What have we been up to in 2016?

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Saffron, A New High-Value Crop for Diversified Farmers

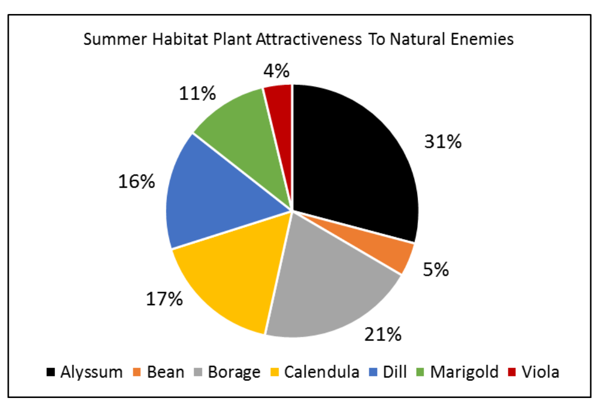
Saffron bloom at harvest; stigma (orange threads, stamen (yellow structure).

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 stigmata, 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 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. 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 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. We obtained saffron yields (stigmata only) averaging 0.88 – 1.39 grams per square meter. Yield was significantly higher the crates than in the ground. The yield from our study was greater than what is reported from other established saffron growing regions. For example, in Iran, yields are generally around 0.34 gr/sq. meter, and in Spain around 0.6 gr/sq meter. 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, greater than that from most other vegetable crops grown in high tunnels. We continued the research in 2016 and have obtained similar results. 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

Habitat plants in 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, transmit virus diseases and 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 have a 3-year project to 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. Alyssum, beans, marigolds, borage, calendula, viola and dill are being tested as habitat plants for the summer season and alyssum, beans, marigolds, calendula and viola for the winter season. These plants provide pollen and nectar in the absence of the prey. For the banker plants hard spring wheat was used for the summer and winter wheat for the winter. We will determine if these systems support and enhance populations of commercially-available and naturally-occurring beneficials. Over 2,100 natural enemies were encountered on habitat plants. In both the summer and winter seasons, most were parasitic wasps (32-51%) and *Orius* (22-25%). The greatest abundance and diversity of natural enemies was observed on alyssum, borage and marigold. Alyssum had the greatest tolerance to extreme heat and cold conditions and flowered throughout most of the growing season.



Percentage of total natural enemies observed by habitat plant type.

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

For several years we have been assessing marigold attractiveness to western flower thrips (WFT) in the 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. Test plants are infested with WFT, and a flowering marigold is placed in the middle. The number of WFT attracted to the marigold and the number on the bedding plants are counted. 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. This year we tested orange and yellow marigolds within marigold crop plants. In general, there were more WFT on yellow marigold trap plants than nonflowering yellow marigold crop plants. Fewer WFT were detected on orange trap plants than on yellow flowering crop plants. Marigold effectiveness as a trap plant in thrips hot spots was also tested in 14 greenhouses at 6 commercial greenhouses producing bedding plants. Flowering yellow marigolds were placed in the center of WFT hot spots, after which nearby crop plants were inspected. After 2 weeks, over 30% of the marigolds had WFT compared with 13% of the crop plants. When up to 49% of the crop plants were flowering, 8 WFT per marigold trap plant was observed. When over 50% of the crop plants were flowering, 4 WFT per marigold trap plant was detected. This shows the importance of getting the flowering marigold trap plants in the crop early to attract WFT out of the crop plants before they begin to flower.

Orange marigold in yellow flowering marigold

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

We are lab-testing the compatibility of entomopathogenic (insect-killing) fungi (*Beauveria bassiana* (GHA), the fungus in BotaniGard®) with commercial fungicides (Banrot® and Subdue MAXX®, *Trichoderma harzianum*, (an antagonistic fungus in RootShield® and PlantShield ®. *Trichoderma* isolates grew faster than ento-fungi. When both fungal types were grown on the same plate (dual culture), the anti-fungi suppressed growth of the ento-fungi. Growth of the anti-fungi was also reduced. Trials were also conducted to assess spore germination of the ento-fungi, when anti-fungi were spread on the plates immediately after or 3 and 6 hrs after and *vice versa*. When ento-fungal inoculations were followed by inoculation of anta-fungi, most of the ento-fungi germinated within 20 hrs. However, when ento-fungi were inoculated after anti-fungi, germination of the ento-fungi was suppressed. This shows that ento- and anti-fungi are not particularly compatible. The anti-fungi will likely reduce the effectiveness of ento-fungi. The effect of chemical fungicides on entomopathogenic and antagonistic fungi was also assessed. Subdue Maxx (mefenoxam) did not inhibit germination of *B. bassiana*, but Banrot (thiophanate methyl & etridiazol) did. This will help growers make decisions about when and where to apply fungicides to reduce their impact on beneficial fungi.

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. 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.

Other UVM-ERL Research Webpages to Check Out!

Greenhouse Energy Efficiency (Bubble Greenhouse Technology)
https://www.uvm.edu/~entlab/Other%20Research/Bubble%20Greenhouse%202010/BubbleGreenhouse.html
High Tunnel Pest Management: https://www.uvm.edu/~entlab/High%20Tunnel%20IPM/HighTunnelIPM.html
Invasive Worms: https://www.uvm.edu/~entlab/Forest%20IPM/Worms/InvasiveWorms.html
Landscape IPM: https://www.uvm.edu/~entlab/Landscape%20IPM/LandscapeIPM.html

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