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Floral Notes Newsletter

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Save the Date!

Greenhouse Vegetable Production – In Containers

December 10, 2014

Publick House, Sturbridge, MA

The program will feature:

- Growing Greenhouse Tomatoes and Greenhouse Cucumbers in Containers
- Biological Control of Pests for Greenhouse Tomatoes, Cukes and Greens
- Growing Bench-top Greens
- Diseases and Disorders of Greenhouse Tomatoes, Cukes and Greens
- Grower to Grower Panel

University of Massachusetts Extension Greenhouse Crops and Floriculture Program and Vegetable Program

Neonicotinoids, Native Pollinators, and Greenhouse Production

Tina Smith
Outreach Educator
UMass Extension
Amherst

Note: The 2015-2016 New England Greenhouse Floriculture Guide will contain an expanded version of this article. Contributors to the new section of the guide "Protecting Bees and Pollinators from Pesticides" are Dr. Richard Cowles, The Connecticut Agricultural Experiment Station, Dr. Raymond Cloyd, Kansas State University, Dr. Kimberly Stoner, The Connecticut Agricultural Experiment Station and Dr. Lois Berg Stack, University of Maine. The new guide will be available in November 2015 at the Northeast Greenhouse Conference.

Populations of honey bees and native pollinators have declined worldwide in recent years. According to current research, a wide range of factors have contributed to their decline including parasites, disease, low genetic diversity, poor nutrition, loss of habitat, management stress and pesticides applied to crops.

The current state of honeybee health has been detailed in a joint comprehensive report released by the USDA and EPA: http://1.usa.gov/1kBLeJI (this is case sensitive)

About Neonicotinoids

Concerning the role of pesticides, neonicotinoid insecticides have been implicated as a potential contributing factor. Neonicotinoid insecticides are insect neurotoxicants. They are primarily systemic, which means that the active ingredient may be absorbed by the roots and move through the entire plant including pollen and nectar. There is evidence that foraging bees may receive sublethal doses in pollen and nectar which may make bees more vulnerable to other stressors, or may combine with doses from contact with other treated plant material.

Neonicotinoids are also persistent in the environment and even as they degrade, they remain toxic to bees. Pollinators are particularly vulnerable to exposure to neonicotinoids that are sprayed on open flowers of insect pollinated plants or move systemically into pollen and nectar.

Neonicotinoids that are labeled for greenhouse ornamentals include Group 4 A insecticides:
imidacloprid (AmTide Imidacloprid, Benefit, Bounty, Mantra, Mallet, Marathon, Quali-Pro Imidacloprid); thiamethoxam, (Flagship)
acetamiprid (TriStar) and
dinotefuran (Safari).
One other neonicotinoid, clothianidin, is not currently used in greenhouses, but is used in other green industries. Many neonicotinoid products are also currently available to home gardeners. See the link to the fact sheet "Protecting Honey Bees from Pesticides in Home Gardens and Landscapes" at the end of this article for trade names of products available to home gardeners.

Steps to reduce pesticide exposure to pesticides

Many non-neonicotinoid pesticides are also toxic to bees and native pollinators, including some pesticides used for organic production. Pesticides applied to protect crops can affect pollinators through multiple routes of exposure: direct contact with sprays, contact with treated surfaces, pesticide-contaminated dust or pollen particles that are collected or adhere to the body of the insect (and may be taken back to hive), and ingestion of pesticide-contaminated pollen and nectar.

Growers' decisions make a difference in the level of exposure of bees and other beneficial insects to pesticides. Taking precautions to minimize pesticide poisoning of pollinators in all crops is an important responsibility of all pesticide applicators.

Reduce or eliminate the use of neonicotinoid insecticides. The Environmental Protection Agency (EPA) or state governments may ban or restrict the use of neonicotinoid insecticides in the future. It has been reported that some mass markets will require neonicotinoid treated plants to be labeled.

Therefore, growers should consider reducing the use of and reliance on neonicotinoid insecticides. Only use neonicotinoid insecticides when other effective products do not exist and use neonicotinoids in ways that are protective of pollinators. Monitor crops for pests and spot-treat pests when they are first observed. Use environmentally sound alternatives whenever possible.

Avoid treating "Bee Friendly" plants. Avoid treating plants that are attractive to bees with neonicotinoid insecticides. These include many perennial and native plants and also annual bedding plants. Many retailers now market plants as "Bee Friendly". These plants should never be treated with neonicotinoids, even during production.

Timing. When greenhouses are "opened up" for ventilation, for example side-walls rolled up, be aware of bee activity on plants, especially if pesticide applications are made during the day. Avoid applications when bees are actively foraging in a greenhouse. Make applications in the early morning, late in the day or at night when pollinators are not foraging. Control weeds under benches where bees may forage. Research in European farmland found evidence that honeybees on average forage 1 mile from their hives, but may travel up to 6 miles. Effects would likely be greatest on hives within 1 mile of treated areas and decline for hives further away, as fewer and fewer bees will reach treated areas from distant locations.

Formulation. Wettable powders, dusts and microencapsulated products have a greater toxic hazard than emulsifiable concentrates (or other liquid formulation with active ingredient in solution). Products that do not have acute toxicity but could cause injury to immature bees if carried back to the hive should not be applied in particulate form; this may include insect growth regulators.

Drying time before exposure. Some products are highly toxic when wet, but much less so after the pesticide is dried. Apply when there will be adequate drying time before pollinator activity.

Drift. If applying a pesticide in an outdoor production yard, avoid drift on non-target areas particularly onto clover and other flowering plants including weeds near the yard. Prior to treatment, mow weedy areas to reduce flowers that may be attractive to pollinators. Temperature inversion conditions, wind speed, application equipment characteristics and operator skill may influence drift.

Pesticide toxicity. Do not apply insecticides rated as 'High' or 'Moderate' directly to bees that are actively foraging on blooming crop or weeds. EPA registration includes an acute, single-dose laboratory study designed to determine the quantity of pesticide that causes 50% mortality (LD50) in a test population of bees.

Read the label for bee hazard rating

The EPA recently introduced a label change for insecticides used outdoors that contain one or more of the neonicotinoids in order to protect bees. Some of these pesticides are also be labeled for greenhouse use. Specifically, all insecticides which can be applied as outdoor foliar sprays (not granular) and contain the active ingredients chlothianidin, dinotefuran, imidacloprid or thiamethoxam will contain warning icons and directions for use to minimize impact on pollinators. The Bee Hazard warning (see below) will be placed in the Environmental Hazards section of the pesticide label.

The EPA bee toxicity groupings and label statements are as follows:

High (H) Bee acute toxicity rating: LD50 = 2 micrograms/bee or less. The label has the following statement: "This product is highly toxic to bees and other pollinating insects exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees or other pollinating insects are visiting the treatment area." If the residues phrase is not present, this indicates that the pesticide does not show extended residual toxicity.

Moderate (M) Product contains any active ingredient(s) with acute LD50 of greater than 2 micrograms/bee, but less than 11 micrograms/bee. Statement: "This product is moderately toxic to bees and other pollinating insects exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product if bees or other pollinating insects are visiting the treatment area."

Low (L) All others. No bee or pollinating insect caution required.

In addition, specific use restrictions are placed in the "Directions for Use section." See the full EPA text: http://www2.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides .

References and Resources

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- New England Vegetable Guide: Protecting Honeybees and Native Pollinators. https://nevegetable.org/protecting-honeybees-and-native-pollinators
- Pesticide Environmental Stewardship – Pollinator Protection. www.pesticidestewardship.org/PollinatorProtection
- Pesticide Task Force of the North American Pollinator Protection Campaign (NAPPC). www.Pollinator.org/nappc
- Pollinator Protection - EPA Actions to Protect Pollinators. www.epa.gov/opp00001/ecosystem/pollinator/risk-mgmt.html
- Stoner K. Planting Flowers for Bees in Connecticut. http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/entomology/planting_flowers_for_bees_in_connecticut.pdf
- Stoner K. Protecting Bees from Pesticides. http://www.ct.gov/caes/lib/caes/documents/publications/fact_sheets/entomology/protecting_pollinators_from_pesticides_-_fact_sheet_final.pdf
- The Xerces Society for Invertebrate Conservation. http://www.xerces.org/pollinator-conservation/
- USDA Report on the National Stakeholder Conference on Honey Bee Health, National Honey Bee Health Stakeholder Conference Steering Committee. 2013. http://www.ars.usda.gov/news/docs.htm?docid=15572
- White A. http://pollinatorgardens.org/

Fact Sheet available to be printed and distributed to home gardeners. "Protecting Honey Bees from Pesticides in Home Gardens and Landscapes" http://ag.umass.edu/fact-sheets/home-lawn-garden/protecting-bees-and-pollinators-pesticides-home-gardens-and-landscapes

Can Raising the Level (ppm N) of Liquid Organic Fertilizers Optimize Plant Growth Relative to Chemical Water-soluble Fertilizer?

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Many growers and researchers who try organic fertilizers see less growth with the organics compared to chemical water-soluble fertilizer when they applied at the same level (ppm N). The question is, would simply raising the level of the organic fertilizer stimulate plant growth enough to make up for the difference in growth compared to chemical fertilizer? This is an important question because the answer would affect the amount of fertilizer used (cost, waste, nutrient pollution) and the chance of injuring the plants (ammonium toxicity, high EC).

How the plants were grown

'First Lady' marigolds and 'Ringo 2000'seed geranium plugs sown 22 March 2014 were potted on 7 April and 17 April, respectively, in 4½-inch pots of Fafard 3B soilless mix. Plants were fertilized with 225 ppm N from Plantex (20-2-20) chemical fertilizer or Nature's Source (3-1-1) liquid plant extract fertilizer levels of 225, 250, 275 or 300 ppm N. Fertilizer was applied at every other watering or about twice a week. The marigold portion of the experiment ended 3 June and the geranium portion ended on 17 June. Plants height was measured on the day when the experiments ended.

Results

'Ringo 2000' geraniums. The tallest geraniums resulted from fertilizing with Plantex fertilizer (Table 1). Plantex plants were larger than plants fertilized with Nature's Source at the same level, 225 ppm N. Nature's Source plants increased in size with 275 and 300 ppm N, but plants were still markedly smaller than plants in the Plantex treatment. Flower bud development was not greatly affected by Nature's Source and no chlorosis due to ammonium toxicity developed on any of the geraniums.

Table 1. Plant height as affected by fertilizer and fertilizer level.

Fertilizer	ppm N	Geranium	Marigold
Plantex 20-2-20	225	14.3a	11.0^{ns}
Nature's Source 3-1-1	225	9.1d	10.4
Nature's Source 3-1-1	250	9.2d	10.7
Nature's Source 3-1-1	275	11.2bc	10.9
Nature's Source 3-1-1	300	10.3cd	11.2

Figure 1. Geranium fertilized with (L to R) Plantex 225 ppm N, Nature's Source 225 ppm N, Nature's Source 275 ppm N.

'First Lady' marigold. In past experiments, depending on the organic fertilizer, marigolds were either slightly smaller or significantly so than with chemical fertilizer. Here there were no differences in size between plants fertilized with Plantex and those with Nature's Source (Figure 2). Also, there were no increases in height or differences in appearance with fertilizer levels above 225. No abnormalities developed on plants fertilized with Nature's Source. In short, all of the marigolds turned out the same in this experiment.

Figure 2. (L to R). Plantex 225 ppm N, Nature's Source 225, 250, 275, and 300 ppm N.

Conclusions

In my opinion, the results of this experiment show that it's questionable practice to try raise the level of organic fertilizer to compensate for the reduced growth compared to chemical fertilizers often observed by growers and researchers. However, if you do it and feels it's a successful strategy in your greenhouse, carry on! In my work raising the level was partially successful with geraniums and not at all with marigold a plant, like many others, that responds well to Nature's Source fertilizer. Applying Nature's Source fertilizer to marigolds at levels above 225 would be a waste of fertilizer.

Another lesson from this experiment is that it's probably safe to say that how plants respond to current organic fertilizers is species-specific. Look at the difference between geraniums and marigolds in their response to Nature's Source fertilizer. This emphasizes the importance of trialing these new fertilizers on a small scale with the plants you grow before applying them to your whole crop.

Spray Coverage is Key for Effective Treatment Results in Greenhouse

Tom Dudek, Michigan State University Extension

Greenhouse growers need to understand proper spray application coverage when applying pesticides and growth regulators to ensure successful treatment results.

Greenhouse growers often are heard complaining that they aren't getting uniform control of an insect or dis ease, or that a plant growth regulator has been erratic- some plants affected, while others not at all or very little. Michigan State University Extension states that in many of these cases, the problem isn't the pesticide or plant growth regulator; it turns out that the material was not applied uniformly or didn't get to where the problem was located

.While many products will move from the top of a leaf to the bottom or from a leaf into the stem, it's unrealistic to expect these materials to move from one side of the plant to the other, from one leaf to another or from one plant to another. However, that's what must happen if foliar sprays or drenches aren't uniformly applied. Plant growth regulators like paclobutrazol (Bonzi, Piccolo, Paczol) and uniconazole (Sumagic) don't move out of leaves, but the site of action is the stem and meristem of the plant. Avid, an insecticide, moves from one surface of the leaf to the other, but not from leaf to leaf. Imidicloprid (Marathon, Mallet), another insecticide, moves up into the plant from roots, but not down from treated leaves . The control material you are applying must come into contact with the pest, or in the case of growth regulators, the growing sites, before anything good can occur.

Penetration into the leaf canopy of greenhouse crops can be a major headache. Unless there is very good air movement, when plants are widely spaced or the canopy hasn't yet filled in, foggers, air blast sprayers, smokes or spray applications that don't flip over leaves will deposit material mostly on the top surface of the upper leaves; relatively little penetrates deep into the canopy or to the underside of the lowest leaves. Changing the spray droplet does increase canopy penetration, but the leaves must still be flipped over by the force of the spray for optimal coverage of the lower surfaces. Applications must be made from several directions in or der to hit leaves shielded by other leaves or other plants. This type of application method will greatly improve insect and disease control in crops with dense canopies.

Droplet size is also a key to coverage of the plant surface and penetration into unfolding leaves and other hiding places. The smaller the average droplet size, the greater the coverage, and penetration. Droplet size is directly dependent upon the type of nozzle, the nozzle size and the pump pressure. Generally speaking, the higher the pump pressure, the greater the proportion of small drop- lets in the spray pattern. Growers need to check that the nozzles you're using are of the correct pattern and size, aren't worn and that the pump is providing the necessary pressure. Many growers change nozzles every year to insure good coverage. For good coverage of plant leaves, hollow cone nozzles are much better than flat fan nozzles. Also, watch for dripping nozzles because that means they are plugged.

Very small droplets tend to float in the air rather than fall out on to the leaf surface and don't move long distances. Larger droplets fall out readily and can be sprayed long distances, but don't cover the surface as well. While using a "hand gun" and spraying only from the center isle may be convenient for you, the plants on the outer edges of the houses are only being reached by very large droplets, so a great deal of the surface is wide open to pest attack.

Uniform application is also dependent upon the amount of the spray or drench used. Drenching with too small a volume of solution per container means that part of the media might not be saturated and any roots in this area won't take up the material. On the other hand, applying too much solution can cause overdosing and phytotoxicity. Applying ultra-concentrated materials is convenient because the application equipment is light and can be easily moved, but applying very small amounts of materials uniformly over large areas is tricky.

The bottom line is that no material will work as well as it could unless it is applied uniformly and to the proper area. Don't let the pressure of everything else that must be done this season cause you to take shortcuts in pesticide and growth regulator applications; you are really wasting valuable time and may put the crop at risk.

This article was published by Michigan State University Extension. For more information, visit http://www.msue.msu.edu. Be sure application method, application rate, and target pest are consistent with pesticide label use.

Chris Beytes, Keynote Speaker at Greenhouse Conference & Expo

Join Chris Betyes, Editor of GrowerTalks at the **Northeast Greenhouse Conference & Expo**, Thursday, November 6 at the Mass Mutual Center in Springfield, Massachusetts for his keynote presentation, "Acres Online Live."

Do you get the weekly email newsletter Acres Online from Chris Betyes? Almost 27,000 industry insiders from around the world depend on his news and insights to help them keep up with the fast-paced world of professional horticulture.

Chris combines 30 years of industry experience, professional journalism skills and a wry sense of humor to keep it informative, fact-filled and fun. And now he's live! In Acres Online Live, Chris will share the latest horticulture industry trends from around the world New England, North America and the world—the most timely information you need for the coming season. From downy mildew in the U.S., floral trends from Europe and more, Chris will cover the gamut. And you can expect a few things he wouldn't dare put in print!

For more information about the Northeast Greenhouse Conference & Expo and keynote presenter Chris Betyes, visit: www.negreenhouse.org.

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