Prepping for a Healthy Fruit Harvest

Marion Murray
USU IPM Program
Fruit Production Questions

- Pruning
- Fertilization
- Thinning
- Irrigation
- Fruit Varieties
- Harvesting

Contact:
- County Extension Office
- Dr. Teryl Roper (Fruit Extension Specialist, Logan, UT) - teryl.roper@usu.edu
Timely Integrated Pest Management Alerts for Fruits, Vegetables, Landscape Ornamentals, Turf, and Urban Areas

FRUIT IPM ADVISORY • 2018 - FRUIT
Backyard: Prepping for a Healthy Fruit Harvest
March 12, 2018

FRUIT IPM ADVISORY • 2017 - FRUIT
Fall Orchard Chores
October 12, 2017

VEGETABLE IPM ADVISORY • 2017 - VEG
Post-Harvest Cleanup, Tomato Russet Mites, and Diseases
September 26, 2017

VEGETABLE IPM ADVISORY • 2017 - VEG
Sunburn/Sunscald, Squash Diseases, and Spider Mites
August 31, 2017
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- Utah Post News quarterly newsletter
APPLE, PEAR
- green apple aphid
- rosy apple aphid
- blister mites
- San Jose scale
- iron chlorosis
- fire blight
- codling moth
- woolly apple aphid
- powdery mildew
- spider mites
- flatheaded borers
- stink bugs
- leafhopper
- leafroller
- pear slug

PEACH, NECTARINE, PLUM, APRICOT
- green peach aphid
- leafcurl plum aphid
- peach twig borer
- cytospora canker
- iron chlorosis
- greater peachtree borer
- coryneum blight
- peach powdery mildew
- apple powdery mildew

CHERRY
- black cherry aphid
- iron chlorosis
- western cherry fruit fly
- bacterial canker
- powdery mildew
- shothole borer
- spider mite
- leafhopper
- coryneum blight
Dormant Timing – Buds Tightly Closed

APPLE, PEAR – Prune 15-20% last year's growth to let light in
  • also remove dead and diseased branches

TART CHERRY – Prune crossing, dead, and over-extended limbs
“Delayed Dormant” Timing – What is This?

Apples: swollen bud - 1/2"

Pears: swollen bud – green cluster

<table>
<thead>
<tr>
<th>Silver Tip</th>
<th>Green Tip</th>
<th>Half-Inch Green</th>
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<tbody>
<tr>
<td>Swollen Bud (Scale Separation)</td>
<td>Bud Burst (Blossom Buds Exposed)</td>
<td>Green Cluster (Tight Cluster)</td>
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</table>
Delayed Dormant – What is This?

Peaches and Nectarines: swollen bud – first pink

<table>
<thead>
<tr>
<th>Swollen Bud (First Swell)</th>
<th>Calyx Green</th>
<th>Quarter-Inch Green (Calyx Red)</th>
<th>Pink (First Pink)</th>
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</table>
Delayed Dormant – What is This?

Cherries: swollen bud – tight cluster

Apricot: swollen bud

<table>
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<tr>
<th>Swollen Bud (First Swell)</th>
<th>Bud Burst (Green Tip)</th>
<th>Tight Cluster</th>
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</table>

| First Swell (Bud Swell) | Tip Separation (Swollen Bud) |
Delayed Dormant – What is This?

Plum: swollen bud – green cluster

Swollen Bud  Bud Burst  Green Cluster
1. PEACH, NECTARINE, APRICOT, PLUM, SWEET CHERRY: prune for light and fruit production
Delayed Dormant Timing – Bud Swell and Beyond

Pruning Stone Fruit Trees

To PREVENT - Cytospora Canker that causes gumming
Prune 4 inches beyond dead tissue.
Delayed Dormant Timing – Bud Swell and Beyond

1. PEACH, NECTARINE, APRICOT, PLUM, SWEET CHERRY: prune for light and fruit production

2. ALL FRUIT TREES: Spray application to target certain insects and diseases (if they were present the prior year)
Delayed Dormant Timing – Targeted Pests

APPLE, PEAR
- green apple aphid
- rosy apple aphid
- blister mites
- San Jose scale
- fire blight

PEACH, NECTARINE, PLUM, APRICOT
- green peach aphid
- leafcurl plum aphid
- peach twig borer

CHERRY
- black cherry aphid
Delayed Dormant – Pest Management

ALL FRUITS - Aphids

- Green apple aphid
- Rosy apple aphid
- Green peach aphid
- Black Cherry Aphid
- Mealy plum aphid
Overwinter as eggs
Eggs hatch in spring
ALL FRUITS - Aphids

winged aphids
Most aphids leave fruit trees by early June for weeds and vegetable hosts for the summer.

Also, they provide food for beneficial insects.

By June, curled leaves will be empty of aphids.
Tiny eriophyid mites that feed within leaf blisters all season long

Blister mite symptoms on apple early season (top) and late season (bottom)

Blister mite symptoms on pear
Mites overwinter in bud scales and start emerging at bud swell.
APPLE, PEAR - San Jose Scale

Immobile insect that feeds on twigs, limbs, and fruit

Large infestations weaken trees and kill limbs
APPLE, PEAR - San Jose Scale

Overwinter on tree bark

Over 200 crawlers hatch from each female in June

stylet (mouthpart) feeding in plant tissue
Delayed Dormant – Pest Management

PEACH, NECTARINE, APRICOT - Peach Twig Borer

Larvae feed inside ripening fruit
Delayed Dormant – Pest Management

PEACH, NECTARINE, APRICOT - Peach Twig Borer

Overwinters as a larva in protected sites in the tree
Delayed Dormant – Pest Management

ALL FRUIT TREES - Oil Spray

**Horticultural oil:** 2% mixture  5 TBS oil per gal water
- Spray entire tree (full coverage of buds, etc.)
- Only use when temps > 45°F
- Do not use not within 24 hr of frost
- Do not use within 24 hr of rain

- Paraffinic oil
- Mineral oil
- Canola oil
Delayed Dormant – Pest Management

APPLE, PEAR - Fire Blight

Caused by a bacterium – *Erwinia amylovora*
Bacteria overwinter in old infections
Bacteria becomes active in early spring
APPLE, PEAR - Copper Spray

Works by preventing fire blight bacteria from multiplying

Thorough coverage of bark and areas of infection

Can be mixed with oil spray
Delayed Dormant Timing – Bud Swell and Beyond

1. PEACH, NECTARINE, APRICOT, PLUM, SWEET CHERRY: prune for light and fruit production

2. ALL FRUIT TREES: Spray application to target some insects and diseases (if they were present the prior year)

3. ALL FRUIT TREES: Soil application of chelated iron to prevent iron chlorosis (at bud swell)
1. PEACH, NECTARINE, APRICOT, PLUM, SWEET CHERRY: prune for light and fruit production

2. ALL FRUIT TREES: Spray application to target some insects and diseases (if they were present the prior year)

3. ALL FRUIT TREES: Soil application of chelated iron to prevent iron chlorosis

4. APPLE and new fruit trees: Apply nitrogen fertilizer
   Yearly or every other year
   Collect soil for nutrient analysis from Utah State University Analytical Lab (usual.usu.edu)
Summary: Dormant – Delayed Dormant

**DORMANT**

APPLES, Pears - prune

**DELAYED DORMANT**

PEACH, NECTARINE, APRICOT, PLUM, SWEET CHERRRY: prune

ALL FRUITS: oil spray (if insects present last year)

APPLE, PEAR: oil spray plus copper (if fire blight present last year)

ALL FRUITS:

Apply chelated iron (if necessary)
Determine fertilizer needs
Spring

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</table>
1. APPLE, PEAR (some), PEACH, NECTARINE, APRICOT, PLUM: thin fruit

2. Pest management
Spring - Fruit Thinning

APPLE at bloom:
hand-remove all flowers except king bloom

APPLE, PEAR (some) at ½ - 1-inch diameter:
space clusters to 6 inches apart
thin remaining clusters to a single large fruit

PEACH, NECTARINE, APRICOT, PLUM when fruits are ¾ - 1-inch diameter:
space fruit 6-8”
Spring

1. APPLE, PEAR (some), PEACH, NECTARINE, APRICOT, PLUM: thin fruit

2. **Pest management**
   - APPLE, PEAR: powdery mildew, fire blight, codling moth, woolly apple aphid
   - PEACH, NECTARINE, APRICOT: peach twig borer, coryneum blight
   - CHERRY: western cherry fruit fly
APPLE: Apple Powdery Mildew

Caused by a fungus: each host tree has its own species

Overwinters in terminal buds and on twigs
Monitor by looking for fuzzy whitish patches.

Fungicides
- Apply at “open cluster” stage
- Repeat every 7 – 14 days two to three times
## Spring – Pest Management

### APPLE, PEAR – Powdery Mildew Products

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<tr>
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<th>Brand</th>
<th>Residual (days)</th>
<th>Type</th>
<th>Comments</th>
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<td>Spectracide Immunox</td>
<td>14</td>
<td>conventional</td>
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<tr>
<td>potassium bicarbonate</td>
<td>Monterey Bi-Carb</td>
<td>5-7</td>
<td>organic</td>
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<td>sulfur</td>
<td>many products</td>
<td>7</td>
<td>organic</td>
<td>do not use in temps above 85F</td>
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<tr>
<td>sulfur + pyrethrin</td>
<td>Bonide Citrus, Fruit and Nut Orchard Spray; Nature’s Care 3-in-1</td>
<td>7</td>
<td>organic</td>
<td>do not use in temps above 85F</td>
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<tr>
<td>sulfur + insecticidal soap</td>
<td>Safer 3-in-1</td>
<td>7</td>
<td>organic</td>
<td>do not use in temps above 85F</td>
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<tr>
<td>neem oil</td>
<td>many products</td>
<td>5</td>
<td>organic</td>
<td>do not use in temps above 85F</td>
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</tbody>
</table>
Highly susceptible varieties:

- Fuji, Gala, Gingergold, Granny Smith, Honeycrisp, Jonathon, Jonagold, Idared
- Asian pears, Bosc, D’Anjou

Primary infections occur through open blossoms
Copper application at delayed dormant timing

Prevent infections with streptomycin fire blight spray only during bloom

• Use only when temperatures over a 4-day period are above 75F AND moisture is present (rain, irrigation water)

AND / OR

Monitor for new infections starting 2 weeks after bloom, and prune them out immediately
Spring – Pest Management

APPLE, PEAR - Fire Blight Management

- Cut twig at twice this length
- Prune this infection off by cutting into healthy wood 8-12 inches beyond the symptomatic tissue.
Spring – Pest Management

APPLE, PEAR - Codling Moth

Larvae burrow into the fruit to feed on seeds

Can infest 100% of the fruit on a tree
Codling Moth Life Cycle

1. overwintering larvae pupate into moths in spring
2. moths lay eggs on fruit mid spring
3. eggs hatch and bore into fruit
4. mature larvae pupate to adults; begins another generation
Spring – Pest Management

APPLE, PEAR - Codling Moth Management

Thin fruit to one apple/cluster

Clean and mow or remove all unharvested or dropped fruit all season

Remove unmanaged trees
Spring – Pest Management

APPLE, PEAR - Codling Moths: Fruit Bagging

Bag during thinning

Remove any fruit that you don’t bag

Options

• Japanese 2-ply apple bags
• waxed paper or clear plastic sandwich bags
• white or tan paper sacks
• clear poly bags with drawstring closures
• disposable nylon foot socks
Spring – Pest Management

APPLE, PEAR - Codling Moth Management

Extension hangs monitoring traps to help determine when to make first spray

First spray of the season is applied by recommended date

Re-apply for each generation
## Codling Moth Spray Timing Information, First Generation

Choose either Option A or B when starting your codling moth sprays.

- **Option A** is what most people will do. Apply insecticide at the recommended date, and repeat.
- **Option B** is an alternative that may help to reduce sprays. Liberally apply horticultural oil (1%) on the first date, and then apply your regular insecticide on the later date. The oil kills eggs that have been laid on fruit up to that point.

Apply treatments, spaced 7-21 days apart (depending on material) to protect fruit up to the end of the first generation egg hatch (dates not yet known). Make sure fruit is protected during the "period of greatest egg hatch."

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<th>Option A Apply first spray</th>
<th>Option A Apply oil</th>
<th>Option A Apply first insecticide</th>
<th>Option B Apply oil</th>
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*PDF document linked within Fruit IPM Pest Advisory message*
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### Period of Greatest Egg Hatch

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### Option B

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<td>May 28</td>
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</tr>
</tbody>
</table>

**Dates:**
- June 3 - unknown
- June 4 - unknown
- June 9 - unknown
- June 6 - unknown
- unknown
- May 28 - unknown
- May 22 - June 12
- May 12 - May 29
- June 6 - unknown
- June 10 - unknown
### Spring – Pest Management

#### APPLE, PEAR - Codling Moth Conventional Products

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Brand</th>
<th>Residual (days)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>acetamiprid</td>
<td>Ortho Fruit &amp; Veg</td>
<td>14</td>
<td>max 4 applications</td>
</tr>
<tr>
<td>gamma-cyhalothrin</td>
<td>Spectracide Triazicide</td>
<td>14-17</td>
<td>wait 21 days to harvest</td>
</tr>
<tr>
<td>carbaryl</td>
<td>Sevin</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>permethrin</td>
<td>Bonide Eight</td>
<td>14</td>
<td>pears only</td>
</tr>
<tr>
<td>malathion</td>
<td>Bonide Malathion</td>
<td>5-7</td>
<td>max 2 sprays</td>
</tr>
<tr>
<td>malathion</td>
<td>Hi-Yield 55% Malathion; Ortho Malathion</td>
<td>5-7</td>
<td>pears only; max 2 sprays</td>
</tr>
</tbody>
</table>
## Spring – Pest Management

### APPLE, PEAR - Codling Moth Organic Products

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Brand</th>
<th>Residual (days)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>azadirachtin</td>
<td>Safer BioNeem</td>
<td>7-10</td>
<td></td>
</tr>
<tr>
<td>spinosad</td>
<td>Ferti-lome / Monterey / Natural Guard</td>
<td>7-10</td>
<td></td>
</tr>
<tr>
<td>oil</td>
<td>All Seasons Oil; EcoSmart; neem products; Natria Multi-Insect</td>
<td>3</td>
<td>Use 1% in water; apply at start of each generation</td>
</tr>
<tr>
<td>pyrethrin plus soap and neem</td>
<td>Safer End All plus Neem</td>
<td>5-7</td>
<td></td>
</tr>
<tr>
<td>pyrethrin plus neem or canola oil</td>
<td>Ferti-lome Fruit Tree Spray; Monterey Take Down; Nature’s Care Insect Control</td>
<td>3-5</td>
<td></td>
</tr>
<tr>
<td>pyrethrin</td>
<td>Ortho Fruit Spray; Fertilome Fruit Tree Spray; Monterey Bug Buster-O</td>
<td>3-5</td>
<td></td>
</tr>
<tr>
<td>kaolin clay</td>
<td>Surround</td>
<td>7</td>
<td>produces protective barrier</td>
</tr>
</tbody>
</table>
Spring – Pest Management

Pesticide Pre-Mixes (Labeled for Insects and Diseases)

Products containing non-organic fungicide + insecticide—**Not Recommended**
- applying these products means that you may be using a fungicide when it is not necessary, or vice-versa
- if used repeatedly, there is greater risk for resistance

Products with organic insect and disease control—**OK**
- products containing sulfur plus pyrethrin
- products containing neem oil plus pyrethrin
- no risk of resistance
Spring – Pest Management

APPLE - Woolly Apple Aphid

Feeding causes galls on stems and roots that cause reduced tree vigor or even death of young trees.

Life cycle:

- Overwinter on roots or in the tree.
- Individuals become active in **late spring**.
Woolly Apple Aphid Damage
Monitor starting in mid May for aphid presence

Insecticides

- insecticidal soap
- 1% oil
- Bonide Malathion

must contact insect
apply to dripping
do not apply when temps > 85F
Spring – Pest Management

PEACH, NECTARINE, APRICOT – Peach Twig Borer Management

Delayed dormant oil application

One application of *Bacillus thuringiensis* or spinosad before or after bloom

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Brand</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bacillus thuringiensis</em></td>
<td>Natural Guard Caterpillar Spray Bonide Captain Jack’s Monterey Bt others</td>
</tr>
<tr>
<td>spinosad</td>
<td>Ferti-lome Spinosad Monterey Spinosad Natural Guard Spinosad others</td>
</tr>
</tbody>
</table>
Caused by a fungus

Infections occur on new growth in spring

Later, fruit becomes infected
Early infections on peach and apricot
Spring infections later turn scabby
Summer infections render fruit inedible

Occur during heavy rains close to harvest
Spring – Pest Management

PEACH, NECTARINE, APRICOT, PLUM - Coryneum Blight

Prevent wetting of foliage with irrigation

Fungicide at shuck split; repeat all season as necessary (after 4+ hour rainfalls)

**Conventional:**
- **Daconil** (chlorothalonil): don’t use after shuck split
- **Spectracide Immunox** (myclobutanil): can be used all season
- **Captan** (captan): can be used all season (not as effective)

**Organic:**
- Natural Guard Copper Soap
Spring – Pest Management

CHERRY - Western Cherry Fruit Fly

A maggot pest of tart and sweet cherries; one infested cherry can ruin an entire commercial crop

Overwinters as pupa in the soil

Adults begin to emerge in May, and lays up to 200 eggs under the skin of fruit until harvest
Egg-laying begins when fruit turns a salmon blush color.
Spring – Pest Management

CHERRY - Western Cherry Fruit Fly Management

- Add tarp under tree
- Remove dropped fruit
- Remove all unharvested fruit
- Net entire tree
### Spring – Pest Management

### CHERRY – Western Cherry Fruit Fly Pesticide Products

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Residual (days)</th>
<th>Type</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ortho Fruit &amp; Veg (acetamiprid)</td>
<td>14</td>
<td>conventional</td>
<td>max 4 applications</td>
</tr>
<tr>
<td>Hi-Yield 55% Malathion; Ortho Malathion; Bonide Malathion</td>
<td>5-7</td>
<td>conventional</td>
<td>max 2 - 4 sprays</td>
</tr>
<tr>
<td>Spectracide Triazicide (gamma-cyhalothrin)</td>
<td>14-17</td>
<td>conventional</td>
<td>wait 21 days to harvest</td>
</tr>
<tr>
<td>Monterey / Ferti-lome / Natural Guard Spinosad</td>
<td>7</td>
<td>organic</td>
<td></td>
</tr>
<tr>
<td>Sevin (carbaryl)</td>
<td>14</td>
<td>conventional</td>
<td></td>
</tr>
<tr>
<td>(pyrethrin) Ortho Fruit Spray; Fertilome Fruit Tree Spray; Monterey Bug Buster-O</td>
<td>3-5</td>
<td>organic</td>
<td></td>
</tr>
</tbody>
</table>
1. APPLE, PEAR (some), PEACH, NECTARINE, APRICOT, PLUM: thin fruit

2. Pest management
   APPLE, PEAR: powdery mildew, fire blight, codling moth, woolly apple aphid

   PEACH, NECTARINE, APRICOT: peach twig borer, coryneum blight

   CHERRY: western cherry fruit fly
Summer

1. July - Get **foliar nutrition analysis** (if necessary)
   Collect foliage for nutrient analysis from Utah State University Analytical Lab ([usual.usu.edu](usual.usu.edu))

2. **Proper irrigation**
Summer - Irrigation

Especially important during
• fruit maturation
• dry periods in August (flower bud formation)

Reduce amount by late August
Summer

1. July - Get foliar nutrition analysis (if necessary)

2. Proper irrigation

3. Pest management

APPLE, PEAR:
• continue to prune out fire blight infections
• continue sprays to prevent codling moth until Sept 15

CHERRY:
• continue western cherry fruit fly until harvest
• bird control

PEACH, NECTARINE, PLUM:
• greater peachtree borer
PEACH, NECTARINE, PLUM - Greater Peachtree Borer

A clearwing moth that attacks the trunk at soil level

Threats:
- kills young trees
- pre-disposes older trees to other injuries
Greater Peachtree Borer Life Cycle

1. overwintering larvae start feeding in spring

2. larvae pupate to adults starting in mid June

3. adults lay eggs on bark from July through September

4. eggs hatch and immediately bore into lower crown and roots
Summer – Pest Management

PEACH, NECTARINE, PLUM - Greater Peachtree Borer Organic Control

Remove all weeds and mulch from touching the bark
Summer – Pest Management

PEACH, NECTARINE, PLUM - Greater Peachtree Borer Organic Control

Expose and kill larvae in gum
Summer – Pest Management

PEACH, NECTARINE, PLUM - Greater Peachtree Borer Organic Control

Nematodes

Steinernema carpocapsae
**Summer – Pest Management**

**PEACH – Greater Peachtree Borer Products**

Mid June through September

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Brand</th>
<th>Residual (days)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>permethrin</td>
<td>Hi-Yield Lawn, Garden, Pet Bonide Eight</td>
<td>30</td>
<td>peach only</td>
</tr>
<tr>
<td>esfenvalerate</td>
<td>Monterey Bug Buster II</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>spinosad</td>
<td>Monterey / Ferti-lome / Natural Guard Spinosad products</td>
<td>5-7</td>
<td></td>
</tr>
</tbody>
</table>
Summer - Summary

1. July - Get foliar nutrition analysis (if necessary)

2. Proper irrigation

3. Pest management

APPLE, PEAR:
- continue to prune out fire blight infections
- continue sprays to prevent codling moth until Sept 15

CHERRY:
- continue western cherry fruit fly until harvest
- bird control

PEACH, NECTARINE, PLUM:
- greater peachtree borer – protect lower trunk from late July through September
<table>
<thead>
<tr>
<th>September 2018</th>
<th>October 2018</th>
<th>November 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon Tue Wed Thu Fri Sat Sun</td>
<td>Mon Tue Wed Thu Fri Sat Sun</td>
<td>Mon Tue Wed Thu Fri Sat Sun</td>
</tr>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>8 9 10 11 12 13 14</td>
<td>5 6 7 8 9 10 11</td>
</tr>
<tr>
<td>15 16 17 18 19 20 21</td>
<td>12 13 14 15 16 17 18</td>
<td>19 20 21 22 23 24 25</td>
</tr>
<tr>
<td>22 23 24 25 26 27 28</td>
<td>26 27 28 29 30 31 32</td>
<td>26 27 28 29 30 31 32</td>
</tr>
</tbody>
</table>
Fall

1. **Irrigate** before ground freezes

2. Pest management
   - PEACH, NECTARINE, PLUM: coryneum blight
Fall - Pest Management

PEACH, NECTARINE, APRICOT, PLUM - Coryneum Blight

Shuck split fungicide and repeat through summer as necessary

Apply Copper Fungicide in fall at 50% leaf drop

good coverage to protect leaf scars
Fall

1. **Irrigate** before ground freezes

2. Pest management

3. **NEW TREES:**
   - Paint trunks with latex paint
   - OR
   - Apply white tree wrap to trunks from Dec - March

Flatheaded borers
Cytospora canker
White Tree Wrap
Paint Trunks White

latex paint and water

1:1 ratio
Fall - Summary

1. **Irrigate** before ground freezes

2. Pest management

   PEACH, NECTARINE, PLUM: coryneum blight

3. NEW TREES:

   Paint trunks with latex paint
   OR
   Apply white tree wrap to trunks from Dec - March
For CEU Credits

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Subject line: Fruit Webinar CEU Credits

Include in the email message:
Full Name
City, State (including Nevada)
Applicator’s License Number
Your Email Address
Other products to use

Insecticidal Soap
  • aphids, mites, leafhopper, thrips

Spinosad
  • for thrips, apply at petal fall