WALNUT PEST MANAGEMENT ALLIANCE 2003 – YEAR 5 UPDATE

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ABSTRACT

The walnut PMA work plan continues with the broad based implementation project designed to encourage adoption of reduced-risk pest management programs in walnuts statewide. The focus of this project is to continue current efforts to demonstrate economical reduced-risk management strategies on walnuts and to improve communication and cooperation among the different groups involved. The PMA project has evolved into a broader program than originally envisioned with individual researchers working closely with the PMA in the area of codling moth and blight. This research feeds directly into the PMA project, allowing the PMA project to better focus on testing and demonstration that are near term. Several factors have increased the prospects for development of reduced risk practices for codling moth, which is the primary target for broad spectrum insecticides in walnuts. These factors include the documentation of resistance to the most commonly used insecticides and the development of newer pheromone application technologies such as sprayable pheromone and puffers. This coupled with the development of new, more selective insecticides that can help provide control without disruption of naturally occurring biological control.

The codling moth PMA project in 2003 again demonstrated pheromone mating disruption at the five sites with the using two different rates of Suterra CM-F in the sprayable formulation. Since sprayable pheromone is more practical for walnut growers to apply, there is a higher probability that growers will incorporate it into their existing codling moth control programs. In addition, the project expanded to include 18 grower implementation sites throughout the walnut growing region. The implementation sites were managed by the grower and PCA using protocols written by the walnut PMA. The PMA sites used the newest technology in a lure for monitoring with traps that contains a kairomone instead of a pheromone, and catches both males and females. The PMA has continued to test Xanthocast, the walnut blight model, as well as helping growers learn to use the model. A satellite project using reduced risk materials for walnut husk fly management was conducted in as well. The PMA will continue to develop management techniques from research funded by the Walnut Marketing Board, using UC IPM monitoring programs refined by the walnut PMA, and outreach programs that will result in increased adoption of a reduced-risk walnut program to decrease the use of pesticides in walnuts.
OBJECTIVES

The objectives of the fifth year of the Walnut PMA focused on reduced risk techniques with an emphasis on standardizing the treatments statewide. By building from the positive results from the first four years, we will continue to develop economic reduced-risk pest control and to push forward validation of monitoring techniques for walnut pests.

Objective 1: Continue to build upon the Walnut Pest Management Alliance Team for implementation of reduced-risk strategies.

Objective 2: Demonstrate IPM strategies to control codling moth, *Cydia pomonella*, while putting increasing effort into extension and implementation of these newer technologies.

Objective 3: Demonstrate IPM strategies to control blight, *Xanthomonas campestris*.

Objective 4: Reevaluate in-season damage assessment protocols. In collaboration with pest control advisors, determine whether less labor-intensive methods are reliable for predicting damage.

PROCEDURES

Objective 1
The Walnut PMA Management Team is the drive behind the Walnut PMA. The Management Team is responsible for developing strategies to best show the use of reduced risk pest management, as well as standardizing treatments across sites. The Team incorporates the various stakeholders into the program and seeks new ideas constantly. By meeting throughout the year to plan, coordinate, and share new ideas, the Management Team is able to work effectively and efficiently to ensure that the PMA gathers scientifically reliable and easy to interpret results across the state. With input from the end users, the Management Team is able to better design the project to fill the needs of all interested parties.

Objective 2
In 2003, there were five codling moth research sites in San Joaquin, Yuba, Butte and Tehama counties. All orchards were the Vina variety, which is known to be codling moth susceptible. The treatments consisted of Suterra’s CM-F sprayable pheromone at 10 grams a.i./acre, at 5g a.i./acre and the untreated control. All sites received four pheromone sprays with an interval of 30 days or more, and all sites had at least one supplemental application of insecticide. To make the program more economical, the first pheromone spray was applied together with a blight treatment.

Treatment blocks were between ten and twenty acres each. Untreated control blocks were approximately one acre. Each orchard was monitored with traps weekly from biofix to harvest and the trap liners were changed as necessary. The treatment blocks had at least three Trece Delta Traps each with a different lure. Each treatment block contained one trap hung low with the Suterra 1X Biolure, and two hung high in the canopy, one with Suterra’s 10x Biolure, and
one with Trece’s new DA kairomone lure. Suterra donated the Biolures and the CM-F sprayable pheromone. The lures were changed according to the manufacturers’ instructions.

Five trees were selected in the center row of each treatment and monitored for damage assessment throughout the season. The overwintering codling moth generation was monitored by nut drop, recording the total number of codling moth damaged dropped nuts, subsequent generations were monitored by canopy count recording the damage in 50 nuts low and 50 nuts high as well as canopy counts from the ground only, inspecting 30 nuts on each of 20 trees. The in-season damage monitoring is very important in pheromone-disrupted orchards because it allows the grower to apply a supplemental insecticide if the damage readings are high enough. A harvest evaluation was collected from the same five trees, and consisted of a 100-nut harvest sample from each of the trees. Harvest damage data was also collected from the ‘Grower Standard’ treatment in the same orchard which consisted of the grower’s normal farming practices.

The portion of this project focusing on extension and implementation included 6 sites in each of the Northern San Joaquin Valley, the Southern San Joaquin Valley and the Sacramento Valley, for a total of 18 implementation plots. Results to be reported by Dr. Steven Welter.

Objective 3
The PMA and University of California Farm Advisors conducted three trials to further field-test the Xanthocast walnut blight model and to evaluate it for clarity and ease of use by growers and researchers. There were a total of 3 treatments in the blight trial: (1) a Manex and Copper treatment at 2% pistillate bloom, then sprays following the Xanthocast model, (2) the growers’ standard practice, and (3) the untreated control with no sprays of Manex or Copper.

The Xanthocast walnut blight model’s prediction of disease pressure (“blight index”) was made available for no cost on the website [www.Fieldwise.com](http://www.Fieldwise.com). The blight index was checked daily for spray recommendations by researchers. This information was passed to the cooperating growers who treated the corresponding blocks as indicated by the model. Due to a malfunction at the nearby weather station, there was no daily blight index for the Riverbank test plot in San Joaquin County to follow. Therefore, the treatments at that site were: (1) Grower Standard with Early Spray, (2) Grower Standard with Late Spray, and (3) Untreated Control. At each of the research sites, the treatments were surveyed for blight damage to nuts when the rainy season was over.

Research results concerning walnut blight and the use of the Xanthocast model to be reported by Dr. James Adaskaveg.

Objective 4
In previous work, the walnut PMA has monitored in-season damage using the canopy count method at the end of the second and third generation of codling moth. Orchard ladders are carried through the plots to evaluate damage to nuts in the middle to upper canopy and nuts are also inspected from the ground level. This method has been relied upon to protect the cooperating grower from economic damage, although is very labor intensive. Examining nuts high in the canopy provides very detailed data for research, but is unlikely to be done by a pest
control advisor or commercial grower due to lack of skilled labor. In 2002, the walnut PMA found that there was no statistical difference between the percent damage found in a canopy count performed using ladders and a canopy count taken from ground level (which is the traditional method used by PCAs). In-season monitoring of damage is critical in reduced-risk programs, and more likely to be completed in a timely manner if it can be done quickly and easily. User-friendly methods of monitoring in-season damage will lead to a higher level of adoption of pheromone mating disruption in walnuts.

RESULTS

Objective 1: Continue to build upon the Walnut Pest Management Alliance Team for implementation of reduced-risk strategies.

The Walnut Pest Management Alliance Team has been proactive in demonstrating reduced-risk practices that are more economical for growers to use, and keeping the information moving from Farm Advisors, to field scouts, and to growers. The strength of the PMA comes from the standardized treatments across the state for scientific data analysis. Continuing to publicize results from these standardized sites across the state is the method by which reduced risk practices will become more widely used, with implementation and adoption being the long term goals. The Management Team met during the season to compare results and make group decisions such as whether to supplement the pheromone treatments with insecticides or IGRs (insect growth regulators). Field meetings are held in the each of the growing regions to demonstrate technology and products to a wide audience. Commodity groups such as the Walnut Marketing Board further extend information to the whole industry and to the public via newsletters and websites.

Objective 2: Demonstrate IPM strategies to control codling moth, *Cydia pomonella*, while putting increasing effort into extension and implementation of these newer technologies.

Results are calculated by how well each treatment controlled damage. Not all sites included all the different treatments. Table 2.1 shows the percent damage by treatment for each site and each treatment. Chart 2.1 shows the average percent damage at harvest with each site being a replication.

Table 2.1. Percent damage at harvest in each orchard and each treatment in the Walnut PMA 2003.

<table>
<thead>
<tr>
<th>% Damage @ Harvest</th>
<th>CM-F @ 5g/acre</th>
<th>CM-F @ 10g/acre</th>
<th>Untreated Check</th>
<th>Grower Stand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tehama *</td>
<td>2.20</td>
<td>2.40</td>
<td>2.30</td>
<td>-</td>
</tr>
<tr>
<td>Butte</td>
<td>2.40</td>
<td>1.40</td>
<td>1.60</td>
<td>0.40</td>
</tr>
<tr>
<td>Yuba</td>
<td>0.60</td>
<td>2.20</td>
<td>1.00</td>
<td>0.40</td>
</tr>
<tr>
<td>SJ-C</td>
<td>0.00</td>
<td>0.20</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>SJ-P</td>
<td>0.80</td>
<td>0.20</td>
<td>1.20</td>
<td>0.00</td>
</tr>
<tr>
<td>Average</td>
<td><strong>1.20</strong></td>
<td><strong>1.28</strong></td>
<td><strong>1.22</strong></td>
<td><strong>0.20</strong></td>
</tr>
<tr>
<td>Std Dev</td>
<td>1.049</td>
<td>1.055</td>
<td>0.844</td>
<td>0.231</td>
</tr>
</tbody>
</table>

* Tehama Rep 1 (North) data used.
Although the damage was very low across all treatments, there was no significant difference between treatments at the 95% confidence level. The reason for this is that there was much less damage than expected in the untreated control. Chart 2.2 shows that the pheromone treatments resulted in up to 90% trap shutdown. This shows that the pheromone treatment blocks caught far fewer moths than the untreated control, however this difference was not evident in the damage at harvest.
It is possible that the control may be too small to show significant damage. During the season, there was at least one instance when the control was accidentally sprayed with insecticide; incidents such as this will reduce the harvest damage. This may point to a need to change the research design for testing pheromone-mating disruption, such as larger treatment blocks and larger untreated controls.

Objective 3: Demonstrate IPM strategies to control blight, *Xanthomonas campestris*. Walnut blight trial results will be reported by Dr. James Adaskaveg.

Objective 4: Reevaluate in-season damage assessment protocols. In collaboration with pest control advisors, determine whether less labor-intensive methods are reliable for predicting damage.

Nut drop and canopy counts are important tools to aid in determining damage levels after each respective generation and the canopy counts have been the best indicators of damage at harvest. Damage from the first flight, or the ‘overwintered’ generation, was monitored by examining dropped nuts for codling moth damage, Chart 4.1. For damage from the second and third flight of codling moth, researchers continued to monitor damage using very labor intensive methods such as ladders to examine nuts high in the tree canopy, Chart 4.2. In 2003, we did not see a good correlation between either the damage to the dropped nuts, or that found in the canopy to the damage at harvest. This is probably due to some of the damage being only to the husk and not the nut meat. The damage at harvest data cited here includes only damage to the meat.

Chart 4.1. Codling Moth Damage to Dropped Nuts compared to Damage at Harvest in the Walnut PMA 2003.
Chart 4.2. Percent CM Damage found in Canopy Counts 1 & 2 compared to Damage at Harvest in the Walnut PMA 2003.

The pheromone treatments were also surveyed for damage using a ‘ground search’, a method more likely to be correctly used by the industry. To determine the accuracy of surveying for damage without the use of ladders, the following comparisons were studied:

1. total damage found high and low in the 5 trees compared to just that found low in the canopy of the 5 trees, Chart 4.3
2. total damage found high and low in the 5 trees compared to that found using a ground search, examining 30 nuts each of 20 trees, Chart 4.4
Chart 4.3. Percent CM Damage ‘High & Low’ compared to ‘Low’ only during Canopy Counts in July and August in the Walnut PMA 2003.

Chart 4.3 includes only 4 cases out of 20 in which a 'low only' canopy count may have resulted in a false negative damage assessment. With a correlation coefficient of 86.5%, it looks likely that a ‘Low only’ canopy count is as accurate as a ‘High and Low’ count.

Chart 4.4 Percent Damage ‘High & Low’ on 5 Trees compared to a Ground Search of 30 nuts on 20 trees, Walnut PMA 2003.
In Chart 4.4, the two methods are not as closely correlated, but still may have utility in the implementation of reduced risk walnut production.

**DISCUSSION**

The walnut PMA has maintained a strong alliance between the industry, UC researchers, UC farm advisors, BIOS partners, grower cooperators and PCAs. This year, the PMA narrowed its focus to the pheromone mating disruption technology that will fit most easily into growers’ current spray programs. The sprayable formulations are also more economical, therefore more likely to be adopted by walnut growers. Now that the alliance has developed and demonstrated reduced-risk practices, we can reach more growers by increasing the number of field trials. The alliance has been instrumental in serving as a communication body between all groups interested in reducing the reliance of pesticides in walnuts. It has helped direct and attract research funded by the walnut board that is directly relevant to the needs of developing economic reduced-risk practices for growers. The farm advisors and BIOS project managers have been able to participate and keep abreast of the reduced-risk practices which they can quickly extend to their local BIOS and extension programs. The data collected by the PMA and extended to the walnut industry is an information base from which parallel projects are moving into an implementation phase. The added visibility of these additional projects greatly enhances the adoption of pheromone mating confusion by even more growers, thereby reducing insecticide sprays. The Center for Agricultural Partnerships Walnut Expansion project in 2002 had cooperators in the same growing regions and trained PCAs to conduct the demonstration and the monitoring. The Nature Conservancy conducted field trials on more than 1,000 acres of environmentally sensitive land, allowing the grower to control codling moth while still maintaining reduced risk methods. These projects are an important step, including the PCAs who will be the ultimate end user, and ensuring adoption of pheromone confusion with successful demonstrations. At the same time, they will be learning how to monitor the effectiveness of mating disruption so there is little risk to the grower.

The walnut PMAs outreach program includes publishing reports in the Walnut Research Reports, and the Walnut PMA newsletter. When the walnut PMA newsletter is published, it is contained in the California Walnut Commission’s reports, and is sent to all 5500 walnut growers through the walnut handlers. The walnut research report is distributed to growers on request. The results of the Walnut PMA demonstrations are presented at field meetings in the three regions of the project. The PMA has been able to generate interest in using this technology and the information on the emerging technology for pheromone application was well received.

The walnut PMA has been able to reach their goals of incrementally demonstrating a successful mating disruption program and to see emerging application technologies become commercially available that will be much easier for walnut growers to use such as the sprayable formulations. In 2003, the PMA focused on making the use of these sprayable pheromones more economical by reducing the number of applications and testing rates. We have also been able to develop effective monitoring protocols and are continuing work on how to best make use of the kairomone lure, which became commercially available in 2002.