II. Pome Fruits

f. Implementation

Pest: Codling moth (Cydia pomonella); Host: Pears

R. Freeman and S. Welter
Department of Entomology
201 Wellman Hall
University of California
Berkeley, CA 94720

Selective Integrated Pest Management Program for Pears

The following research focused on the development of integrated pest management programs that provide effective control of key pests while maximizing the beneficial aspects of existing biological control. The research includes three field experiments conducted in California.

The basis of the these programs has been the selective control of the key pest, codling moth, (*Cydia pomonella*), using the insect growth regulator, Dimilin. Control of other pests such as pear psylla and spider mites has been accomplished with a combination of applications of oil and biological control. One premise of these programs is that effective control of most secondary pests can be achieved in most orchards with existing biological control. A secondary objective of this research has been to identify those pests that are not effectively controlled within the selective program and target these pests for additional research and monitoring. While the program has been effectively demonstrated in orchards in Oregon, a similar program needed to be developed and evaluated under California growing conditions.

The selective program using only Dimilin for control of codling moth was compared to standard pesticide programs as well as an untreated check in two pear orchards (Courtland and Walnut Grove) located in Sacramento County, CA.

In the Courtland orchard, the program was successful for control of both codling moth and the associated secondary pests such as pear psylla, spider mites, etc. However, this is the first year of transition from a standard commercial program to a more selective program. As such, the pressure from the various pests was relatively low as would be expected within a well-managed orchard.

Control of codling moth was evaluated at three times throughout the season; after the first, second, and third flights of codling moth No codling moth infested fruit were found within any treatment after the first flight. At harvest, infestation levels were still low with 0.33% in the untreated control, 0% in the standard program, and 0.17% in the selective program. These differences were not significantly different at $P < 0.05$. However, by the third flight of codling moth, the number of fruit infested by codling moth started to increase to 6.5% in the untreated control, 3.1% in the standard program and 1.7% in the selective plot. The fruit infested by the third flight were fruit left on the tree at harvest due to inferior size or shape. This increase in the number of infested fruit presumably resulted from the increase in number of codling moth throughout the season and the reduced number of fruit available after harvest for egg laying. Success within the first year of the study does not necessarily mean success within the second year of the study, if the source of codling moth within an orchard continues to increase. The selective program needs to be repeated over several years within a single site before widespread adoption is recommended.

Control of the more volatile pest, pear psylla, was also excellent within this orchard. Within all treatments, the number of adult pear psylla never exceeded 0.08 adults per beat sample, whereas the number of psylla nymphs never exceeded 0.007 per leaf throughout the entire season.

A similar pattern was observed for all spider mites and rust mites. Within all treatments, none of the mite species exceeded economic thresholds. The number of twospotted mites and European red mites each peaked at 0.02 mites per leaf. No pear rust mites were detected throughout the season. Similarly, no problems with leafhoppers or leafrollers were detected within this orchard.

In the Walnut Grove orchard, the control of codling moth was similar to the Courtland orchard. One fruit was infested by codling moth in the untreated control plot after the first flight of codling moth. After the second flight, the fruit collected before harvest indicated a slight, yet non-significant, increase in codling moth. The untreated control had 1.5% infested fruit, whereas the standard program and Dimilin program had 0.25 and 0.0% infestation, respectively. Given that all fruit were effectively stripped from the trees at harvest, no evaluation after the third flight was possible.

No problems with pear psylla were observed within any treatment during the growing season. The number of adult pear psylla per beat sample started to increase late in the season with the number of adults reaching 1.1 per beat sample in the untreated control plots on Sept 21. No statistically significant differences between treatments were detected at any other time in the season.

The pear rust mite did reach high numbers in July within the untreated control plots. Only July 25, the mean number of rust mites per leaf reached 78 per leaf compared to 0.5 per leaf in the standard treatment and 0.04 mites per leaf in the selective program. The oil used within the selective program gave good control for the entire season, whereas the rust mites did increase in the standard program to 14 mites per leaf. The increase in the standard program may have resulted from a spill-over from the untreated control plots and disruption of predation. The peak in the standard program occurred two weeks after the peak in the untreated control plots. Damage levels within the untreated control exceeded commercially acceptable levels of foliar damage.

Populations of spider mites reached relatively high levels late in the season Prior to harvest in late July, no infestations of spider mites were detected. However, infestations within the selective Dimilin plots started to increase on Aug. 8 after harvest. By Aug. 22, the number of mites per leaf in the Dimilin plots had reached 1.8 mites per leaf, whereas the standard program reached 0.6 mites per leaf. The populations of spider mites declined by Sept. 21 within the Dimilin and standard plots. While foliar damage was apparent within the plots, the number of mites per leaf did not exceed the post-harvest threshold of 2.0 mites per leaf. Therefore, the grower did not sustain economic losses due to spider mites.

The number of leafhoppers was statistically greater in the standard program compared to the Dimilin and untreated plots . The untreated controls consistently had the lowest numbers of leafhoppers per beat sample for the entire season. The peak number of leafhoppers per beat sample reached 5.8 leafhoppers after harvest on Aug. 22.

Lacewings were found frequently during the pear growing season in both orchards. The number of larvae and adults was generally higher in the Dimilin and control plots than in the standard plot. Minute pirate bugs were found infrequentlylater in the season. Predatory mites were rarely encountered. Research is currently in progress to investigate the response of green lacewings and predatory mites to various selective and broad spectrum pesticides.

The results of this project indicate excellent potential for managing pear pests such as the codling moth, pear psylla, spider mites and rust mites in commercial orchards by utilizing "soft" chemicals that have minimal effects on natural enemies.