New Insecticides, Application Timings, and Registration Updates

Western cherry fruit fly
Peach twig borer
Codling moth

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Utah State University Extension
Northern Utah Fruit Growers Meeting
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Update on Guthion Registration

- Apple, Pear, Sweet & Tart Cherry
  - Registration will end in 2012
  - Phase-down of allowed pounds per acre for the season
  - 60 ft buffer from treated orchards to bodies of water
  - 60 ft buffer from orchards to human occupied buildings
  - Lengthy PHI for U-pick orchards
Western Cherry Fruit Fly (Rhagoletis irregularis)

Do You Know?
- Western cherry fruit fly is the primary pest of sweet and tart cherries in Utah.
- Damage occurs from the larva developing inside fruit.
- Females lay eggs under the skin of fruit, so target adult flies for control.
- Insecticides are currently the most effective control method.
- A new insecticide technology-attract-and-kill (BAI) may be effective for control in commercial and home cherry orchards.
- Use of ground baits (mochi, fabric) can reduce population and delay emergence.
- Post-harvest sanitation can reduce populations.

The western cherry fruit fly (Rhagoletis irregularis) is the most important pest of sweet and tart cherries in Utah. Once the skin of the fruit becomes soft enough to penetrate, adult females (Fig. 1) insert eggs with their ovipositor, and larvae develop inside the fruit. The result is a “wormy” fruit that is undesirable. It is difficult to determine whether a fruit is infested until the larvae exit through a hole that it chew (Fig. 2) or the fruit is cut open to reveal the larva inside. For processed cherries, detection of one larva by the processor can result in rejection of the entire crop from the orchard and/or farm. Therefore, the best management strategy is to prevent fruit infestation.

Adult flies migrate one short distance (<40 m) if host fruit is available. This causes infestations to be spotty in a region; however, once established in an orchard, the western cherry fruit fly can spread rapidly and require annual control. Protective insecticide sprays are currently the major tactic for preventing infestation. A new insecticide technology called “attract-and-kill” where adults are enticed to feed on a sticky bee pollen containing an ultrawide range of insecticides, has proven effective in experiments in Utah orchards.

There is one generation per year; however, adults can emerge from the soil over a period of 12 weeks or more. Cherry fruits are susceptible to infestation from when they first open to a salmon-brown color (Fig. 4) until they become too soft or fall from the tree.

HOSTS
Sweet, tart, and wild species of cherries

LIFE HISTORY

Pupa – Overwintering Stage
- Size: about 0.5 inch (12 mm) long
- Color: light to dark brown and shaped like a large grain of wheat
- Where: overwinters in the soil of the orchard, 1 - 4 inches (2.5 - 10 cm) deep
- Rate of pupal development and adult emergence affected by soil temperature and moisture

Adult – Monitoring Stage
- Size: about 0.5 inch (12 mm) long
- Color: black body with white bands on abdomen (posterior body region); wings are transparent with a distinctive pattern of dark bands (Fig. 1 and 5)
- Where: adults begin emerging from soil in late May to early June (Tables 1 and 5) depending on soil temperature and moisture and continue to emerge throughout the summer and into early fall.
- After emerging, females require about 5 - 7 days (119 degree-days) to become sexually mature, after which they can begin laying eggs.
- Females lay eggs under the skin of fruit without leaving visible holes, over a period of about 30 days.

EGG
- Size: about 0.5 inch (12.5 mm) long
- Color and shape: creamy white, irregularly shaped, topped at the head and rounded at the tail (Fig. 5)
- Where: deposited beneath the skin of cherries
- Eggs hatch in 6 - 8 days

Larva – Damaging Stage
- Size: mature larvae are about 0.5 inch (12 mm) long
- Color and shape: creamy white, waxy maggot, tapered at the head and rounded at the tail (Fig. 2)
- Where: lives and feeds in the fruit
- After approximately 14 - 21 days, fully-grown larvae exit from the fruit, drop to the ground, burrow into the soil, and pupate

LIFE HISTORY
- There is one generation per year.

METHODS

Method 1: Fruit Maturity
Cherry fruits are not susceptible to egg-laying by adult females until they ripen to a salmon blush in color (Fig. 4). Green fruits will not be attacked. Consider the maturity of the ripened fruit on the orchard, not the average.

Method 2: Adult Trapping
Adult flies do not use sexual pheromones, but are attracted to certain colors and odors. Yellow sticky panel traps (Pheroxon Arodil) with an external ball of ammonium carbonate (AC) are a moderately effective monitoring tool (Fig. 7); unbaited traps should not be used. Place traps in cherry orchards before the tree is expected [500,000 degree-days (DD)] or by mid-May (Tables 1 and 2). Apply the beetle insecticide treatment 5 - 7 days (199 DD) after first catch. Females require 3 - 5 days for ovaries to mature before egg-laying.

Trapping and Monitoring:
- Places AC-baited Pheroxon Arodil traps on the eastern side of trees, otherwise they will be more active on the western side of trees.
- Traps at least 8 ft high, preferably in the upper 1/3 of the tree canopy.
- Remove fruit, leaves, and twigs within 2 weeks of the trap.
- A minimum of two traps should be placed in each orchard. Research conducted in Utah commercial cherry orchards indicates that 1 - 2 traps per acre catches significantly more flies than...
Key Points of Interest in Cherry Fruit Fly Life History

- Adults fly only short distances (<40 m)
- Females lay eggs under skin of fruit, so target adult flies for control
- Adult flies are the monitoring stage
- Fruits too hard for egg laying until they begin to color

Yellow sticky trap with ammonium carbonate bait
Key Points of Interest in Cherry Fruit Fly Life History

- One generation per year, but adults emerge over 12 weeks or more (late May to September)
- Full-grown larvae exit fruit and burrow into soil to pupate
- Spend winter as pupae in the soil
Timing Control of Cherry Fruit Fly

- Insecticides are the most effective control method
- 3 methods to time sprays
  1. Fruit Maturity (use in combo with another method)
  2. Adult Trapping
  3. Degree-Day Model
#1: Fruit Maturity

- Cherry fruits are not susceptible to egg-laying by adult females until they ripen to a salmon blush in color.
- Green fruits will not be attacked.
- Consider the maturity of the ripest fruit in the orchard, not the average.
#2: Adult Trapping

- Adult flies are attracted to certain colors and odors
- Yellow sticky panel (Pherocon AM®) + ammonium carbonate bait
- Place traps before first fly is expected
  - 750-800 DD
  - by mid-May
  - on southern side of trees, > 6 ft high, upper 1/3 of canopy, remove obstructions
  - minimum of 2 traps per orchard, preferably 1-2 traps per acre, place on borders & interiors & “hotspots”
  - replace when covered with debris/insects, refill AC bait boxes
  - keep a trap catch record
  - inspect banding pattern to determine fruit fly species
- Spray within 5-7 days after first fly is caught
#3: Degree-Day Model

Major events in western cherry fruit fly management. Timing of events is based on degree-day accumulations* and first activity of adults.

<table>
<thead>
<tr>
<th>Degree-Days (DD)</th>
<th>Management Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>750-800</td>
<td>Place traps in orchards</td>
</tr>
<tr>
<td>900-950</td>
<td>First adult flies expected on traps; treat 5-7 days or 190 DD after first fly is caught if cherries have developed blush color</td>
</tr>
<tr>
<td>1060</td>
<td>3% of flies emerged, 1% of flies sexually mature</td>
</tr>
</tbody>
</table>

*Based on 41°F lower threshold and no upper threshold for development. Begin accumulating DD Jan. 1.
#3: Degree-Day Method

- Use 1060 DD as a guideline to initiate sprays if you don’t have fly trapping information
  - 3% fly emergence & 1% females with mature ovaries
- Need max/min temperature data & look-up table (see WCFF fact sheet)
- Or go to the USU Extension IPM Web Page for “Pest Advisory” information
  - [http://utahpests.usu.edu/ipm/htm/advisories](http://utahpests.usu.edu/ipm/htm/advisories)
Commercial Orchard Insecticides

- Organophosphates
  - Guthion – 14 d
  - Imidan – 14 d
    - do not use on sweets
  - Lorsban – 14 d
    - do not use on sweets
  - Diazinon – 10-14 d

- Synthetic pyrethroids 7-14 d
  - Ambush, Pounce
  - Asana
  - Baythroid
  - Warrior

- Neonicotinoids
  - Provado – 14 d
  - Spinosad – 7 d
  - GF-120 (bait spray)
  - Success
  - Entrust – organic

- Sevin – 5-7 d
- Malathion – 3-5 d

-Reapply based on protection interval of insecticides
-Rotate type of insecticides between applications to reduce likelihood of resistance & negative effects on beneficials
Attract-and-Kill

- **GF-120**
  - mixture of bait + ultra-low concentration insecticide (0.2% a.i. spinosad)
  - applied with a 4-wheeler, electric-pump sprayer
  - not rainfast
  - must maintain enough droplets to "feed" your fruit fly populations

Photo courtesy of Tim Smith, WSU Ext.
Cultural Controls

- **Ground covers and mulches**
  - dense ground covers/vegetation
  - landscape fabric

- **Sanitation**
  - keep cff populations low
  - destroy dropped fruit
  - remove “unmanaged” trees

- **Biological control**
  - Parasitic wasps, birds (fowl), rodents
Peach Twig Borer

Do You Know?
- Major pest of peach, nectarine, and apricot in Utah.
- Overwintering larvae cause damage by tunneling into young shoots, which can be visible by plucking the shoots.
- Larvae have been known to attack shoots in late May and June.
- Use of pheromone traps and the degree-day model are tools for timing control targeting overwintering generations.
- Insecticides are currently the primary control tactic.

The peach twig borer is one of the most significant pests of peach, nectarine, and apricot in Utah. There are three generations of peach twig borer in northern Utah and four in southern Utah. The larvae of the overwintering generation emerge in late February and March into developing shoots. When populations are high, these larvae can cause substantial damage to young trees. The first flush of flowers is usually detected during mid-March to early April in northern Utah. Most economic damage results during the second flush when larvae of overwintering generations attack the fruit. Insecticides are the most effective control tactic. Peach trees may become disfigured in the late summer, particles to branches that target the young larvae provide the best control of twig borer.

Hosts:
- peach
- nectarine
- apricot
- almond

Life History

Larva—Overwintering Stage
- Where: overwinter as young larvae under the bark of the trunk or branches in clusters called hibernacula.
- When: pupae emerge in the spring (flowers to petal fall) and chew their way into developing buds and terminals, following the shoot for a short distance and then moving to another one.
- Size & color: full-grown larvae are about 0.5 inch long and clump brown in color with dark heads. The area between body segments is lighter in color giving the larvae a striped appearance.
- Nature of damage: larvae emerge from the shoot and search for protected sites on the trunk and branches to pupate.

Pupa
- Where: usually found under bark or cracks in the trunk.
- Color: brown and does not reside in a cocoon.

Adult—Monitoring Stage
- Where: adults of the overwintering generation emerge during late May in northern Utah.
- Size: about 0.5-1.2 inch long.
- Color: small gray moths with white and dark speckled wings.
- The female lays about 80-90 eggs.

Egg
- Where: eggs are deposited on shoots, the underside of leaves, and developing fruit beginning about the time of flower fall.
- Color: yellowish white to orange and oval-shaped.

Host Injury
- Shoots: Larval feeding in terminal shoots causes leaves to wilt and drop, reduces growth, and may introduce microorganisms that cause rots.

Larva—Damaging Stage
- Where: feed in the terminal shoots early in the season, but the summer generations attack the fruit about the first part of July to harden.
- Larvae generally enter fruit at the stem end, where two fruit seeds or where leaves touch the fruit.
- These larvae complete development in the fruit, then emerge, pupate, and become the second generation of adults.

Timing Control
- Arrow indicates direction of prevailing wind:
  - Insert one trap into the upper third of the tree canopy; make sure the trap entrance is not blocked and that it is parallel to the prevailing wind direction.
  - Dark line indicates moth flight path to the trap.
- Figure 1: Proper placement of pheromone trap.
Key Points of Interest in Peach Twig Borer Life History

- Larvae spend the winter as young larvae in silken cases on limbs
- In the spring, larvae burrow into tender shoots/twigs
- Delayed dormant and bloom-time sprays can provide control
Key Points of Interest in Peach Twig Borer Life History

- Summer generation larvae attack fruit once terminal shoot growth slows down
- 3 summer generations in recent years
- Use pheromone traps to determine "biofix" (beginning of moth flight)
Early Season Control of PTB

- **Delayed Dormant**
  - Horticultural Oil
  - Synthetic Pyrethroids
    - Asana, Ambush/Pounce, Warrior
  - Lorsban, Diazinon, Thionex, Supracide
  - Success, Intrepid

- **Pink to Petal Fall**
  - Microbials
    - Bt (Dipel, Crymax)
    - Success
  - Insect growth reg.
    - Dimilin
    - Intrepid
  - Syn. Pyrethroids
    - Imidan, Thionex

- Prevent twig/shoot tunneling injury
- Lower the PTB population
- Many low toxicity options
- Minimize effect on beneficials
Timing Control of Summer PTB

- Delta or wing trap
- PTB pheromone lure
- Place traps by 300 DD after March 1, first moths expected by 400-450 DD, determine “biofix”
# PTB Degree-Day Model

Major events in peach twig borer management. Timing of events is based on degree-day accumulations* and first activity of adults.

<table>
<thead>
<tr>
<th>Degree-Days (DD)</th>
<th>Management Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>Place traps in orchards</td>
</tr>
<tr>
<td>400-450</td>
<td>First moths expected, check traps every 1-2 days until biofix is determined</td>
</tr>
<tr>
<td>Reset DD to 0 at biofix</td>
<td></td>
</tr>
<tr>
<td>220 DD after biofix</td>
<td>1% egg hatch</td>
</tr>
<tr>
<td>300 DD after biofix</td>
<td>5% egg hatch</td>
</tr>
</tbody>
</table>

*Based on 50°F lower threshold and 88°F upper threshold for development. Begin accumulating DD Mar. 1.
Commercial Orchard Insecticides

- **Organophosphates**
  - Imidan
  - Diazinon
  - Malathion

- **Organochlorines**
  - Thionex

- **Carbamates**
  - Sevin

- **Synthetic Pyrethroids**
  - Asana, Proaxis, Warrior, Pounce, Ambush

- **Microbials**
  - Success, Bt

- **IGRs**
  - Intrepid

*Mating disruption:*
- not as effective as for codling moth, but can use to eliminate some sprays
Codling Moth

Codling Moth (Cydia pomonella)

Do You Know?
- Codling moth is the major pest of apple and pear in Utah.
- Damaging stage: larvae tunnel into fruit.
- Monitoring stage: adult moth.
- Use of pheromone traps and the degree-day model (based on daily temperature) are critical for determining optimal treatment timings.
- Insecticides and pheromone-based mating disruption are currently the main management tactics.
- Insecticides are targeted at newly hatched larvae and/or eggs.
- Leaf rolling devices need to be applied immediately after bloom (first moth activity) to prevent or adequately delay moth mating.
- Biological control is minimally effective because larvae are protected inside fruit.
- Insect development and spray timing information are available on the USU Extension Integrated Pest Management (IPM) Pest Advisor Web page (http://pests.usu.edu/ipm/htm/ad/overwinter.html) or from your county USU Extension office.

Fig. 1. Codling moth adult.

Fig. 2. Codling moth larva.

**In southern Utah, most or all of a third generation will occur. First generation moths begin to emerge about bloom time and peak in June in northern Utah. Second generation moths begin emerging in late June to early July and peak in late July to early August. Third generation moths remain active from mid-August to mid-September before declining length day induces the end of activity for the year.**

**HOSTS**
- apple, apricot, cherry, crabapple, English walnut, hawthorn, quince, pear

**Monitoring with Pheromone Traps**
- Trap placement: Delta or wing style pheromone traps can be used to monitor adult activity (Fig. 5).
- Chart indicates direction of prevailing wind and drift line indicates moth flight path up the pheromone plume to the trap.
- Hang traps within the upper third of the tree canopy, parallel to the prevailing wind direction, and with an unobstructed view.

**TIMING CONTROL**

**Trap Placement**
- Sex pheromone (codemone) lures are used in traps to attract moths. There is a choice of lures available, in a rubber septum or membrane.

<table>
<thead>
<tr>
<th>Lure Type</th>
<th>Sex Attracted</th>
<th>Orchard Type</th>
<th>Lure Longevity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(codemone)</td>
<td>Males</td>
<td>Non-mating</td>
<td>30-40</td>
</tr>
<tr>
<td>(codemone)</td>
<td>Males</td>
<td>Disrupted</td>
<td>30-40</td>
</tr>
<tr>
<td>CM-CA combo</td>
<td>Both</td>
<td>Both orchards</td>
<td>30-40</td>
</tr>
</tbody>
</table>

- Place traps in orchards by first bloom or based on degree-day (temperature) accumulation (Table 1).
- Place traps within the upper third of the tree canopy, preferably 6-7 ft. high, and where the trap entrance is not blocked and that it is parallel to the prevailing wind direction (Fig. 6).
- A minimum of two traps should be placed in each orchard. For orchards greater than 10 acres, place one trap for every five acres.
- Hang at least one trap on the edge and at least one near the center of the orchard to determine if moths are immigrating from outside sources and/or overwintering within the orchard. Suspected “hot spots” within the orchard should be monitored separately.
- Check traps every 1-2 days until the first moth is caught.

**Biotia**
- Biotia is a biological marking point from which the rest of an insect’s development is measured. It is the beginning of consistent moth flight, or where at least two moths are trapped on consecutive nights.
- It is imperative to determine the date on which biotia occurs to accurately initiate the codling moth model.

**Trap Servicing**
- Trap catches data can be used to monitor moth emergence to start degree-day accumulations, to assist with determining optimal spray timings, to determine the relative size of the moth population, and to help in evaluating the success of your management program.
- Check traps weekly and record the number of moths caught (see Codling moth sampling form, ENH-130P-65). After recording, remove moths from trap.
- Change pheromone caps based on manufacturer’s recommended product longevity and change sticky trap papers after catching 20-30 moths or other debris has collected on the surface.
- Zero trap catch does not necessarily mean there are no moths in the orchard. Events temperatures below 40°F are not conducive to moth flight, and a lack of wind in the evening means the trap cannot create a pheromone plume, which lures moths inside (Fig. 6). Also, old or ineffective lures can cause zero trap catches.
- Do not cross-contaminate lures or traps between insect species. Do not handle or store unused pheromone lures together from more than one species. Do not reuse a trap that contained a pheromone lure from another species.
- Plan to use the same type of trap and lure from year to year so that you can compare results.
Updated the Codling Moth Fact Sheet
http://utahpests.usu.edu/ipm

Includes:
- Monitoring in MD orchards
- Lure types
- Timing insecticides that target multiple life stages
- Revised DD and “management events” table
- Insecticide options
- Mating disruption
Major events in a codling moth management program, based on accumulated degree-days (DD)

Recommended timing for insecticides based on their mode of action
2006 was a tough year for codling moth injury

- High populations
- Even with MD, supplemental insecticide sprays were needed
- Resistance & cross-resistance to insecticides
- Hot weather, 3 generations
- Insecticide timing issues
- Full monitoring program!
- No room for error
Key Points of Interest in Codling Moth Life History

- Spend the winter as full-grown larvae in silken cocoons under bark
- In the spring, they pupate and emerge as adult moths – delayed dormant spray is not effective
- Use of pheromone traps & the degree-day model are critical for determining optimal treatment timings
Key Points of Interest in Codling Moth Life History

- Eggs are laid on leaves and fruit
- Within 24 hr of hatching, larva can enter fruit
- Insecticides target eggs & young larvae
- Mating disruption can help lower populations
# CM Degree-Day Model

Major events in codling moth management. Timing of events is based on degree-day accumulations* and first activity of adults.

<table>
<thead>
<tr>
<th>Degree-Days (DD)</th>
<th>Management Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Place traps in orchards</td>
</tr>
<tr>
<td>150-200</td>
<td>First moths expected, check traps every 1-2 days until biofix is determined</td>
</tr>
<tr>
<td>Reset DD to 0 at biofix</td>
<td></td>
</tr>
<tr>
<td>50-75 DD after biofix</td>
<td>Pre-egg-laying</td>
</tr>
<tr>
<td>100-200 DD after biofix</td>
<td>Early egg-laying</td>
</tr>
<tr>
<td>Horticultural oil (1%), Esteem, Intrepid</td>
<td></td>
</tr>
<tr>
<td>220-250 DD after biofix</td>
<td>First egg hatch</td>
</tr>
<tr>
<td>Assail, Calypso, Asana, Warrior, Guthion, Imidan, CM Virus</td>
<td></td>
</tr>
<tr>
<td>340-640 DD after biofix</td>
<td>Peak egg hatch (12-80%)</td>
</tr>
<tr>
<td></td>
<td>Critical fruit protection period</td>
</tr>
</tbody>
</table>

*Based on 50°F lower threshold and 88°F upper threshold for development. Begin accumulating DD Mar. 1.
Mating Disruption

- Appropriate for orchards > 10 acres or in contiguous blocks
- Lower codling moth population to allow fewer and lower toxicity insecticides
- Does not eliminate insecticides in most cases
- Continuous adult monitoring is critical

New trap lure for monitoring in MD orchards
Cultural & Mechanical Controls

- Fruit thinning
  - Eliminate clusters/touching fruit

- Sanitation
  - Destroy June-drop fruit
  - Eliminate pupation sites (bins, debris)
  - Destroy cull piles
  - Eliminate outside sources

- Trunk banding
  - Corrugated cardboard bands
    - May to late June (1st gen.)
    - August to late October (2nd - 3rd gen.)
New CM Products

- Insecticides (broad spectrum)
  - Battalion (deltamethrin) - 5th gen. synthetic pyrethroid, less mite flare, Arysta LifeScience Corp.
  - Altocor (rynaxypyr) - new class, “anthranilic diamide”, interferes with calcium gates in muscles, affects movement, DuPont Crop Protection
  - Delegate (spinetoram) - new spinosyn insecticide, Dow AgroSciences
  - Belt and Synapse (flubendiamide) - new class, “phthalic acid diamides”, disruption of cellular calcium balance, Bayer CropScience
New CM Products

- Pheromone MD products
  - CideTrak DA-Combo dispenser - pear ester + pheromone in dispenser, Trece
  - CideTrak DA MEC - micro-encapsulated, sprayable pear ester MD product, Trece
  - SPLAT - flowable pheromone dispenser, MD and attract-&-kill if insecticide added, ISCA Technologies
  - Pheromone flakes & fibers - applied in sticky glue, not commercially available
Finding Information on our Web Sites
http://utahpests.usu.edu
USU IPM Web Site

http://utahpests.usu.edu/ipm
IPM Pest Advisories

Tree Fruit IPM Advisory: July 5th, 2006

Past IPM advisories are archived at:
http://extension.usu.edu/cooperative/imp/index.cfm?tid=610/

New Alert! New Alert!

Please send any biofix date information for greater pear tree borer (GPTB). No adults have been caught yet at the USU Kayyville Research Farm.

Insect Advisory

Due to the Fourth of July holiday this week, degree-days (DDs) will be updated on Wed and Fri. This week’s advisory is brief. View the updated DDs and predictions for beginning of egg hatch of the 2nd generation of codling moth and peach twig borer at:
http://extension.usu.edu/cooperative/imp/index.cfm?tid=644 (Select 2nd Generation CM and PTB in the right-side column).

CODLING MOTH (Apple and Pear): Larval emergence for the 1st generation is now completed in warmer northern Utah sites. Those sites where 1st generation is not yet completed will end within the next week (West Mountains- Jul 4, Alpines- Jul 8, Logan- Jul 11, North Logan- Jul 14). Keep fruit protected through the end of the generation. Larval emergence for the 2nd generation is underway (1100 DDs correlates to 1st egg hatch) or will be later this week in warmer northern Utah locations (Salt Lake City- Jul 2, Payette- Jul 4, Gemode- Jul 7, Payette- Jul 8, Provo- Jul 8, Sanpete- Jul 8, Kayyville- Jul 8). Ensure that fruit is protected with mating disruption and or insecticides as 2nd generation eggs begin to hatch.

PEACH TWIG BORER (Peach, Nectarine, and Apricot): Emergence of 1st generation larvae is completed in all northern Utah sites with monitoring information. Egg hatch of the 2nd generation is predicted to reach 5%, the point we recommend applying a cover spray, from July 12-21 (see http://extension.usu.edu/cooperative/imp/index.cfm?tid=644 for dates for individual monitoring sites; select 2nd generation PTB). No sprays are necessary until then.

Refer to past advisories for a listing of insecticides recommended to control codling moth and peach twig borer in commercial and home orchards.

Codling Moth (CM) Biology and Management

Degree-Day Totals and Spray Dates (current as of midnight, 7/5/06)

The spray dates in each table are based on the developmental biology of codling moth. The “Projected Larval Emergence” is the period of time in which codling moth larvae (conspecifics) are likely to be hatching from eggs and looking for fruit. Sprays that are targeting the conspecifics will be more effective if applied during this period.

The treatment dates are predictions using site-specific weather data, short-term weather forecasts, and 30-year temperature averages. The “Onset” date represents approximately 200 DDs (degree-days) accumulated from the biofix date, which should correspond to 1% egg-hatch (1% of the 1st generation eggs have likely hatched at this point). The “End” date represents approximately 920 DDs from the biofix, which should correspond to 50% egg-hatch. The projected Onset and End dates of the spray period will be updated as current weather data becomes available.

1st Codling Moth Generation:

Unless otherwise noted, all information is based on weather readings through 7/5/06.

<table>
<thead>
<tr>
<th>Boxelder County</th>
<th>Degree-Day Totals</th>
<th>Larval Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>DDs since March 1st</td>
<td>Biofix Date</td>
</tr>
<tr>
<td>Perry</td>
<td>1337</td>
<td>May 1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cache County</th>
<th>Degree-Day Totals</th>
<th>Larval Emergence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>DDs since March 1st</td>
<td>Biofix Date</td>
</tr>
<tr>
<td>Logan (bench)</td>
<td>976</td>
<td>May 1</td>
</tr>
<tr>
<td>North Logan</td>
<td>968</td>
<td>May 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>Davis County</th>
<th>Degree-Day Totals</th>
<th>Larval Emergence</th>
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<td>DDs since March 1st</td>
<td>Biofix Date</td>
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