Session 8A: Almond Pests and Integrated Pest Management

Moderator: David Haviland, UC Cooperative Extension

#135: California almond production and sustainability: lessons learned through long-term adoption of integrated pest management

David Haviland, University of California, Cooperative Extension- Kern County, 1031 South Mount Vernon, Bakersfield, California, 93307, United States of America; dhaviland@ucdavis.edu (presenting author)

Over the last 20 years, almond growers in California have adopted major changes in how arthropod pests are managed. In the early 2000s, pest management programs relied heavily on broad-spectrum organophosphate insecticides for worm and scale control that were extremely detrimental to populations of natural enemies. More recently, monitoring programs and improvements to treatment thresholds, coupled with shifts to increasingly selective insecticides, have allowed for integrated pest management programs that are increasingly sustainable and reliant on biological control.

In the case of the San Jose scale, *Diaspidiotus perniciosus*, reductions in the use of organophosphates during dormancy have led to a resurgence of *Aphytis* sp. and *Encarsia* sp. parasitoids that now provide near complete control of this pest statewide without the use of pesticides. In the case of navel orangeworm, *Amyelois transitella*, a shift to selective insecticides, and the adoption of mating disruption, have made it possible for an increase in biological control of a variety of pests, such as peach twig borer, *Anarsia lineatella*, oriental fruit moth, *Grapholita molesta*, and spider mites in the genus *Tetranychus*.

In the case of spider mites, defoliation events associated with mite outbreaks were common occurrences in the early 2000s. Today, they are extremely rare. These shifts have occurred due to the increased prevalence of a predatory species of thrips, *Scolothrips sexmaculatus*, that was previously suppressed by the use of broad-spectrum insecticides. Researchers have now documented six spotted thrips biology, learned how it can be monitored, and developed treatment thresholds that take into account mite and thrips densities. As a result, defoliation events from spider mite outbreaks have become extremely rare occurrences.

Changes in practices by California almond growers serve as a model for how increased adoption of integrated pest management, decreased reliance on broad-spectrum insecticides, and increased reliance on biological control, can lead to long-term improvements in the sustainability of nut crop production.

Keywords: IPM, sustainability, biological control, natural enemies, almonds

#94: New biomarker approach for RKN resistance in Prunus progenies

Maria Jose Rubio Cabetas, Unidad de Hortofruticultura, Avda Montañana 930, 50059 Zaragoza, Spain; mjrubioc@cita-aragon.es (presenting author)

Dr. BEATRIZ BIELSA, MONTAANA 930, 50059 Yes ZARAGOZA, Spain; bbielsa@cita-aragon.es (co-author)

Nematodes huge problem on agriculture. Among them, the root-knot nematodes (RKNs) *Meloidogyne* spp. are considered as the number one threat caused by nematodes on crops. Three RKN resistance genes have been identified in three different *Prunus* species, *Ma* in plum, *RMia* in peach and *RMja* in almond. The identification of intra-gene markers for the two

nematode-resistance genes *Ma* and *RMia* has allowed the application of marker-assisted selection for these two genes. In particular, *RMia* confers resistance to *M. incognita* and *M. arenaria*. Currently, specific markers are available for *RMia* of the peach 'Nemared', that is located in LG2 in the *Prunus* map, being three of them closely linked to the gene. *R* genes, as *RMia*, encode proteins of the Nucleotide type Binding and Leucine-Rich Repeat (NB-LRR). In this work, an *in-silico* characterization of the genomic region where *R* gene is located was performed analyzing different genotypes from resistant and susceptible rootstocks. Then, an InDel was found in resistant genotypes that will be useful to identify a candidate resistance biomarker closer to the *RMia* gene in *Prunus* progenies.

Keywords: biotic stress, deletion, nematodes, RKN, SAM

#32: Influence of winter cover crops on navel orangeworm in California almond orchards

Dr. Kadie Britt, 9240 S. Riverbend Ave., Parlier 93648, United States of America; kadieb@ucr.edu (presenting author)

Dr. Kent Daane, 9240 S. Riverbend Ave., Parlier California 93648, United States of America; kdaane@ucanr.edu (co-author)

Jessica Maccaro, 900 University Ave., Riverside, United States of America; jmacc003@ucr.edu (co-author)

Reva Scheibner, 9240 S. Riverbend Ave., Parlier California 93648, United States of America; reva.scheibner@ucr.edu (co-author)

Sarah Meierotto, 9240 S. Riverbend Ave., Parlier California 93648, United States of America; smeierot@ucr.edu (co-author)

Dr. Amelie Gaudin, University of California, Davis, Davis, United States of America; agaudin@ucdavis.edu (co-author)

Dr. Houston Wilson, 9240 S. Riverbend Ave., Parlier California 93648, United States of America; houston.wilson@ucr.edu (co-author)

While the use of winter cover crops in orchards has typically focused on their ability to restore and improve soil quality, it is known that increased on-farm diversity can influence multiple ecosystem services, including control of arthropod pests. Navel orangeworm (Pyralidae: *Amyelois transitella*) (NOW) is the primary pest of almonds. Larvae feed directly on nuts, which reduces crop yield and quality, and infestation has been associated with aflatoxin, a known human carcinogen heavily regulated in key markets. NOW overwinter as larva or pupa in remnant "mummy" nuts that remain in the orchard after harvest. In the spring, adults emerge from these remnant nuts and make use of them as a reproductive substrate. As such, the removal and destruction of remnant nuts is a key component of NOW control. Here, a 2-year study was carried out to evaluate the influence of two winter cover crop treatments on the survival of overwintering NOW as well as egg deposition by first flight adults in the spring. Results suggest that the plots with winter cover crops were associated with increased mortality of overwintering NOW, possibly due to changes in abiotic conditions and/or increased decomposition of the remnant nuts. Reduced egg deposition was also observed in the cover crop plots, likely due to the cover crop biomass impeding female NOW from locating and accessing remnant nuts. Findings from this