

Northeastern IPM Center Partnership Grants Program

A. Grant Data

- Today's date: November 11, 2008
- Type of Project: MINIGRANT
- Title: Behaviorally Based Management Strategies for the Plum Curculio and Apple Maggot Fly in Northeastern Apple Orchards
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- State(s) involved: WV, VT, and NH
- Funding Start Date: March 1, 2008
- Funding Amount: \$7,222

B. Nontechnical Summary. The plum curculio and apple maggot fly are two of the most serious pests of apple in eastern North America. Growers in the northeast generally apply three full insecticide applications to their entire orchard to control immigrating adults plum curculio in the spring and early summer, and three more insecticide applications to control immigrating apple maggot flies during the summer. We evaluated two behaviorally-based attract-and-kill strategies designed to manage these pests and reduce insecticide applications. The trap tree management strategy for plum curculio utilizes olfactory lures designed to attract and aggregate adults in particular border-row trees that subsequently are treated with insecticide. This approach resulted in a reduction of ~70% of the total trees being treated with insecticide compared with perimeter row sprays, and 93% compared with standard full block sprays. Protection to fruit using this low input approach was equal to that of perimeter row sprays. Attracticidal spheres used to manage apple maggot fly incorporate attractive olfactory and visual cues as well as a toxicant into the trap design. Deployment of these spheres in the perimeter of orchard plots resulted in elimination of insecticide treatments against this pest. Furthermore, this strategy protected from injury as well as standard insecticide sprays.

C. Objectives. We evaluated the efficacy of the odor-baited trap tree strategy to manage plum curculio and odor-baited attracticidal spheres to manage apple maggot fly in commercial apple orchards in New England. Overall injury within trap tree plots ranged from 1.0-8.5% compared with 0.0-4.5% in perimeter row treated plots. Injury was higher than in previous years, although nearly all growers used softer "reduced-risk" insecticides rather than organophosphates for trap-tree and perimeter row treatments. These newer insecticides may need to be applied to trap

trees and perimeter rows more frequently than traditional broad spectrum materials such as organophosphates to adequately protect apples from oviposition injury. In plots protected by attracticidal spheres, injury from apple maggot ranged from 0.0-3.0% at the perimeter of plots and 0.0-3.8% in the interior of plots. In the paired control plots, injury at the perimeter ranged from 5.0-8.0% and 1.0-3.0% in the interior of plots. Attracticidal spheres protected fruit from apple maggot injury as well as conventional insecticide treatments.

D. Approach. In cooperating commercial apple orchards in New Hampshire and Vermont, we evaluated the efficacy of reduced-input, behaviorally based attract-and-kill strategies for the plum curculio and apple maggot fly. For the plum curculio, eight blocks that were bordered by hedgerow or wooded habitat were used. Each block was divided into two paired ~2.5 ha plots to compare trap-tree and perimeter-row treatment management strategies only. In the trap-tree plot, 6-12 perimeter row trees (3 in either perimeter row on each side of the plot and up to 3 on exposed lateral ends of the rows) were baited with a synergistic odor blend for plum curculio consisting of 4 dispensers of benzaldehyde and a single dispenser of grandisoic acid. Trap trees were deployed ~25 m from the end of the row, and separated by ~50 m within the perimeter row or row ends. At petal fall, each grower applied a full-block insecticide application. After petal fall, plum curculio was managed in the trap-tree plots using the trap-tree management protocol or with perimeter row sprays in the comparison plot. In trap-tree plots, only the trap trees were treated with insecticide following the full block insecticide application at petal fall. Need for, timing, material, and rate of insecticide applications was decided by individual growers. The incidence of injury to fruit by plum curculio in each of the two experimental plots was quantified ~8 weeks after the petal fall spray.

We also assessed the protective capability of odor-baited attracticidal spheres for direct control of apple maggot fly as a commercial substitute for summer organophosphate sprays in the same two plots. In the experimental plot, we deployed a perimeter arrangement of odor-baited sphere traps to intercept and kill immigrating apple maggot flies; these test plots receive no insecticide spray from mid-June through harvest. The paired plot at each orchard received a normal summer insecticide treatment targeting apple maggot fly. Again, need for, timing, material, and rate of insecticide applications was decided by individual growers. At harvest, we evaluated fruit for the presence of damage in plots protected by odor-baited attracticidal spheres and by conventional insecticide treatments.

E. Results. Trap trees were deployed during full bloom. Subsequently, all growers applied a full-block insecticide treatment at petal fall. After petal fall, plum curculio was managed in the trap-tree plots using the trap-tree management protocol or with perimeter row sprays in the comparison plot. Injury was significantly greater in baited trap trees compared with unbaited perimeter row treated trees indicating significant aggregation by adults in baited trap trees. Overall injury within trap tree plots ranged from 1.0-8.5% compared with 0.0-4.5% in perimeter row treated plots. Injury was higher than in previous years, although nearly all growers used softer "reduced-risk" insecticides rather than organophosphates for trap-tree and

perimeter row treatments. These newer insecticides may need to be applied to trap trees and perimeter rows more frequently than traditional broad spectrum materials such as organophosphates to adequately protect apples from oviposition injury.

We deployed a perimeter arrangement of odor-baited attracticidal spheres for direct control of apple maggot fly in early July in the same experimental plots used for plum curculio ; these test plots received no insecticide spray from mid-June through harvest. The paired control plots received a normal summer insecticide treatment targeting apple maggot fly. Again, need for, timing, material, and rate of insecticide applications was decided by individual growers. In early September, we evaluated fruit for the presence of damage in plots protected by odor-baited attracticidal spheres and by conventional insecticide treatments. In plots protected by attracticidal spheres, injury ranges from 0.0-3.0% at the perimeter of plots and 0.0-3.8% in the interior of plots. In the paired control plots, injury at the perimeter ranged from 5.0-8.0% and 1.0-3.0% in the interior of plots. Attracticidal spheres appeared to protect plots as well as conventional insecticide treatments.

Both of these studies were described in detail at the New Hampshire Tree Fruit Growers Twilight meeting in July sponsored by the University of New Hampshire Extension service and held at Apple Hill Orchard in Concord, NH. Over 70 stakeholders attended this event.

F. Impacts. The trap tree management strategy for plum curculio and attracticidal spheres for apple maggot fly resulted in significant reductions in insecticide applications. For plum curculio, the percentage of trees treated with insecticide was reduced by over 90% compared with full-block insecticide applications and by 70% compared with perimeter row sprays. Insecticide applications were eliminated for the apple maggot fly in plots protected by attracticidal spheres. Both of these approaches are being advocated by the IPM-based labeling program, Eco-Apple as strategies that warrant further research and likely will result in grower adoption and implementation. The tenets of this project have been included in a larger integrated program aimed at pursuing extramural funding for development and adoption of advanced IPM practices for Northeastern apples.