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Research Advances on the Application of Pheromone Mating Disruption for Management of Navel Orangeworm on Walnut

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Navel orangeworm (NOW), *Amyelois transitella*, is well known as a primary pest of almond and pistachio in California; however, it also attacks walnuts, particularly in the southern San Joaquin Valley. Other hosts include fig and pomegranate. Early in the growing season (April-mid-May), the first generation of adults may lay eggs on blight-infected walnuts or on nuts infested with codling moth (CM). In late summer, emerging females prefer to lay eggs on the open husk or on the exposed nutshell. Growers are familiar with monitoring for and managing CM in walnut; therefore, NOW incidence in walnut may be underestimated and grouped with CM damage under the general classification of "worm damage." Because CM damage predisposes walnut to NOW infestation, effective management of CM additionally protects the crop from NOW. Strategies for NOW management vary by crop. For example, sanitation is the primary strategy for management of NOW in almond, but is less effective for mitigating NOW damage in pistachio. Pheromone mating disruption (PMD) has been successfully utilized for management of NOW in almond and pistachio, and may similarly have application in walnut. It is estimated that over 15,000 acres of nuts in California are treated with PMD for NOW.

Figure 1. Frass and webbing are diagnostic signs of NOW infestation in walnut. Photo: Elizabeth Fichtner

Differentiating between CM and NOW damage in walnut

One can easily differentiate between NOW and CM damage on walnut when larvae are present in the nut. NOW infestation is associated with extensive webbing and frass (Figure 1). Additionally, NOW larvae have a crescent-shaped marking on each side of the body, behind the head (Figure 2).

Figure 2. The crescent-shaped mark behind the head is a diagnostic feature of NOW. Photo: Jack Kelly Clark

Management of NOW in walnut

Orchard sanitation is the first consideration for management of NOW. Similar to almonds, removal of mummy nuts from the orchard will reduce overwintering sites. Overwintering populations can generally be reduced by flailing or burning all crop debris containing nuts before mid-March. During the 2012 growing season, however, NOW emergence was documented prior to March 15 and populations of NOW were present in some orchards despite rigorous sanitation efforts. Additionally, practices utilized to manage CM infestation, walnut blight, and sunburn indirectly protect nuts from NOW because NOW only attacks walnuts with damaged or split husks. Prompt harvest of walnuts also reduces NOW infestation because it may prevent the cycle of a 4th generation of the insect in orchards.

New studies are currently being conducted to investigate the use of PMD for management of NOW in walnut orchards. Use of PMD is not a new concept for some walnut growers who are already using the technology to control CM, with the result of reducing or even eliminating the need for CM insecticide treatments in early, more susceptible varieties. PMD is already implemented for management of NOW in over 15,000 acres of almond and pistachio in California.

What are the benefits of Pheromone Mating Disruption (PMD)?
Broad-spectrum insecticides have historically been the primary method of control for CM and NOW in walnut. More recently, commitment to environmental stewardship and reductions in pesticide use have become primary goals worldwide. Water and air quality issues have caused the Department of Pesticide Regulation (DPR) to re-evaluate pyrethroids and chlorpyrifos as well as pesticides that contain volatile organic compounds, possibly leading to use restrictions and cancellations. In addition, many insecticides harm beneficial insects in the orchard, which can lead to outbreaks of secondary pests, requiring additional insecticide and miticide applications. The need has become crucial for reliable, environmentally and economically sustainable pest management technologies such as PMD. The most widely used system for dispensing pheromone into a walnut orchard is the aerosol pheromone puffer.

What is PMD?
Mating disruption is a relatively new method of control which uses insect specific pheromones released throughout an orchard to confuse and prevent males from finding females to mate with. One of the methods of PMD that has been developed is a timed-release aerosol pheromone dispenser (TRAPD). TRAPDs house a pressurized canister (Figure 3) containing insect-specific pheromones that release a puff of the pheromone at timed intervals. These TRAPDs are hung on branches within the orchard and are fully automated. It is important to remember that pheromones are insect-specific; thus, TRAPDs used for CM control will not disrupt the mating of NOW.

Figure 3. Puffers®, a TRAPD marketed by Suterra®, were utilized in the current study. Photo: Elizabeth Fichtner

Because TRAPDs are fully automated, they require little human maintenance after the initial installation. Some growers have reported leaving TRAPDs in orchards over winter, only physically handling them in spring to insert a new pheromone canister.

Recent advances on use of PMD for NOW in walnut. A current research study led by Dr. C. Burks, USDA in cooperation with Dr. E. Fichtner, UCCE Tulare County, is designed to compare the phenology and damage between NOW and CM in walnut and to examine the impact of PMD on reproduction and damage by NOW on walnut. Grower cooperators in Tulare and Kings Counties have worked with our research team to allow for weekly insect monitoring using egg traps and female-baited pheromone traps at 10 sites. Additionally, Puffers®* were installed in 4 commercial walnut orchards in Tulare County to experimentally test the efficacy of PMD for NOW management (Figure 4).

Figure 4. Puffer® suspended in Tulare Co. walnut orchard. Photo: E. Fichtner

Preliminary results from the 2012 field season indicate that overwintering populations of NOW are present at most sites. The number of males captured in mating disruption plots comprised 79% of those captured in non-mating disruption sites before treatment started, but 0.1% of those in non-mating disruption sites after treatment began. The findings to date indicate walnuts

can support high abundance of NOW independent of other crops, and NOW has potential for damage independent of CM in some walnut orchards, depending on management. The impact of PMD on rate of NOW infestation on walnut will be determined at harvest, and the results will be summarized in future newsletters as well as in the Walnut Research Reports which are searchable online through the Fruit and Nuts Research and Information Center: http://fruitsandnuts.ucdavis.edu/. For more information on pest management in orchards, please visit the UC IPM Website: http://www.ipm.ucdavis.edu/index.html. Always read the label of the product being used, and note that all registered pesticides are not necessarily listed on the UC IPM Online website or in this newsletter. Always check with the certifier to determine which products are organically acceptable. Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the University of California.

*Puffer® is a registered trademark of Suterra®.

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