

Navel Orangeworm Management and Monitoring

Joe Connell, UC Farm Advisor, Butte County

Management

The original four point program for navel Orangeworm (NOW) management included winter sanitation, a dormant spray (for peach twig borer control), an in-season spray, and a timely harvest. Each can be important to help assure the delivery of quality almonds.

Winter sanitation is the most critical component of the management strategy for NOW control. Removal of overwintering mummies down to an average of less than two mummy nuts per tree is essential. Often, birds don't do as well as we would like to believe. Make a mummy count in the orchard this winter and clean the trees if there are too many mummies left. Destroy mummies on the ground by March 15.

Controlling peach twig borer (PTB) is important since NOW often follows PTB into the nuts. If PTB is present, the strategy of using sprays at bloom to control PTB could be substituted for a dormant spray in the NOW program.

An in-season spray at hull split can help keep NOW damage low but it is not as effective as the cultural methods of sanitation and a timely harvest. If winter sanitation is completed effectively and early harvest is practiced, the in-season spray may not be needed if external sources of infestation are more than ¼ mile away.

Commence rapid, early harvest once 100% of the Nonpareil nuts at eye level have just begun to split. Nut removal at that time should be at least 99% when the trees are shaken. Anything that delays harvest will increase worm damage. Unexpected rain that slows down Nonpareil harvest and delays the pollinizer harvest will increase damage to soft-shelled pollinizers. Consider on-farm stockpile fumigation along with early harvest to preserve optimum quality.

Monitoring

Black egg traps baited with almond press cake and 10% almond oil are good monitoring tools. Place egg traps in orchards by the first week in April. Use at least four traps per orchard, and in large orchards use an average of one trap per 10 acres. Hang egg traps at head height on the north side of Nonpareil trees, 1 to 3 feet inside the drip line.

In sprinkle irrigated orchards, hang the traps over the sprinkler head to keep the press cake bait dry. These traps are good and they maintain their attractiveness even after hull split.

Check traps twice a week in April and May until the first eggs are found providing a biofix date. Once a biofix for the first generation is obtained in the spring, the degree-day phenology model can be used to predict the onset of the second to fourth generations. Each time traps are checked, remove the eggs, record the number of eggs, and chart or graph the number of eggs per trap per day.

Insect Life Cycle

There are several approaches to predicting the NOW life cycle. A simple degree-day model using a lower development threshold of 55 F and a horizontal upper development cutoff of 94 F is similar to models used for other insects and works quite well. The horizontal upper cutoff assumes that development continues at a constant rate at temperatures in excess of the upper threshold. This method tends to overestimate development at temperatures over the upper development threshold (i.e. during especially hot summers).

Mean development time for NOW on mummy nuts is 1056 degree-days, and on new crop nuts is only 723 degree-days due to improved diet. Mean egg hatch is at 100 degree-days. We know there are three generations each year that have the potential to affect the crop. The first generation takes 1056 degree-days on mummy nuts but part of the second and all of the third generation only takes 723 degree-days on new crop nuts after hull split begins.

Practical application

Monitoring with egg traps is useful for two reasons. First, they let you know how much NOW pressure is in the orchard and where it's the worst. Second, once you note when spring egg laying begins, degree-day projections will tell you when worm pressure is likely to increase during harvest and if the crop will be subject to attack by a fourth generation. This can help you determine which blocks to harvest first or it may provide clues as to whether or not in-season sprays on the Nonpareil or soft-shelled pollinizers are likely to be beneficial.

Usually, the third generation comes in mid to late August through September and the fourth generation starts in late September to October and over-winters. When the biofix for the first generation is in May, populations follow this pattern of NOW activity. Although the third generation can do significant crop damage, its impact under these conditions can be minimized with the cultural controls discussed earlier.

When the biofix for the first generation egg laying is a month earlier (mid-late April) there is more time for the third generation to damage the nuts. In addition, the fourth generation may begin in mid-September instead of in October. Under these conditions, the full impact of the third generation and

part of the fourth generation may be felt on the soft-shelled varieties. This is why we have more severe worm problems on late harvesting soft-shelled pollenizer varieties in years when harvest is delayed.

Using egg traps to monitor NOW activity will help you develop a better appreciation for the severity of worm pressure from year to year. In addition, it can help you anticipate the potential effects of a delayed harvest.

Insect Life Cycle Models (Phenology models, degree-days):

Although the Internet puts incredible resources at our fingertips, most of us are too busy to spend much time browsing. We usually need specific information and we need it quickly.

Web based degree-day models are now easy to use and can predict insect life cycles once you provide a start date (the biofix) from insect traps on your farm. Degree-day projections from your spring biofix can be made using the UCIPM web site and weather data from a station close to your location.

Here are simple steps to help you navigate.....

- 1) Go to the UCIPM web site using your browser.
http://www.ipm.ucdavis.edu
- 2) Once at the web site, go down the list and click on "degree-days".
- 3) Under "Run Models", highlight "navel orangeworm" and click on the "Run Model" button.
- 4) Make sure the "crop choice", almond, is correct and click on the "Continue" button.
- 5) Specify the source of temperature data: "Weather station from the UCIPM weather database", then,
- 6) "Select from stations in which California county?", highlight "your county's name".
- 7) Fill in the time period –
 - a. Biofix Start: month date year ← Enter your biofix.
 - b. End date: month date year ← Enter the latest date you care about or the end of the growing season. The program will use long-term average temperatures to project degree-days for the remainder of the season.
- 8) Click on "Continue", then, select the weather station (from the list of county stations) that you wish to use. For example, click on "Durham.A (cimis #12, Durham)" or "Nickels Soils Lab.P"
- 9) Select the Output file format you prefer -- Ex. select "Formatted report (for viewing or printing)"
- 10) Click on the "Calculate" button.
- 11) You're done!

- you get an NOW degree-day report on your screen (you can print it by clicking on File, print at the top of the browser page)

- The report also shows which temperatures are current (normally up through the date when you ran the model) and which are long-term averages (indicated by an "A" following the temperature)
- The accumulated degree-days column is used to identify the dates when each generation should end and the next egg laying cycle will begin (For example, after 1056 degree-days the first generation should end and the second generation egg laying should begin. Then, 723 degree days after that, the third generation egg laying should begin).

If you know the daily maximum and minimum temperatures you can also read and accumulate NOW degree-days from published charts.

The graph pictured below does NOT reflect 2009 data. It is simply an example of how the navel orangeworm degree-day model can be useful for anticipating worm pressure at harvest. Monitoring and identifying the spring biofix dates for the major worm pests is an important component of a good pest management program in your orchard.

