Interim Progress Report
USDA Northeast IPM Competitive Grants Program
September 1, 2006

A. Grant Data

- Title: **Promoting IPM Implementation in Greenhouses: Banker Plants, Grower Education and an Assessment of Consumer Attitudes**

- Lead investigator (name, title, institution, address, phone, fax, email):
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The University of Vermont, Entomology Research Laboratory
Cheryl Smith & Alan Eaton, The University of New Hampshire
Bruce Watt, University of Maine Extension System

- State(s) involved: **Maine, New Hampshire, Vermont**

- Years funded: **5/15/2005-5/14/2008**

- Funding amount: **$86,743**

B. Nontechnical Summary.

Overview outlining context and key components f*or lay audience.*

The goal of maintaining productivity and profitability while reducing pesticide usage in greenhouse crops is a significant challenge. Greater adoption of IPM practices is essential to meet this challenge, yet lack of time, knowledge, and perceived costs appear to be major barriers to their broader implementation. This project will promote ways of decreasing reliance on toxic pesticides by increasing opportunities to use biological controls, providing IPM education for growers, and assessing the public's awareness and appreciation of IPM, and its value to them and the environment.

C. Introduction.

An introduction to the project of approximately *500 words.*

Historically, dairy farms have dominated the rural landscape in the Northeast, but this traditional farming sector is declining as production agriculture becomes more diversified. In contrast, the greenhouse industry is expanding, and has become a vital component of the Region's agricultural economy. In fact, revenues from greenhouse crops far exceed that of any other crop commodity in the Northeast, with annual sales in excess of $551 million in New England alone. Public demand has driven this expansion, as people seek to beautify their homes and gardens with flowering plants.

Arthropod pests and diseases limit productivity and economic returns in greenhouse crops. Growers rely heavily on conventional pesticide-based strategies for their control. The compounds used pose a risk to applicators, consumers and the environment, and there are many negative aspects associated with extensive pesticide use. Repeated pesticide applications can also adversely impact plant physiology and appearance.

Thrips, aphids and spider mites remain the most significant persistent insect pests in greenhouse ornamentals and bedding plants. The specific economic losses associated with these pests are unknown. However, growers repeatedly ask what non-pesticide strategies are available for their management. Concerns are regularly expressed regarding the potential for pesticide resistance to develop in these pest populations.

The goal of maintaining high levels of agricultural productivity and profitability while reducing pesticide use presents a significant challenge. Research and outreach efforts must focus on increasing IPM implementation on all crops–strategies that emphasize cultural and biological controls as the main defense against pests but include the judicious use of pesticides. IPM reduces risks associated with pesticides, yet growers assert that they must use these materials to meet consumer demands for 100% pest-free plants. To be successful, control agents and IPM programs that are appropriate to local conditions must be developed. Generic IPM techniques developed for large, year-round facilities in southern states – where pests may be year-round rather than seasonal threats –are often not applicable to small, family-run greenhouse operations that are predominant in the Northeast. Furthermore, if not accompanied by appropriate extension and outreach activities, they will have little chance of adoption. Educational efforts must not only target growers, but also consumers. Consumers are a driving force in our market society; if, through education about the value of IPM-grown crops in terms of human health and environmental quality, consumer demand could be created, this would serve as a valuable incentive for growers to implement IPM.

Adoption of multiple management tactics – IPM – is essential to ensure that high-quality plants are produced, the greatest revenue generated, and the least amount of chemical insecticide used. Time, knowledge (or lack of), and ease of implementation appear to be the greatest barriers to the wider adoption of IPM techniques. This project will promote ways of reducing risks associated with pesticide use. The research components address issues related to the cost and quality of natural enemies and novel strategies for their greenhouse use. Outreach/extension activities promote grower education and document consumer knowledge and attitudes about IPM.

D. Objectives. Restate objectives. and provide a brief narrative about whether you've achieved it; if it was modified, mention how.

1. Evaluate the use of banker plants for production of predatory mites in spring bedding plants. **This is the second year of conducting research relating to this objective and all is on target**.

2. Assess the quality of natural enemy shipments received at different times of the year from Regional and National distributors. **This work is underway**. **It is the second year of the research and all is going well**.

3. Develop, organize, and conduct hands-on IPM training programs for greenhouse growers in ME, NH and VT. Workshops were held in January 2006 in Maine, New Hampshire and Vermont. Plans are underway to organize workshops in January 2007. **No modification is required, the objective is ongoing throughout the project and thus is not yet achieved**.

4. Conduct follow-up surveys at garden centers in ME, NH and VT to determine changes in consumer attitudes and knowledge about IPM. **This objective is not to be initiated until the last year of the project, so it has not been started, achieved or modified**.

E. Approach. *Briefly, in 1-2 paragraphs,* describe your approach, the methods used, and the overall design of your project.

Lack of time, knowledge, and ease of implementation appear to be the greatest challenges to increased adoption of IPM practices in greenhouse ornamentals. The research objectives evaluate banker plants for in-house production of natural enemies to provide a steady supply for control of spider mites in spring bedding plants. Cost, quality and availability are factors currently limiting growers' use of natural enemies. Banker plants reduce the need for multiple releases, and ensure a resident population is present should a pest outbreak occur. Few inputs are needed to achieve long-term suppression. The cost of shipping natural enemies is often higher than the cost of the beneficials themselves. Costs can be reduced by using ground shipping, which is one-third the price of overnight shipping. However, this can take 1-2 days longer, and we do not know how this will affect the quality of the natural enemies received by the grower. We will thus assess the quality of predaceous mites used over a growing season by ordering natural enemies from three distributors and shipping via these two methods. We will produce and distribute an informational pamphlet reporting results of our research, outlining methods to evaluate the viability of shipments. In the extension component of our proposal, we address grower-identified needs by offering effective hands-on educational IPM workshops, drawing on the expertise of specialists in Europe and North America. Through our customer surveys, and other IPM education activities, we want to raise public awareness about the value and benefits of IPM. Understanding the criteria people use when purchasing a plant, and influencing these criteria, will play a key role in creating demand for IPM-grown plants. The survey proposed for the current project will provide a means of measuring the outcome of these activities.

F. Progress. Describe, *in 1-2 paragraphs,* the progress made on your project during the past year in one .

Early intervention is critical for successful biological control. We assessed banker plants as a reservoir for biological control agents. Banker plants serve as a food source, by producing pollen or supporting a prey population. These systems can be a cost effective means of providing a continuous supply of beneficials, which spread throughout the greenhouse. In year 1 and 2 (2005 & 2006) banker plants were tested in a 25x50 m research greenhouse containing bedding plants, managed according to better management

practices (BMP), where pesticide applications were used sparingly as a last resort, relying on biological control when possible. Three different varieties of marigolds and pepers and beans were tested as banker plants for sustaining predatory mites to control spider mite pests. The ability of predatory mites to survive over the season on the plants was assessed. In addition, the ability of these plants to maintain spider mite pest populations at low levels was evaluated.

Biological control agents must be healthy and released in sufficient numbers to be effective. Natural enemies are commonly shipped long distances under adverse conditions which may reduce survival. The quality of shipments of three predatory mite species, *Amblyseius cucumeris*, *Hypoaspis miles*, and *Phytoseiulus persimilis*, are being assessed, using different methods to determine the number of live mites per shipment. Shipments from three suppliers are being tested from April-July.

Greenhouse IPM workshops were held in ME, NH and VT in January, attended by 150 growers, extension personnel and pest specialists. Insect and disease specialists presented IPM information focused on practical approaches to reduce grower reliance on chemical pesticides. Growers presented their IPM successes and challenges. This session is effective for stimulating discussion among growers.

G. Results. Provide a brief explanation of your results *in 1-2 paragraphs*. Include a discussion of any unexpected events that seem noteworthy.

We evaluated marigolds and other plant types as banker plants for predaceous mites to manage spider mite. In year 1 (2005) the predatory mites *P. persimilis* and *N. fallacis* were released onto the plants. Similar numbers of predatory (0.42/plant) and pest (0.25/plant) mites were observed early in the season (4 April to 8 June). Thrips were especially attracted to the banker plants, but with applications of a low-toxicity pesticide in mid-May, their numbers remained low (1.7/plant). However, by June spider mite and thrips populations began to rise. Thrips appeared to be particularly attracted to the marigold plants. The predatory mite population remained stable throughout the season at an average of 0.73/plant despite increasing spider mite and thrips populations. Our goal of sustaining a predatory mite population over the season was achieved, though thrips and spider mites were not suppressed below economically damaging levels. In year 2 (2006), we conducted two trials (one early and one late season). For the early season trial we inoculated banker plants with 10 spider mites each, along with the predator mites *N. fallacies* and *N. californicus*. Predators were detected on the plants throughout the trial period, sustained by the spider mite and pollen. However, thrips populations on the plants became so high, the banker plants had to be removed as they were serving as a source for an infestation. Spider mites were also seen infesting plants in the vicinity of the banker plants. A second trial was run later in the season, in which the plants were only inoculated with predatory mites; no spider mites were added. Predatory mites were detected throughout the trial period, but in far lower numbers than for trial 1, suggesting that the presence of spider mite prey increased predatory mite populations. Thrips were again a problem on these plants, indicating that adding a thrips predator in with the mite predators might be necessary. Analysis of the data for this study is currently underway.

For our assessment of natural enemy shipments, in the first year, a clear pattern in mite survival was not observed. Some shipments contained fewer live mites than ordered, others contained more. Data from year 2 should help to clarify the results. Data for Year 2 of this study is currently being analyzed. Based on results from two years of testing, guidelines for assessing the quality of mite shipments will be developed for use by growers.

According to the exit evaluations completed by the attendees, the workshops we organized provided the audience with new information that they felt would be useful in the coming year. Growers were very interested in banker plants for managing their pests, and enquiries from growers following the workshop indicated they intend to implement this technique for control of aphids.

H. Impacts. Describe and assess the impacts of your work--highlight the value of IPM research and education and the real-world impacts of project. Below are some questions that will guide you in assessing the impacts of your project. The relevance of each question may vary depending on whether yours is a research or extension project. Please answer as many as you can to the best of your ability, and feel free to discuss any impacts not mentioned below.

Through this project, novel approaches are being devised and tested to provide greenhouse growers with efficient methods of early pest detection and management, a cornerstone of IPM. A significant barrier to the greater use of natural enemies in greenhouses is the high cost of shipping and the poor rate of survival. Comparisons between different shipping methods are being made, which will help growers determine how best to order their biological control agents so that they arrive on time and alive. Public education about IPM benefits the grower as well as the consumer. Several educational materials have been produced for distribution by growers. This will promote the values of IPM and could lead to enhanced economic benefits for growers who use this environmentally friendly approach. Through a customer survey in the final year of the project, data on the effectiveness of IPM education in the region will be evaluated. Workshops will be held to further encourage growers to implement IPM more fully in their greenhouses.

1. *Safeguarding human health and the environment:*
   - **a.** Are there new IPM practices that have been or could be adopted as a direct result of your project? What is the total number of acres (or homes, schools, greenhouses, nurseries) on which these practices could be implemented? **No new IPM practices are ready for adoption at this stage in the research. However, there may be a time when banker plants could be used effectively.**
   - **b.** Has the project reduced risk (or could it potentially do so) by changing the use of pesticides on farms, or in homes, schools, etc.? For example, could it result in fewer sprays per season or a switch to lower-risk pesticides? **Not yet, the value of using banker plants has not yet been determined.**
   - **c.** Are there any other impacts on human health or the environment as a result of your project? **The IPM brochure encourages homeowners to use IPM rather than relying heavily on chemical pesticides. This will reduce their exposure to pesticides.**

2. Economic benefits:

a. What is (or could be) the economic benefit (e.g., dollars saved) for clientele who adopt IPM strategies and systems you studied? Do you envision potential commercialization or mass production of these systems? **It is premature at this time to determine the economic benefit of the banker plants to growers. First we have to determine if they are effective.**

b. How many IPM personnel might be employed as a result of your work? (e.g., private consulting services, nursery operators, food service growers) **Ideally a scout would be employed to assist in the maintenance of the banker plants and to ensure that pest populations are monitored regularly.**

c. How many clients are satisfied with IPM results (such as improved yield, quality of yield, reduced pest populations, more effective pest control, greater preservation of nonpest species)?

d. Are there other financial benefits that might be realized as a result of your project? **With help from growers we are spreading the word to consumers about the positive aspects of IPM, and why it is worth purchasing IPM-grown plants. In time, this will hopefully result in increased revenues for growers who market their crops as IPM-grown.**

3. Implementation of IPM:

a. How many IPM strategies and systems have been validated through this project (e.g., through on-farm trials, large plot tests, and other methods used to confirm efficacy)? **One strategy, banker plants, is being tested in research greenhouses.**

b. How many educational materials were delivered? **6** To whom? **Greenhouse growers who attended the workshops**

c. What is the number of growers/personnel trained? **150**

d. For a website, what volume of traffic and type of use has the site experienced? (For example, # visitors per day/month; # page views; # of unique user sessions; change in volume during growing season; average viewing time) **Not applicable**

e. How many more people adopted IPM practices as a direct result of your project, or how many people adopted new IPM practices?

Almost 100% of the growers who attended the workshop indicated on their exit evaluation that they learned techniques they planned to use in the coming year. For example, several growers indicated they would use banker or habitat plants, others said they intended to implement better sanitation and preventative control programs.

f. Are there other ways in which your work will result in improved use or increased implementation of IPM strategies in your region or across the Northeast?

Yes, growers were encouraged to distribute brochures about IPM. These included recommendations on how homeowners could implement IPM. Though there is no way to directly determine how many heed these recoommendations, the information is being disseminated.

4. Has your project or study enhanced collaboration among stakeholders interested in the development and implementation of improved IPM strategies and systems? (e.g., number of growers or other stakeholders that have participated in advisory committees, surveys).

The Tri-state Greenhouse IPM Advisory Group has worked together for over 10 years, putting on cost-effective workshops together. These workshops would not occur without external funding from organizations such as NEIPM. This year, Dr. Bruce Watt, Univ. of Maine Extension System, assisted with the workshop. He found the experience so productive that he has agreed to continue to play an active role in this initiative. A grower from New Hamsphire, Ben Shambaugh, has also recently joined the Advisory Group. He also took part in the workshops as a grower participant in the Maine and New Hamsphire sessions.

I. Appendices. Please attach to your report any of the following that will enhance our understanding of your project and its impacts:

- Photographs **See below an album of images relating to this project.**

- Any presentations, such as in Powerpoint, resulting from this project. **Program and list of presenters for the 2006 Greenhouse IPM workshops in Maine, New Hampshire and Vermont.**

- Printed fact sheets or other publications resulting from your work. **These are being sent by regular mail.**

Tri-state Greenhouse IPM Workshop
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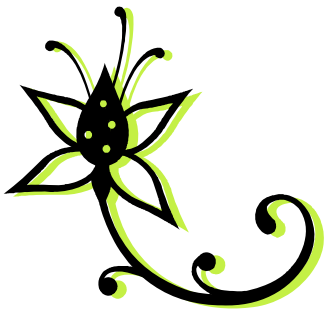

AGENDA

TRI-STATE GREENHOUSE IPM WORKSHOP

Wednesday, January 4, 2006
Longfellow's Greenhouses, Manchester, ME

8:00-8:30	**Registration & Coffee** *Tom Doubleday & Cheryl E. Frank – Univ. of Vermont*
8:30-8:45	**Welcome** *Margaret Skinner – Univ. of Vermont*
8:45-10:00 (concurrent)	**New Strategies to Enhance Success with Biological Control: Banker and Habitat Plant Systems*** *Carol Glenister – IPM Laboratories, Inc., NY* *Kathy Kessler – Baker's Acres, NY* *Cheryl Frank – Univ. of Vermont*
10:00-10:30	**Coffee Break**
10:30-11:45 (concurrent)	**Producing Plugs from Seed: Increasing your Success*** *John Wells – Rimol Greenhouse Systems, Inc., NH*
11:45-12:45	**Lunch**
12:45-1:45	**Grower to Grower Discussions: Sharing Challenges and Solutions** *Ben Shambaugh – Wayside Farm, LLC, NH* *Kathy Kessler – Baker's Acres, NY*
1:45-2:45 (concurrent)	**Disease Management for Seedlings & Young Plants*** *Cheryl Smith – Univ. of New Hampshire* *Bruce Watt – Univ. of Maine*
2:45-3:45 (concurrent)	**Conventional vs Biologically-Based Management: Costs & Benefits/Pros & Cons*** *Tom Doubleday & Cheryl E. Frank – Univ. of Vermont*
3:45-4:15	**What's Out, What's In, What's New, What are Growers Using?** *All Participants*

Award Door Prizes and Pesticide Credits (5 credits!)

Special thanks to the following organizations and companies, without whose help and support, this workshop would not have been possible:

Longfellow's Greenhouses
UVM Entomology Research Laboratory
Univ. of Maine, Coop. Extension, IPM Prog.
Univ. of New Hampshire Extension, IPM Prog.
Univ. of Vermont, Extension System, IPM Pro
Tri-state Greenhouse IPM Advisory Group
Northeast IPM Competitive Grants Program
New England Greenhouse Conference
IPM Laboratories
Baker's Acres
Gempler's
Agdia Inc.
Ball Publishing
Koppert Biol. Syst.
Rimol Greenhouses
Vermont Dept. of Agriculture
New Hampshire Dept. of Agriculture
Maine Dept. of Agriculture
Griffin Greenhouse & Nursery Supplies
Northeast Sustainable Agriculture Research & Education Partnership Program
American Floral Endowment

Promoting IPM Implementation in Greenhouses: Banker Plants, Grower Education and an Assessment of Consumer Attitudes

Cheryl Frank and Tom Doubleday, UVM Entomology Research Laboratory, reporting our results from the banker plant study at the Greenhouse IPM workshop in Maine.

Dave Hamlen, local grower, sharing his IPM success stories at the Greenhouse IPM workshop in Vermont.

Banker Plant Varieties Tested

Antiqua Yellow marigold

Hero Yellow marigold

Lemon Gem marigold

Green pepper
(Variety New Ace)

Green bean
(Variety Royal Burgundy)