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In This Issue

Budworms on Petunias, Calibrachoas and Geraniums

Although seldom a problem in greenhouses, symptoms of damage caused by budworms tend to show up in customer's home gardens and landscapes. Petunias and geraniums that were blooming beautifully, suddenly have no blossoms. The plants still look healthy, but all the flowers are gone. Caterpillars of the tobacco budworm attack the flower buds and ovaries of developing flowers of petunias, calibrachoa, geraniums and nicotiana. The damaged buds fail to open and this loss of color is often the first injury observed. Young larvae tunnel into small flower buds, and larger caterpillars eat the flowers, giving the flowers a ragged appearance. The amount of damage progresses through the growing season, becoming most noticeable during late summer.

The adult is a moth about 1½"wide with light green wings and 4 wavy, cream-colored bands. In the early evening, females lay single eggs on buds or undersides of leaves. Eggs hatch into tiny rust-colored or green striped caterpillars which eat holes in buds or unfolded leaves.

The caterpillars become full-grown in about a month, drop to the soil and pupate. Adults emerge to repeat the cycle, with two generations normally produced each year here in the northeast. In MA budworm damage is often reported in July and August. They over-winter as pupa below ground, 4-6 inches deep in an earthen cell. They survive temperatures as low as 20F.

Numbers tend to build up in the soil over time, especially when host plants such as host plants such as petunias or geraniums are planted in the same bed year after year.

Monitor budworm by checking buds and flowers for small holes to detect early stages of infestation. Larvae are most active during dusk and best discovered at this time. During daylight hours, they often hide around the base of the plant.

Controlling budworms with pesticides is difficult. They have developed resistance to many pesticides and budworms often tunnel quickly into buds or stems, making them difficult to reach with sprays. Insecticides containing spinosad may provide control. Insecticides containing *Bacillus thuringiensis*/Bt (Thuricide, Deliver, Dipel, Javelin etc.) are effective biological controls on petunia where caterpillars eat the blossom. On geraniums, where the caterpillars drill into the buds and eat little of the outside surface, Bt may not be effective. Bt must be ingested for it to be effective.

Cultural practices: Rototilling garden beds in fall or in spring may destroy overwintering pupa and help provide some control. Soil should be removed from containers at the end of the season to prevent them from overwintering. Rotating beds out of host plants (petunias, geraniums and calibrachoas), will help to reduce populations. *Tina Smith, UMass Extension*

Sunflower Moths on Composites

If flowers of composites such as Echinacea are looking rain-damaged, messy and quickly going by, inspect the flower heads more closely, the damage may be caused by sunflower moth larvae. This has been a pest in previous years.

The caterpillar of the sunflower moth, *Homoeosoma electellum*, damages the flower heads of echinacea, sunflower, marigolds cosmos, coreopsis, heliopsis and other composites (*Asteraceae*). Newly hatched larvae are small pale yellow caterpillars, but darken to shades of brown or purple with longitudinal white stripes. Look for mats of webbing on the face of flowers for signs of larval feeding. The injury caused by larval feeding can lead to *Rhizopus* head rot.

Flowers are susceptible in the early stages of bloom, and females lay their eggs at the base of the florets. The newly emerged larvae feed on pollen and florets. The larvae begin tunneling into seeds upon reaching the third instar (larval growth stage). Tunneling continues throughout the remainder of larval development. Later instars bore into the head and consume receptacle tissue and seeds. Many overlapping generations occur throughout the summer. Although a portion of larvae pupate in the heads, the majority of maturing larvae drop to the ground on silken threads to pupate in crevices or under leaf litter. Diapausing larvae overwinter 2 to 3 inches underground.

Flowers do not last long and seed heads are not formed, overall creating an unattractive flower.

Control: *Bacillus thuringiensis* subsp. *kurstaki* on early instar larvae or spinosad (Conserve). If in a greenhouse then Pylon would also be a good choice. *Tina Smith, UMass Extension*

Keynote Presentation: Connecting People with Flowers

Kate Santos, Dümmen Orange Chief Operating Officer
Northeast Greenhouse Conference and Expo, Holiday Inn, Boxborough, MA

The horticulture industry and its customers are constantly changing. Understanding each generation's similarities and differences allows businesses to be active participants in customers' decisions about purchasing plants. Kate Santos shares what the global firm Dümmen Orange is doing to understand who are the industry's customers, how the customers impact company activities, and what the company is doing to help connect people with flowers.

Kate earned a Bachelor of Science degree in Plant Biology from the University of New Hampshire. Following undergraduate school she worked as a grower for Cavicchio's greenhouse operation (Sudbury, MA), where she was responsible for growing a variety of container grown annuals and perennials. Kate returned to graduate school and worked with Dr. Paul Fisher at the University of Florida, where she focused on quantification of nutrient uptake during propagation of unrooted cuttings. After earning her PhD she joined Costa Farms (Miami, FL) as the Director of Research and Development where she oversaw the trial garden and research teams at each of their facilities. Kate currently works for the global firm Dümmen Orange (http://dummenorange.com/) as the Operations Director where she has the opportunity to devise strategies to develop and bring new products to market. For more information on the Northeast Greenhouse Conference and Expo, visit the website, www.negreenhouse.org

Plant Response to Nature’s Source and Eco-Vita Organic Fertilizers vs. Plantex Chemical Fertilizer

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In recent years I’ve have written articles about my work with organic fertilizers as alternatives to traditional water-soluble chemical fertilizers (Cox, 2014; Cox, 2013a; Cox, 2013b; Cox and Eaton, 2013). I’ve worked with several types of soluble organic fertilizers manufactured from extracts of sugar beets and other plants as well as granular organic fertilizers made from poultry waste and other materials. Not surprisingly, because of their differences in the makeup, success in growing acceptable greenhouse crops has been variable. However, one thing is clear: organic fertilizer combinations work better than relying on one type alone.

Growers interested in trying or learning more about organic fertilizers should read my fact sheet “Thoughts on using organic fertilizers for greenhouse plants” which can becan be found at https://ag.umass.edu/fact-sheets/organic-fertilizers-thoughts-on-using-liquid-organic-fertilizers-for-greenhouse-plants

This article reports on the effectiveness of Nature’s Source and Eco-Vita organic fertilizers versus Plantex chemical fertilizer for growing a typical bedding plant. The current project was supported by grants from New England Floriculture, Inc., Massachusetts Flower Growers’ Association, and the New England Florist Credit Endowment.

How the plants were grown

‘First Lady’ marigold plugs were potted on 2 April 2015 in 4½-inch pots of Fafard 3B soilless mix. Pots were suspended through the lids of larger containers to collect the leachate for ammonium (NH_4-N) and nitrate (NO_3-N) analysis every 10 days.

Plants were fertilized with 250 ppm N from Plantex (20-2-20) chemical fertilizer or Nature’s Source (3-1-1) liquid plant extract fertilizer (oil seed extract). In another treatment, Eco-Vita (7-5-10) granular fertilizer (bone meal, soybean meal, cocoa shell meal, feather meal, and fermented sugar cane and sugar beet molasses) was incorporated in the growing mix at a rate of 7.2 gm/pot (0.26 oz./pot). Also, Eco-Vita was applied in combination with Nature’s Source. In this treatment one-half of the N was supplied Nature’s Source and the other half by Eco-Vita. In this treatment Nature’s Source was applied 10 times during the 50 day crop and one-half of the N was supplied by Eco-Vita and the other half by Nature’s Source. The same amount of nitrogen (500mg N) was supplied by all fertilizer treatments. Plants in all treatments were irrigated with the same amount of fertilizer solution or plain water during the experiment.

Recently-matured leaves and the remaining portions of the shoots were harvested for shoot dry weight determination and nutrient analysis 28 May, 50 days after transplanting.

Results

Plant growth, water use and nitrogen leaching. Plants were similar in height and had about the same number of open flowers and buds at harvest (Figure 1). The Nature's Source and Eco-Vita plants were lighter green in color. No significant difference in plant growth plant growth as measured by shoot dry occurred between fertilizer treatments (Table 1).

Figure 1. (Left to right). Plantex, Nature's Source, Eco-Vita, and Nature's Source + Eco-Vita.

During the experiment 6300 ml (6.3 liters)/pot of water and/or liquid fertilizer was applied to the treatments. The volume of leachate collected during the experiment was about the same for all fertilizer treatments. Overall about 19% of the liquid applied during the experiment ended up as leachate, meaning that 81% was used by the plants or retained by the growing mix. Water use and leaching results reflected the fact that the plants grew equally as well in all treatments. In other trials, however, I've found much larger differences in leaching volumes between fertilizer treatments due to differences in shoot growth and root development due to fertilizer types.

Fertilizer treatment affected N leaching (Table 1). The least amount of total N (NH_4-N + NO_3-N) leaching occurred with Nature's Source followed by Plantex. The largest amount of total N leaching occurred with Eco-Vita alone. NO_3-N leaching was greatest with Plantex and Eco-Vita while NH_4-N leaching was greatest with Eco-Vita.

Table 1. Shoot dry weight, leachate volume and nitrogen leaching.

Fertilizer	Shoot dry wt. (gm)	Leachate vol. (ml)	NH_4-N (mg/pot)	NO_3-N (mg/pot)	Total N (mg/pot)
Plantex 20-2-20	13.8^{ns}	1153^{ns}	6.4c	53.2a	59.6bc
Nature's Source 3-1-1	13.7	1263	2.8c	27.1b	30.0c
EcoVita 7-5-10	13.6	1259	45.0a	53.3a	98.3a
Nature's Source + EcoVita	13.6	1158	24.7b	41.4ab	66.1b

Elemental leaf analysis. Analysis of the recently-matured revealed some differences between fertilizer treatments (Table 2). Despite these differences none of the element levels were above or below the optimal levels for marigold. Nitrogen was highest in the leaves from Plantex plants and significantly lower in the leaves from plants fertilized with organic fertilizers. Perhaps this is why the Nature's Source and Eco-Vita plants were somewhat pale compared to the Plantex plants. There were no differences between treatments in phosphorus, potassium, and calcium. More magnesium, manganese and iron accumulated in the leaves of Eco-Vita and Eco-Vita + Nature's Source plants. Growth medium EC was low for all treatments and pH values were within the appropriate range for marigold.

Table 2. Elemental leaf analysis.

	Elemental leaf analysis							Growth medium	
Fertilizer	**N (%)**	**P (%)**	**K (%)**	**Ca (%)**	**Mg (%)**	**Fe (ppm)**	**Mn (ppm)**	**EC**	**pH**
Plantex 20-2-20	4.84a	0.54^{ns}	3.02^{ns}	1.53^{ns}	0.75b	140c	170c	0.33^{ns}	6.0ab
Nature's Source 3-1-1	3.18b	0.60	2.57	1.56	0.96a	159b	115c	0.41	5.8b
EcoVita 7-5-10	3.54b	0.51	3.18	1.81	0.85ab	274a	387a	0.32	6.1a
Nature's Source + EcoVita	3.69b	0.58	3.14	1.78	0.97a	243a	293b	0.29	6.1a

Conclusions

In this experiment plant growth, flowering, and water use were about the same regardless of what fertilizer treatment was applied to the plants. Nitrogen leaching was greatest with Eco-Vita and least with Nature's Source. Nitrogen was higher N in the leaves from Plantex plants and more magnesium, manganese, and iron was in the leaves of Eco-Vita and Nature's Source. Growth medium and EC were not greatly different among the treatments. The bottom-line is that the three organic fertilizer treatments were as successful for growing marigold as the chemical fertilizer Plantex.

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Disease Control with Products that Elicit Plant Defenses

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Although they do not have immune systems like those of mammals, plants do have the ability to generate substances that protect them against invasion by pathogens. There are two types of natural disease resistance in plants. The first is Systemic Acquired Resistance (SAR), which can be induced by certain pathogens and various substances. The second is Induced Systemic Resistance (ISR), which is stimulated by the activity of some soil-dwelling microorganisms. Although their biochemical pathways are different, both SAR and ISR result in the activation of plants' natural defense systems.

The active ingredients of several products can induce plants' natural defenses against disease. Acibenzolar-s-methyl (Actigard), potassium phosphite (Alude, ProPhyt), potassium silicate (Sil-MATRIX), chitosan (Elexa), and extract of *Reynoutria* (Regalia, Milsana) have been shown to induce SAR in several crops. In addition, biochar and algal extracts have also been shown to stimulate SAR. Plant growth promoting rhizobacteria (PGPR) such as *Bacillus subtilis* (Cease, Serenade, Kodiak, etc.) and members of the fungal genus *Trichoderma* (RootShield, TrichoPlus, etc.) can induce ISR. It should be noted that some products have protective effects other than eliciting plant defenses. For example, potassium phosphite can directly inhibit fungal activity, and *Bacillus subtilis* also acts by competing with pathogenic microbes and producing substances that inhibit their growth.

The majority of efficacy studies on plant defense elicitors have focused on vegetable crops and were primarily conducted under field conditions. Some studies have shown that these products can decrease disease severity on ornamentals under greenhouse conditions; however, efficacy can vary greatly among crops, cultural systems, geographical regions, and growing seasons. Several factors may influence the efficacy of these plant defense elicitors. Chief among these are the genetics of the crop. The same product may stimulate a strong response in some plant species and a weak response in others; similarly, the response to a particular product may vary among cultivars of the same species. The duration of the response can also vary; for instance, studies indicate that resistance induced by acibenzolar-s-methyl is notably longer lasting in monocots than in dicots. It is also possible that the resistance response may be more effective against some pathogens than others. Resistance can be influenced by crop nutrition and the overall health of the host plant. Products based on the activity of living organisms can be particularly sensitive to environmental factors such as temperature, irrigation, and soil fertility, as well as the activity of other soil microbes. Application timing, the composition of potting media, intensity of disease pressure, and plant age can all influence the degree of disease control. Little is known about the ways in which these various factors affect product performance in the greenhouse. The level of disease protection conferred may be significant, but not sufficient to insure crop salability.

Finally, the effects of these products are often short-lived, and the need to reapply products frequently can be costly.

Plant defense elicitors are often recommended for use in integrated pest management programs along with other products. Studies on the efficacy of plant defense elicitors for disease prevention have been limited and have yielded inconsistent results; however, many have also been shown to improve overall plant health, increase crop yields, and enhance plant resistance to abiotic stresses such as drought. These aspects indicate that products that elicit plants' natural defenses may be useful for disease prevention and control, as robust plants are less susceptible to disease than those that are in suboptimal health. These products alone should not be relied upon to provide effective disease protection, but it may be valuable to incorporate them as one element of an integrated pest management program. If it is within your budget to purchase these products, experimentation is encouraged.

Things to keep in mind:

- Always read the label thoroughly and follow label instructions.
- When using a new product, new combination of products, or working with a crop that is new to you, always make an application to a small number of plants first to test for phytotoxicity.
- Products such that inhibit the growth of microorganisms may decrease the efficacy of products based on living microorganisms.

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