Fuller Rose Beetle Treatment Options

Fuller Rose Beetle Workshop
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(Revised slightly after the meeting)

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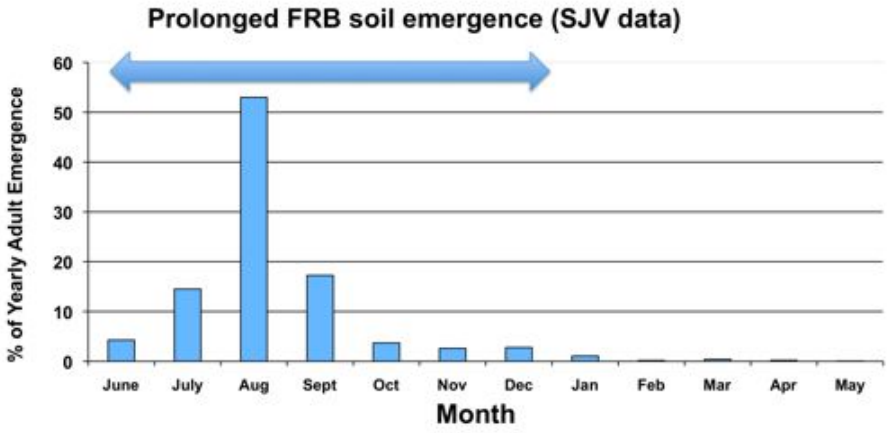
Some Reasons Why FRB Management is Difficult

See the next 3 slides:

- Slide 3: Some adult FRB emerge out of the soil each month of the year with significant numbers emerging June-December
- While in the soil, larvae and pupae are fairly protected (soil treatments with nematodes or pesticides are only of limited efficacy)
- Slide 4: Once they get into the tree and feed on leaves, the adult beetles are very long lived (average 111 days)
- Slide 5: See Dr. Grafton-Cardwell's talk – foliar sprays only last 2-3 weeks and do not control all adults

Significant FRB adult emergence out of the soil June – Dec. (7 months)



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Longevity of Newly Emerged Adult FRB

- 22 beetles (9 dates) provided no food
  - Lived 2-28 days (mean of 11.5)
  - 1 beetle had a small egg mass attached to the tip of its abdomen on day 10 (died on day 11) (eggs unviable)
- 25 beetles (10 dates) provided water only
  - Lived 2-39 days (mean of 16.4)
  - 1 beetle laid 7 eggs on day 7 (died on day 16)
- 20 beetles (9 dates) provided grapefruit leaves + water
  - Lived 7-242 days (mean of 110.8) in the lab (77°F)
  - Laid an average of 5.0 egg masses, 88.5 total eggs per beetle
  - Last beetle died on day 242

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Foliar Sprays Are Only of Limited Help

- Pesticides only somewhat effective and must be reapplied ca. every 6 weeks to be effective
- Best 3 products – Kryocide (cyrolite), Sevin (carbaryl), Actara (thiamethoxam)
- Because of MRLs, Actara may be the only material we can use on Korean export fruit (label allows 2 sprays at 5.5 fl oz/acre)
- Because beetles continue to emerge out of the soil over time, foliar sprays by themselves will not be an effective method of dealing with FRB
- FRB eggs take 593 degree days (51°F threshold) to hatch – once eggs are laid and the weather turns cool (mid October), it is too late to control adults

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Export MRLs Limit Our Options

Trade name	Common name	U.S. tolerance (ppm)	Codex MRL (ppm)	Japan MRL (ppm)	Korea MRL (ppm)	PHI (days)
Brigade WSB [a]	bifenthrin trunk spray	**0.05**	0.05	2	0.5	1
Sevin	carbaryl	10	15	7	0.5	5
Kryocide	cryolite	7	--	--	--	15
Actara	thiamethoxam	0.4	0.4	1	1	0

[a] Brigade is not registered for foliar use (do not allow fruit contact).

Low MRL for Sevin in Korea and no MRL for Kryocide in Japan or Korea suggests the only foliar spray that can be used is Actara.

Evolution of the FRB Problem

- Magarey et al. 1993 – Evaluation of lamda-cyhalothrin and deltamethrin trunk treatments for control of Fuller's rose weevil … (Plant Prot. Quart.)
- Correspondence and visits by Australians over the years (no CA work on FRB 1993-2010)
- Call from AU PCA Rob Weppler 2-25-11 – Problems shipping fruit to Korea, Thailand because of FRB
  - Beat sampling better than sampling a small number of fruit
  - Based on Magarey et al., using trunk sprays of lamda-cyhalothrin spaced every 6 weeks (3 or more)
  - All AU shipments to Thailand suspended due to FRB

CCQC / Citrus Australia FRB Conference Call 13 June 2013

- AU - Only certified groves can ship to export countries
- DAFF does in-grove beat sampling and inspects 600 fruit in the packinghouse for viable egg masses
- Do not use foliar sprays at all – not sufficiently persistent and cause the upset of other pests
- Use trunk sprays of gamma- or lamda-cyhalothrin every 6 weeks (ca. $61/acre per treatment labor + material)
- 2-6 trunk sprays needed per year, very low levels after 2 years of sprays (3 years of experience with trunk sprays)
- A lot of research on ethyl formate but so far, do not have it working
- Pruning / trunk sprays are expensive but worthwhile for those with prime fruit / sizes due to high returns from the Korean market (Mildura treated 1,850 acres this year)

Evolution of the FRB Problem in California

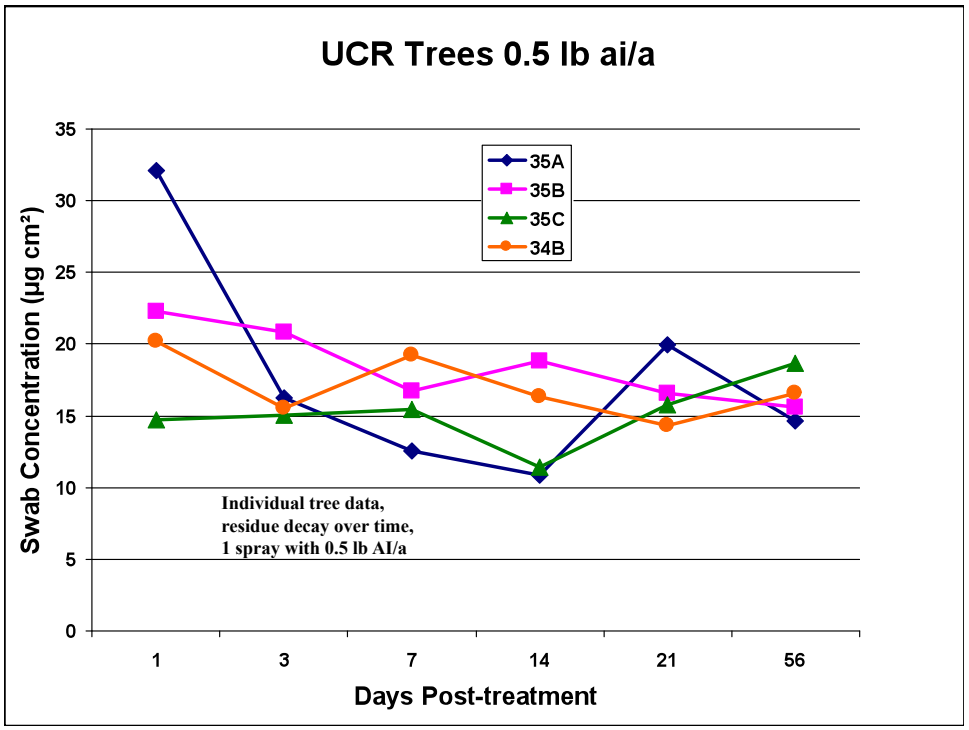
- Serious concerns from Korea during the 2011-12 CA shipping season (high levels of live FRB eggs found)
- Blanket methyl bromide fumigation allowed at the last minute for the 2012-13 CA season – in serious question for 2013-14
- Research on FRB restarted during 2011
  - Beth Grafton-Cardwell – foliar sprays
  - Joseph Morse – FRB biology, *Fidiobia* egg parasitoid, 3rd attempt to rear larvae (unsuccessful), trunk sprays

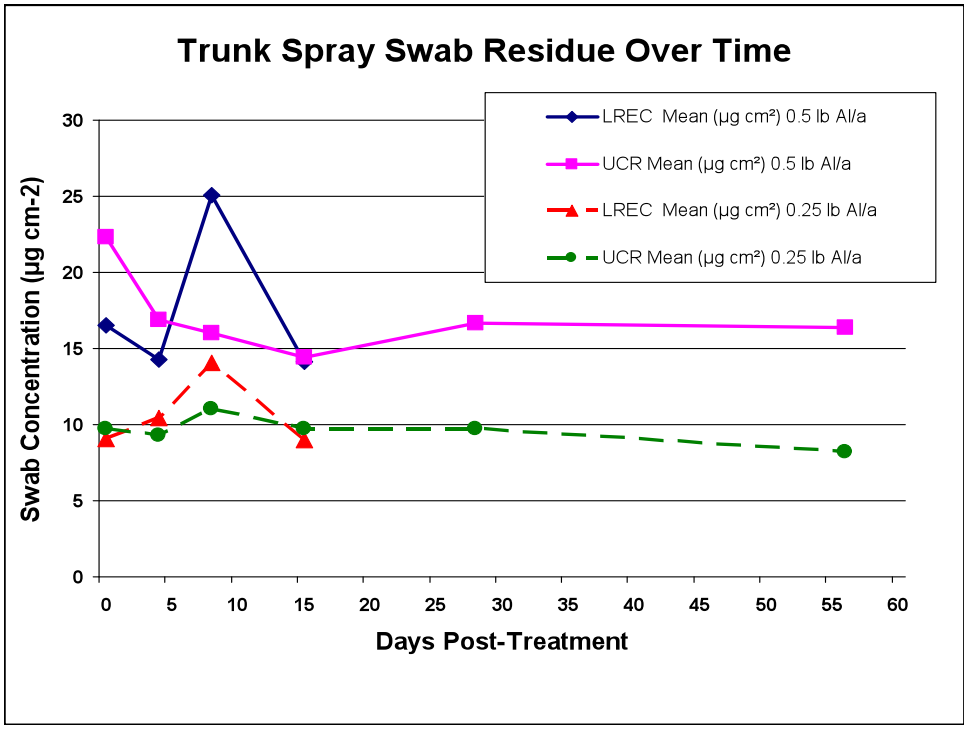
Key Results of 2011-12 FRB Research

- Brigade WSB much more persistent in paralyzing adult FRB versus lamda-cyhalothrin (Warrior)
- Brigade registered on citrus as a soil spray against Diaprepes neonate larvae (cannot contact fruit)
- Obtained a 2ee label allowing 0.5 lb ai/a/yr Brigade application to the trunk
- Adult FRB paralyzed for 2-3 days after crossing the Brigade barrier

Brigade Efficacy Trials with FRB

- FRB adults available in numbers for testing only Aug – Oct.
- Developed a relationship between beetle paralysis and levels of bifenthrin on trunks using isopropanol swabs (5 cm wide x 20 cm = 100 square cm sample)
- Bioassays done at Lindcove followed by swab residue analysis (gas chromatography) after soaking in acetone / methanol
- LD99 (99% paralysis) = 0.1572 ug/cm2
- Threshold for treatment (10X safety margin) = 1.572 ug/cm2
- Trunk sprays applied using home build wand, swabs taken at various dates post-treatment to evaluate persistence





Key Differences – FRB Situation – Japan and Korea

- Japan insisted we reduce the levels of live FRB eggs but allowed methyl bromide fumigation as a backup when live eggs were detected
- Japanese sampling protocol of 400 fruit per load EXTREMELY efficient in finding eggs if the load was infested
- Korean protocol appears to be even more stringent – 600 fruit per load
- 1-2 foliar sprays with Sevin or Kryocide (September) were fairly effective in reducing FRB egg mass levels for Japan
- This levels of control is NOT sufficient for Korea without backup methyl bromide fumigation

How do we deal with FRB in 2013?

- Realize we are in a very difficult situation
- Korea likely to reject the load if a single live FRB egg mass is found in the 600 inspected fruit per load
- This level of inspection requires FRB be controlled to EXTREMELY LOW levels in export blocks
- Foliar sprays by themselves will not do the job
- An effective post-harvest treatment (only on Korean loads) is the ideal solution and research on this is in progress
- Extreme action is needed in 2013 if loads are going to pass inspection in Korea

How do we best deal with FRB in 2013?

- Skirt prune trees to a height of 24" off the ground
- Build a U-shaped "wand-sprayer" to apply trunk sprays WITHOUT CONTACT to fruit - test it with water sprays
- Apply bifenthrin trunk sprays (see following slides for timing)
- Police the grove monthly to eliminate weeds and/or low-hanging suckers or limbs
- The bifenthrin is both toxic and repellant – FRB will find ways around the trunk spray if they are made available
- Realize in advance this will not be easy or inexpensive

Strategy for Bifenthrin Trunk Sprays in 2013

- Assuming the 24c is approved, 2 sprays of 0.5 lb ai/a spaced 12-16 weeks apart, PHI of 9 weeks
- Current Brigade WSB 2ee label allows application of a total of 0.5 lb ai/a to the trunk (do not allow spray to contact fruit)
- CCQC and FMC have submitted a 24c request to DPR to increase the total application limit to 1.0 lb ai/acre
- For added security, consider a later foliar spray timed depending on the date of harvest (650 degree days before harvest)

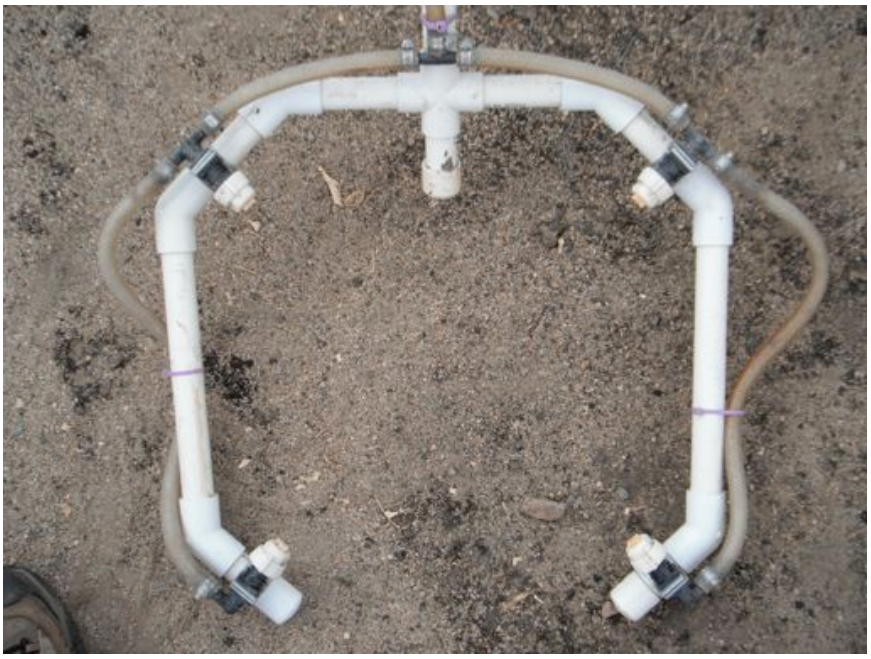
Brigade WSB trunk spray 0.5 lb AI/ acre 1 day after treatment

Cannot get this on fruit (domestic tolerance)

Prune tree to at least 24” off the ground (lower – wastes effort)

Hand-built PVC spray wand powered via a weed rig

Hand-built PVC spray wand (rest on ground) – 4 nozzles spray the trunk



Hand operated lever on the home-built PVC spray wand

Three people can
treat 2 acres per hour
once a good rhythym
is established

Application of the wand spray to a skirt pruned tree

Apply the spray by resting the wand on the soil surface; depress the handle to start the spray; move up 18" and then back down (uniform coverage around the trunk is key).

PVC spray wands build by LREC staff

Wand on the right for small trunks (width of U is 12 inches)

Larger wand on the left built for bigger trunks (opening of 24" with circle diameter 36")

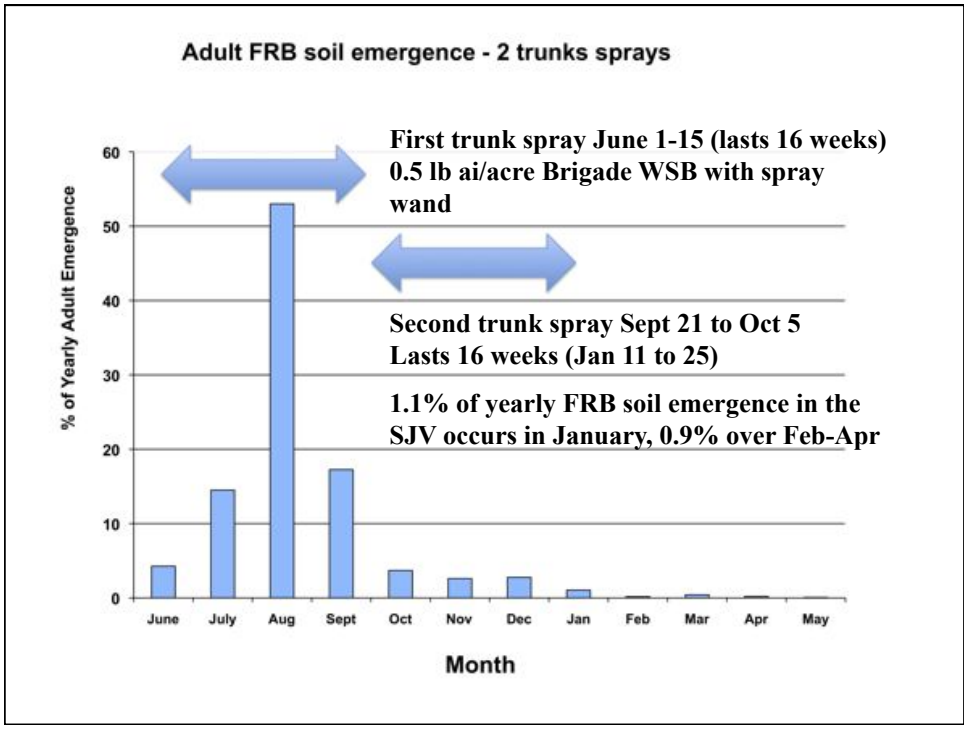
Nozzles are TeeJet XR110-02 Flat Fan which is 110° spray, #2 orifice, 50 mesh screen.

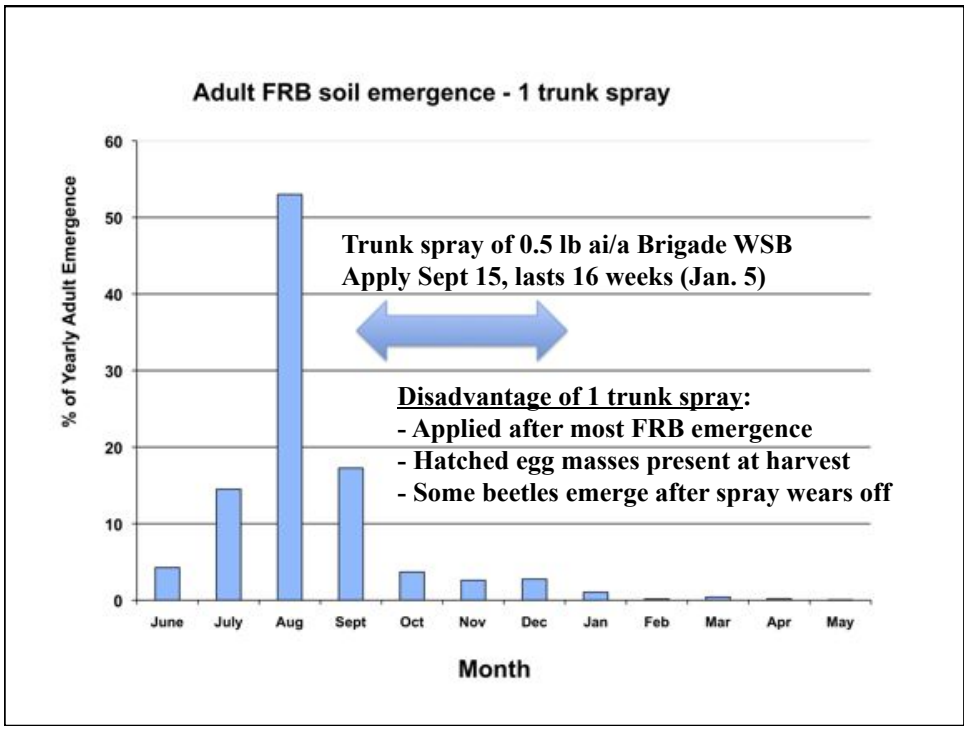
Larger wand built for bigger trunks (opening of 24" with circle diameter 36")

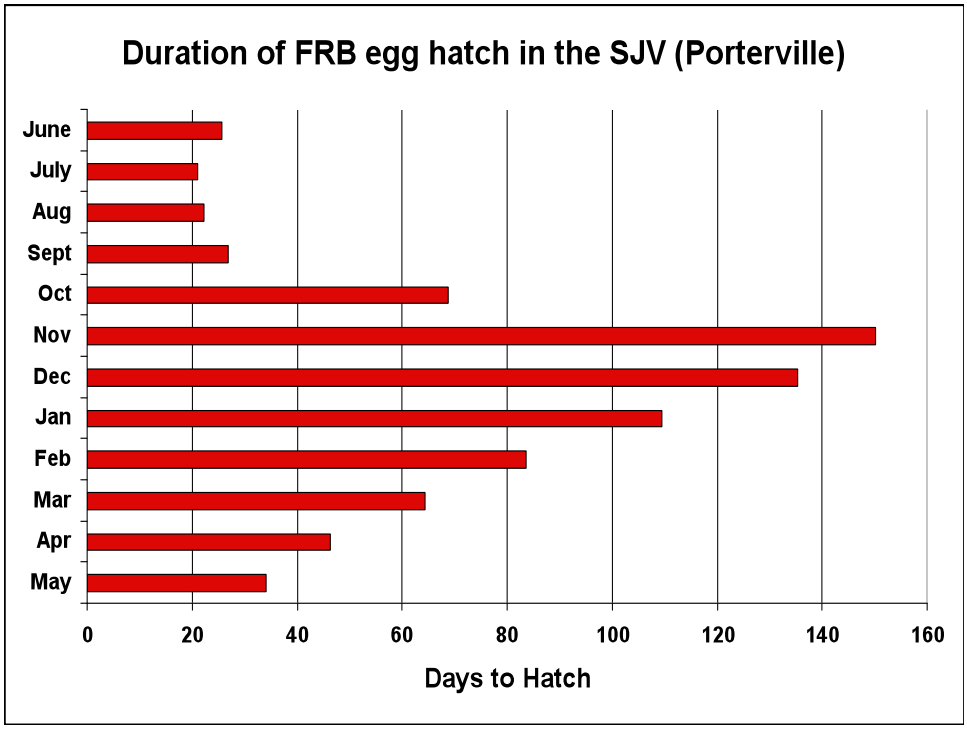
One nozzle on the end is OC (off center) and is angled to spray out one side to cover the open end of the wand

Growers and PCAs Need to Share Experience / What Works

- Wand spray (4 TeeJet flat fan XR110-02 nozzles, 50 mesh screen) in Bakersfield – 8.5 gallons of spray (20 year old trees, 181 trees per acre) (4 applications of 0.25 lb ai/acre)
- 5.0 lbs of Brigade WSB (0.5 lb ai) in 8.5 gallons of water – very thick solution – almost "painting" the trunk
- Good agitation needed to keep the pesticide in solution; have extra nozzles on hand in case of plugging
- Consider using larger nozzles, larger mesh screen, removing the spinner – see what works with your system
- Test out and modify the unit in advance of the spray


Adult FRB soil emergence - 2 trunks sprays
First trunk spray June 1-15 (lasts 16 weeks)
0.5 lb ai/acre Brigade WSB with spray wand
Second trunk spray Sept 21 to Oct 5
Lasts 16 weeks (Jan 11 to 25)
1.1% of yearly FRB soil emergence in the SJV occurs in January, 0.9% over Feb-Apr
% of Yearly Adult Emergence
0
10
20
30
40
50
60
June
July
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Month

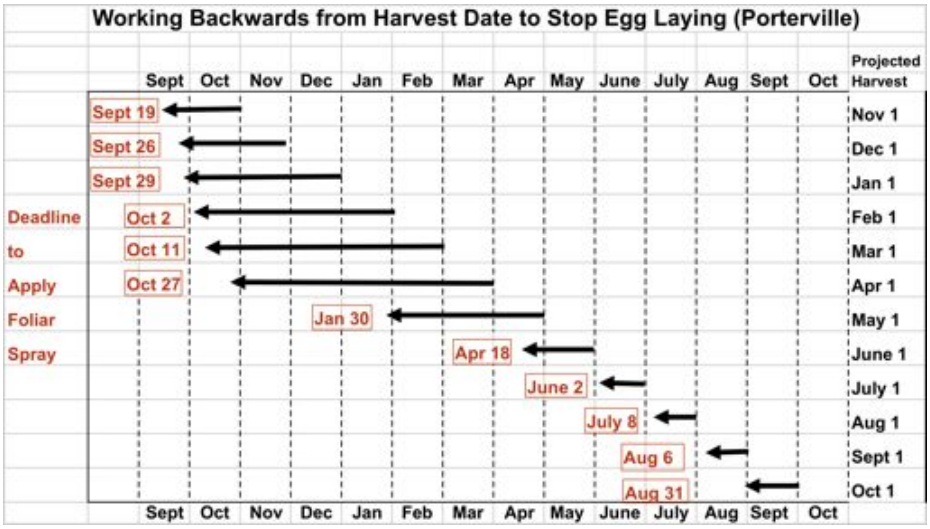

Adult FRB soil emergence - 1 trunk spray
Trunk spray of 0.5 lb ai/a Brigade WSB
Apply Sept 15, lasts 16 weeks (Jan. 5)
Disadvantage of 1 trunk spray:
- Applied after most FRB emergence
- Hatched egg masses present at harvest
- Some beetles emerge after spray wears off
% of Yearly Adult Emergence
0
10
20
30
40
50
60
June
July
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Month



Touch Up Foliar Spray – Timing Depends on Harvest

- Consult online Pest Management Guidelines – list of degree days each month of the year by location in CA
- 99% egg hatch occurs after 593 degree-days above 51°F (use 650 to be safe)
- Foliar sprays by themselves will not be effective (not persistent enough)
- Use a spray timed 650 degree-days or more before harvest as an added security measure
- Kryocide (rain) most effective (check MRL situation)
- If we cannot use Kryocide, Actara would be the best option

Timing foliar sprays in relation to harvest (see degree-day handout or Online citrus Pest Management Guidelines under FRB)



Grove Selection for FRB Trunk Sprays

- To the degree possible, it would be wise to prioritize specific groves for fruit export to Korea
- FRB control will be expensive (skirt pruning, trunk sprays, regular inspection for weeds and suckers/limbs allowing ground access, possible foliar spray)
- Start by selecting groves with appropriate fruit and LOW INITIAL FRB LEVELS (take a 300-600 fruit sample to count the number of hatched egg masses; look at inside foliage for past feeding damage)
- It appears that irrigation sprinklers hitting the trunk reduce Brigade levels to some degree (more data coming early July)
  - If sprinkler water will hit the trunk, look at whether there is a 12" band ABOVE the area hit by irrigation water that can be sprayed with Brigade

Summary of FRB Strategy for 2013 (Korean Market)

- Skirt prune trees to 24" high
  - Pruning must be high enough so that weeds growing up and branches bending down will not later allow a bridge to the tree AND high enough to prevent fruit contamination (18" spray band on trunk)
- Build a U-shaped hand wand for trunk spray applications and test it out on trunks using water
- Watch for future CCQC advisories for updates
- 2ee allows a single application of Brigade WSB at 0.5 lb ai/a) – DO NOT ALLOW THE SPRAY TO CONTACT FRUIT
- Absolutely critical the grove be policed once a month to remove weeks and suckers or limbs that might provide a bridge around the trunk spray
- For added security (not effective by itself), consider applying a foliar Kryocide or Actara spray prior to harvest to catch any adults that bypassed the trunk spray

Sources of FRB Information as it is Developed

- FRB research in CA was restarted late in 2011 – insect is extremely difficult to rear in the laboratory – thus we have one opportunity at research each year, mostly July - September
- Pest Management Guidelines: www.ipm.ucdavis.edu/PMG/r107300311.html or go to www.ipm.ucdavis.edu and select Pest Management Guidelines, then Citrus, then Fuller rose beetle (Degree day table for FRB egg hatch)
- Other sources of information:
  - Beth Grafton-Cardwell's web site (FRB Pest Control Circular) http://ucanr.org/sites/KACCitrusEntomology/
  - County farm advisors
  - Joseph Morse
- Review April 2013 FRB Citrograph article (Morse & Grafton-Cardwell)
- Keep an eye out for CCQC advisories providing updates on the situation