Greenhouse Integrated Pest Management (IPM)
University of Vermont Entomology Research Laboratory
Summary of Current & On-going Research 2010-2011

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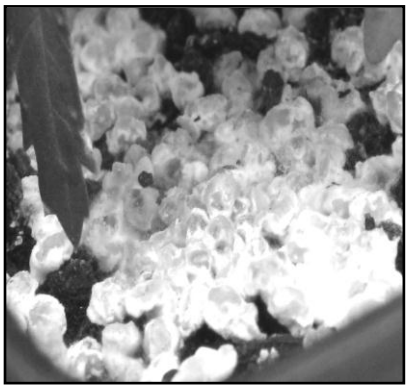
IPM One-On-One Program: Reducing Pesticides by Increasing IPM Proficiency

This marks year 2 of VT Greenhouse IPM One-on-One. The main goal is to increase grower adoption of IPM in greenhouse ornamentals through an individualized goal-oriented educational program that provides hands-on learning experiences tailored to their unique interests, skill levels and needs. In year 2010 we enlisted 4 participating greenhouse operations and expect 8 in 2011. Through meetings, surveys, site visits and evaluations we assisted growers in their effort to meet the goals of their individualized learning plans. As a result of taking part in this program, (1) all participants adopted new IPM practices, including use of sticky cards and indicator plants for early pest detection, sanitation and rouging of infested plants, spot treatments to reduce pesticide use and refinement of biological control and pesticide programs. (2) Pest damage to plants was reduced on plants at all locations. Because of their improved scouting skills and implementation of a systematic scouting program, growers took action earlier to reduce or prevent pest outbreaks and damage. (3) Growers indicated that participating in the program gave them greater confidence in their ability to identify and manage their pest problems and they transferred their knowledge of pest id to other workers. (4) In three of the four sites (75%), IPM implementation advanced sufficiently enabling them to refine their use of biological control and use fewer chemical pesticides. Most locations sprayed fewer times and one used more biorational pesticides that had lower toxicities to beneficials and (5) Growers indicated that the greatest challenges hindering their adoption of IPM were a lack of time to scout, hard to control insect/mite pests, lack of workers skilled in IPM, consumer intolerance for infested plants, ineffective pesticides and lack of knowledge of pest biology.

Efficacy of Insect-killing Fungi, Predatory Mites with Plant-Mediated Systems for Thrips Biological Control

This project builds on previous research by evaluating use of entomopathogenic fungi and predatory mites together within a plant mediated system to manage WFT. Marigolds are highly attractive to WFT and can be used for early detection. Because marigolds produce pollen, they also may serve as a habitat for predatory mites, providing a food source in the absence of WFT prey. We will enhance the effectiveness of this plant mediated system by incorporating entomopathogenic fungi in a granular formulation in the soil to target pupating WFT below the surface and the addition of predatory mites targeting WFT in the foliage. Together, these three management tools will be combined to provide an innovative, cost-effective and sustainable approach for pest management. Greenhouse and laboratory trials were conducted to evaluate the effectiveness of granular fungal formulations produced on millet grains applied at different rates combined with predatory mites (*Neoseiulus cucumeris*). Four fungi strains were tested: (1) untreated control, (2) *Beauveria bassiana*, the commercial strain found in Botanigard, 3) an experimental strain of *Beauveria bassiana*, and (4) and experimental strain of *Metarhizium anisopliae*. Our results have demonstrated the potential of combined applications of the experimental *Beauveria* and predatory mites for reducing WFT populations. Predatory mites reduction of WFT populations in plant foliage, appear to have assisted in fewer thrips entering the soil for pupation. This research could revolutionize IPM for WFT. It demonstrates the great potential of insect-killing fungi for use against WFT when a highly virulent strain is utilized as part of a total system. This could significantly reduce growers' dependence on chemical pesticides and therefore reduce exposure of the public and agricultural workers to toxic residues. This year, we are selecting the most effective fungal and mite treatments and testing them in local commercial greenhouses.



Fungal-based granular formulation on potting soil.

Fungi, Predatory Mites and a Plant Mediated System for Thrips IPM in Organic Greenhouse Ornamentals

This project tested a novel approach for thrips IPM in a commercial greenhouse of organically-grown spring bedding plants, combining predatory mites, granular insect-killing fungi and marigolds into one effective "guardian plant" system (GPS). The assumption was that adult thrips would be attracted out of the crop to the flowering marigolds, where they would become

established. The immature thrips would serve as prey for the predatory mite, *Neoseiulus cucumeris*, sustaining them and encouraging their dispersal through the crop. Thrips escaping predation would drop to the soil to pupate, where they would become infected with fungi. The granular formulation would enable the fungus to colonize the potting mix, eliminating the need for reapplication. This represents a low-cost, organic approach, achieving thrips IPM through a holistic system: ATTRACT, SUSTAIN & KILL. Because fungal treatments and mite releases are applied to the guardian plants rather than the entire crop, management costs will be reduced, while control is maximized. Marigolds were tested as a GPS in greenhouses of organic vegetable crops: one with the GPS and predatory mites and fungi, one using marigolds as a GPS with predatory mites and no fungi and one with no marigolds. Predatory mites were released onto the marigold GPS canopy in hanging saches two times throughout the experiment duration and the soil was treated with granular fungi once before placing then in the greenhouse. For 12 weeks thrips and mite numbers were monitored biweekly with plant tapping on marigolds and a random assortment of crops and yellow sticky cards. Blossom samples from the GPS were taken after 6 weeks and 12 weeks to assess predatory mite and thrips populations within and soil samples and thrips samples taken and tested for presence of fungi.Thrips populations were higher in the greenhouse that had only predatory mites on the marigolds than in the greenhouse that had the combined fungus and mite treatment. More mites and thrips were present in the marigold blossoms than on foliage with lower numbers of thrips occurring in blossoms that had the fungus and mite treatment. Thrips numbers were also lower overall on sticky traps in the fungus/mite greenhouse than the house with predatory mites alone. Thrips were found to be infected with fungus at the end of the experiment and fungal growth was consistent throughout the experiment duration on the soil surface. These results demonstrate the potential of the marigold GPS as a useful tool for thrips management in organic greenhouses.

Marigold GPS in organic commercial greenhouse onion crop.

Greenhouse Energy Efficiency

Bubble generation

Greenhouses are oftentimes significant consumers of energy. We are currently testing cost-effective environmentally-friendly greenhouse designs. This involves technologies to reduce heat loss. Specialists in greenhouse design, solar energy have been enlisted to collaborate on this project being demonstrated at a local commercial greenhouse operation. At this location, we are testing the energy saving of three greenhouse designs, a bubble insulating system and a solar energy curtain and a traditional poly greenhouse. This project is just getting underway and observations of significant heating cost reductions have already been noticed!

Scientists and Technicians Currently Involved with these Activities

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Cheryl E. Frank
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Funding Sources and Grower Collaborators (Alphabetical Order)

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- USDA Agric. Research Service
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- VT Greenhouse IPM Program
- Walker Farm

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