

# SEASONAL PEST MANAGEMENT TASK: INSECT MONITORING IN ALMOND AND WALNUT ORCHARDS

By JHALENDRA RIJAL | UCCE Area IPM Advisor, Merced, San Joaquin, and Stanislaus Counties

**UC** | University of California  
**CE** | Agriculture and Natural Resources ■ Cooperative Extension



BMSB first instar nymphs after they hatch from the eggs in almond leaf. They often lay 28 eggs. All photos courtesy of Jhalendra Rijal.

**M**ONITORING FOR INSECTS AND DISEASES is a vital part of any pest management program in nut crop production. Although pest monitoring is a continuing process, March-April is that time of the year when growers and pest control advisers actively begin monitoring for insects by deploying the traps, scouting the orchard for the presence of the different life stages, and the crop damage. Trap-based monitoring are often tied with the degree-day models which help to make pest management decisions.

## Use of Degree-days Models

Insect trapping provides a basis to determine the biofix date (i.e., beginning of the insect activity following the winter) at which the degree-day calculation starts. In a general sense, biofix is the date when the targeted insect is captured consistently in the trap. Since insect development is regulated by the external environmental conditions (mainly temperature), insect flight activities (initiation, peak, cessation of seasonal flight) are dependent on temperature. We use degree-days (calculation of the heat accumulation over time by using lower and upper-temperature thresholds) to predict the insect developmental stage in certain days or weeks for making appropriate spray decisions.

Degree-day models are available for major worm pests of the nut crops such as navel orangeworm (NOW), codling moth, Oriental fruit moth, peach twig borer. UC IPM website has provided a platform for these models. Growers, pest control advisers (PCAs)

and other professionals can access these models via this URL, (<http://ipm.ucanr.edu/WEATHER/ddretrievetext.html>) or simply by googling 'UCIPM run degree-days.' In this webpage, degree days models are available for the number of insects (see the list in the page). You can select the pest (e.g., codling moth); select the crop of your interest (e.g., walnut). On the next page, you have the options to select the County (e.g., Stanislaus), biofix date (e.g., March 29), and end date (i.e., for determining the period that you are interested in running the model) and then hit the 'continue' button. Next, you can select your local weather station (i.e., CIMIS # 260, Modesto or NCDC#6168, Newman) for the weather data. You can also utilize the map link if you are not sure which station is the best representative of your orchard location. Make sure that the temperature available for the time period of your interest. If you have access to weather data from other sources, you have an option to upload that data as well. Once you hit the 'calculate' button, you can see the calculated degree days (daily and accumulated) for all dates from biofix to the end date entered. Contact your local University of California (UC) Advisor if you have further questions on this.

## Insect Trapping and Orchard Scouting

Timely utilization of available monitoring tools is essential for effective navel orangeworm management. Winter sanitation (removal and destroying the last-season mummy nuts from the

orchard) is considered as the foundation of navel orangeworm (NOW) control. Mummy nuts harbor NOW larvae during the winter and also serve as the only food source to support the first-generation larvae when seasonal nuts are not yet suitable for larval survival. Assessing the percent mummy infestation and the number of larvae per mummy nuts can help to estimate the carryover potential of the winter population to the season. In almonds, put navel orangeworm egg traps out by March 15 (South San Joaquin Valley) or by April 1 (North San Joaquin and Sacramento Valleys). Use black egg traps filled with the bait (e.g., almond meal) + 10 percent crude almond oil. Some PCAs use other baits as well such as ground pistachio or almonds, etc. Hang the traps on the north side of the tree, at least five trees in from the edge. Since the egg capture rate is highly variable among traps, a greater number of traps is better, with a minimum of four traps per orchard. Set the biofix based on the egg trap. The biofix is the first of the two dates when egg numbers and number of traps with eggs increase for at least two consecutive sampling periods or when 50 percent or more of the traps have eggs. Check the traps one to two times per week, clean the trap surface after each inspection, and replace the bait as needed.

The use of the ovibait traps (i.e., wing or delta traps baited with ground almond or pistachio to attract females) has become more and more common in the past two to three years. These traps

*Continued on Page 12*

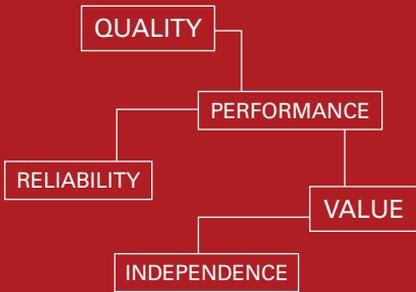


# TRUST

HELM's reputation for quality reflects 117-years of tradition and heritage, built and strengthened through trust.

With a passion for people, products and service, we deliver best in class crop protection, reliable supplier support and strong relationships that will stand the test of time.

**Earning Your Trust is Our Vision for Success.**



Continued from Page 10

are known to capture mated and relatively older female moths. Although these traps capture substantially a smaller number of moths compared to the pheromone traps, ovibait trap information is considered more reliable as their number is more strongly associated with the crop damage at harvest in almonds based on a study in the south San Joaquin Valley. Also, the ovibait traps can be used to track NOW flight of the orchard under mating disruption influence as pheromone traps are not useful to track seasonal flight for those orchards. Due to the potentially short active distance of the bait (kairomone), wing trap performs better compared to the delta trap although the latter is more user-friendly. A new type of lure which has Phenyl Propionate (PPO) as the attractant is currently available with the commercial name 'NOW Female/Male Lure' and is intended for the orchards under mating disruption influence. PPO is a proven attractant to capture NOW

adults in nut crop orchards based on several published peer-reviewed articles.

NOW pheromone trap which attracts male moths can be used to track seasonal NOW activity in the orchard without mating disruption. These traps should be placed in the almond orchard before April 1. In the orchard with NOW mating disruption, use of the pheromone trap especially in borders, low-lying areas is also recommended to assess whether the mating disruption is working. Negligible to no moth capture is the indicator that mating disruption is working properly.

Leaffooted bug (LFB) may not be a big issue in every almond orchard every year, but they can cause a severe economic loss when they occur. The LFB adults overwinter outside of the almond orchard in other hosts (e.g., pomegranate, under the bark of eucalyptus, cypress, or juniper trees, etc.) and protected spots (e.g., woodpiles). They move to the orchard during March-April and attack young nuts. Early infestation on nuts before the shell hardening causes aborted nuts,

internal gumming and staining nut shells. Feeding on the young nuts may lead to significant nut drops. Unfortunately, we don't have a specific trap/lure to monitor LFB activity in the orchard. Thus, regular scouting in the orchard to look for eggs, live bugs and dropped nuts, are the ways to detect the presence of leaffooted bugs in the orchard. Almond varieties such as Fritz, Sonora, Aldrich, Livingston, Monterey, and Peerless are more susceptible to LFB damage. Native stink bug (Green, Redshoulder, and Uhler stink bug species) attacks can produce similar signs of feeding on developing almonds, including nut drops, but this will happen usually later in the season (June), compared to March-April as in the case of LFB. Don't get confused by the signs of the true bug (i.e., stink bug, and LFB) feeding damage (clear discharge from the nut, with the bacterial spot infection (amber color discharge). Sometimes, other physiological causes gummosis with a clear discharge, but when you cut the nut, you should be able to see the sign of feeding

**PERSONNEL & LAND MANAGEMENT**

*Always*  
**WORKING**  
**FOR YOU!**

*Cream of the Crop*  
AG SERVICE

**PROVIDING DEPENDABLE LABOR – SECURING HR & SAFETY COMPLIANCE SINCE '95**

WEBSITE **COTCAG.COM** BAKERS-FIELD (661) 588-8675 VISALIA (559) 625-5152

## PERCENT DAMAGE BY ANTS TO ALMONDS ON THE GROUND IN AN ALMOND ORCHARD

**Photo 1.** BMSB adult feeding damage to developing almonds.

No. of colony entrances per 5,000 sq. ft. in spring	Days nuts are on the ground				
	4	7	10	14	21
15	0.9%	1.6%	2.1%	3.1%	4.9%
45	1.4%	2.3%	3.2%	4.7%	7.0%
185	2.0%	3.6%	5.0%	7.0%	11.1%



“Leaffooted bug (LFB) may not be a big issue in every almond orchard every year, but they can cause a severe economic loss when they occur.”

mouthpart in the case of bug damage.

Brown marmorated stink bug (BMSB) is a new invasive stink bug species that has begun to cause damage to almonds in the northern San Joaquin Valley. BMSB feeding can begin as early as mid-March when they begin to migrate into the orchard from overwintering shelters and may be present in the orchard throughout the season. BMSB are capable of doing damage to the almond kernel throughout the season after that initial migration in the spring.

However, early season feeding (from the fruit set to before shell hardening) seems to be serious as adult feeding at this time can cause substantial nut abortion and drop. The major feeding signs on developing nuts include gumming nuts with multiple feeding spots, yellowish nuts, the presence of the feeding sign (i.e., pinholes), and presence of the cork spots internally on the hull. Some of the symptoms of BMSB damage resemble leaffooted and other stink bugs, but the severity and timing of damage seem to be different. BMSB damage occurs as early as mid-March and seems to continue for a few weeks to months. In the northern San Joaquin Valley in the 2018 season, we observed a substantial almond fruit drop in a few orchards infested by BMSB during April, with damaged kernels from later feeding. We also observed multiple feeding sites (up to 13 pinholes) within the fruit and multiple numbers of injured fruits in a cluster within the branch, and these patterns are less common in the leaffooted bug infested nuts. We also noticed the higher level of BMSB activity and damage in edges next to the other host trees such as ‘tree of heaven’ and potential overwintering shelters (e.g., houses, barns, wood piles). BMSB is a landscape-based pest and tends to switch hosts among different host crops within the season.

For monitoring, commercial traps and lures that attract both nymphs and adults of BMSB are available. We recommend using the sticky panel (9 x12-inch double-sided sticky trap) that can be affixed to the top of a 5-foot long wooden stake, 1-foot of which is pounded into the ground (**Photo 1**). The traps should be placed in a border-tree row facing an open field or other potential overwintering sites. In addition, we recommend conducting visual sampling of the orchard for stink bug and damaged nuts is important as trap counts may not always represent the population density. The visual observation should also be focused on

border trees.

For spider mites and their predators in almonds, start monitoring orchards biweekly from March-May, and weekly after that. Early damage is indicated by the lightly stippled leaves (<http://ipm.ucanr.edu/PMG/T/I-AC-TSPP-CD.113.html>) likely seen in the lower and interior portion of the tree canopy. Take a minimum of 75 leaves from 5 random trees and inspect the leaves using a hand lens for the presence of mites and mite predators (No need to count the eggs and mites). Sampling before July 1 should focus on ‘hot spots’ of the orchard (i.e., area near to the dirt roads, weak trees, and edges). Follow the sampling guidelines for details, <http://ipm.ucanr.edu/PMG/C003/m003fcspdmmites02.html>.

*Continued on Page 14*

### Bring the heat on hard-to-kill weeds and insects with





**R-Agent DL™**  
d-LIMONENE ADJUVANT

**100% Active Ingredient!**

Spreader-Activator with Citrus Extract

**R-Agent DL® dramatically boosts performance.**

Use R-Agent DL with and without oil on agricultural, turf, ornamental, and non-cropland sites.

**For more information:**  
email: [tom@chemurgic.net](mailto:tom@chemurgic.net)  
Tom Kelm: 559 696-6558

Distributed by



**Chemurgic Agricultural Chemicals, Inc.**  
P.O. Box 2106 • Turlock, CA 95381

- Adjuvants
- Nutrients
- Organics
- Formulation Services

[www.chemurgic.net](http://www.chemurgic.net)

Continued from Page 13

Ant colony survey begins in June in the upper San Joaquin Valley and April-May in the lower San Joaquin Valley. Select five locations within the orchard (~1000 sq. feet per location). Count a total number of ant colonies from the sampled area and compare it with the Table above to estimate the potential nut damage at harvest. The longer the nuts remain on the ground after the harvest, the more damage you can expect.

For the San Jose scale, put out pheromone traps by March 1. For peach twig borer, the time to put the traps out is

mid-March. Follow this link, <http://ipm.ucanr.edu/PMG/C003/m003bcsanjosescale.html> to learn more about how and when to set up traps and monitor San Jose scale and peach twig borer.

### Walnuts

In walnuts, the activity in codling moth in the upper San Joaquin Valley begins from late-March to early-April. Hang codling moth traps with 1x lures (standard 1-mg pheromone lures) at six to seven feet height on trees in March to determine biofix and start accumulating degree-days. Biofix is the first date when moths are found consistently in traps,



Necrotic spots internally in almonds by BMSB feeding.

and sunset temperatures have reached 62°F. Keep in mind that if your orchard or nearby orchards are under codling moth mating disruption, the 1x trap is not useful for biofix/degree-day calculation due to very few to no moth capture. So, if you have one of these situations, we recommend using both 1x and CM-DA combo trap. The combo trap attracts both male and females, and it is useful to know the seasonal flight patterns. No moth capture in the 1x trap is the indicative of disruption happening. In addition to traps, conducting nut sampling for damage particularly near the end of each generation is important. For the damage evaluation, look for the larvae entry points packed with the larval frass (excrement) in nuts. Based on 1000 nuts sampled, damage exceeding one percent (after 1st generation) or two percent (after 2nd generation) may result in >5 percent damage at harvest. Not only that, codling moth damaged nuts are vulnerable to navel orangeworm infestation which has become a major insect problem in walnuts in recent years. Follow UCIPM guidelines for other details, <http://ipm.ucanr.edu/PMG/r881300211.html>

Like almonds, winter sanitation is an important method of controlling navel orangeworm in walnuts. Before husk-split, early season NOW utilizes nuts that are damaged (by codling moth sunburn, blight, mechanical injury) for egg laying. All sound nuts become vulnerable to NOW damage after the husk-split in walnuts. Use pheromone traps for monitoring NOW adult activity in the orchard. If your orchard has NOW mating disruption, you should be able to see very minimum to no moth



## EXTINGUISH ANTS *IN YOUR ORCHARD*

Stop problem ant infestations from taking a bite out of your profits by using Extinguish® Professional Fire Ant Bait. Its grower friendly label solves the problems that make ant control difficult and inconvenient because it can be used everywhere ants colonize.

### Extinguish® Professional Fire Ant Bait features:

- Controls Southern (California) fire ants, Pavement ants and Red Imported fire ants
- Approved for **ALL CROPS**
- A usage rate of 1 – 1.5 lbs per acre
- Available in economical 25 lb bags

\*See label for ants controlled by Extinguish® Professional Fire Ant Bait.



To learn more about Extinguish® Professional Fire Ant Bait and to find a list of regional sales representatives near you, visit [CentralAntControl.com](http://CentralAntControl.com) or call 800.347.8272.

Always read and follow label directions. Extinguish is a registered trademark of Wellmark International. ©2017 Wellmark International.

Continued on Page 16

**NON-GMO**

# BIOSTIMULANT FERTILIZERS, PEST CONTROL & BIO FUNGICIDE

**INCREASE FLOWERING  
& FRUIT PRODUCTION  
WHEN USING PURE  
PROTEIN DRY**

99% OF NITROGEN DERIVED  
FROM FISH PROTEIN  
HYDROLYSATE, INCREASES  
WEIGHT OF  
FRUITS & VEGETABLES

**PURE PROTEIN DRY  
15-1-1  
PRIMO AMINOS**

18 TYPES OF AMINO ACIDS  
CONTAINS 80% + AMINO ACIDS  
100% WATER SOLUBLE

7.5-1-25  
5-7-14  
11-8-8

**ORGANIC TREE NUT  
NUTRITION FOR ALL  
STAGES OF GROWTH**

## ALMOND FERTILIZER PROGRAM

Apply as a Foliar Spray or Through Irrigation



AT PETAL FALL – APPLY ONE POUND PER ACRE OF  
PPD – PURE PROTEIN DRY 15-1-1



WHEN DIME SIZE – SPRAY 2 POUNDS /ACRE PPD



SPRAY 3 WEEKS LATER – 2 LBS/ACRE CAN ADD EX-ICUTE  
FOR MITE CONTROL WITH THE PPD - IN ONE SPRAY



3 WEEKS BEFORE HARVEST 1 TO 2 LBS/ACRE PPD,  
CAN APPLY EX-ICUTE WITH PPD IF MITES PERSIST



AFTER HARVEST SPRAY 1LB/ACRE PPD FOR HELPING  
THE DEVELOPMENT OF NEXT YEARS FLOWER BUDS

## EX-ICUTE™ & RID-BUGS

25(b) OILS MINIMUM RISK  
ORGANIC INSECTICIDES

AND BIO-FUNGICIDE



APHIDS



LEAF FOOTED BUG



POWDERY MILDEW



RUST ON LEAVES



LYGUS BUG



NAVEL ORANGE WORM



BOTRYTIS



HULL ROT



MITES



SCALES



ALTERNARIA



ANTHRACNOSE



THRIPS



WHITE FLIES

**Weed-a-Way**  
CONTACT AND  
PRE EMERGENT  
HERBICIDE



SALES CONTACT INFO:

ED ZYBURA  
(805) 550-7776  
edzybura@charter.net

JOE HASLETT  
(805) 748-4033  
joehaslett.oap@gmail.com



WSDA LISTED



www.OrganicAGProducts.com

Guaranteed by AZ ENTERPRISES INC DBA ORGANIC AG PRODUCTS  
2367 Brant Street • Arroyo Grande, CA 93420



BMSB damage showed up in almonds at harvest.

*Continued from Page 14*

catches in the traps.

The ideal time for the walnut scale monitoring and treatment is during the delayed-dormant period. However, if you miss that opportunity, put out double-sided sticky traps in May to determine the crawlers' emergence and treat the crawlers with insect growth regulators (Centaur or Seize).

For spider mites and their predators in walnut, map out the area for sampling. In June-August, sample leaves from 10 trees (10 leaflets/tree from both high and low branches), look for the presence of the spider mites, predator mites, and sixspotted thrips. Based on the UCIPM Guidelines, the treatment thresholds can be different for the

orchards based on the pest management program (with/without broad-spectrum insecticide). In the orchard with no pyrethroid/organophosphate use, no treatment is necessary when >50 percent of the leaves have predator presence but treat at 20-50 percent mite infestation level if <50 percent leaves have predators. In the orchard with pyrethroid/organophosphate use, <10 percent leaves with predators, spray at 10 percent mite infestation but spray

at 20 percent infestation level if >10 percent leaves have predator presence.

### Use of Mating Disruption

April is the time to apply mating disruption products for navel orangeworm, codling moth, peach twig borer and Oriental fruit moth in the field. Several mating disruption products under three formulations (sprayable, hand-applied, and aerosol dispensers) are available for codling moth, and two types (hand-applied MESO and aerosol dispensers) are for navel orangeworm. It is recommended to use these dispensers before the beginning of the expected first flights to cover the entire season.

For navel orangeworm, 5 commercial mating disruption products from 4 companies are available (Suterra-Puffer NOW, Semios-NOW Extra, Semios-NOW Eco (organic), Pacific Biocontrol-Isomate NOW Mist, and Trece-Cidetrak Meso (organic/conventional). Application considerations for navel orangeworm mating disruption



# The Future of Mating Disruption is NOW

Remote-controlled camera traps and dispensers

Unique variable rate pheromone application

Installation, monitoring, and maintenance included

A full-service solution of sensors and controls to monitor and manage pests, weather, disease risk, and soil moisture.

Call us at  
**1.855.924.3282**

or email us at:  
**info@semios.com**

semios.com





Sticky panel trap with lure for BMSB monitoring.

products in the orchard:

- **Timing:** Apply before the moth emergence time in the spring (before April 1 if possible). Follow the product label.
- Distribute the dispenser units in a grid pattern, plus few more in upwind edges to compensate for the influence from the wind.
- Consider orchard size, wind direction, edge-effects, etc. while applying these products. Every orchard is different.
- Select the limb closer to the center of the tree at upper 1/3 of the tree height to hang the dispensers and apply in a way to avoid direct insecticide sprays on them.
- Make sure nozzle is pointing away from foliage and limbs (3-foot clearance if possible)
- Make sure the dispenser units are working before applying to the field.

Growers can discuss the strategy of using mating disruption with their PCAs, product representatives, and Area IPM Advisors so that the benefit can be maximized with efficient pest management planning. Use of the mating disruption may need to combine with other control tactics including insecticide. Despite the effectiveness of the mating disruption in reducing the navel orangeworm damage, the mating disruption should not be taken as a replacement for the winter sanitation and early harvest practices.

Comments about this article? We want to hear from you. Feel free to email us at [article@jcsmarketinginc.com](mailto:article@jcsmarketinginc.com)

# Independence<sup>®</sup> self-fertile almond

Patent #20295



**ONE shake  
ONE harvest  
NO BEES.**

**Independence<sup>®</sup> blooms with Nonpareil & is harvested 2 to 3 days before Nonpareil.**



**Discuss the advantages of Independence<sup>®</sup> self-fertile almond with your sales rep today!**



**209-874-1821**

**800-654-5854**

**[www.davewilson.com](http://www.davewilson.com)**