



## Cornell University Cooperative Extension

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### Preventing “Worms” in Apples With IPM Technology

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#### Who cares and why?

The NY processing apple market (excluding juice) is worth \$33 M, and fresh market is worth \$137 M. Apple IPM programs are being challenged by codling moth (CM), oriental fruit moth (OFM), and lesser appleworm (LAW). These pests have been in the background historically and controlled by strategies meant for control of other pests.

These are direct fruit feeding pests, the larvae of which feed in the flesh of fruit, commonly referred to as “internal leps”.

In the early 2000’s, these pests were most commonly noted in apples at harvest where insecticides for obliquebanded leafroller were more selective to leafrollers replacing broad-spectrum organophosphates.

There is a zero tolerance in most fruit markets for infestation by these pests, requiring



Codling moth infested apple is unacceptable in the processing and fresh market.

intensive control strategies. There is a very large economic impact on the apple industry

either by fruit value lost due to infestation or through increased cost in controlling these pests. A 50 bin truckload of Idareds in NY for processing is worth \$3957, but if rejected for juice due to worm infestation, the value is only \$1630. That is a potential loss of \$7 M with 3400 acres of Idared in NY. When 3 codling moth larvae were detected in apple shipments from Washington to Taiwan, the Washington State apple industry lost access to a \$47M market in Taiwan for 5 months in

2005 which impacted on our domestic market.

There are many IPM methods under development bringing opportunities for extension programs to reduce the economic risk of fruit infestation, and minimize the risks of pesticides used.

#### What has been done?

In 2006-07, the Lake Ontario Fruit Program of Cornell Cooperative Extension conducted several demonstrations of IPM methods that would help prevent these larvae in fruit.

- A pheromone trap network to monitor moth flight of these pests published through web, email, faxes, and newsletters.
- On-farm demonstration of the degree day model (PETE) used across the country to predict insect development and spray timings.

- On-farm demonstrations for mating disruption pheromone technology
- A survey of fruit at harvest at apple receiving lines to assess the extent of the infestation and identify the primary pest.

The Lake Ontario Fruit Program, led by Deborah Breth, was awarded a NYFVI grant to evaluate the use of the PETE model in NY, and monitor the trap network across the region. The mating disruption projects were supported

by the pheromone companies, chemical companies, and cooperating growers and consultants.

Pheromone traps (163) were hung in each of 32 locations to monitor adult CM, OFM, and LAW flight and use information to predict insect development and spray timing. Traps were monitored weekly to maintain reliable data. The trap data was entered into an Excel spreadsheet that could be viewed on the LOF website at

<http://www.fruit.cornell.edu/lof/trapreports/index.html>) so growers and consultants could see moth counts in various locations, identify peak flights on each farm and observe how variable populations are from one farm to another. Degree-day accumulations were calculated for each pest for each base temperature to report optimal spray timing in *Fruit Fax (faxed or emailed to 108 subscribing growers and consultants)* and *Fruit Notes (newsletter mailed to 400 enrollees)*.

To demonstrate the use of the PETE, 4 growers agreed to split 3 plots from their farm and spray one based on PETE recommendations, spray a second based on a modified degree-day timing model using seasonal trap data, and a third would be a grower standard. Fruit was evaluated for internal lepidopteran damage at harvest.

Four demonstration plots were arranged with 3 growers to evaluate 3 pheromone products available for disrupting mating behavior of

CM, OFM, and LAW. Two 20 acre plots were in the second season of disruption using Isomate CM/OFM TT. A third plot was treated with a sprayable formulation, Checkmate CM-F and OFM-F, and a fourth plot was treated with a paraffin based formulation, SPLAT. Insecticides were applied with spray timing based on trap information and degree-day model predictions from nearby orchards that were not under mating disruption. Harvest evaluations were done in disrupted plots and non-disrupted plots for internal lepidopteran infestation.

During harvest season of 2007, we collected wormy apples found by NYSDAM fruit inspectors at processor receiving stations. The signs of infestation were documented and the larvae were identified by sample number. This information is being passed onto growers to help them weigh risks of fruit infestation and improve control of these pests for 2008.



### What is the Impact?

- The trap network raises growers' and consultants' awareness of high flight activity that occurs at different timings not predicted by the degree day insect developmental model (PETE). This prevented surprise infestation early and late in the season on farms where this was taken into account.
- Consultants have intensified their pheromone trap network from installing a few traps for other pests for regional recommendations to more closely monitor flight activity of oriental fruit moth and codling moth on a farm by farm basis.
- The cost of trap supplies is \$20 per trap, not including travel and time. To monitor for the worm complex, the recommendation is to hang 2 traps for each of CM and OFM - \$80 per location. If one spray is saved on a 10 acre block, the savings could be as much as \$170-300

including the cost of application and spray material. If the trap data indicated a different spray timing, it could save a significant economic loss of fruit damage.

- Field demos of the PETE degree day timing model revealed that under low pressure, spray timing is overestimated by as much as 3 sprays, and underestimated in high pressure orchards by 2-6 additional sprays depending on moth flight and insecticides used.
- Using the modified degree-day timing based on seasonal trap catches improved control in all moderate to high pressure orchards. The PETE plots based on the first moth catch for the season to make season-long timing decisions resulted in significantly higher percent of internal lep damage in 2 of the 4 orchards.
- Mating disruption pheromones reduced the amount of internal lep infestation from an average of 11% in non-disrupted orchards to 0.7% in disrupted orchards, a significant improvement in control.
- The number of truckloads of fruit infested is increasing significantly compared to previous seasons – 13 truckloads in 2001; 113, 2002 from 48 growers; less than 20, 2003-4; 83 from 45 growers, 2005; 111 from 48 growers, 2006. In 2007, there were 313 loads documented with 1 or more larvae detected from 78 growers.
- The infested apple survey showed a significant shift from 75% OFM in 2001 to 75% CM in 2006-7.
- 300 growers and consultants have increased their knowledge about identification of the worms and the biology of the pest complex.
- Consultants and growers are adopting alternative controls for these pests including mating disruption pheromones and “softer” insecticides for control. This decreases the human health risk and environmental risk associated with pest management activities.
- This effort helps the tree fruit industry to optimize insecticide use and minimize environmental and economic impact on fruit farms.

Primary impact areas (Check at least one.)

EDUCATION    EXTENSION    RESEARCH