Statement of Work

Background. The plum curculio, *Conotrachelus nenuphar* (Herbst) is an extremely destructive pest of apple in eastern North America. In a recent survey of commercial apple growers in New England, the plum curculio was identified as the pest that required the greatest pest management effort (Clifton 2005). Broad-spectrum insecticides, in particular the organophosphates (OPs), have been the materials that growers have relied upon to provide a commercially acceptable level of control. Growers typically apply three insecticide treatments to manage plum curculio in northeastern apple orchards (Prokopy et al. 1996; Reissig et al. 1998). Based on the results of a 2004 survey, 96% of New England apple growers applied insecticides to manage plum curculio, with most using OPs on a majority their acreage (Clifton 2005). The apple maggot fly, *Rhagoletis pomonella* (Walsh) is a key pest of apple production in the Northeast, typically requiring three whole-orchard insecticide treatments (Prokopy et al. 1990). As with plum curculio, OP insecticides are the most common and cost-effective treatment option, and treatments targeting apple maggot fly (applied July-August) are the most prevalent source of detectable OP residues on harvested fruit (Wright et al. 1998).

Because the practical use of OPs is being severely limited and may be eliminated altogether as a result of the tolerance reassessments stipulated by the Food Quality Protection Act, growers need a set of alternatives to OPs for control of these key pests. To date, the bulk of research and extension effort has been aimed at replacing OPs with newer chemistries which, while potentially effective, tend to possess less margin for error in rate and timing, and are typically far more expensive. Given this, the management transition away from OPs demands treatment precision, and provides the opportunity to expand the relevance of IPM-based approaches to managing key pests. For plum curculio, one of the most promising approaches involves whole-plot treatment at petal fall, followed by lure-based aggregation and control of immigrating adults in treated trap trees at the orchard perimeter. Our small-scale demonstration trials of this novel, reduced-input strategy has resulted in commercially acceptable levels of control of plum curculio, while reducing the post-petal fall treated orchard area by 70-90%.

For apple maggot fly, behavioral control using odor-baited, sticky-coated sphere traps has been demonstrated as highly effective in controlling fruit damage, but is prohibitively difficult and expensive to maintain. In the past five years, we have refined and demonstrated a unified strategy of behavioral and chemical control—perimeter deployment of odor-baited traps consisting of a visual stimulus, feeding stimulant, and toxicant. In small-scale, commercial-orchard trials from 2004-2007 we and others have demonstrated effective trap-based control of apple maggot fly; however, broader demonstration of this behavioral control technique is required to validate the reliability and flexibility of treatment effectiveness. For both trap-based control of apple maggot fly and trap tree-based control of plum curculio, eventual commercial implementation depends on demonstration, assessment, and refinement of strategies to accommodate the inherent variation within and across grower orchards.

Project Objectives. We will evaluate the efficacy of the odor-baited trap tree strategy to manage plum curculio and odor-baited visual traps to manage apple maggot fly in commercial apple orchards in New England.

Project Description. In cooperating commercial apple orchards in New Hampshire, Massachusetts, and Vermont, we will evaluate the efficacy of reduced-input, behaviorally based management strategies for the plum curculio and apple maggot fly. For the plum curculio, eight blocks that are bordered by hedgerow or wooded habitat (preferred overwintering sites for curculio adults) will be identified. Each block will be 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) will be baited with a synergistic odor blend for plum curculio consisting of 4 dispensers of benzaldehyde and a single dispenser of grandisoic acid. Trap trees will be 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 will apply a full-block insecticide application. After petal fall, plum curculio will be managed in the trap-tree plots using the trap-tree management protocol or with perimeter row sprays. In trap-tree plots, only the trap trees will be treated with insecticide following the full block insecticide application at petal fall. The perimeter-row treatment plot will receive insecticide sprays on all four sides of the plot. Need for, timing, material, and rate of insecticide applications will be decided by individual growers. The incidence of injury to fruit by PC in each of the two experimental plots will be quantified ~8 weeks after the petal fall spray.

We also will assess the protective capability of odor-baited visual traps for direct control of apple maggot fly as a commercial substitute for summer organophosphate sprays. In each of the cooperating commercial orchards in New Hampshire, Massachusetts, and Vermont, we will select two plots of bearing apple trees of similar size (6-15 acres), cultivar composition, tree size and density, and location within the orchard. In one of these plots, we will deploy a perimeter arrangement of odor-baited sphere traps to intercept and kill immigrating apple maggot flies; these test plots will receive no insecticide spray from mid-June through harvest. A paired plot at each orchard will receive a normal summer insecticide treatment targeting apple maggot fly. Again, need for, timing, material, and rate of insecticide applications will be decided by individual growers. At harvest, we will evaluate fruit for the presence of damage in plots protected by odor-baited visual traps and by conventional insecticide treatments.

Expected Impact. Grower adoption of new, ecologically sound IPM strategies depends on successful commercial demonstration of their effectiveness. In the past several years, we have collaborated with growers in New England on developing behaviorally based, reduced-input strategies for the plum curculio and the apple maggot fly. In order to increase grower awareness and facilitate understanding and adoption of these approaches, fruit growers in New Hampshire, Massachusetts, and Vermont will be invited to attend at least one meeting where the intent, logic, structure, and results of these proposed projects will be described and demonstrated. Results of these studies also will be published in *Fruit Notes of New England.* We expect that this project will continue to help propel the development of these strategies toward the ultimate goal of commercial adoption in northeastern apple orchards.

References

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