A Publication of the UMass Extension Greenhouse Crops & Floriculture Program

Floral Notes Newsletter

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In This Issue

The issue begins on a sad note with an article on the passing of Paul J. Mahoney. This issue has announcements of two upcoming programs: Farm Succession School and from UMass Extension a program on spring pest management. Following, are educational articles on biological control, soluble salts in high tunnel soil, "biological products", how different types of fertilizers effect the growth and nitrate content of lettuce, and managing plants during cloudy weather.

Stockbridge School of Agriculture
Celebrating 100 Years

Upcoming Greenhouse Programs

Greenhouse Production 2019 - Focus on Pest Management
Date & Time: Wednesday, January 9, 2019, 9:30 AM – 3:30 PM
Location: Holiday Inn & Suites, 265 Lakeside Ave, Marlborough, MA (see next page)

Winter Flower Growers Program
Date: Tuesday, February 5, 2019
Location: Northeast Greenhouse & Nursery Supply, 8 Dearborn Rd, Peabody, MA

A full day educational program for greenhouse and floriculture businesses. Co-sponsored by the UMass Extension Greenhouse Crops and Floriculture Program and the Massachusetts Flower Growers Association. For more information, visit ag.umass.edu/greenhouse-floriculture or contact Geoffrey Njue (781)891 0650 x 12 or gnjue@umext.umass.edu, or Bob Luczai at (781) 275-4811 or bluczai@massflowergrowers.com

Paul J. Mahoney

Paul J. Mahoney of Winchester, passed away peacefully with his family by his side on September 30th, 2018 after a long illness. Paul is survived by his beloved wife Doris (Barbaro) of 59 years. Loving father to Paul Jr. and his wife Linda of West Tisbury, Peter of Wayland, Susan Covino of Winchester, Thomas and his wife Cindy of Winchester, Michael and his wife Nicola of Townsend, and Lauren Danaher of Winchester.

Paul was the cherished grandfather of Emily, Audrey and Julia Covino, Lorianne Wescott, Patrick Danaher, and Sean, Shannon, Brett, Russell, Morgan, Andrew, Molly, Trevor and Jack Mahoney and great-grandfather to Jack and Beckette Wescott.

Paul touched the lives of everyone he knew with his generous spirit, warm smile, and humble nature.

Born in 1935 to Charles B. and Martha Mahoney (Russell), Paul was the youngest sibling to Martha Logan of CA, Charles Mahoney of NH and was predeceased by Marie Donovan, Margaret C. Mahoney and Edward Russell Mahoney.

Paul was a 1953 graduate of Winchester High School and received a B.S. in Economics from Boston College in 1957. Paul served in the US Army after college before a brief stint as a high school history teacher at Boston Latin.

In 1959, Paul established the company that would ultimately become his lifelong passion: Mahoney's Garden Center. He grew a tiny roadside farm stand on Cambridge Street in Winchester selling vegetables, into a full-service garden center with seven locations throughout Eastern MA. Working alongside his children and grandchildren was the joy of his life. Paul's innovation and success in business made him an admired leader in the industry and a close friend to many of his colleagues. He will be forever remembered for his kind nature and generosity to his peers, employees, community and family.

Paul's other great passions were history and travel. He spent a lifetime exploring the world and experiencing new cultures and their history with his family and friends. Paul was a true patriot who loved his country dearly. He was active in many historical and military organizations, most notably the Ancient and Honorable Artillery Company of Massachusetts in which he was Captain Commanding in 1996-1997. With the Ancients, he was proud to travel the world and see it through a historical lens to honor those that came before him.

Throughout Paul's life, he marveled at the outdoors and immersed himself in the natural world. He was in his element in the woods of Nova Scotia, at peace boating in the waters of Cape Cod, and was most content skiing the mountains of Loon. Even after 83 years, Paul was still in awe of a beautiful sunset or the stars in a clear night sky.

Paul's remarkable life was always grounded by his strong Catholic faith, his love for his wife Doris and the time spent with his children and grandchildren. Paul will be remembered for living without pretension and embracing everything life had to offer, always living it to the fullest.

A burial service was held in Winchester on Saturday October 6th.

Greenhouse Production 2019 – Focus on Pest Management!

Wednesday January 9, 2019, 9:30 -3:30
Holiday Inn & Suites, 265 Lakeside Ave. Marlborough, MA

8:00 – 9:00 Registration and coffee/tea

9:00 – 10:00 Strategies for success with biological control – forecasting, quality control and storage *Ronald Valentin, Head Technical Support – North America, Bioline AgroSciences*
For successful biological control program timing of application, quality control and storage of the biological control agents (BCAs) is very important. In this presentation Ron will discuss how to forecast for BCAs needed, how to assess the quality and how to properly store the BCAs.

10:00 – 10:10 Break

10:10 – 11:10 Strategies for success with biological control – forecasting, quality control and storage Continued….. *Ronald Valentin, Head Technical Support – North America, Bioline AgroSciences*

11:15 – 12:15 Top 5 troublesome insect and mite pests, plus some dishonorable mentions
Dr. John Sanderson, Associate Professor of Entomology, Cornell University

This presentation will discuss the identification and control of major insect and mite pests of greenhouse crops including, aphids, thrips, mites (spider mites and broad mites), fungus gnats and whiteflies and brief mention of others. The discussion will also include tips on the most effective approaches to manage these pests.

12:15 – 1:15 Lunch on your own and networking

1:15 – 2:15 Using mineral nutrition to prevent diseases in greenhouse crops
Dr. Wade Elmer, Dept. Head, Plant Pathology and Ecology, Connecticut Agricultural Experiment Station
Mineral nutrients are essential for growth of plants and are important in plant-disease interactions.
Dr. Elmer will discuss how mineral nutrients affect plant response to disease

2:15 – 3:15 Utilizing Biofungicides to manage diseases in greenhouse crops
Dr. Anissa.Poleatewich, Assistant Professor, University of New Hampshire

Integrated pest management (IPM) is the new normal in greenhouse. Microbes and other biofungicides are now playing and important role in IPM for managing diseases of greenhouse crops. In this presentation, Dr. Poleatewich will discuss biological control of plant diseases in the greenhouse highlighting available biofungicide products.

4 Pesticide Credits requested. For more information contact:
Geoffrey Njue, Univ. of Mass, Waltham (781) 891-0650 x 12, gnjue@umext.umass.edu

Thinking About Starting a Biological Control Program in Your Greenhouse?

Angela Madeiras
UMass Extension Plant Diagnostic Lab
Amherst

Next season may seem may seem a long way off, but greenhouse growers will find themselves planning for spring of 2019 soon! While some of you may have biocontrol programs in place, others may be considering biocontrol for the first time. If you are one of the latter, be aware that implementing a biocontrol program takes planning, commitment, and a willingness to experiment. You should also know that biocontrol programs work best as part of an integrated pest management approach that includes good cultural practices. It can take some time and experience to develop a successful biocontrol program, but the potential rewards are many.

Before you take the plunge, here are a few things to consider:

- Start with a clean greenhouse. Sanitation is one of the keys to preventing insect and disease problems from becoming unmanageable. Good sanitation practices include cleaning surfaces and structures, removing debris, careful examination of plant material before it is brought in, and managing weeds, both inside and outside of the greenhouse.
- Know your enemies. Identify the insect pests you want to manage. Understand their habits and life cycles.
- Know your friends. Learn to identify common biocontrol agents (BCAs) used in greenhouses. Understand their life cycles and the conditions they need in order to do their jobs well. Extension fact sheets and biocontrol company websites provide a great deal of information.
- Establish a relationship with a reputable BCA supplier. The Biological Products Industry Alliance (BPIA) website provides a list of its member companies: see https://www.bpia.org/
- Start releasing BCAs as soon as you bring new plant material into the greenhouse. A good biological control program is designed to prevent insect pest epidemics from occurring. Have your troops in place before the enemy arrives.
- Know what your suppliers are spraying. If you buy in plug trays or other plant material, ask your suppliers what pesticides they use. Some pesticide residues may be harmful to BCAs.
- Scouting is an important part of a good biocontrol program. Scout crops regularly and keep records. Keep an eye on the populations of both pests and BCAs in the greenhouse. Records will help you make the decisions by which you will refine your program.

Your peers in the greenhouse industry are also good sources of information. If you know growers who have experience with biocontrol, ask them for advice.

Lastly: watch this space! We will be publishing more articles about biocontrol in the coming months.

High Soluble Salts in High Tunnel Soil

A sample from a floriculture crop growing in a high tunnel was recently submitted to the UMass Extension Plant Diagnostic Lab. The plants were stunted, leaves were turning yellow and brown, and flower stems were shriveled near the blossoms. No rot was observed in the crowns of the plants. Roots were dry and brittle. No pathogens were observed on microscopic examination. Roots were cultured on selective media, but no pathogenic organisms grew out. No *Botrytis* or other pathogens were observed in the flower stalks.

The soil accompanying the plant sample had a pH of 6.3 and electrical conductivity (EC) of 4.5 mS/cm (measured by 1:2 method). This EC value is very high and indicates that high soluble salts in the growing medium are most likely responsible for the symptoms observed.

Salts may accumulate through irrigation water that is high in salts, or by run-off from areas where road salt is used in winter. Soluble salts are also introduced to growing media whenever fertilizers are applied. Calcium, magnesium, sodium, chloride, sulfate, and bicarbonate salts are among the most common found in growing media.

It is important to note that soluble salts accumulate more rapidly in high tunnel and greenhouse media than in field soil, as exposure to rainfall dilutes salts and flushes them out of the root zone in the case of field soil. If salts are allowed to accumulate to levels beyond the optimum range for a crop, plant roots can be injured or impaired, plants may become stunted or wilted, and leaves may turn yellow or brown.

Suggestions for managing EC in high tunnel soil include:

Regular monitoring of EC and pH. This can help growers understand the effects that management practices are having on the soil. Many greenhouse and high tunnel growers choose to purchase portable pH and EC meters for their businesses. For information on interpretation of EC values, please see https://ag.umass.edu/greenhouse-floriculture/fact-sheets/soluble-salts-electrical-conductivity-ec-for-greenhouse-crops

Reconsidering the fertilizer program. Avoid fertilizers with high soluble salts, such as animal manure. For more information on choosing organic fertilizers, see https://ag.umass.edu/greenhouse-floriculture/fact-sheets/organic-fertilizers-thoughts-on-using-liquid-organic-fertilizers

If the EC of the growing medium is too high, it should be flushed well with clear water to the extent reasonable. According to the Western Fertilizer Handbook (8th Edition) applying 6 inches of water will leach approximately 50% of the salts; 12 inches will leach about 80%.

High soluble salts may occur in conjunction with nutrient imbalances such as ammonium toxicity. After flushing with clear water, the medium should be re-tested for EC, pH, and nutrient status. For information on submitting a soil sample to the UMass Soil and Plant Tissue Testing Lab, see http://ag.umass.edu/services/soil-plant-nutrient-testing-laboratory

Angela Madeiras, Extension Educator & Diagnostician, UMass Extension Plant Diagnostic Lab
May 10, 2018

Biocontrols, Biopesticides, Biostimulants, Oh My!

Amara Dunn, New York State IPM Program

Editors Note: This article was originally published in the June 2018 issue of Agricultural News, a publication of Cornell Coop. Ext.of Suffolk County, NY.

There are a lot of different "biological" products on the market. Frankly, the terms used to describe them can be a little confusing. So let's take a closer look at a few terms and exactly what they mean.

First, what is a pesticide? According to the Cornell Pesticide Management Education Program http://pmep. cce.comell.edul, "a pesticide is any substance or mixture of substances used to kill pests or to prevent or reduce the damage pests cause" . Pesticides include repellents, but exclude traps (if they are only mechanical or physical) . The important point is that pesticides are defined by their purpose, not by their ingredients. Pesticides may be chemicals, plant extracts, or microorganisms, but their purpose is to prevent pest damage. Pesticides are regulated by the Environmental Protection Agency (EPA), and must always be used according to their labels.

"Biopesticide" is a term defined by the EPA (https:11 www.epo.govlingredients-used-pesticide-productsl what-are-biopesticides) as "certain types of pesticides derived from such natural materials as animals, plants, bacteria, and certain minerals ," All biopesticides are pesticides, and must be handled and applied as such. They fall into one of three groups:

- Microbial - active ingredient is a living microorganism (fungi, bacteria, viruses, protozoa) or a product made by a microorganism
- Biochemical - natural compounds including both plant extracts and naturally-occurring chemicals
- Plant-incorporated protectants - the products that result from inserting new genes into plants (i .e., the result of genetic engineering)

Biopesticides control pests or prevent pest damage in four ways:

1 . Consuming or parasitizing the pest, directly - An example of this is a beneficial fungus that eats a pest fungus, or a beneficial fungus that infects and kills a pest insect.

2 . Poisoning the pest - Some microorganisms produce antibiotics that are toxic to pests. There are numerous bacteria that do this.

3 . Crowd out the pest - Pest microorganisms (pathogens) can't colonize and invade a plant if the surface of the plant (leaves, roots, etc.) are already covered with beneficial microorganisms. There just isn't space.

4 . Stimulating plant defenses - Although very different from human immune systems, plants do practice self-defense. Beneficial microorganisms can cause plants to "turn on" their defenses before they encounter a pest. The plant is then less likely to be damaged by the pest.

Sometimes a single biopesticide functions in more than one of the above ways. But, again, the purpose of using a biopesticide is to control a pest. Biostimulants have a different primary purpose: enhancing plant health (which can lead to the plant being less susceptible to attack by a pest). The European Biostimulants Industry Council has defined a biostimulant as "containing

substance(s) and/or microorganisms [e.g., bacteria and fungi] whose function when applied to plants or the rhizosphere [soil surrounding plant roots] is to stimulate natural processes to enhance/benefit nutrient uptake, nutrient efficiency, tolerance to abiotic [non-biological] stress, and crop quality." This definition is also supported by the Biological Products Industry Alliance http://www.bpia.org/solutions-provided-by-biological-products-biostimulants/. No regulatory definition of biostimulant currently exists in the United States . Biostimulants are registered either as fertilizers or as biopesticides, depending on the claims (pest control vs . plant health enhancement) made by the registrant.

Biostimulants can include a wide variety of ingredients, which can be placed in the following four categories:

- Microorganisms (e ,g., fungi and bacteria)
- Extracts from plants or seaweed
- Organic (i .e., carbon-containing) molecules including various components of soil organic matter
- Inorganic (i .e., not carbon-containing) elements or molecules

Biostimulants can enhance plant health in multiple ways. In some cases, scientists don't yet know how a biostimulant enhances plant health, just that it does. Like biopesticides, a biostimulant may have more than one of the following modes of action:

1 . Improve soil quality by impacting soil characteristics like water holding capacity, structure, or aeration

2. Improve plant access to nutrients already present in the soil

3 . Stimulate plant defenses or otherwise increase the plant's tolerance to stress (from biological or nonbiological sources)

4 . Improve root growth of the plant (so that the plant can take up nutrients better)

5 . Improve the quality of something produced from or by the plant (e.g., improved flavor or nutrition of fruit)

And where does biocontrol fit in? In several places on this blog, I have noted that definitions of biocontrol vary. I think most scientists who study biocontrol would agree that a living microorganism that is applied to the soil or to a plant and that consumes or parasitizes a pest (a type of biopesticide) is a biocontrol agent. But there are lots of gray areas. What if the biopesticide contains only products ofthe microorganism which are antagonistic to the pest, and no living organisms? If a microbial biostimulant enables a plantto more efficiently take up nutrients, making the plant more tolerant of stress (whether from an abiotic source like drought,or a biotic source like a pathogen that causes disease) is that still biocontrol?

These are debates I'd rather not spend a lot of time on (at least on this blog). Suffice it to say that at least some biopesticides and at least some biostimulants are also considered types of biocontrol. There are a lot of biological products available to you. Exactly how each is classified (biostimulant versus biopesticide) makes a difference in how the product can be legally used. Know what you are using and why. And always, always, always read and follow the label! **This article was originally published in Biocontrol Bytes, to subscribe to the Biocontrol Bytes Blog, visit: https:// blogs.cornell.edu/biocontrolbytes/**

Nitrate Accumulation and Growth of Lettuce Under Commercial Organic and Chemical Fertilizer Solutions

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Discussion

One of the earliest and most standard hydroponic solutions is Hoagland and Arnon solution. As growers know, organic solutions unlike chemical solutions are not readily available for crop production in hydroponics. Organic solutions are often a mixture of organic compounds that are optimized only for nitrogen (N), Phosphorus (P), and potassium (K).

Vegetables such as lettuce show a pronounced yield and quality response to fertilizers. Although nitrogen is necessary in lettuce growth, high accumulations of nitrate are shown in lettuce leaves with optimum N nutrition. In fact, high intake of nitrate is reported to be a potential human health hazard. The accumulation of nitrate in lettuce strongly depends on N source and release time and happens due to imbalances between nitrate uptake and its reduction to ammonia. Lettuce head morphology also causes differences in mineral nutrient accumulation.

Varieties with phenotypes of iceberg ('Caretaker'), romaine ('Arroyo'), butterhead ('Buttercrunch'), and loose leaf ('Bergam's Green') are the most consumed types of lettuce in the USA. There is a need for out-of-season and higher quality vegetable production in greenhouses. As such, it is important to know the responses of iceberg, romaine, butterhead, and loose-leaf lettuce cultivars produced with an organic liquid fertilizer or with Hoagland and Arnon solution in greenhouse production.

Results

The results of the experiment show that Hoagland and Arnon (HOAG) solution gave a 67% increase in yield compared to organic fertilizer (OF) and a 90% increase compared with an unfertilized treatment (UNF). Low nitrate under organic fertilization resulted in high quality lettuce for human nutrition. HOAG solution resulted in the highest nitrate accumulation in lettuce (Table 1) and in the highest yields (Figure 1). The varieties with the most nitrate accumulation were 'Bergam's Green' and 'Buttercrunch' (Table 1). These varieties are loose leaf or loose head compared to 'Arroyo' or 'Caretaker', which have a tighter head morphology.

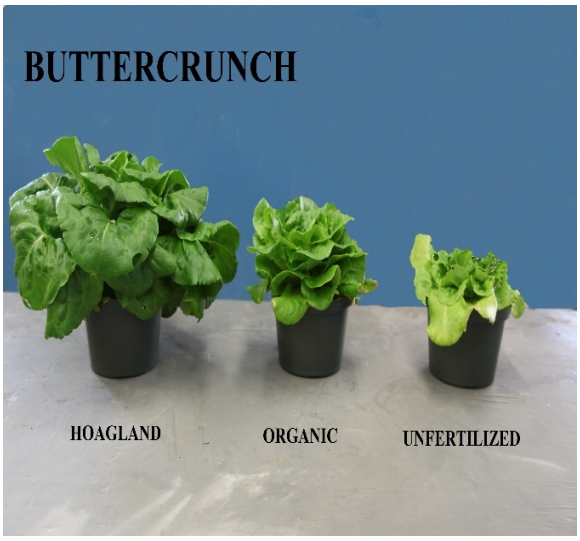
Discussion

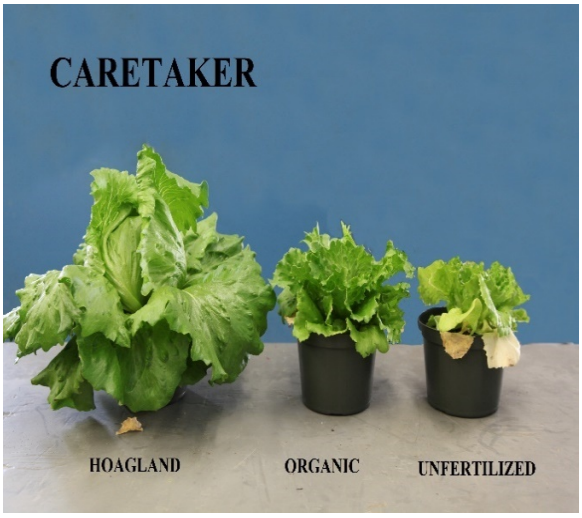
The experiment conducted highlights that nutrients are soluble and immediately available for uptake by lettuce under application of Hoagland and Arnon solution. Specifically nitrate-N can be accumulated to a very significant level in the lettuce leaf tissue. Organic liquid fertilizer in this study (Earth Juice Grow, 2-1-1, Hydro-Organics, Chico, California) resulted in significantly lower biomass and, except for P, lower nutrient content than Hoagland and Arnon solution. Although in a liquid form, nutrient release with the organic fertilizer was too slow to meet lettuce demand. However, low nitrate under organic fertilization resulted in high quality lettuce for human nutrition.

Table 1. Nitrate-N concentration in lettuce leaves as affected by fertilizer type and variety.

Variety	UNF	OF	HOAG	Mean
Nitrate-N mg/kg				
Arroyo	24	57	8,858	2,980b
Buttercrunch	36	66	9,967	3,356a
Bergam's Green	36	44	10.205	3,425a
Caretaker	24	30	8,657	2,904b
Mean	27b	50b	9,422a	

Means of rows are averages of cultivar and means of columns are averages of fertilizers (no fertilization (UNF) or by fertilization with organic fertilizer (OF) or Hoagland and Arnon solution (HOAG). Means followed by different letters in rows or in columns are significantly different by Duncan's New Multiple Range Test (P=0.05).





Cloudy Weather Greenhouse Tips

Here are some management tips especially important for periods of cloudy, inclement weather:

Clean Plants: Keep plants in retail areas clean. Remove dead and injured plants and spent flowers a couple times a day even during the busy season. *Botrytis* and high ethylene concentrations from decaying plant tissue will cause premature loss of foliage and flowers.

Water sparingly: Let plants run on the dry side and spot water areas as needed to prevent over-watering. Avoid watering late in the day or when water will sit on leaf surfaces for long periods of time.

Lower humidity levels in greenhouses to minimize *Botrytis*: Heat and vent greenhouses to lower humidity levels. See: Reducing Humidity in Greenhouses.

Switch fertilizers temporarily: To prevent ammonium toxicity, use fertilizer with 40 percent or less ammoniacal nitrogen when growing conditions are cool and wet. A common strategy used by growers is to alternate to a 15-0-15 Dark Weather Formula. This eliminates the extra ammonium input temporarily, but then allows growers to return to their normal formula when growing conditions improve.

Cool temperatures (less than 60°F average daily temperature), water-saturated (low oxygen) growing media, and low medium pH can cause ammonium to build up to toxic levels in the growing medium. Symptoms of ammonium toxicity include upward or downward curling of lower leaves depending on plant species; and yellowing between the veins of older leaves which can progress to necrosis. Reference: Nitrogen: Not All Forms are Equal, by Cornell University.

Be aware of pesticide phytotoxicity and activity: Some pesticides such as horticultural oil and neem oil will cause phytoxicity if it remains wet on the foliage. Read pesticide label precautions.

Fungicides (for root disease) will work more slowly in cool media. It may take longer to see results of an application or an application may be less effective.

Apply beneficial nematodes: A cloudy or rainy day is an ideal time to apply beneficial nematodes (Steinernema feltiae) for fungus gnats and thrips as nematodes are very sensitive to UV light and desiccation. Consider adding a compatible biofungicide such as Cease to the nematode application to prevent *Botrytis*. Note that Decree (fenhexamid) is not listed on compatibility charts. Check nematode pesticide compatibility charts.

Late season fungicides for *Botrytis*: Decree (fenhexamid) with capsil is still many grower's first choice in terms of plant safety based on past grower experiences. Note that Decree resistance has been reported. To prevent resistance, the label recommends not making make more than two consecutive applications and after the second application, using an alternative fungicide effective in controlling *Botrytis* for two applications before reapplying the active ingredient in Decree. The label also states not to use lower rates than is recommended.

Decree will perform better with a surfactant such as CapSil added (8 oz per 100 gallons or ½ teaspoon per gallon) to increase coverage and reduce visible residue. Considering plant safety and residue as of primary concern, other possible alternatives that growers are using are CEASE (*Bacillus subtilis* QST 713 strain) and Affirm (previously Veranda O) (polyoxin D zinc salt).

Tina Smith, UMass Extension and Leanne Pundt, UConn Extension