Management of San Jose Scale for Orchard Crops

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What are scale insects?

- Scale insects are part of a large group of insects. There are many forms and they are highly specialized.
- They are part of the Order Homoptera, Superfamily Coccidae: They have piercing, sucking mouthparts.
- Females are wingless and sessile (non-moving and attached to the plant).
- Adult males usually have wings and do not feed.

Armored Scales (Family Diaspidae)

- Largest family of scale insects and contains several important pest species.
- Females are small, soft bodied and are concealed beneath a separate layer of wax and cast skins.

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Soft Scales (Family Coccidae)

- Females are elongate-oval.
- Usually have hard smooth exoskeleton or are covered with wax.
- Not too common on deciduous fruit trees.

Other scales of interest

- Lac scales: They excrete copious amounts of lac, a form of resin. Twigs with lac are cut and the lac is melted off, refined, and made into shellac and varnish.

- Cochineal scales: Some contain pigments which were harvested for dyes.

- Mealybugs: Can be called motile scales. There are several important pests in this group.

Some scale have symbiotic relationship with ants

- Scale can produce copious amounts of honey-dew.
- Ants feed on this waste product.
- Ants will keep the scales “clean” and protect them from predators.

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Scale insects
examples

- San Jose scale
- White peach scale

- SJS is a sporadic pest that is making a comeback
  - Less OP use is allowing scale to build-up,
  - Limited pre-bloom oil,
  - Pyrethroid use exacerbates the problem
- White peach scale is common in the SE and Mid-Atlantic States

San Jose Scale

- An armored scale.
- Introduced accidentally into California from China on ornamental peach by James Lick in 1870.
- Rapidly spread to become a major pest of many different plants including ornamentals, pome and stone fruit.
- In 1890, SJS was introduced into NJ. It wiped out most of the NJ peach industry by 1920

San Jose Scale

- Immediate impacts: Marks fruit
- Heavy infestations can weaken and kill twigs, branches, and trees
- SJS can be distinguished from other scale by red coloring associated with feeding

San Jose Scale Diagnostic

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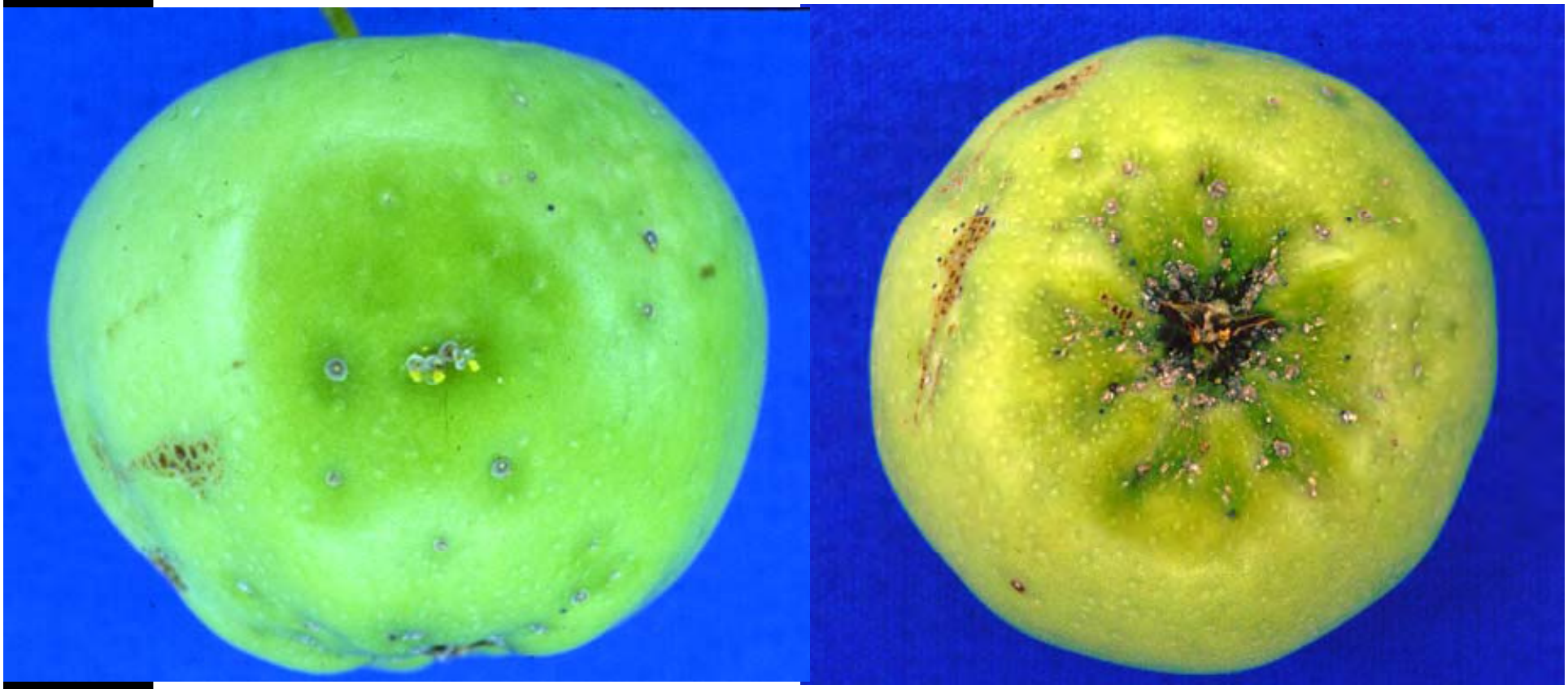
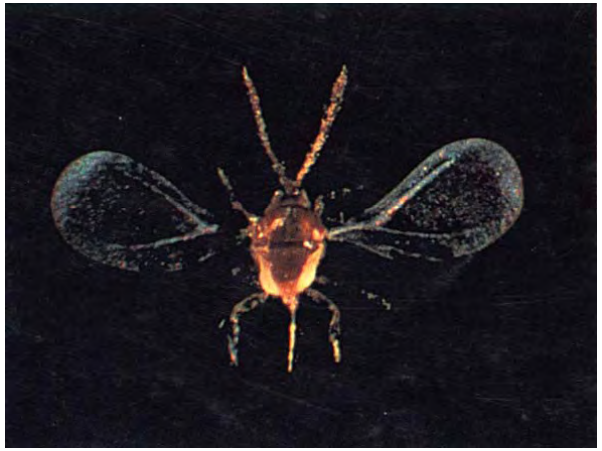
European Fruit Scale: very similar to SJS in appearance, life cycle, control. No red pigment around feeding sites



San Jose Scale



- Overwinters as partially grown immatures under protective waxy coatings on trunks and scaffolds
  - Most can tolerate -10 ˚F winters
- They start growing when sap begins to flow
- They mature around apple bloom
- Males emerge, fly, walk to females where they mate

San Jose Scale

- After mating, females live for another 6 weeks producing crawlers (an immature stage) at about 10/day (150-500/female)
- Crawlers are the motile immature stage of scale
- They are very active for the first few hours and most have settled down and have begun to feed within 24 hours.
- Once sessile and feeding, they begin to secrete wax. The wax plus shed skins form the cap.

San Jose Scale

1st generation crawlers are synchronized

- Occurs between 4-6 weeks after apple bloom
- 7 days from first crawlers to peak emergence

Approximately 3 generations per year in NJ

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White Peach Scale

- Common in SE and Mid-Atlantic states
- Hosts: stone fruit, mulberry, privet
- Overwinter as mated females

White peach scale

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White Peach Scale

- Overwinter as mated females beneath wax covering.
- Petal fall of peach, females start laying 100-150 eggs over a 1 month period.
- Eggs start to hatch about 10 days after being laid and the crawlers leave the female scale and move to new areas.
- About 1 week after settling down, crawlers form covering.

White Peach Scale

- Male scales are clustered and put out the waxy “whitewash” covering.
- Females tend to disperse more, found under a wax “cap”.
- Males develop wings when mature then seek out females to mate.
- In NJ & VA, 3 generations/year, crawlers present late April, July, late Aug.

Monitoring for scale

- Pheromone traps and degree-day model available. Not really practical.
  - Males are weak fliers, may walk to females, thus won't be detected in trap; lots of look-a-likes

Crawler detection is the best way to time summer sprays

- Crawlers are a juvenile form.
- They crawl around for a while after they hatch.
- This activity can be monitored.

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Monitoring for crawlers

- Wrap black electrician's tape around limb with scale.
- Cover with petroleum jelly or double-sided sticky tape.
- Look for crawlers starting 3-4 weeks after apple bloom, they will get stuck on tape.
- Look for crawlers with hand lens or dissection scope.

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So how do you know if you have a scale problem?

- Most scale problems are found at harvest.
- Harvested fruit have “all these red spots on them”.
- At harvest, its too late to do anything that year.
- If you see a small amount of damaged fruit at harvest, realize that next year you could have a lot bigger problem.
- Scale problems increase rapidly.

Factors that can increase scale

- Limited pre-bloom oil use.
- Loss of methyl-parathion (Penncap-M) and restrictions in azinphos-methyl use.
- Pyrethroid use: These chemicals are toxic to natural enemies that can suppress scale. Possibly some hormolygosis, as well.
- New insecticides: Some substitutes for broad spectrum insecticides don’t control scale.

Scale Management

- Volume of spray is very important.
- Thorough coverage is essential!!
- How much water is enough?
  - A lot more than you want to use.

Scale Management: Stone fruit

Dormant through Delayed Dormant

Horticultural mineral oil	6-8 gal*
-or-	
Horticultural mineral oil	6-8 gal*
plus one of the following	
Diazinon 50WP	4 lbs
Esteem 35WP	4-5 oz
Lorsban 4E	4 pts
Supracide 2E	3-12 pts

Apply in a minimum of 200-300 gallons for a mature tree

*Late DD, use 6 gal oil

Scale Management: Stonefruit

Crawler sprays

Diazinon 50WP	4 lb
Centaur 70WDG	34.5 oz
Esteem 35WP	4-5 oz
Neonicitinoids (Assail, Provado)	see label
Movento 2SC	6-9 oz*

Apply as full coverage sprays

*Do not apply before petalfall

surfactant is required

San Jose Scale Management: Pome fruit

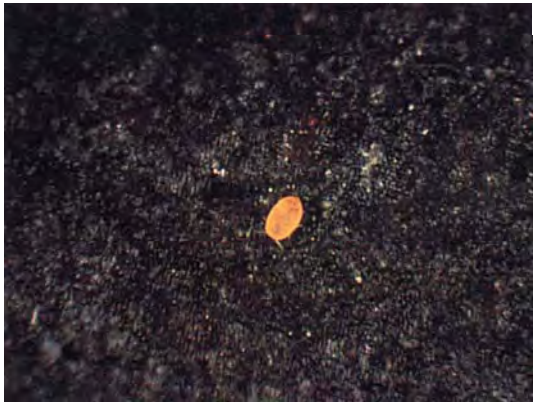
Delayed Dormant

Superior Oil	4-6 gal
	-or-
Superior Oil	4-6 gal
plus one of the following	
Diazinon 50WP	3 lbs
Lorsban 4E	1.5-4 pts
Supracide 25WP	2-6 lbs
Esteem 35WP	4-5 oz

Use full dilute for severe problems on standard trees

San Jose Scale Management: Pome fruit

Crawler sprays



Material	Rate/A
Diazinon 50WP	3 lb
Imidan 70WP	3-5 lbs
Azinphosmethyl 50WP	1-2 lbs
Esteem 35WP	4-5 oz
Centaur 70WDG	34.5 oz
Neonicitinoids (Assail, Provado)	see label
Ultor 1.25SC	10-14 oz*

*Apply after petalfall, surfactant required

Reminder: High volume sprays with recommended materials give best control of scale problems

Any questions?

Ph.D. work in Hawaii

- Dissertation research dealt with the impact of orchard vegetation on southern green stink bug damage to macadamia nuts.

- Key findings:
  - Stink bugs “prefer” certain weeds over macadamia nuts.
  - Stink bugs build up on weeds within and outside macadamia orchards then disperse from senescing weeds to feed on macadamia nuts.
  - Weed management is a key tactic for minimizing stink bug damage to macadamia n

It seemed appropriate to implement orchard ground cover studies in New Jersey

Peach Orchard Ground Cover Management to Reduce Arthropod Damage

P. Shearer, B. Majek, D. Polk, N. Lalancette,

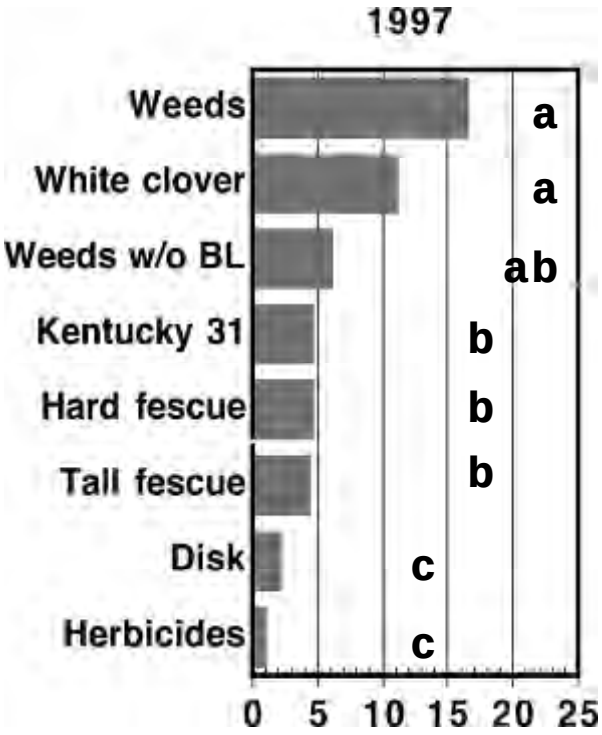
R. Belding, & J. Halbrendt

Funded by NE Sustainable Agricultural Research & Education Grant

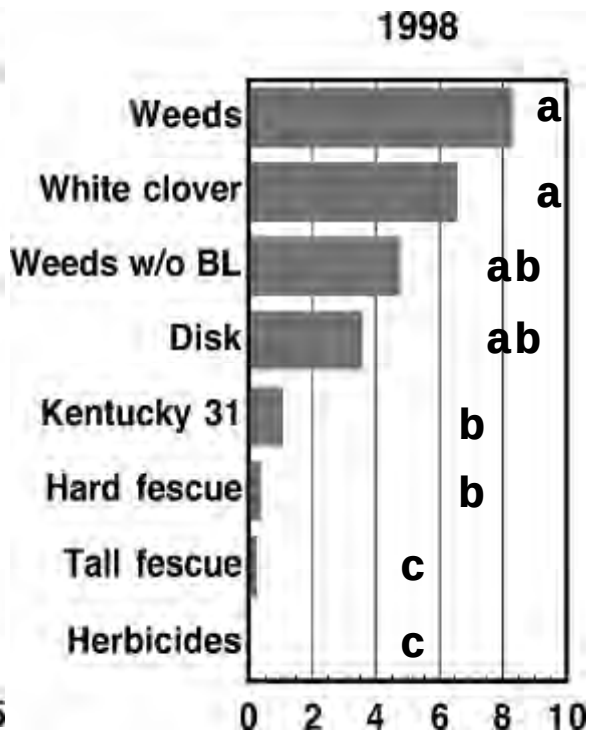
Peach orchard ground cover study objectives:

1. Determine suitability of selected ground covers for use in integrated crop production strategies for peaches.
2. “Demonstrate” how ground cover management in commercial orchards affects arthropod abundance and damage to peaches.

Orchard floor management impacts TPB abundance in the absence of insecticides

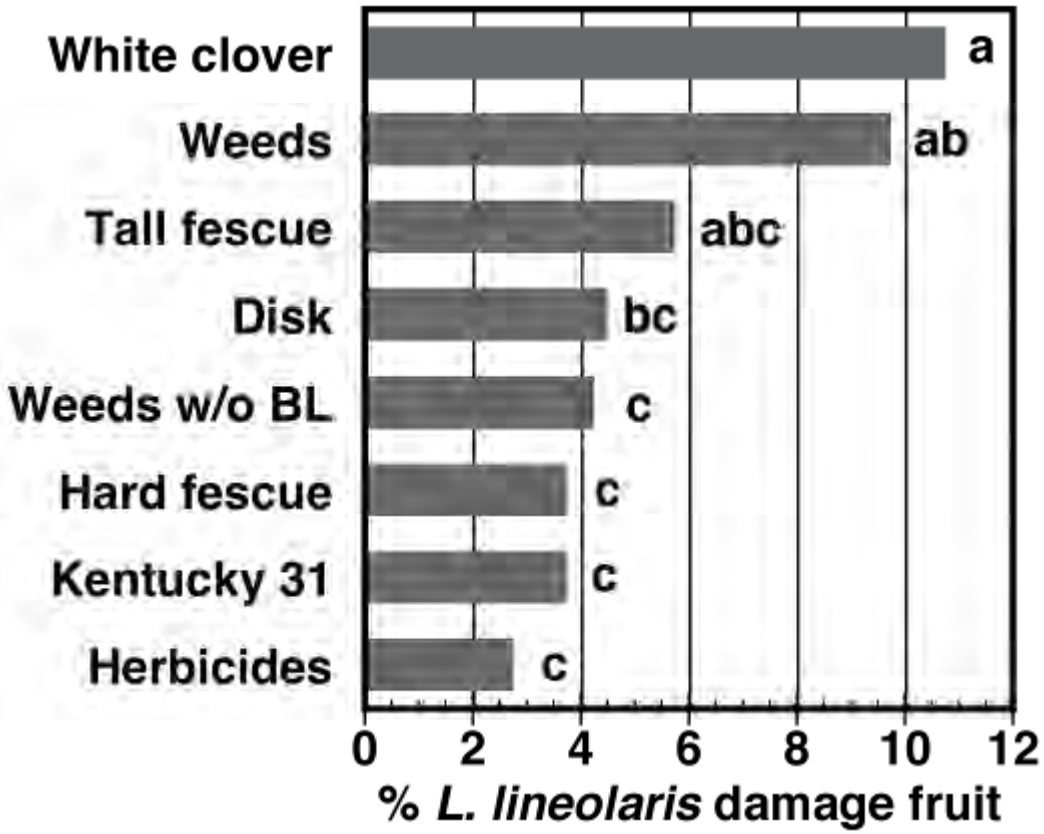


Seasonal avg. # TPB / sweep



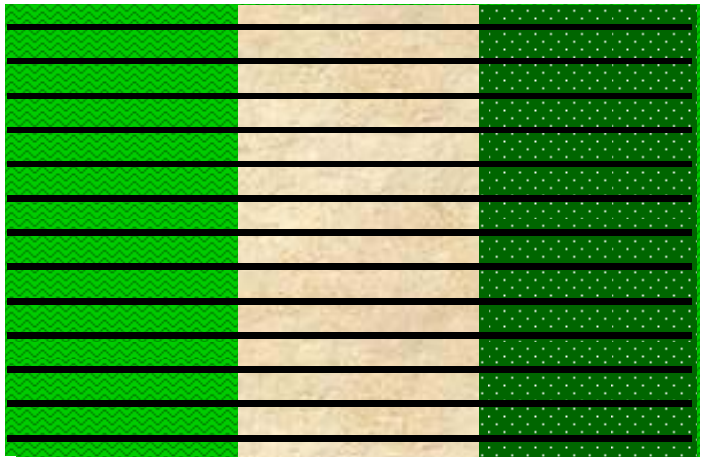
Seasonal avg. # TPB / sweep

Catfacing damage to peach fruit grown with different ground covers and no insecticides: 1998

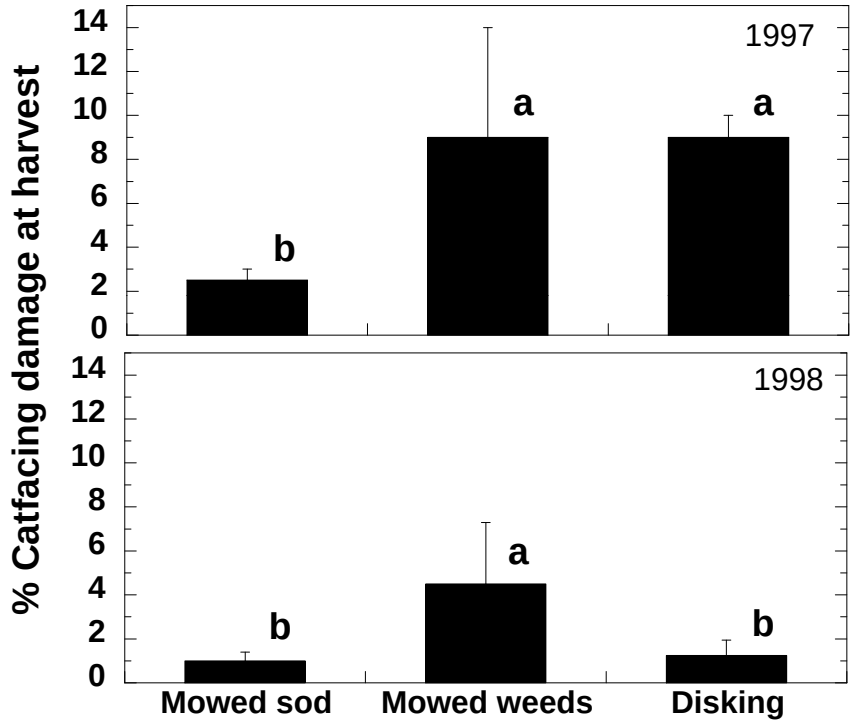


Impact of orchard floor management on catfacing insect damage to peach: 1997-8

- 4 commercial peach blocks
- Growers worked up orchard floor
  - Planted sod
  - Mowed sod and weeds
  - Cultivated the disk plots
- Trees treated the same



Sod **Disk** **Weeds**



Conclusions:
Orchard floor management

- Research at RAREC and on growers farms demonstrated the importance of removing broad leaf weeds to minimize damaging pests.

- Managed sod drive rows and weed-free tree-rows reduces catfacing insect abundance and damage.
  - Fruit IPM database has documented a 60% reduction in damage in “clean” orchards.

- Subsequent research in Oregon (pears) and Canada (apples) validates this approach in other crops.

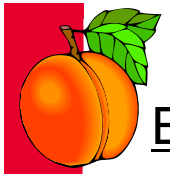
Integration of Ground Cover Management into Peach Production Systems

In 1999 we started the:

"Reduced Risk Peach Pest Management Program"

P. Shearer, G. Hamilton, D. Polk, A. Atanassov

Funded by USDA Pest Management Alternatives Program



Experimental design

- 4 study sites planted to the late harvested cultivar ‘Encore’.
- Each block was divided in half and designated as Reduced Risk or conventional.
- The Reduced Risk blocks utilized oriental fruit moth mating disruption and managed sod in the drive rows.
- The conventional blocks received standard grower spray programs and had weedy drive rows.

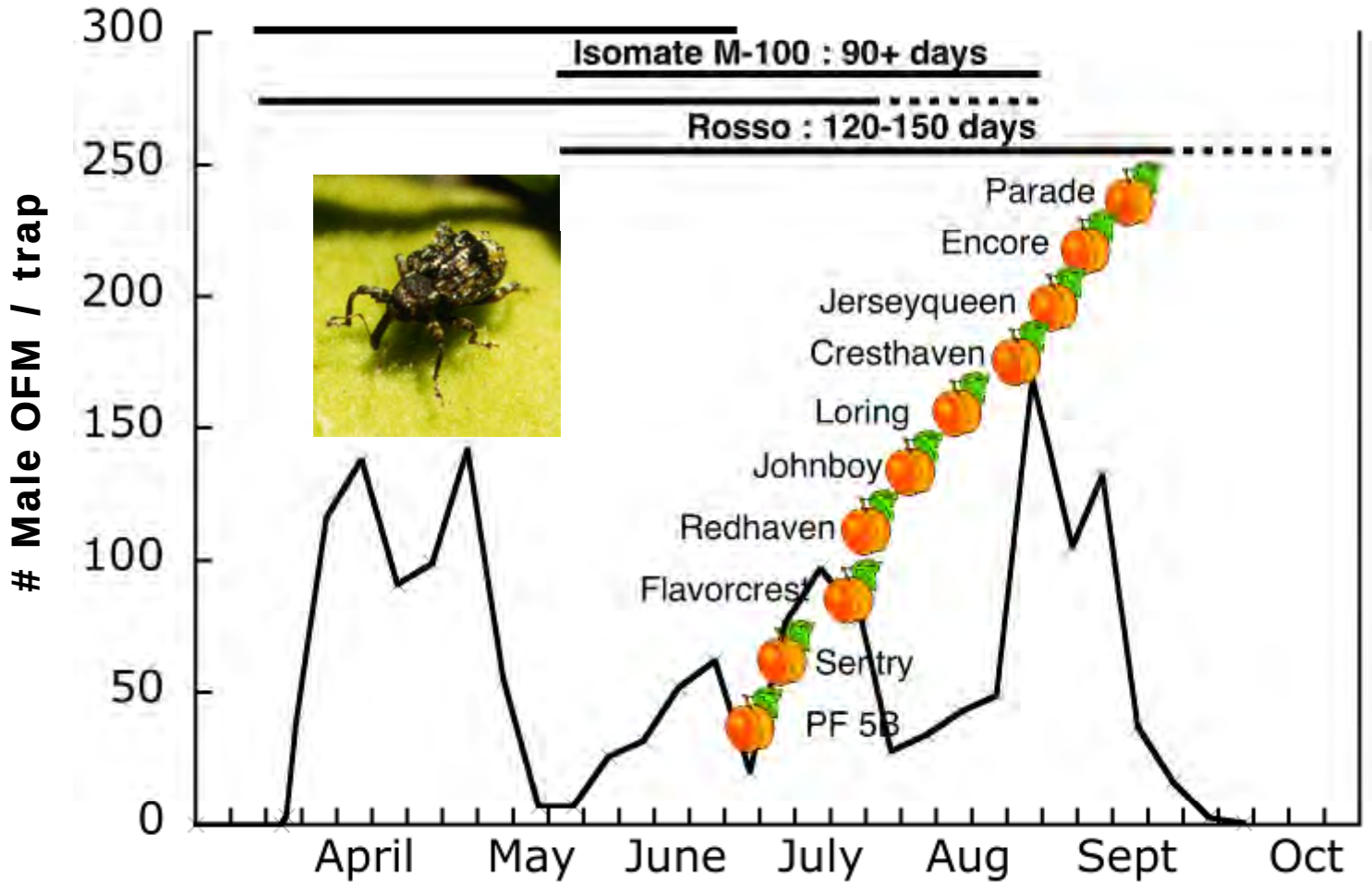
Managed sod

“Conventional ground cover”

Oriental Fruit Moth
Grapholita molesta

- Key pest of peaches and nectarines.
- Attacks all stone fruit plus apple and pear.
- 4-5 generations per year in NJ.
- 1st 2 generations attack shoots, later broods attack fruit and shoots.
- Seasonal activity is monitored with pheromone traps and phenology model.

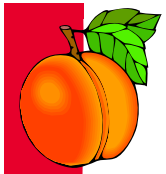
Expected length of protection of Isomate products in relation to peach harvest date



Seasonal Tarnished Plant Bug Levels: 2000

Percent Damaged Fruit at Harvest

	Catfaacing damage		Oriental fruit moth	
Program	1999	2000	1999	2000
Reduced Risk	0.8 b	3.4 ns	0.2 ns	0.3 ns
Conventional	1.6 a	3.9	0.2	0.1



Organophosphorus and Carbamate Applications

Program	Number of applications 1999	2000
Reduced Risk	2.8 b	1.9 b
Conventional	6.5 a	6.6 a
Reduction in number of sprays	≈60%	≈70%

Organophosphorus and Carbamate Use

Program	Amount (lbs a.i./acre) 1999	2000
Reduced Risk	2.0 b	1.2 b
Conventional	3.9 a	5.0 a
OP/carbamate reduction	≈50%	≈75%

In 2001, we expanded the program to 12 orchards with side-by-side comparisons

- **We went from research mode to Extension outreach**

- **Conventional: Standard OP and carbamate program**

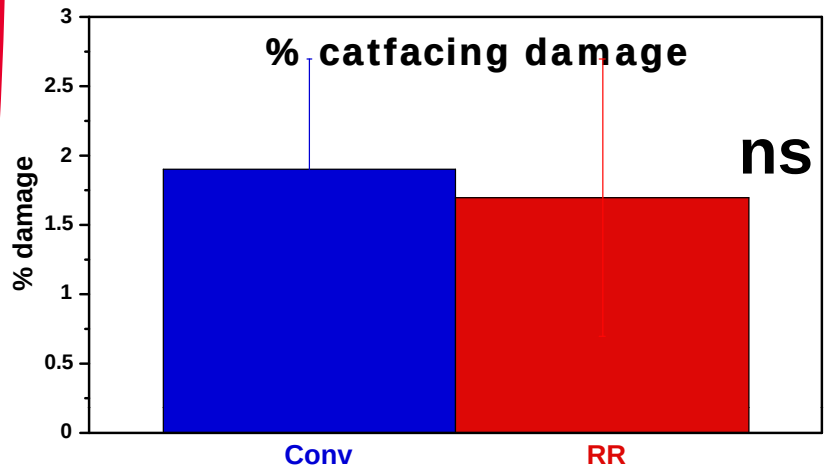
-versus-

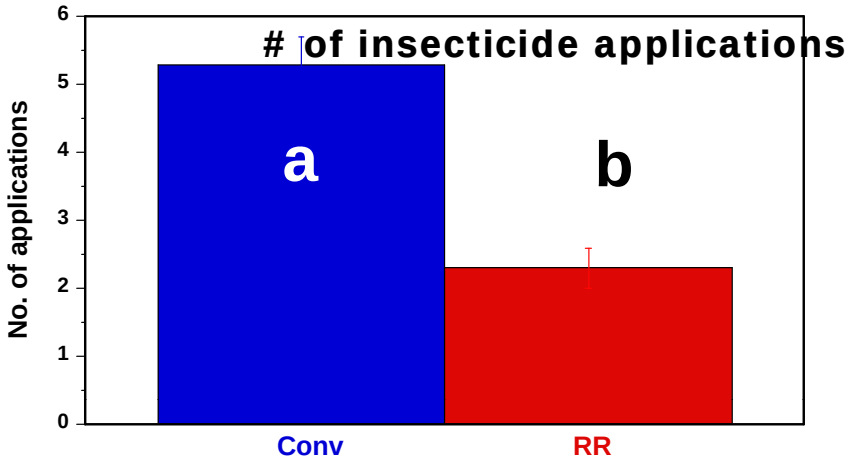
- **Reduced Risk: OFM mating disruption and sod ground cover**

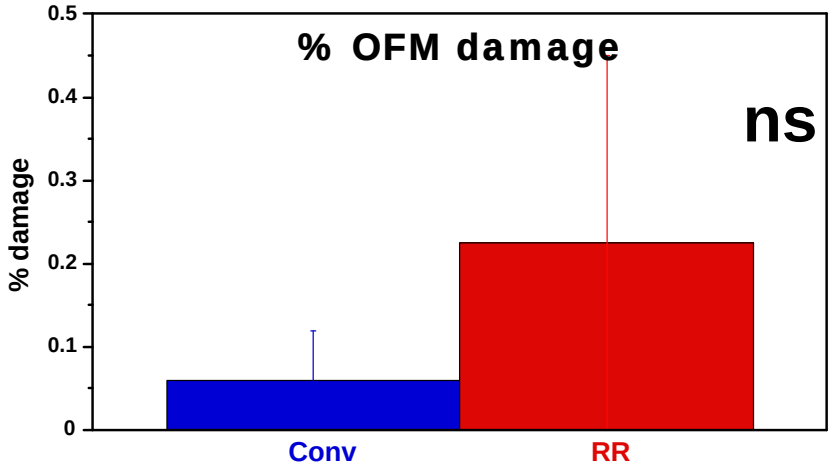
- **Included fruit residue component**

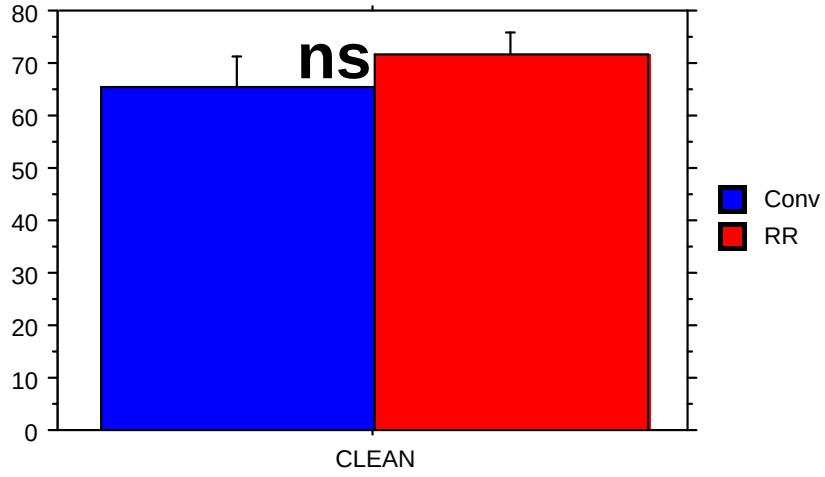
Funded by USDA Pest Management Alternatives Program and EPA Environmental Stewardship Program

Implementation study results: 2001
n=12 farms









Shearer 2009

Summary

- Managing broadleaf weeds in this peach system reduced pest abundance and damage
- Orchard floor groundcover management combined with mating disruption reduced the amount of insecticides that were sprayed
- There fruit quality was comparable between the conventional and reduced-risk IPM programs.
- Consider adopting this for your orchard.

Thanks again and have a great season!

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