The Entomology Research Laboratory

What have we been up to in 2017?

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Saffron, A New High-Value Crop for Diversified Farmers

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 (Fig. 1). It is used as an anti-carcinogenic agent, an anti-depressent and to treat eye diseases. Saffron is adapted to arid/semi-arid areas and believed to tolerate low temperatures to -4°F. In 2015 we began a project to assess the productivity of saffron and its ability to survive the winter in a high tunnel in northern Vermont. Two cultivation methods were tested: in plastic milk crates and in raised beds. Our hypothesis was that saffron will survive cold Northern winters if grown in the protection of high tunnels. If grown 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 tunnels for other high value crops from Mar.–Sept. In Year 1 we obtained saffron yields averaging 0.88 – 1.39 grams/meter sq., which was considerably greater than yields reported in other established saffron growing regions. Yield was significantly greater in the crates than in the raised beds. The retail price of organic saffron in Vermont health food stores is $19/gr. Based on our yields in 2015, saffron could generate revenues of $100,000/acre. For various cultural reasons, yields in 2016 were lower than 2015, but still greater than in other regions.In 2017, as a result of considerable media coverage, hundreds of growers across the US planted saffron for the first time. With funds from the VT Dept. of Agric., we are currently assessing the suitability of growing saffron in the field (not in high tunnels) in different coldhardiness zones in Vermont. To learn more about this research and read the recent press releases, please visit our **Saffron Webpage**: http://www.uvm.edu/~entlab/Other%20Research/Saffron/Saffron.html

Fig. 1. Saffron is the stigmas (red arrow) of a fall-blooming crocus. The stamens (yellow arrow) are sold as a fabric dye and food coloring.

Attracting and Sustaining Aphid Natural Enemies in High Tunnels

Habitat plants in tomatoes.

Aphids are the #1 pest of vegetables in Northeastern high tunnels. To combat them, 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. These plants provide pollen and nectar to natural enemies in the absence of their pest prey. For 3 years we have been evaluating these IPM systems in year-round high tunnel vegetables (summer crops and winter greens) in Maine, New Hampshire, Vermont and Pennsylvania to determine if they support and enhance populations of beneficial insects. Alyssum, beans, marigolds, borage and dill were tested as habitat plants during the summer; whereas alyssum, beans, marigolds, calendula and viola were used during the winter. To date, over 2,500 natural enemies were encountered on habitat plants. Most common were parasitic wasps and their mummies, *Orius* and syrphid adults. The greatest abundance and diversity of natural enemies were observed on alyssum, borage and dill. Alyssum had the greatest tolerance to extreme heat and cold conditions, flowered throughout most of the growing season and was least attractive to aphids. For more information, and pictures of commonly encountered natural enemies, please view the *Attracting and Sustaining Aphid Natural Enemies in High Tunnels – Update Handout* in your folder and visit **High Tunnel Pest Management Website:** https://www.uvm.edu/~entlab/High%20Tunnel%20IPM/HighTunnelIPM.html

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

We assessed marigold attractiveness to western flower thrips (WFT) in the flowering and non-flowering stages of bedding plants during four spring-summer growing seasons in greenhouse cage trials. Each year, two plant varieties of different colors were tested over 6 weeks. Test plants were infested with WFT and a flowering marigold placed in the middle. The number of WFT attracted to the marigold and on the bedding plants were counted. We 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. We also tested both orange and yellow marigolds within yellow marigold crop plants. Consistent results over all years were observed: marigolds were attractive to WFT in both flowering and non-flowering stages of the crop, but were more attractive when crop plants were not flowering. We also observed yellow marigolds were more attractive to WFT than orange marigolds and thus serve as a better trap plant. Marigold effectiveness as a trap plant in thrips hot spots was tested over two seasons in several commercial greenhouses. Flowering yellow marigolds were placed in the center of WFT hot spots, after which nearby crop plants were inspected. In year 1, after 2 weeks, over 30% of the marigolds had WFT compared with 13% of the crop plants. When less than 50% of the crop plants were flowering, an average of 8 WFT per marigold trap plant was observed. When over 50% of the crop plants were flowering, an average of 4 WFT per marigold trap plant was detected. In year 2, after 2 weeks in place, 64% of both marigolds and crop plants observed had thrips; 27% had WFT on marigolds only and 9% had WFT only on crop plants. When less than 50% of the crop plants were flowering, 29 WFT per marigold trap plant was observed. When over 50% of the crop plants were flowering, 15 WFT per marigold trap plant was detected. This suggests that WFT disperse more readily into the crop when it is in bloom and demonstrates the importance of getting the flowering marigold trap plants in the crop early to attract WFT out of the crop before flowering.

Compatibility & Sustainability of Chemical & Biological Fungicides & Fungi within a Guardian Plant System

We tested the compatibility of insect-killing fungi (entomopathogens; *Beauveria bassiana*: experimental isolates and GHA (the fungus in BotaniGard®), *Metarhizium* and *Lecanicillium*) with the antagonistic fungi *Trichoderma harzianum* (the fungus in RootShield® and PlantShield®) and *Gliocladium* and two commercial fungicides (Banrot® and Subdue MAXX®). In general, the antagonistic isolates grew faster than the entomopathogens. When both groups of fungi were cultured on the same plates (dual culture), the *Trichoderma* isolates suppressed growth of the *Beauveria* isolates. *Trichoderma* growth was also reduced these dual cultures. When *Beauveria* inoculations occurred before inoculation of *Trichoderma*, most of the *Beauveria* isolates germinated within 20 hrs. However, when *Beauveria* was inoculated after the *Trichoderma*, germination rates of the *Beauveria* were severely suppressed. Subdue Maxx (mefenoxam) did not inhibit germination of *B. bassiana* and *M. anisopliae*, but Banrot (thiophanate methyl & etridiazol) did. Results demonstrate that compatibility varies between entomopathogenic and antagonistic fungi, and chemical fungicides, which growers must consider when both types of controls are used concurrently. This will help growers make decisions about when and where to apply fungicides to reduce their impact on beneficial fungi.

Attention Ornamental & High Tunnel Growers!

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 and more recently, in high tunnels. Individualized goal-oriented educational programs provide hands-on learning tailored to growers' unique interests, skill levels and needs. 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. If your operation is in VT and you would like to be a part of this program, please contact us or fill out the *"Part of the Action"* form.

Scientists, Technicians and Students Involved with these Activities

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