Tarnished Plant Bugs, Mites, and Other Strawberry Insect Pests

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Commercial Fruit IPM In-Service Training
October 10, 2012
Fruit Research Station
Clarksville, AR
Training Agenda:

What is Insect Pest Management?
Tour online resources
Identification of fruit pests
Calculating degree days (DD)
Season Sampling Plan - files in Online DropBox:
  History - 2011 trap/damage data
  By fruit crop (apple/peach; bramble and grape):
  - Seasonal phenology of key insect pests
  - Sheets identifying damage, time to scout, pest ID, name
  - Pest monitoring procedures
  - Making pest management decision (economic thresholds)
  New pests? Barbara will check traps for BMSB and SWD
Insect Pest Management (IPM)

• Identify the pest and its damage
• Understand pest life cycle relative to crop growth stages (phenology)
• Annually, by crop or cultivar block record history of pest phenology, abundance & % damage
• Know when and how to sample for each pest
• Is there an economic threshold that alerts you to need for a spray?
  • Example: 1 plum curculio/trap/week
• If you need to spray - what to spray and when?
• Alternate insecticide/ miticide sprays with different modes of action (IRAC#) to delay resistance development
Pest Alert:

Spotted Wing Drosophila in Arkansas

Stink Bugs and Pecan Weevils Damaging Nuts

Arkansas Pest Management News- click here

New Fact sheets:

Brown Marmorated Stink Bug

Spotted Wing Drosophila

Raspberry Crown Borer

Link: http://comp.uark.edu/~dtjohnso/
Specific Online Resources from Webpage:

*Fruit / Nut Pest Management*

Fruit Pest Management home page:
- [http://comp.uark.edu/~dtjohnso/](http://comp.uark.edu/~dtjohnso/)

Scouting suppliers: I use Great Lakes IPM:
- [http://comp.uark.edu/~dtjohnso/PM_Suppliers.html](http://comp.uark.edu/~dtjohnso/PM_Suppliers.html)

Degree day calculator:
- [http://comp.uark.edu/~dtjohnso/DD_calculator.html](http://comp.uark.edu/~dtjohnso/DD_calculator.html)

Fruit Newsletters:
- [http://comp.uark.edu/~dtjohnso/Arkansas_Fruit_Newsletter.html](http://comp.uark.edu/~dtjohnso/Arkansas_Fruit_Newsletter.html)

Fruit spray guides & IRAC # (Mode of Action):
- [http://comp.uark.edu/~dtjohnso/Management_and_Spray_Guides.html](http://comp.uark.edu/~dtjohnso/Management_and_Spray_Guides.html)

Efficacy tables:
- [http://comp.uark.edu/~dtjohnso/Spray_Efficacy_Tables.html](http://comp.uark.edu/~dtjohnso/Spray_Efficacy_Tables.html)
Cornell University Diagnostic Tool for Berry Crops

Click:  http://www.fruit.cornell.edu/berrytool/

**STRAWBERRY**  **RASPBERRY**  **BLUEBERRY**  **BLACKBERRY**  **Currant & Gooseberry**

Strawberry:  http://www.fruit.cornell.edu/berrytool/strawberry/STRparts.htm
### Strawberry Plant Pest Symptoms, When to Monitor, and Arthropod Pest Description

**Dr. Donn Johnson and Barbara A. Lewis**  
Department of Entomology, AGRI 319, University of Arkansas, Fayetteville, AR 72701

<table>
<thead>
<tr>
<th>Pest Symptoms on Plant</th>
<th>When and How to Look</th>
<th>Arthropod Description</th>
<th>Arthropod Common Name</th>
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<tbody>
<tr>
<td>Stunted or dead plants with roots pruned</td>
<td>After planting, dig up dying or stunted plants to check for presence of white grubs in soil</td>
<td>Grubs, ½” to 2”, “C”-shaped, white with 6 legs</td>
<td>White grubs</td>
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<td>Misshapen fruit</td>
<td>First flower buds to first bloom, check weekly 30 strawberry flower clusters and sweep net adjacent blooming weeds (clover, vetch, curly dock, alfalfa) to detect a dult bugs</td>
<td>Adult, ¼”, oval, yellow “Y” marking between wings, stylet mouthparts; Nymph, 1/4”, pale green to greenish-brown</td>
<td>Tamished plant bug</td>
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<td>Stem of flower bud girdled, bud dies and falls off</td>
<td>As flower buds swell, look for girdled flower bud stems or jar 30 clusters onto a white paper plate to detect a dult weevils</td>
<td>Adult weevil, 1/10”, snout, dark-reddish brown body; Larva, 1/10”, white, legless inside flower buds</td>
<td>Strawberry bud weevil or Strawberry clipper</td>
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<td>Leaves rolled or tied together by silk</td>
<td>From bloom on, look for leaves held together with silk</td>
<td>Caterpillar, ¼”, green, very wiggly when leaf is unfolded</td>
<td>Leaf rollers</td>
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<td>Sticky honeydew on leaflets that is clear becomes moldy black</td>
<td>In spring or fall, check for aphids on underside of newer leaflets</td>
<td>Aphid, 1/12”, pear-shaped, light-green to green, soft-bodied, and with or without wings</td>
<td>Aphids</td>
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<td>Leaves bronzed (loss of chlorophyll) or webbed with fine silk</td>
<td>Weekly from early-November to harvest, use hand lens to determine percentage of leaves with spider mites present</td>
<td>Mite, 1/3 mm long, 8 legs, yellow with green spots or whole body red</td>
<td>Spider mites (two species)</td>
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<td>Ripening fruit look soft or sunken</td>
<td>Weekly, determine presence of pest by floating white fly larvae from 30 randomly collected ripening fruit in a bag of salt water (¼ lb salt in gal. water)</td>
<td>Adult fly, 1/8”, female has serrated ovipositor, male has spotted wing, 2 black combs on front legs; Larva, white, headless</td>
<td>Spotted wing drosophila (new invasive pest of ripening, soft-skinned fruits)</td>
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</table>
White Grubs

- **Damage**: Grubs prune off roots of transplanted strawberries
- **Biology**: some white grub species have 2 yr. life cycle in soil
- **Cultural tactic**: transplant into fields kept fallow of grass for 2 yrs. = allow white grubs to die (no roots to feed on) or mature and exit soil as May beetles
- **Composted manure** may attract green June beetles to lay eggs and larvae (large grub) to tunnel in soil and uproot strawberries in fall
Tarnished Plant Bug
*Lygus lineolaris* (Palisot de Beauvois)


**Damage:**
- Apple, peach, brambles, strawberry
- Suck on individual strawberry seeds – hollow and straw brown
- “Cat-faced” or “button-berry” fruit have apical seediness
- Deformed or undersized fruit

Source: Cornell TPB Fact Sheet
Tarnished Plant Bug ID

Adult:
- ¼” long, oval, greenish-brown
- Yellow “Y” marking between wings
- piercing-sucking mouthparts

Eggs
- laid in plant tissue
- hatch into nymphs in a couple weeks

Nymph:
- 1/10” to 1/4” long
- Pale green to greenish-brown
- Later instars develop wing pads

Source: Cornell TPB Fact Sheet
Why were tarnished plant bugs (TPB) so bad, especially in 2012?

Problem:

Early 1\textsuperscript{st} bloom by 1 Mar. in Arkansas

Adult TPB were active by early Mar. and nymphs by 1\textsuperscript{st} Apr.

Strawberry growers experienced economic damage from TPBs in Delta region from Memphis to Lonoke to Cabot

Why the increase in numbers of TPB?

Number of TPB overwintering is large due to planting \textit{Bt} cotton and \textit{Bt} corn and success of boll weevil eradication program - result in fewer sprays in row crops for worms and weevils so fewer TPB killed

Warm 2011 produced 4 generations and mild winter allowed more TPBs to successfully overwinter

Resistance to pyrethroid insecticides? use another mode of action
Tarnished Plant Bug Biology

- Overwinter as adults
- 2 generations per year
- Adults become active on flowers of many weed hosts from Mar. to June and from Aug. to Sept.
- Nymphs occur from early Apr. to May and from Aug. to Oct.

Spring Hosts of Tarnished Plant Bugs

- Curly dock
  - http://nycgarden.blogspot.com/

- Crimson clover
  - http://www.swcoloradowildflowers.com

- Alfalfa
  - http://www.hear.org/pier/imagepages/singles/800px-Medicago_arabica-001.htm

- Narrowleaf vetch
  - Jan Kops - Flora Batava (1807)
  - http://www.swcoloradowildflowers.com

Source: Snodgrass et al. 1984
Fall Hosts of Tarnished Plant Bugs

Hairy aster
Lamb’s quarters

Photo: Jennifer Anderson @ USDA-NRCS PLANTS Database

Photo: Wildman
http://www.wildmanstevebrill.com

Source: Snodgrass et al. 1984
Tarnished Plant Bug Monitoring

- Pre-bloom, sample weekly 30 flower clusters across the field (5 clusters at 6 locations)
- Knock nymphs free from plants and flowers buds onto a white colored paper plate
- Set white sticky cards in strawberry row to detect bug flight
Tarnished Plant Bug Pre-bloom Control

• 1\textsuperscript{st} instar TPB nymphs are easiest to kill
• \textit{Spray threshold, if > 4 flower clusters are nymph infested}
• Follow-up spray may be made after bloom if TPB are still present, but check pre-harvest interval (PHI) before selecting material

\textbf{DO NOT SPRAY INSECTICIDES DURING BLOOM}
Tarnished Plant Bug Control
Immediately Pre-bloom

Recommended Insecticides (mode of action; active ingredient):

– Sevin (1A; carbaryl)
– Malathion (1B) or Brigade WSB or Athena (3A; Bifenthrin) (Dr. Greg Loeb, Cornell U.)
– Danitol (3A; fenpropathrin) (Dr. Rufus Isaacs, Michigan S.U.)
– Assail (4A; imidacloprid and acetamiprid)
– Rimon (15; Novaluron) applied prior to egg hatch (Mark Bolda, U. CA-Extension)

* Remember to rotate insecticides to different IRAC # (mode of action)
Strawberry Clipper Recommendations

Monitor:
– When flower buds start swelling and temperatures exceed 65°F, check for clippers in areas close to fencerows, shelterbelts and field margins
– Detect weevils by jarring from flower buds onto a white paper plate

Treat strawberry border if:
– Research suggests that strawberry plants are able to compensate for clipper damage
– Traditionally, spray if > 3 clipped primary buds per 3’ of row
– Research indicates threshold > 20 clipped buds per 3’ of row
Strawberry Clipper Insecticides and rate/acre (IRAC # = MoA, active ingredient)

Sevin XLR Plus at 1-2 qt/A (1A; carbaryl)
Lorsban 4EC at 2 pt/A (1B; chlorpyrifos)
Athena 0.87EC at 7-17 fl oz/A (3A; bifenthrin)
Brigade 10WP (WSB) at 6.4-32 oz/A (3A; bifenthrin)
Danitol 2.4EC at 16-21.3 fl oz/A (3A; fenpropathrin)
Actara 25WDG at 4 oz/A – also suppresses TPB (4A; thiamethoxam)

Source: 2012 Midwest Small Fruit and Grape Spray Guide
2012 warm Mar.-Apr. accelerated growth of winter wheat, a crop that served as a host plant for armyworms

**Identification:** 1/8” to 1-1/2” long
- Small larvae appear pale green to brownish
- Mature larvae marked with two orange, white-bordered strips on each side

**Damage:** feed at night on grasses - problem more concentrated in northeastern to southern part of Arkansas

**Monitoring:** scout for larvae at night when they’re most active or during day lift up dead, chewed grass on the ground to look for larvae

**Control:**
- pyrethroids (3A) are best choice - spray late in the day, or Radiant (5; Spinetoram) or Rimon (15; Novaluron)

Source: Hay & Forage Grower 1 May 2012: Kelly Loftin
High Tunnel Strawberries
(Dr. Garcia and David Dickey)

Nov. 25, Dec. 2, 2011 – cutworms were damaging strawberry foliage and chewing small holes in green and ripe berries

  – Control: applied Deliver ™ (11A; Bt) insecticide

Jan. 27, 2012 - cutworms and crickets causing damage

  – Control: applied Deliver and Malathion
High Tunnel Strawberries
(Dr. Garcia and David Dickey)

Dec. 8 – spider mites bronzing leaves

– Control: applied two miticides - Agri-Mek (kill larvae only) on 8 and 19 Dec., and Oberon (kill eggs/larvae) on 30 Mar.

– Result:

• Albion mite damage reduced yield, some mites on Radiance and Elyana, and a few on Festival

• By 22 Feb. = 35 mites/ Albion leaflet
  ✓ Oberon applied on 30 March did not kill predator mites already on Albion and Elyana
Cumulative TSM Mite Days (Burrack et al. 2009)

Treatments applied 26 Mar. with 22 to 60 mites/leaflet

- Ecotec 2pt
- Untreated
- Ecotec 4pt
- Danitol
- Ecotec + Saf-T-Side
- Organic JMS Oil
- Zeal
- Oberon
- Agri-Mek
- Acramite
- Hyp. - ET = 10/leaflet
Strawberry Miticides and Mite Stages Affected

<table>
<thead>
<tr>
<th>Miticide</th>
<th>REI (hrs)</th>
<th>PHI (days)</th>
<th>Stages controlled</th>
<th>Residual activity (days)</th>
<th>IRAC #</th>
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<td>Savey</td>
<td>12</td>
<td>28</td>
<td>ovicide/larvicde</td>
<td>60</td>
<td>10A</td>
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<td>Agri-Mek</td>
<td>12</td>
<td>21</td>
<td>motile stages</td>
<td>28</td>
<td>6</td>
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<tr>
<td>Apollo (Do not use after Green tip) (not for strawberry)</td>
<td>12</td>
<td>21</td>
<td>ovicide</td>
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<td>10A</td>
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<td>Vendex</td>
<td>48</td>
<td>14</td>
<td>mobile stages</td>
<td>30</td>
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<td>12</td>
<td>7</td>
<td>All stages</td>
<td>long</td>
<td>10B</td>
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<td>Envidor (not for strawberry)</td>
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<td>7</td>
<td>all stages</td>
<td>40</td>
<td>23</td>
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<td>Nexter (formerly Pyramite) (not for strawberry)</td>
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<td>7</td>
<td>Immatures</td>
<td>&lt; 28</td>
<td>21A</td>
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<td>Acramite</td>
<td>12</td>
<td>3</td>
<td>motile stages</td>
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<tr>
<td>Oberon (translaminar)</td>
<td>12</td>
<td>3</td>
<td>Eggs &amp; nymphs</td>
<td>14-21</td>
<td>23</td>
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<td>Brigade (foliar/systemic)</td>
<td>12</td>
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<td>Kanemite (acequinocyl)</td>
<td>12</td>
<td>1</td>
<td>Knockdown/residual Harmless to predator mites</td>
<td>21 d between trts</td>
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<td>Malathion</td>
<td>12</td>
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<td>suppressant</td>
<td>Short/contact</td>
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<td>Insecticidal soap</td>
<td>0</td>
<td>0</td>
<td>Marginally effective</td>
<td>Short/contact suffocant</td>
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- Miticide choice restricted to those with short PHI
- **Note:** Burrack (NCSU) found Agri-Mek, Acramite, Oberon and Zeal miticides all reduced numbers of motile spider mites and eggs for up to 3 weeks.
- JMS Stylet Oil reduced motile spider mites with sprays applied at 3 week interval.

HANDOUT
Relative Efficacy, IRAC # (mode of action) and Availability
Handout
<table>
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<tr>
<th>CHEMICAL</th>
<th>Clipper</th>
<th>Cyclamen mite</th>
<th>Eastern flower-thrips</th>
<th>Leafhoppers</th>
<th>Leafrollers</th>
<th>Root weevils</th>
<th>Rootworms</th>
<th>Slugs</th>
<th>Sap beetles</th>
<th>Spider mites</th>
<th>Spittlebug</th>
<th>Tarnished plant bug</th>
<th>White grubs</th>
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<tr>
<td>Zeal</td>
<td>X</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>+++ M</td>
<td>-</td>
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</tr>
</tbody>
</table>

Efficacy rating system: +++=Highly effective; ++=moderately effective; + = slightly effective; - = ineffective or not sufficient data.

Source: 2012 Midwest Small Fruit and Grape Spray Guide
Be on Look Out for Spotted Wing Drosophila in Arkansas

Handout: [http://www.uaex.edu/Other_Areas/publications/PDF/FSA-7079.pdf](http://www.uaex.edu/Other_Areas/publications/PDF/FSA-7079.pdf)

Males have:
- wing spot
- black spines on front legs
- big red eyes

Females have:
- serrated ovipositor
- big red eyes
- no wing spot

Both are 1/8” or 2-3 mm long
Spotted Wing Drosophila Biology (Cowles)

Life Cycle of the Spotted Wing Drosophila
*Drosophila suzukii* (Matsumura)

*Hosts*: soft-skinned fruit: brambles, blueberries, strawberries, cherries and late peaches

- Adults: 20-30 days
- Eggs: 12-72 hours, 350+ eggs in a lifetime
- Pupation: 4-15 days, inside or outside of fruit
- Larval instars: 5-7 days

Monitoring for Spotted Wing Drosophila

- **Make traps:** clear 1 qt deli cups with plastic lid, drill several 3/16” diameter holes in upper sides and lid, add 2” of liquid bait inside (click video: http://www.extension.org/pages/60592/monitoring-for-blueberry-pest-spotted-wing-drosophila-video)

- **Baits (re-bait weekly):**
  1. “Modified Super bait" - 88 fl oz. water, 32 fl oz. cheap Concord or Niagara grape juice, 6 fl oz. molasses, 3 fl oz. apple cider vinegar, 1 teaspoon unscented dish soap (flies sink)
  2. Yeast bait - 2 teaspoons active dried yeast, 1 teaspoon sugar, 2 cups water; mix and let stand overnight
Detect Spotted Wing Drosophila Larvae in Fruit

- Randomly collect a 30 ripe fruit sample
- Add fruit to black pan or clear baggie
- Add solution of 1 qt water + ¼ cup sugar (or ¼ cup salt) to baggie
- Use ¼” screen to push fruit to bottom to allow larvae to float to surface for 30 min.
- Click video: [http://horticulture.oregonstate.edu/content/spotted-wing-drosophila-fruit-dunk-flotation](http://horticulture.oregonstate.edu/content/spotted-wing-drosophila-fruit-dunk-flotation)
- To identify, rear some larvae with ripe fruit in baggie to adult flies
Recommended Bramble SWD Sprays

- Spray if you find SWD larvae in ripening fruit or > 1 SWD male in baited trap per week
- Follow 5 to 7 day spray interval or re-apply after rain
- Rotate to different Class / IRAC# / mode of action

<table>
<thead>
<tr>
<th>Class</th>
<th>Trade name</th>
<th>Active ingredient</th>
<th>PHI (days)</th>
<th>Days of residual activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organophosphate</td>
<td>Malathion</td>
<td>malathion</td>
<td>1*</td>
<td>5-7</td>
</tr>
<tr>
<td>Pyrethroid</td>
<td>Mustang Max</td>
<td>zeta-cypermethrin</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Danitol</td>
<td>fenpropathrin</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Asana</td>
<td>esfenvalerate</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Brigade</td>
<td>bifenthrin</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Spinosyn</td>
<td>Delegate</td>
<td>spinetoram</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Pyrethrum</td>
<td>Entrust (organic)</td>
<td>spinosad</td>
<td>3</td>
<td>3-5</td>
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<td>Pyganic (organic)</td>
<td>pyrethrum</td>
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</tr>
</tbody>
</table>

*Check the label for the specific Malathion formulation you are using for the correct PHI. Some formulations may allow 0.5 day PHI.

# Estimated residual activity from experience with other insect pests in Michigan and from SWD studies in Oregon.

## Recommended Blueberry SWD Sprays

(rotate to different Class / IRAC# / mode of action)

### Insecticides for SWD control in blueberries

<table>
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<td>Imidan</td>
<td>phosmet</td>
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<td>7</td>
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<tr>
<td>Pyrethroid**</td>
<td>Mustang Max</td>
<td>zeta-cypermethrin</td>
<td>1</td>
<td>7</td>
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<td></td>
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<td>Asana</td>
<td>esfenvalerate</td>
<td>14</td>
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<tr>
<td></td>
<td>Brigade/Bifenture</td>
<td>bifenthrin</td>
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<td>7</td>
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<tr>
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<td>Hero</td>
<td>bifenthrin+zeta cypermethrin</td>
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<tr>
<td>Carbamate</td>
<td>Lannate</td>
<td>methomyl</td>
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</tbody>
</table>

* The new label for Malathion 8F allows only 1.25 pints per acre and this rate has not been tested in efficacy trials. A maximum of three applications are allowed per season. Also, check the label for your specific Malathion formulation for the correct PHI. Most are one day, but some may allow 0.5 day PHI.

** Residual control will be reduced during hot sunny weather.

Questions?