To spray or not to spray? Determining economic thresholds for *Amyelois transitella* using mass trapping

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ABSTRACT

To create a predictive model for 'Nonpareil' almond nut damage caused by navel orangeworm (NOW), *Amyelois transitella* (Walker) (Lepidoptera: Pyralidae), an experiment was conducted in 2011 on ten paired fields implementing mass trapping with a novel bait. Trap data were utilized to indicate best timing for chemical treatments in five fields. Infestation rates (crop damage) at harvest were determined and paired with trap data to construct a model by which growers can predict whether a chemical treatment will be necessary at hull split depending on the amount of damage acceptable. According to this model, which includes mass trapping rate of two traps per acre, damage can be calculated as equal to 0.0049 multiplied by the number of NOW per trap in a field prior to hull split. Additional parameters such as winter sanitation levels, overwintering population levels, rate of traps per acre, and other potential variables for improving this model are discussed.

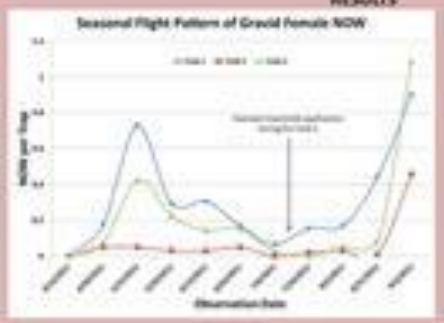
BACKGROUND & INTRODUCTION

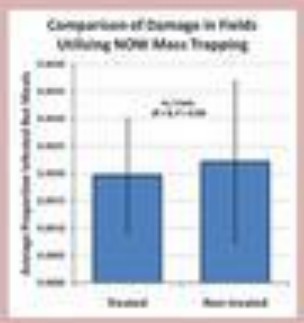
- Navel orangeworm, *Amyelois transitella* (Walker) (Lepidoptera: Pyralidae), is a major pest of almond, *Prunus dulcis* (Rosales: Rosaceae), pistachio, *Pistacia vera* (Sapindales: Anacardiaceae), and walnut, *Juglans regia* (Fagales: Juglandaceae), grown in California's Central Valley (Higbee and Siegel 2009, Burks et al. 2008).
- A novel bait, placed in a sticky bottom wing trap, was developed and utilized for monitoring and mass-trapping of NOW in almonds and pistachios (Nay et al. 2012).
- In almonds, most chemical management of NOW centers around the susceptible hull split stage of the developing fruit. At this stage of plant development, NOW females oviposit on this susceptible stage and the neonate larva penetrates the fruit leading to significant damage of the harvestable product. Damage levels may be as high as 10%, but typically fall in the 1-3% range for 'Nonpareil' almonds.
- Timing of chemical treatments for NOW at hull split have traditionally followed degree day (DD) calculations, various egg counting methodologies, or a "shoot from the hip" strategy. However, these strategies for predicting treatment timing do not predict end-season damage levels.
- The objective of this research was to explore the use of the novel baited mass-trapping system as a monitoring, treatment timing, and end-season damage predictive tool.

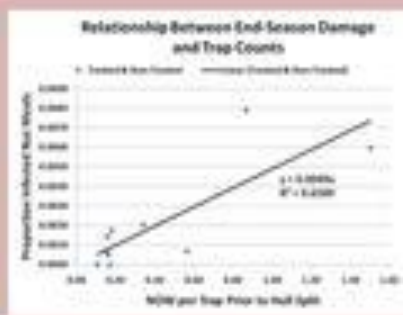
METHODOLOGY

- In 2011, 10 almond field sites totaling 671 acres were selected for mass trapping at two traps per acre; fields were similarly sized and planting schemes had similar varietal proportions
- Fields were paired *a posteriori* by average NOW/trap just prior to hull split
- One of each pair was selected at random to receive an insecticide (esfenvalerate) application for NOW at hull split
- Evaluation – Number of NOW infested nuts from systematically selected field samples
- Statistical analyses – t-test for treated vs. non-treated field proportion infested and regression of proportion infest and NOW per trap

RESULTS







INTERPRETATION & DISCUSSION

- In this experiment no difference was detected between end-season harvest damage in insecticide treated and non-treated fields, hence fields were pooled to create this model. The lack of differences at harvest could be due to lessened chemical activity against NOW, poor timing of treatments, or low NOW pressure. We believe, based on field observations that the last explanation is most plausible for this experiment. In general, 2011 was considered to be a low NOW pressure year, with many growers reporting low damage levels at harvest without insecticide applications at hull split.
- The possibility of having a low NOW pressure year, highlights the need for understanding NOW overwintering population levels as an important variable for inclusion in this predictive model. The role of winter sanitation and overwintering NOW infestation of mummies (=leftover harvestable nuts) has been well documented (Zalom et al. 1984, UCIPM 2005) with many growers practicing winter sanitation as a best practice.
- Damage thresholds vary by grower but, if, for example, a 0.01 proportion nut infestation (1% damage) at harvest was acceptable, then our model would predict that a grower implementing mass trapping would time an insecticide application during hull split when pre-hull split trap captures reach an average of two moths per trap.
- The model developed in this study is simplistic, with several variables requiring inclusion to better refine its predictive power. Experimentation is ongoing to determine how sanitation and NOW infest levels during winter, rate of baited traps per acre, proportion of 'Nonpareil' plantings, and insecticide mode-of-action efficacies may influence this predictive model.

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