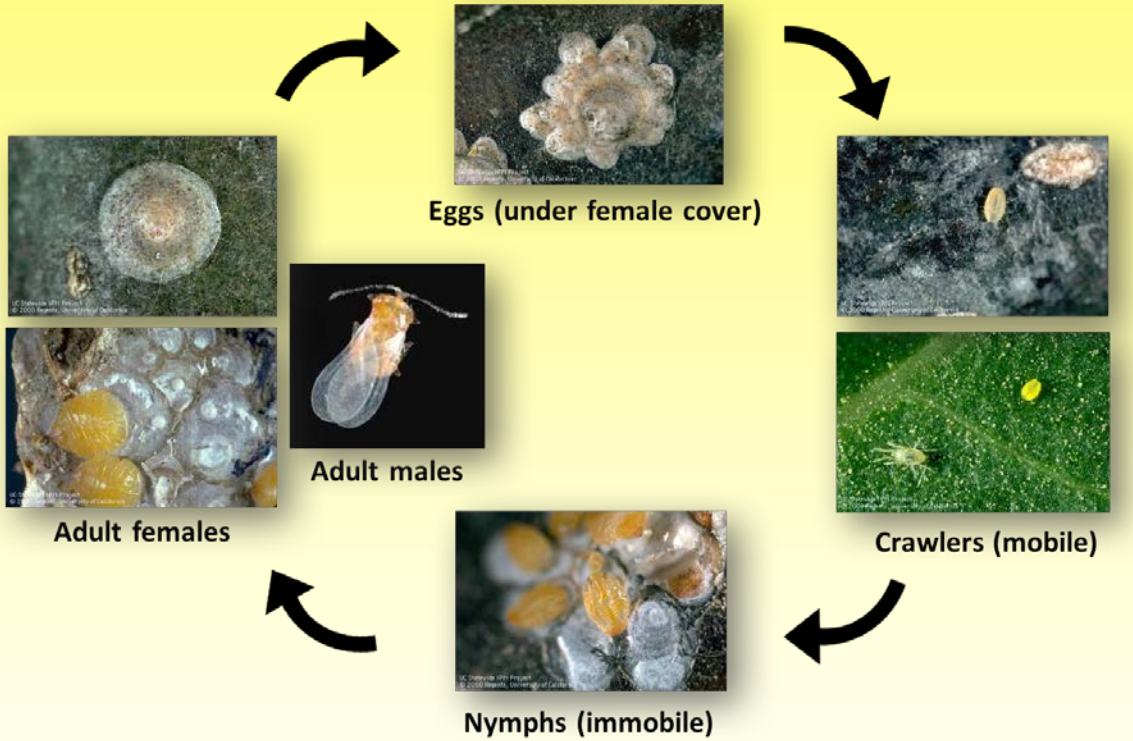
- **Suck plant juices**
- **Infested trees can appear water stressed**
- **Heavy populations may cause dieback of inside fruiting wood on lateral bearing cultivars, cracking of bark, reduced terminal growth & vigor leading to smaller nuts & poor kernel quality**
- **Economic damage rare unless populations very heavy, but…**
- **<u>Feeding can provide entry point for pathogens</u>**
  - **Ex: Bot-walnut scale association**

Walnut Scale Damage



Association with *Botryosphaeria*

Walnut Scale Life Cycle



- Two generations/year
- Overwinter as 2nd instar nymphs
- Resume development late winter – spring
- 1st generation crawler emergence late April – early May
- 2nd generation crawlers late summer – fall

Walnut Scale Management Options & Timing

- **Pre-Bot: Biological control provided adequate suppression of low to moderate populations**

- **Bot-era: Insecticide treatment timings**
  - **Delayed-dormant (March)**
  - **Crawler stage**

Biological Control: Walnut Scale Parasitoids

Walnut Scale Monitoring – Dormant Period

- **Examine scaffolds, limbs, branches, and prunings for scales & evidence of parasitism**

- **Historical treatment thresholds: pests + parasitization**
  - **If high degree of parasitization observed, consider delaying treatments until after crawler emergence**

- **Current thresholds – must consider Botryosphaeria**

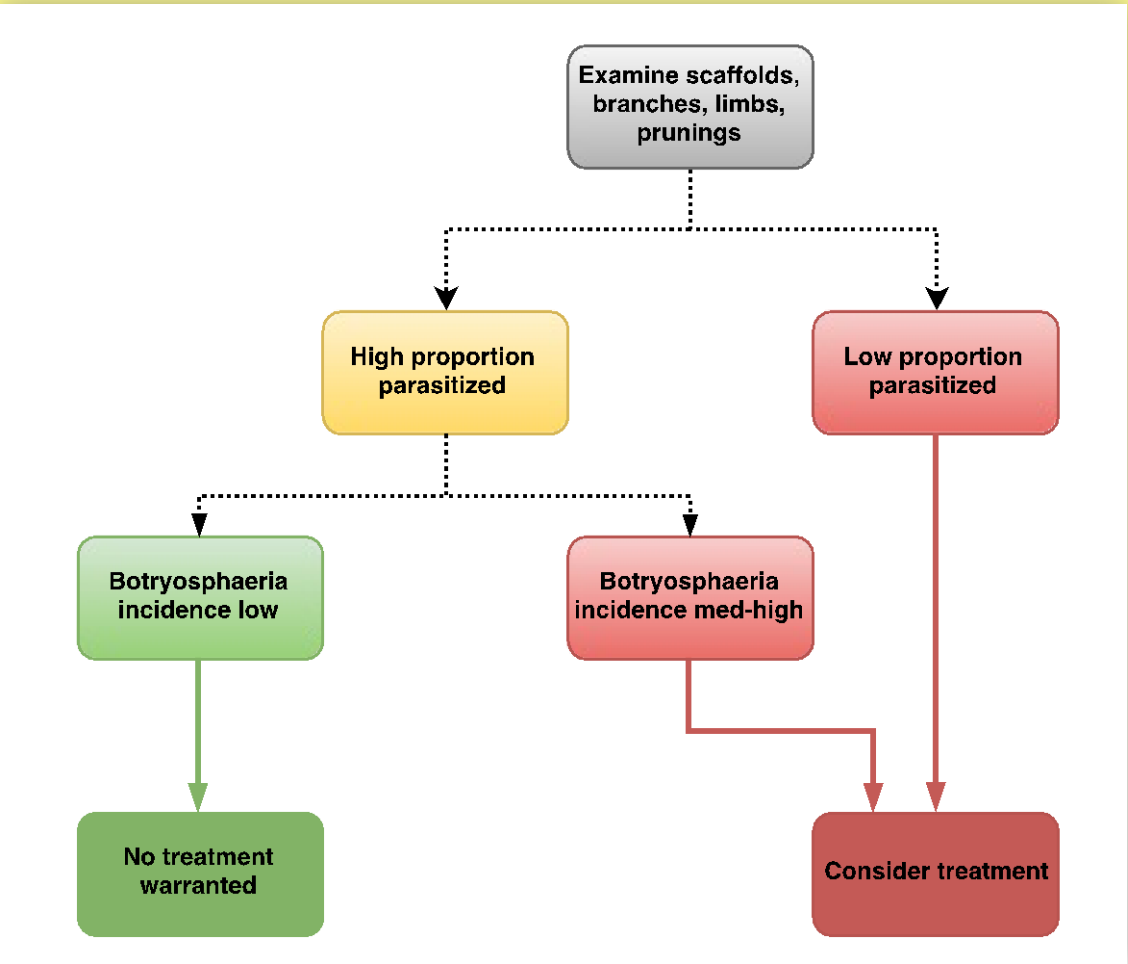
<u>If treatments were applied previous season, confirm whether scales are still alive</u>

Walnut Scale Monitoring – Dormant Period

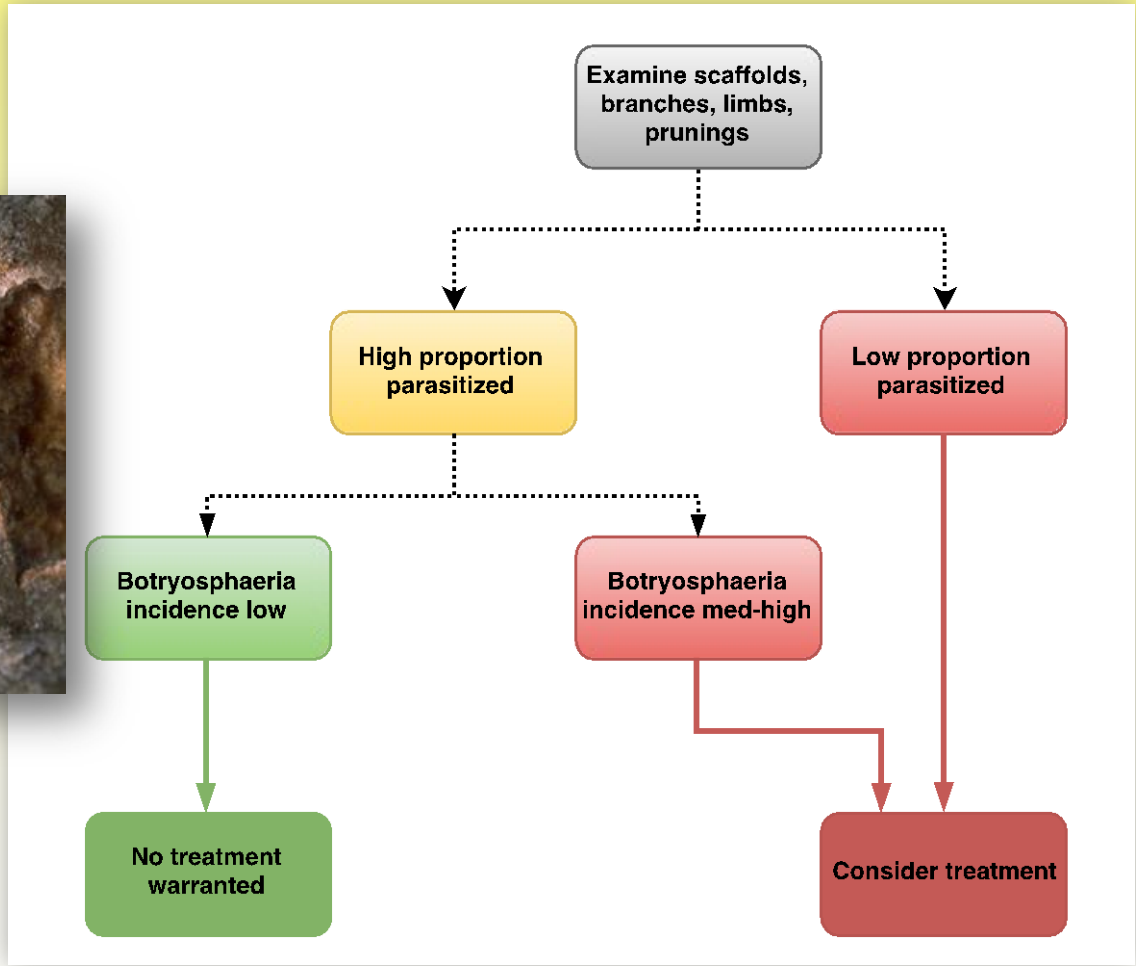
Live walnut scale nymphs (above)
Live walnut scale adult females (below)

Dead adult female walnut scale

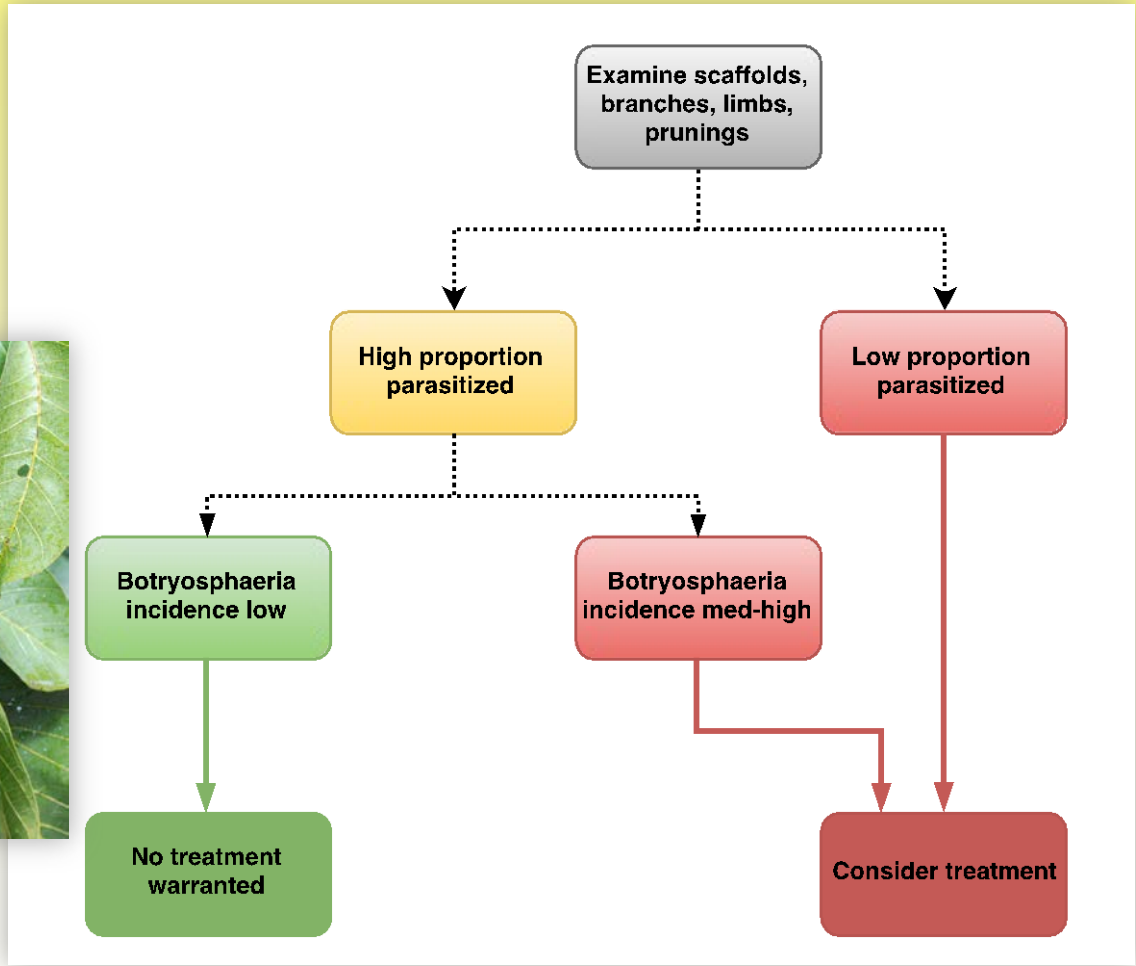
Walnut Scale Dormant Monitoring and Decision Support



Walnut Scale Dormant Monitoring and Decision Support



Walnut Scale Dormant Monitoring and Decision Support



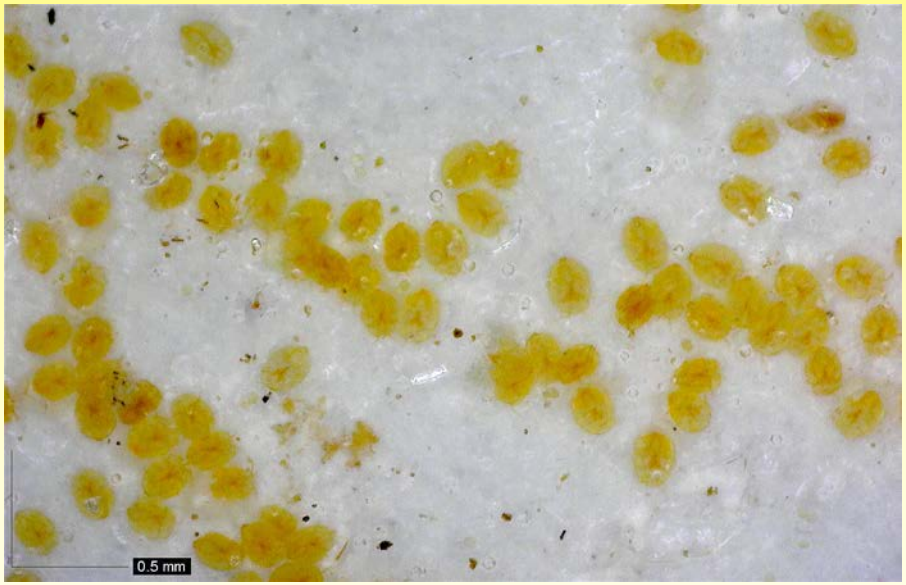
Walnut Scale Monitoring – Crawlers

Double-sided sticky tape

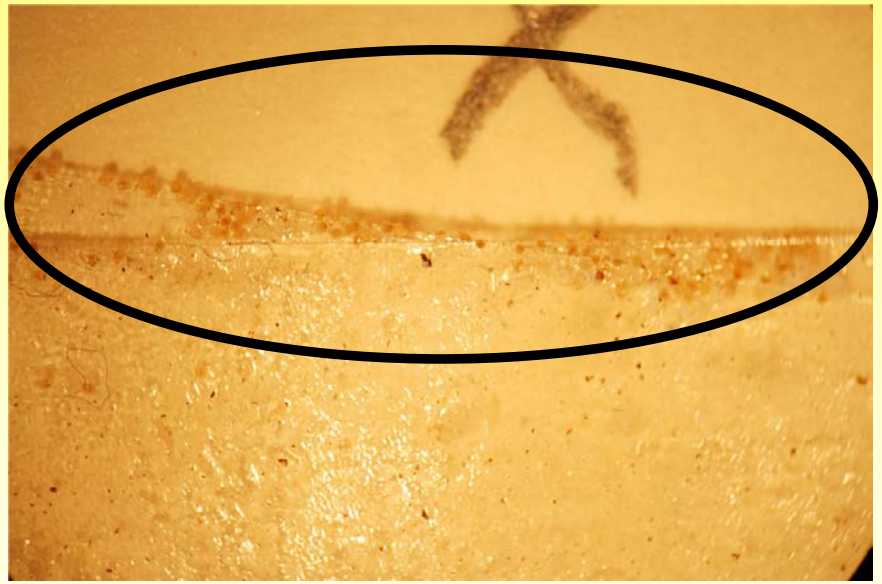
- Place tapes by mid-April
- Monitor weekly
- Aid in treatment timing
- Confirm live populations
- Assess population densities

Photos: D.M. Lightle, R.P. Buchner

Walnut Scale Monitoring – Crawlers



Appr. 100X magnification



Often high densities at margins of tape (low magnification)

Photos: E. J. Symmes (L) and D. M. Lightle (R)

2014-2016 Insecticide Evaluations

Generally performed better than untreated:	Mixed results (relative to controls):	Did not perform well (relative to controls):
Seize DD	Assail C	Sivanto C
Centaur DD	Brigadier C	Sequoia C
Centaur C	Movento C*	
	Movento + Assail C*	

Data based on R. Van Steenwyk field trials

- Spring evaluations showed continued population suppression in previous year treatments
  - Possible every 2-3 year treatment for scale
- Numerical treatment thresholds based on Bot pressure?
- Frosted sclale???

Navel Orangeworm in Walnuts

NOW Management – Points to Remember

- **Consider all varieties important for NOW IPM activities**
  - **Earlier-than-typical, and spread out husk split and maturation led to many later varieties experiencing higher damage in 2016**

- **High NOW damage at harvest = possibility of large overwintering populations**

NOW Management – Key Elements

- **Sanitation**
- **Minimize damage caused by other sources**
  - **CM, blight, sunburn, hail**
  - **Sound nuts most vulnerable to NOW damage after husk split**
- **Timely harvest**
- **Insecticide treatments**

NOW Management – Sanitation

- **Key to NOW management**
  - **Reduce overwintering populations**
  - **Reduce early generation oviposition/development sites**

- **Increasing destruction = greater reduction in emerging NOW**
  - **Shredded vs. bare berm = 100% & 97% reduction**
  - **Double-disked vs. bare berm = 95% & 68% reduction**
  - **Left in weeds vs. bare berm = 85% & 24% reduction**

Sibbett & Van Steenwyk 1992

NOW Management – Sanitation

- **Remove & destroy mummies by early March**
  - **Orchard – trees, floor**
  - **Bins, hulling, drying equipment, buildings**
  - **Maintaining ground cover during winter may aid in decomposing trash nuts**
    - **Do not rely solely on this, especially in dry years**

- **Wet weather helps <u>IF NUTS ARE ON THE GROUND</u>**
  - **BUT less natural mortality expected in walnuts compared to almonds (thicker shell)**

NOW Management – Reduce In-Season Damage

- **NOW is "secondary" pest – intact nuts not vulnerable until husk split**
  - **Good codling moth, blight, sunburn management to reduce earlier season access & development sites**

NOW Management – Harvest Timing

- The longer nuts stay in the orchard after husk split = more time vulnerable to NOW
- Time harvest to avoid late generation NOW flights
- Consider possibility of increased damage in 2nd shake
- Ethephon to advance husk split
  - Especially in high NOW population years & prolonged dry falls
  - Based on in-orchard monitoring, potential for immigration

NOW Management – Insecticides

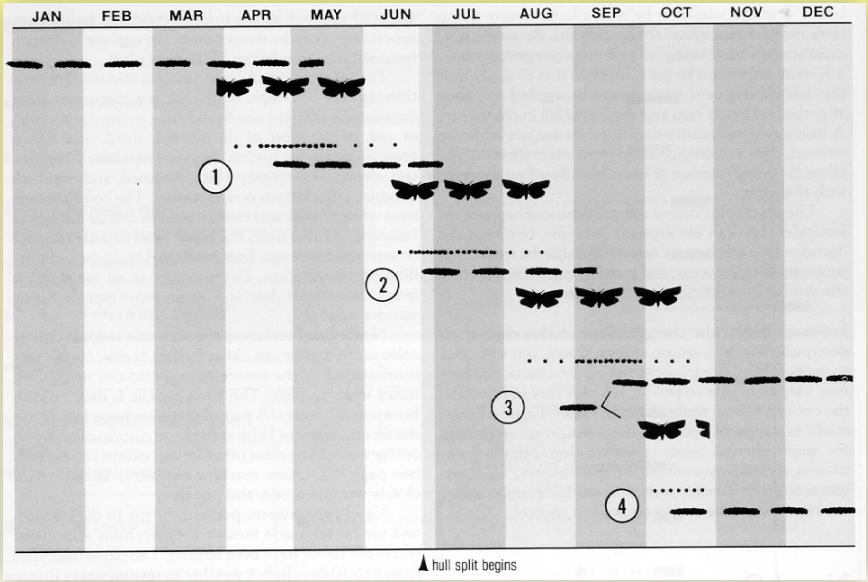
- **Best current guideline - focus protection husk split through harvest**

NOW Monitoring/Treatment Decisions

- **Monitoring options**
  - **Egg traps**
  - **Pheromone traps**
  - **Kairomone traps**
  - **Crop phenology and egg detection**
- **Historical pressure/damage**
- **Immigration potential (risk assessment)**
- **Treatment thresholds?**

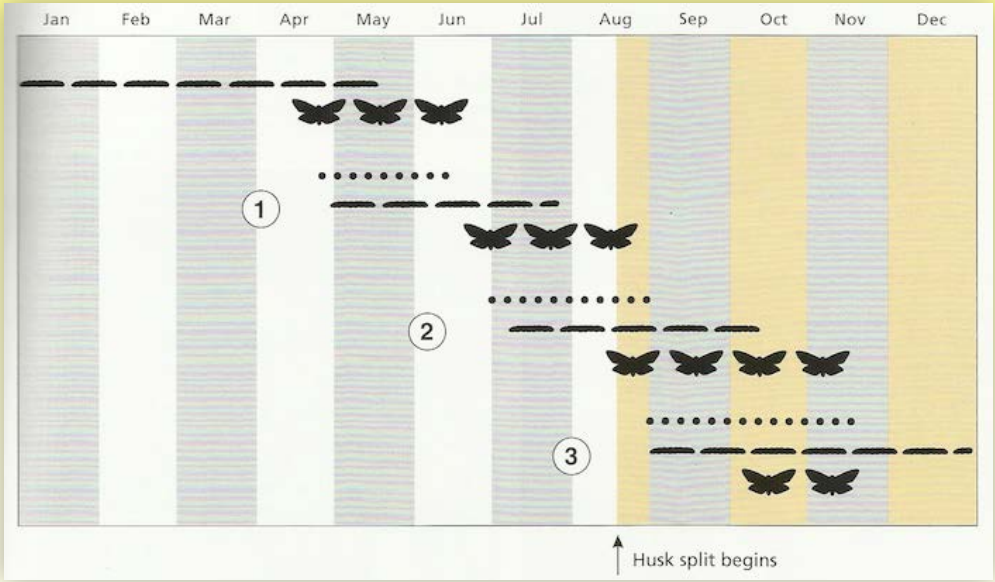
NOW Seasonal Cycle

Almonds



Based on development <u>IN ALMONDS</u>

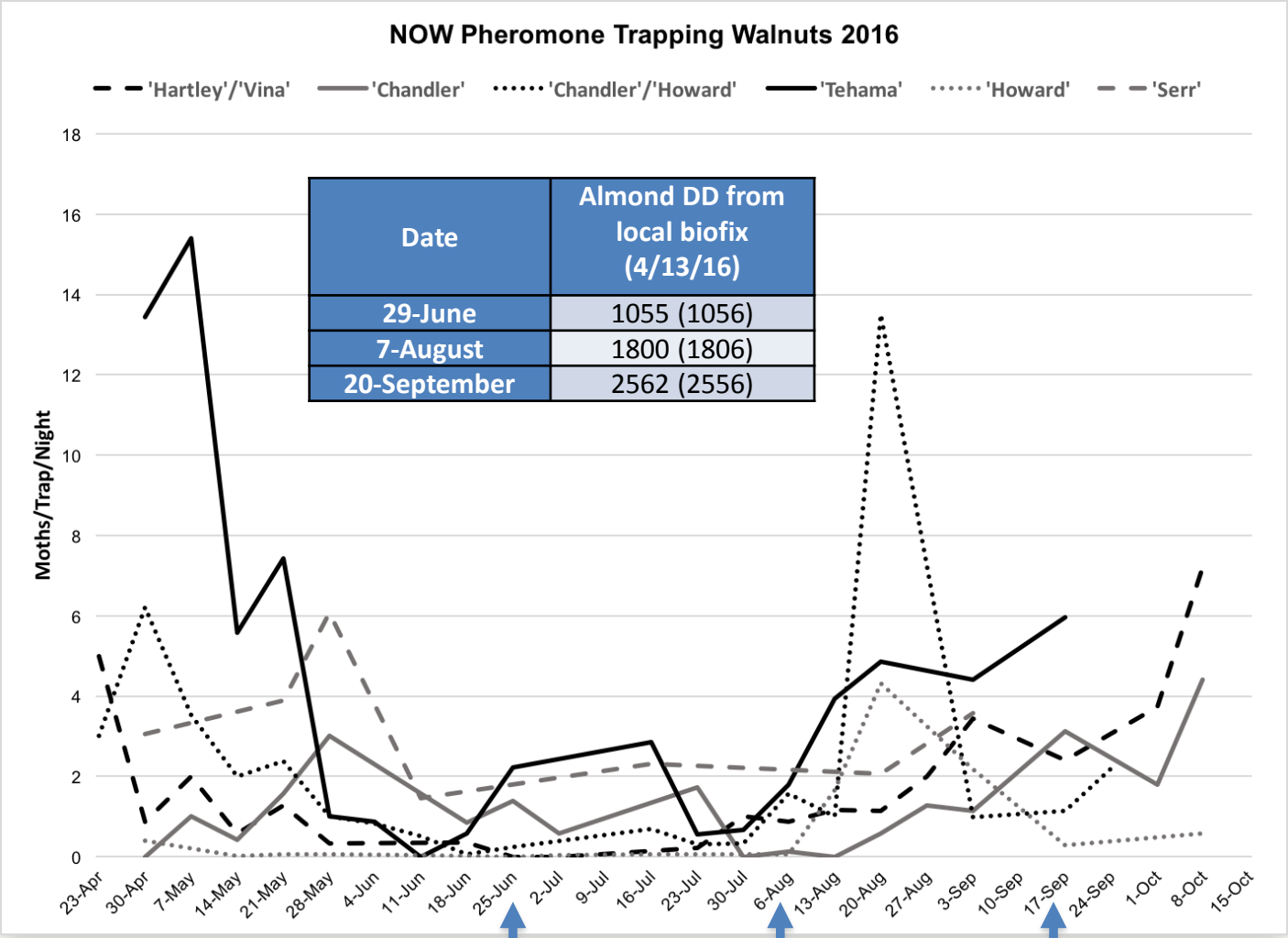
Walnuts



Based on development <u>IN WALNUTS</u>

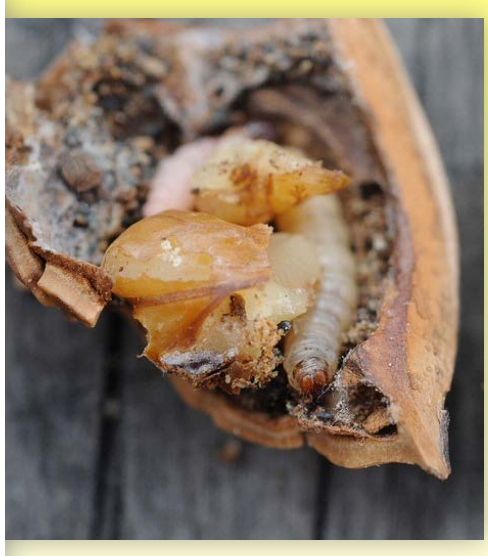
BUT…resident versus immigrant populations???

NOW Monitoring Pheromone Traps 2016



Date	Almond DD from local biofix (4/13/16)
29-June	1055 (1056)
7-August	1800 (1806)
20-September	2562 (2556)

Synthetic Lures vs. Females
Walnuts (2016)



Sacramento Valley

Northern San Joaquin Valley

Southern San Joaquin Valley

Synthetic Lures vs. Females
Walnuts (2016)

Five traps/set

Females (wing)

- **Trece L2L (delta)**
- **Trece L2H (delta)**
- **Suterra Biolure (delta)**
- **AlphaScents AMYTRA (delta)**

Walnut n = 21

Regional Cumulative Trap Catches Walnuts (2016)

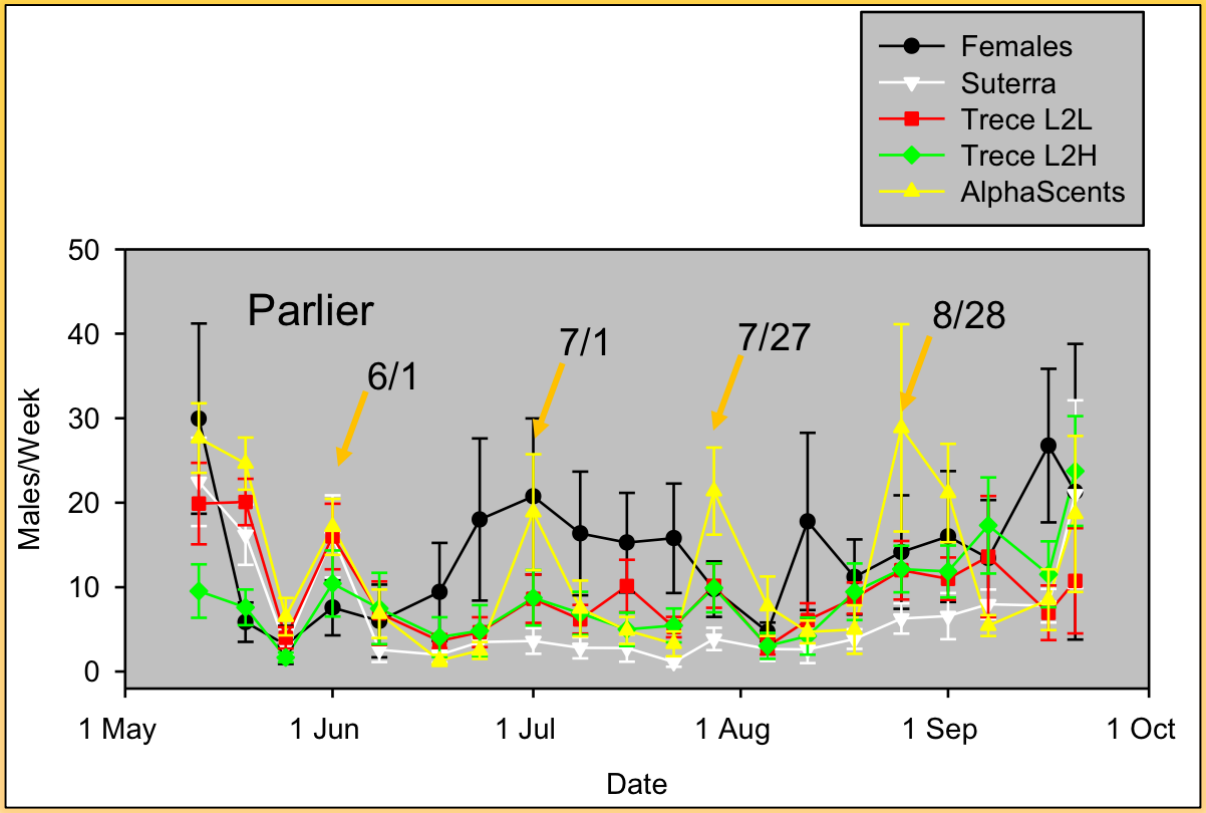
Treatment	Southern San Joaquin Valley	Northern San Joaquin Valley	Sacramento Valley
Females	283 ± 94a	201 ± 45	74 ± 27a
NBL	132 ± 25b	216 ± 46	186 ± 48b
L2L	184 ± 22ab	196 ± 43	277 ± 59c
L2H	168 ± 31ab	166 ± 22	315 ± 57c
AMYTRA	235 ± 54ab	256 ± 54	359 ± 32c
$F_{4,24}$	2.87	2.00	31.16
P	0.0448	0.1262	<0.0001

Regional variability in performance

Effect of Synthetic Lure Age on Trap Catch Walnuts (2016)

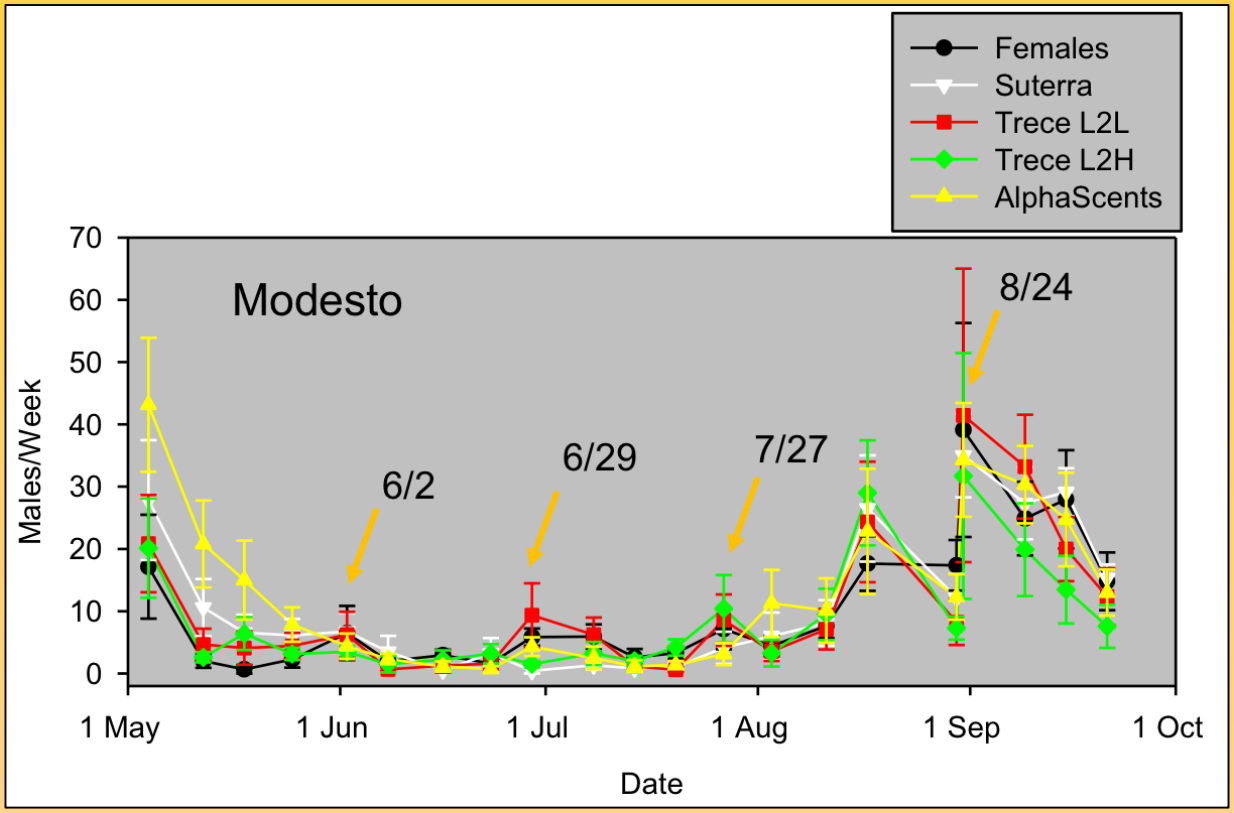
Lure	n	Spearman ρ	*P*
AlphaScents AMYTRA	386	-0.14	<0.001
Suterra NOW Biolure (NBL)	391	-0.02	0.678
Trécé NOW L2 low (L2L)	388	-0.01	0.829
Trécé NOW L2 high (L2H)	391	0.04	0.376

Correlation analysis:
Number of males captured decreased between lure change intervals for AMYTRA only



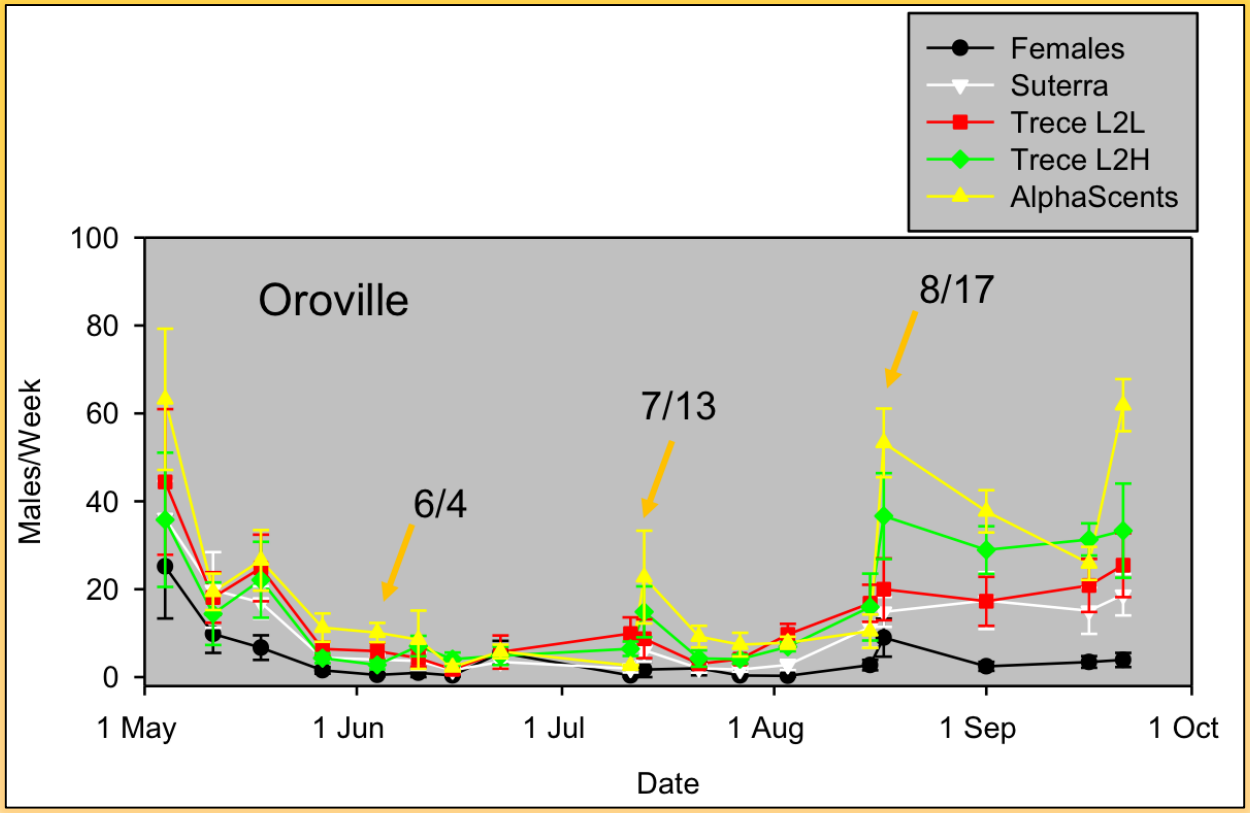
- **Females outperformed lures**
- **Alphascents lures more variable**
- **Suterra performed poorly**

Lures vs. Females: Walnuts
Southern San Joaquin Valley, CA (2016)



- **Less activity between May and August**
- **All lures performed more similarly**

Lures vs. Females: Walnuts
Northern San Joaquin Valley, CA (2016)



- **Less activity between May and August**
- **Poor female performance**
- **Alphascents performed inconsistently**

Lures vs. Females: Walnuts
Sacramento Valley, CA (2016)

Overall Conclusions

- **Female-lure anomaly:**
  - **Evident in pistachio**
  - **Not evident in almonds**
  - **Walnut more intermediate and variable**
- **Variable performance of commercial lures**
  - **AMYTRA was least suitable**
  - **L2 lures were similar and most consistent**
- **More evidence of mid-summer populations in walnuts in SSJV than NSJV or Sacramento Valley**

NOW in Walnuts – Risk Model Assessment

- **Things to consider:**
  - **Proximity to external sources of infestation**
    - **Native habitats, almond orchards, pistachio orchards**
  - **Previous season's harvest damage**
  - **Orchard sanitation**
  - **Carry-over populations in mummy nuts**
  - **Degree-day accumulation and populations cycles in walnuts and surrounding crops**
  - **Harvest timing**
    - **Harvest timing of external sources**
  - **In-season damage caused by other sources**
    - **Codling moth, sunburn, blight, etc.**
  - **Environmental conditions**
    - **Temperature, precipitation, etc.**

Acknowledgements

California
Walnut Board

Survey Feedback Request ☺

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