The Entomology Research Laboratory

What have we been up to in 2015?

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Saffron, A New High-Value Crop for Diversified Farmers

Saffron bloom at harvest; stigma (orange threads, stamen (yellow structure).

Saffron (*Crocus sativus L.*) is the most expensive spice in the world, with a retail price of over $5,000/lb. It is commonly used as a food flavoring in Mediterranean cuisine, but also is believed to have medicinal properties which increases its economic value above other spices. Saffron is made from the flower stigmas which contain hundreds of aromatic volatile and nonvolatile compounds, most importantly crocins, picrocrocin and saffranal (Fig. 1). It is used as an anti-carcinogenic agent and to combat depression. It is also reported to reduce the blood cholesterol levels and mitigate arteriosclerosis. Saffron is adapted to arid/semi-arid areas and is somewhat resistant to cold, tolerating low temperatures to around -4°F. We began a project to assess the productivity of saffron and its ability to survive the winter in a high tunnel in northern VT. Two cultivation methods are being tested: in plastic milk crates and in the ground. Our hypothesis is that saffron will survive if grown in the protection of high tunnels. If produced in crates, growers could remove them in the early spring when the corms are dormant, and store them until Sept., when the saffron blooms (2-4 wk, Oct. – Nov.). This would allow growers to use the high tunnels for other high value crops from Mar.–Sept., maximizing on the ability to generate revenues from diverse crops. In Yr. 1 we obtained saffron yields surpassing those reported for traditional saffron growing areas of the world, demonstrating the great economic potential of this crop for our region. The retail price of organic saffron in VT health food stores is $19/gr. Based on the yield we achieved this year, saffron could generate revenues of $100,000/acre, which greatly exceeds revenues from most other vegetable crops often grown in high tunnels. To learn more about this research check out the summary on the handout table.

Habitat plants in high tunnel tomatoes.

Attracting and Sustaining Aphid Natural Enemies in High Tunnels!

Aphids are the #1 pest of vegetables in Northeastern high tunnels. They stunt plant growth, secrete sticky honey dew and transmit virus diseases. The bottom line is they cost growers money. To combat aphids, some growers spray chemical insecticides, which pose a threat to human health and the environment. Organic growers either do nothing, or spend a lot on frequent releases of natural enemies. Plant-mediated IPM systems (e.g., trap, banker, and habitat plants) offer innovative ways to manage aphids and other pests in high tunnels at low cost. We started a 3-year project to develop and evaluate these IPM systems for high tunnel vegetables at grower sites in ME, VT and PA. The banker plant system and habitat plants are being tested in the summer on tomatoes and in winter for leafy greens. Habitat plants tested this summer were alyssum, beans, marigolds, borage and dill. This winter we are using alyssum, beans, marigolds, calendula and viola. For the banker plants hard spring was used for the summer and winter wheat for the winter. We will determine how well these systems support commercially-available and naturally-occurring beneficials.

Over the summer of 2015, alyssum, borage and dill lured the most natural enemies, attracting over 25% of the beneficials. The remaining 18% were on bean and marigolds. The most common natural enemies observed were parasitic wasps and parasitized aphids (43%), *Orius* adults and nymphs (27%) and syrphid fly adults. The rest were different lady beetle life stages, predatory maggots, lacewing eggs and larvae. We were amazed at how many beneficials from outside the high tunnels were attracted to the habitat plants. Aphids, thrips and spider mites were the most common pests on the habitat plants, providing natural enemies with prey, which supplements the pollen and nectar from the plant flowers.

How attractive are Marigolds for luring Western Flower Thrips out of your Crop?

Through our past research we have found that flowering marigolds, especially Hero Yellow varieties, are very attractive to wetern flower thrips and will pull the pest out of bedding plants early in the season before they flower. Growers have

often asked if marigolds work as well at getting the thrips out when the crop is flowering. To answer that question, for the past three years we have been assessing marigold attractiveness in flowering and non-flowering stages of bedding plants in greenhouse caged trials. Each year two plant varieties of different colors are tested over a 6-wk period. We infest the plants with lab-reared thrips, and then put a marigold in the middle. We count the number of thrips that are attracted to the marigold and the number that stay on the bedding plants. So far, we have tested red and white petunias; yellow and purple calibrachoas; orange and yellow osteospermums; pink and red verbenas, purple and white New Guinea impatiens and red and orange marigolds. In all of the trials, marigolds showed greater thrips damage than the bedding plants. In general, the marigolds were most attractive when the crop plants are not flowering. This demonstrates the need to get the marigolds in the crop early to reduce pest numbers early, before the bedding plants begin to flower. We are also testing the compatibility of insect-killing fungi (*Beauveria bassiana* (GHA), the fungus in BotaniGard®) with commercial fungicides (Banrot® and Subdue MAXX®, *Trichoderma harzianum*, the fungus in RootShield® and PlantShield®). This will help growers decide when and where to apply fungicides to reduce their impact on beneficial fungi.


Marigold in flowering calibrachoas.

How can <u>You</u> decrease your pest Problems while increasing adoption of IPM?

For several years, the VT Greenhouse IPM One-on-One has worked with growers to encourage their use of IPM for greenhouse ornamentals. Individualized goal-oriented educational programs provide hands-on learning tailored to growers' unique interests, skill levels and needs. Participants adopted new practices, such as use of sticky cards and indicator plants for early pest detection, sanitation and rouging infested plants, spot treatments rather than greenhouse-wide sprays to reduce pesticide use, and refinement of biocontrol and more informed pesticide use. Growers felt pest damage to their crops was reduced because they used more IPM. With improved scouting programs, growers took action earlier to reduce or prevent outbreaks and damage. Growers in general said participating in the program gave them greater confidence in their ability to identify and manage pests and they transferred this knowledge to co-workers. Several operations have transitioned from conventional chemical control to a program that relies primarily on biological control to manage insect pests. If your operation is in VT and would like to be a part of this program, please contact us or fill out the *"Part of the Action"* form located on the handout table.

Bubble Greenhouse & Greenhouse Energy Efficiency

Greenhouses demand large amounts of energy to produce crops during the winter. We tested the suitability of two environmentally-friendly methods for reducing heat costs in hoop greenhouses—a standard thermal curtain and an experimental bubble insulation system. This is a unique device that generates soap bubbles to fill the space between the two layers of plastic covering the house. A standard 2-layer inflated plastic hoop house has an R-value of 1-2, while one filled with bubbles is reported to have an R-value of 30-40, which could reduce fuel use by 80%. Results in our test greenhouses (each 30 x 75 ft) showed that the bubble system outperforms the thermal curtain in reducing fuel use. Over the 2011-2014 periods of operation, gas use was less in the houses with the curtain and bubble system than in the unimproved house. However, improvements are needed for the bubble system to fully realize its energy conservation potential. Additional funding was received to continue to refine and improve upon the system to make it more user-friendly. Results will be provided as they become available. For more information, see the handouts called "*Retrofitting a Greenhouse for Energy Conservation*" & "*Novel Approaches to Improve Energy Efficiency in Northern New England Greenhouses*" on the handout table.

Scientists, Technicians and Students Involved with these Activities

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Support for this work is provided by: Amer. Floral Endowment; USDA ARS, Hatch, NRCS CIG, NE SARE, Extension IPM; UVM, USDA Crop Protection Prog., Ctr. for Lake Champlain Watershed Research, Innovation & Implementation

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