The MAYFLOWER & Floral Notes

A Joint Publication
Massachusetts Flower Growers' Association
& UMass Extension

April 2015

"Retailer to Retailer"

Greenhouse Pest Management and Biological Control

April 7, 2015
1:00 PM - 3:30 PM
Volante Farms, 292 Forest St. Needham, MA

1:00	Introductions How Volante Farms is Using Biocontrol in Retail Greenhouses
1:30 - 3:00	Tour and Demonstrations
3:00 - 3:30	Q&A and Discussion

Many wholesale growers of spring crops are now using biological control such as predatory mites and parasitic wasps to manage pests in their greenhouses. Pests are best managed in retail greenhouses when biocontrol agents continue to be applied to plants especially if plants are being finished or grown for several weeks.

Grower to grower meetings are a way to learn from each other about things that work and things that don't. There is limited space, registration on first come first serve basis.

Volante Farms is a family-run farm stand and garden center. Their retail greenhouse is a 16,000 sq. ft. gutter-connected greenhouse with efficient features including rainwater collection, heated floor and shade curtains and they use biological control to manage pests. Our host will be Dave Volante. Dave will demonstrate using beneficial nematodes, management strategies for aphids, thrips and mite and discuss their monitoring techniques.

PESTICIDE RECERTIFICATION credits have been requested. Coffee and light refreshments will be available. Register by mail using the form on the last page of this newsletter or on-line www.extension.umass.edu/floriculture/ (Note that additional fees apply for on-line registration).

Biological Control Conference

June 18, 2015 Young Building, UConn Storrs, CT

Learn more about evaluating you biological control program, using biological controls in outdoor production areas and conservatories, and biocontrol of fungal and bacterial diseases.

Featured Speakers

- Margery Daughtrey, Cornell University
- Suzanne Wainwright-Evans, Buglady Consulting
- Grant Jones, IPM Specialist, Longwood Gardens

Pesticide recertification credits will be available (pending state approval). More details coming soon!

Calibrate Your Fertilizer Injector

Geoffery Njue
Extension Educator
UMass Extension
E. Wareham

Fertilizer injector calibration is an important part of nutrient management in greenhouse production. It's important to check the calibration of your fertilizer injector before the growing season. Injector calibrations take only a few minutes, but a fertilizer injector out of calibration can cause nutrient deficiencies if it is not supplying an adequate amount of fertilizer. Conversely, if the injector is putting out too much fertilizer, it will waste money, may have adverse environmental impacts, and may lead to nutrient toxicities.

There are two common calibration methods: the flow method and the EC (electrical conductivity) method. The flow method is a physical calibration, where the amount of stock solution taken up by the injector is compared to the amount of diluted fertilizer discharged. The EC method checks the concentration of soluble salts in the discharged water containing diluted fertilizer. Below are the steps to follow for both methods.

Flow method
Injector ratio = diluted volume/stock volume
Place 500 ml of stock solution in a graduated cylinder.
Remove all air bubbles from injector lead and place lead in graduated cylinder.
Run water through the injector, collecting fertilizer in a large container to a known volume (eg., 5 gallons; larger quantities for high ratios).
Measure how much stock solution was used (in ml).
Convert diluted volume to ml.
Divide diluted volume by stock volume.
Injector ratio calculated should be within 1% to 2% of the setting on your injector.
Example: Injector ratio = 18,925 ml (5 gallons)/94 ml (amount of stock used) = 201

EC Method
Calibrate EC meter.
Measure EC of clear irrigation water.
Measure EC of irrigation water at the end of the hose after injector.
Subtract EC of irrigation water from EC of fertilizer.
Refer to fertilizer label.

Example: You want to apply 200 ppm of Jack's Professional 20-3-19 Petunia FeED Plus Mg. The clear irrigation water has and EC of 0.12, and irrigation water at the end of the hose after the injector has and EC of 1.40. So 1.40 – 0.12 = 1.28.

Cross-reference the values from the table on your bag of fertilizer with the value you calculated from the EC values.

		Injector Setting		
Desired N level	**1:15**	**1:100**	**1:200**	**EC values (mmhos)**
50 ppm	0.50	3.38	6.75	0.32
100 ppm	1.00	6.75	13.50	0.64
200 ppm	2.00	13.50	27.00	1.28

From the label of Jack's Professional 20-3-19 Petunia FeED Plus Mg. Each fertilizer is different; refer to the table specific to your fertilizer. If the EC of the solution isn't correct, then check if you have a problem with the dilution ratio. For example, if your dilution ratio is 1:100, take 10 ml from the stock solution and add it to 1 liter of water. If the EC is what you expect, then adjust your injector up or down until you get the right EC. If the dilution is wrong, make sure to add the right amount of fertilizer per volume of water to obtain the correct ppm concentration shown on the fertilizer bag.

Transport of Privately-owned Houseplants Into and Out of Massachusetts

What are considered houseplants? Privately owned house plants are commonly small quantities of tropical and subtropical, ornamental plants grown in indoor settings, in the possession of private owners or their agents (including commercial moving companies), and not intended for resale.

What specific state authority applies transporting house plants to another state or into Massachusetts? Massachusetts Department of Agricultural Resources (MDAR)

Transporting Houseplants from Massachusetts into a Different State

Houseplants grown indoors

When houseplants are moved from Massachusetts to another state, the houseplants are required to be inspected by the Massachusetts Department of Agricultural Resources (MDAR) to ensure that they are free of pests. If houseplants were maintained indoors, the procedure to certify the plants is pretty simple. One week prior to moving, contact the state plant inspector, Phyllis Michalewich (MDAR) at 617-626-1801, email: Phyllis.Michalewich@state.ma.us . The plant inspector will make arrangements to inspect the plants and provide an inspection form certifying that plants are free of pests. The form will be needed when moving the plants into the destination state. Place the plants in a convenient place when moving, because inspectors will want to observe the plants at the border.

Houseplants grown outdoors

Sometimes houseplants are grown outdoors for part of the year. If houseplants were growing outdoors, then additional measures may be needed depending on the destination state.

Two pests in Massachusetts that are of concern for some states are Japanese beetles and Gypsy moths. To prevent movement of pests from Massachusetts to another state, the destination state may have special requirements. For some destination states such as California, plants that have been growing outdoors in Massachusetts will need to be shipped either bare-root (without soil or growing medium) or the growing medium will need to be treated with a pesticide and the treatment witnessed by a state plant inspector. The pesticide treatment is a safety precaution to prevent movement of injurious pests. Once treated, the inspector will issue a state phytosanitary certificate. The National Plant Board is a non-profit organization of the plant pest regulatory agencies of each of state and can provide guidelines for each state: http://nationalplantboard.org/index.html

Transporting Houseplants into Massachusetts

When bringing houseplants into Massachusetts, The Department of Agriculture in your current state should maintain a summary of the regulations affecting the movement of plant material into Massachusetts.

Preparing Houseplants (in containers) for Transport

Growing media should be thoroughly moist before packing plants. Place pots in individual plastic bags, pull bag up around the container and tie with a twist tie or string around the crown of the plant. This will prevent media from spilling. Pull the plastic bag down away from the foliage so the

foliage is exposed and dry to prevent foliage from rotting. Pack plants as tight as possible in shipping box. Use crumpled newspaper around plants as filler so the plants cannot move around in the box. Winter travel is risky for plants, depending on the length of time in transit, destination and temperature of the truck. There is risk for chilling injury to plants if they are shipped in an unheated truck. During summer months, closed trucks on hot days may stress houseplants, resulting in scorch leaves on plants. The crumpled newspapers may help insulate plants.

Preparing Bare Root Houseplants for Transport

To remove a plant from a pot, tip the pot upside down and tap on the bottom of the pot. Working a knife around the perimeter of the pot between the pot and outer edges of the root ball can also help. Once removed, gently loosen the growing medium around the root system with your fingers. This works best when the growing medium is not wet. Dip the roots in a bucket of water to dislodge remaining growing medium and thoroughly moisten the roots. Wrap the bare roots, (not foliage) in damp paper towels. Gently squeeze out excess water.

Place the moistened roots into a plastic bag, pull the bag up around the root ball and tie with twist tie, string or rubber band around the crown of the plant (at the top of root ball). Pull the plastic bag down away from the foliage so the foliage is exposed and dry. It is important to have dry foliage. Plants with wet foliage will rot in transit. Next, place the plants into a shipping box. Use crumpled newspaper around plants as filler so the plants cannot move around in the box.

A Publication of the UMass Extension Greenhouse Crops & Floriculture Program

Floral Notes Newsletter

Volume 27, No. 5 http://extension.umass.edu/floriculture March-April 2015

In This Issue

Controlling Aphids this Spring

Aphids (foxglove and green peach and melon) are being found on the usual suspects such as fuchsia, greens and vegetative cuttings. While aphids generally have more offspring and develop faster at warmer temperatures, foxglove aphids are a problem during cooler temperatures, 50-77°F, and are most likely a problem in spring production, so it is important to be on the lookout and monitor your crop regularly. Look for signs of aphids, such as white cast skins on the leaves, honeydew, and curled, deformed leaves, and be sure to check the underside of leaves.

Foxglove aphids tend to cause more leaf distortion than some other aphids. Foxglove aphids have black lines on the legs and antennae and dark green spots at the rear of their body which distinguishes them from green peach aphids. *Aphidius ervi* has been used by some growers against foxglove and potato aphid. *Beauveria bassiana* (Mycotrol O) is also being used. This entomopathegenic fungi generally works better under high humidity situations (i.e. 2-3 days over 90%).

Cyantraniliprole (Mainspring) (MOA 2) is a new translaminar and systemic (non-neonicotinoid) pesticide listed for aphids. Insects stop feeding and become paralyzed after ingestion. It is best used as a preventative. Another new material listed for aphids is the microbial insecticide, *Chromobacterium substsugae strain PRAA4-1* (Grandevo PTO). Grandevo is a contact insecticide and works primarily as a stomach poison, so it must be ingested to be effective. Grandeveo is more effective on newly hatch larvae and nymph stages. For a list of products to manage aphids, see the New England Pest Management Guide or greenhousepestguide (UMass and UConn web-based app).

Tina Smith, UMass Extension and Leanne Pundt, UConn Extension

Managing Downy Mildew of Basil in 2015

Adapted by Tina Smith, UMass Extension from article published in UMass Extension Vegetable Notes, Jan. 15, 2015 by Susan B. Scheufele, Robert L. Wick and M. Bess Dicklow, UMass Extension

2014 was the worst year for basil downy mildew that we've experienced in the Northeast since the disease was introduced to the US in 2007. This was, partially due to the distribution of infected transplants nationally and widespread planting of infected material that led to earlier than usual disease and high levels of inoculum in the environment. Here are some recommendations for reducing the impacts of this disease in 2015.

Disease Spread. Basil downy mildew is caused by the oomycete, *Peronospora belbahrii*, (not the same as Impatiens Downy Mildew). It is an obligate parasite, meaning that it cannot survive outside of a living host. It does not produce overwintering oospores, but survives from year to year on living plants where basil production occurs year round, such as in Florida. From these sites the pathogen spreads via wind-dispersed sporangia that can travel great distances due to their dark pigmentation, which protects them from UV radiation. There is also evidence that the disease can be spread by contaminated seed, though we do not yet understand how this occurs and how important contaminated seed is as a source of primary inoculum.

Symptoms. Early symptoms can be mistaken for a nutritional deficiency. Infected leaves develop diffuse, but vein-delimited yellowing on the top of the leaf and a characteristic fuzzy, dark gray growth on the underside of the leaves, which may be mistaken for soil splashed onto the leaf under-surface, however, close inspection with a hand lens will show the sporangia. More photographs of the signs and symptoms are available at: http://vegetablemdonline.ppath.cornell.edu/NewsArticles/BasilDowny.html

Management Recommendations. Purchase seed or plugs from reliable sources. We know that the pathogen may be seed borne, but the mechanisms involved are not well known and testing is difficult. Since *Peronospora belbahrii* requires a living host, it cannot be grown in a lab culture, making it more difficult to test for presence of the pathogen on or in seed. Seed testing of any pathogen is only a proxy, since you can't test all of your seed. Any sample you submit for testing may not be wholly representative of the seed lot, leading to false negatives. Therefore, our recommendation is to buy seed from a trusted source. Talk with your seed supplier about how the seed was produced, if it has been tested and also if the variety exhibits any resistance to the pathogen.

Do not buy plugs/transplants that were grown in the south where the disease starts earlier. If you purchase plugs or transplants, inspect them carefully upon arrival.

During greenhouse production: Monitor plants at least once a week. Once plants become infected the disease is inside the plant and fungicides will not be effective. Once detected, remove infected plants or seedling trays and treat adjacent plants.

Reduce humidity and leaf wetness in the greenhouse by heating and venting greenhouses– especially when warm days are followed by cool nights. Use HAF fans to improve air flow in greenhouses. Irrigate plants in the morning so foliage dries or use sub/drip-irrigation rather than overhead. Provide space between plants to allow for air circulation.

Advice for garden retailers: Inform customers about this disease, in particular the fact that it starts from spores that can be wind dispersed long distances, therefore it is difficult to avoid on plants grown outdoors. Dr. Meg McGrath, Cornell University suggests encouraging home gardeners to grow some

plants in containers that can be brought inside when humidity outside is high (overnight and on rainy days). The pathogen needs at least 85% relative humidity to be able to infect.

Basil planted outdoors in the ground should be planted and harvest early. The pathogen tends to arrive in MA around mid-July. Last year the disease occurred earlier (June 22) because of the early, widespread distribution of infected plants from nurseries further south. Keep track of where the disease is being found via pest alerts in UMass Extension Veg Notes and via the basil downy mildew monitoring program (Google Docs spreadsheet) that Meg McGrath at Cornell University has put together and maintains, accessible here: http://vegetablemdonline.ppath.cornell.edu/NewsArticles/BasilDowny.html

Basil downy mildew is not soil-borne so it will not stay in the soil. Advise home gardeners to plant in well-drained sites with good air circulation; orient rows parallel to the prevailing winds; control weeds; increase plant spacing; and harvest/prune so as to improve airflow through/around plants if practical.

Relative susceptibility of basil cultivars. All sweet basil (*Ocimum basilicum*) cultivars such as 'Genovese,' 'Italian large leaf,' 'Poppy Joe' and 'Nufar' are very susceptible to downy mildew. The least susceptible basils included the lemon and spice types such as *O. x citriodorum* and *O. americanum* , cultivars , 'Lemon Std', 'Lemon', 'Lime', 'Spice', 'Blue Spice' and 'Blue Spice Fil'. There are no cultivars with resistance to basil downy mildew. Efforts to breed new basil varieties with resistance to downy mildew are ongoing at Rutgers University. 'Eleonora' (available from Johnny's Seeds) is a cross of Thai basil and sweet basil with "intermediate" resistance. Thai basil has a higher disease tolerance, while sweet basil has the more desirable flavor, though some of that spicier Thai basil flavor does carryover in this cross. 'Eleonora' also has flatter leaves and a more open habit which contributes to disease tolerance. Resistant varieties are one important piece of the puzzle, but will need to be used as part of an integrated management plan incorporating cultural practices and chemical controls to effectively manage this disease.

Chemical control. Pay close attention to labels. Basil is a minor crop and is not always found on pesticide labels. Research trials have shown that the phosphite fungicides (eg. K-Phite, Prophyt, Fungi-phite) are among the most effective chemical controls. Other effective materials include mandipropamid (eg. Revus), cyazofamid (eg. Ranman) and Azoxystrobin (eg. Quadris).

OMRI-approved products labeled for basil downy mildew for organic production include potassium bicarbonate (MilStop), hydrogen dioxide (OxiDate 2.0), *Streptomyces lydicus* (Actinovate), *Reynoutria sachalinensis* (Regalia) and neem oil (Trilogy). There is not strong efficacy data for these materials and they should be used as part of an integrated plan. Be sure to make applications preventatively (scout under leaves, follow pest alerts) and keep up regular sprays.

Reference: Tips for Managing Downy Mildew of Basil in 2015
http://ag.umass.edu/sites/ag.umass.edu/files/newsletters/vegnotes-01-15-2015.pdf

Also, read an interview with Rob Wick, UMass here:
http://awaytogarden.com/basil-pressure-fight-devastating-downy-mildew/

Using PGRs for Height Control of Spring Crops

Douglas Cox
Stockbridge School of Agriculture
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Spring greenhouse crop growers often look for a way to control the height or size of their plants. Height or "stretch" can be controlled by chemical PGRs, DIF or DIP methods of temperature control, pruning or shearing, low phosphorus fertilization, controlled irrigation, careful variety selection and scheduling, and photoselective greenhouse plastic. Of these the most popular and reliable methods are chemical PGRs, the subject of this article, and DIF or DIP.

Chemical plant growth retardants (PGRs) are very useful tools for controlling the height of bedding plants and despite the current aversion to chemicals, PGRs remain the first choice of most growers. This article outlines what chemicals are available for spring crops, how they are applied, and some of the factors which affect the success of their use. For more information consult the growth regulator section of the most recent *New England Greenhouse Floriculture Guide*.

Causes of Too Tall Plants

Achieving desirable plant height involves considering why plants tend to be too tall before starting on a PGR program. A PGR may not be necessary if the height problem can be corrected in other ways. There are number of reasons why bedding plants may stretch. The most common reasons for stretching are too low light, too close spacing, and situations where there is a large difference between day and night temperature. Plants that are shaded by old plastic, neighboring plants, or hanging baskets tend to stretch. Lack of ventilation on clear days and resulting heating will increase the difference between the day and night temperature and cause plants to grow taller. Excessive height may also result if the plants were started too soon or tall cultivars were chosen instead of compact ones. Growing in large volume packs or other containers may also contribute to too large plants. Many of the factors interact to encourage development of tall plants (e.g., low light and poor ventilation).

PGRs may be helpful in overcoming some of these problems, but too much reliance on PGRs is potentially costly in terms of material and labor. Also, because PGRs are treated as pesticides and have assigned re-entry intervals, frequent use of PGRs may disrupt other work in some greenhouse operations. Like pesticides, PGRs need to be used wisely and not as substitutes for good cultural practices.

Growth Retardants for Bedding Plants

Plant growth regulators are most effective when applied at the appropriate times to regulate plant growth or development. Growth retardants cannot shrink overgrown plants. They must be applied before the plant is overgrown to prevent plant stretch. When planning PGRs in your production schedule, consider what you want to accomplish with the treatment. Table 1 shows the active chemical ingredients and the brand-names of current PGRs for bedding plants and other spring crops.

Table 1. PGRs for spring crops.

Ancymidol	**Diaminozide**	**Flurprimidol**
Abide	B-Nine	Topflor (liquid)
A-Rest	Dazide	Topflor (granular)
Chlormequat chloride	**Paclobutrazol**	**Uniconazole-p**
Chlormequat E-Pro	Bonzi	Concise
Citadel	Downsize	Sumagic
Cycocel	Paczol	
	Piccolo	
	Piccolo 10XC	

Research has shown that when different products with the same active ingredient are applied at the same time, level, and application method the same plant response will result. Table 2 shows the best application method and the level chemical activity of some PGRs.

Table 2. PGR application method and activity

PGR example	Method	Activity
A-Rest	Spray or drench	Low to moderate
B-Nine	Spray	Low
Bonzi	Spray or drench	High
Cycocel	Spray	Low
Sumagic	Spray or drench	High
Toplflor	Spray or drench	Moderate to high

A foliar spray is the preferred method of applying PGRs to bedding plants in flats, but growth medium drenches can be used on pots. Drench applications of B-Nine have no effect on plants and Cycocel drench is less effective than a foliar spray. Sumagic can be applied as a pre-plant spray made to the surface of the growth medium. This may be a more efficient way of applying PGR.

The term "activity" refers to the general sensitivity of plants to the PGR and the persistence of the growth inhibiting effect after application. The height of plants treated with low activity PGRs is not greatly affected by variations in the spray or drench volume and the persistence of the growth inhibiting effect after application is short (2-3 weeks). Plants are very sensitive to high activity PGRs. Small variations in spray or drench volume can have significant effects on height. The growth inhibiting effect after application, especially by drench, is very persistent. What this all means is that the risk of undesirable side effects is much greater with Bonzi and Sumagic than A-Rest, B-Nine, or Cycocel. More attention to the details of rate, application volume, timing, and possible reapplication is required to successfully use high activity PGRs.

PGR Rates to Use

To choose a rate (ppm) to apply, check the label for the recommended rate for the plant you wish to treat or consult a crop production guide such as the *New England Greenhouse Floriculture Guide*. In the absence of a specific recommendation the grower should run a trial. A trial should be replicated and consist of a small number of plants rather than whole crop! The general rates commonly used for cellpacks, pots or other containers (Table 3) are the starting point for a trial. It's only common sense to test the lowest rates first, especially with Bonzi and Sumagic.

Table 3. PGRs for cell packs and pots.

PGR example	Rates (ppm) & Methods	Uses & Precautions
A-Rest	6-66, spray 1-2, drench	15 ppm for spray trials
B-Nine	2500-5000, spray	Apply during cloudy weather or late in the day.
Bonzi	5-90, spray 0.5-1, drench	15 ppm for spray trials. Apply to stems. For most vigorous species, but not begonia or annual vinca. Apply during cloudy weather or late in the day.
Cycocel	800-1500, spray	Best for geranium and osteospermum. 1250 for trial.
Sumagic	1-50, spray 0-1.2 drench 0.5-1.2, preplant soil spray	5-15 ppm for spray trials. Apply to stems. For most vigorous species, but not begonia.
Topflor	0.5-80, spray 0.25-4, drench	Granular Topflor is used for herbaceous and woody perennials (gm/pot).

Applying PGRs

Normally PGRs are applied early in the growth of bedding plants and seedlings. Timing is related to stage of plant development and not weeks from seeding or transplanting. Timing can be fairly specific for some species and the product label or other reference should be checked. In general plugs are treated when they have developed their first set of true leaves. Young plants are generally treated after transplanting when they begin to grow or when they are 2" tall or 2" wide.

PGRs must be applied uniformly in order to cause uniform inhibition to plant growth. For bedding plants in cell packs PGRs are applied by foliar spray application; drench application can be used for bedding plants in pots and hanging baskets. Sprays should be applied on the basis of volume of spray per area bench to achieve uniform application. Never use a "spreader-sticker" unless directed to by the label. Drench applications are made on the basis of an exact volume per pot to get a uniform effect. Actual drench volume depends on pot size. Of course, more labor is required to make drench applications compared to sprays. Specific spray and drench volume recommendations can be found on the product labels or the *New England Greenhouse Floriculture Guide.*

Normally PGRs are applied during cloudy weather. The effectiveness of Cycocel and B-Nine sprays is increased when conditions favor slow evaporation. Plants to be sprayed should also be fully turgid when PGRs are applied (Cycocel injury is most common on water-stressed plants).

When drench applications are made the growth medium all pots to be treated should be at the same moisture level to get uniform results. Also, response to drench application is affected by the condition of the roots. A poor root system may limit the uptake of chemical. Extra care needs to be taken when drenching large containers like hanging baskets with more than one plant. Drench solution should be applied so each plant is treated equally and the resulting growth inhibition will be the same.

Florel to Increase Branching

Florel stimulates branching and can provide some growth control. Apply Florel as a spray at 250-500 ppm with or without a pinch to stimulate branching of vigorous vines. Florel should not be applied any later than 2-3 weeks before expected flowering. Some leaf chlorosis may appear due to enhanced plant stress.

PGRs and Mixed Containers

PGR use is a special challenge when containers contain multiple plants with different levels of vigor. Prior to planting treat plug trays with a liner dip lasting 5 to 30 minutes to allow the plugs to absorb the chemical. The best chemicals are those which can be applied by drench. A spray treatment, like Florel, can be done two different ways. Plant the variety to be treated in the final container, spray, and later plant the untreated species in the final container or grow the species to be treated in small pots, spray, and then add to the final container closer to finish. Recommended liner dips are Bonzi at 4-16 ppm, Sumagic at 2-8 ppm, or Topflor at 3-12 ppm.

“Holding” Plants in Spring Prior to Sale

Great spring weather can cause some plants to grow too well. PGRs can't make tall plants short, only cutting back can, but PGRs can be used to "hold" the plants. The best way is to apply PGR foliar sprays, rather than a drench, because sprays have a shorter residual life. Apply sprays at the high end of the normal concentration range. Do not drench or use excessive spray rates; the risk is that the growth suppression will carry over into the landscape. Do not use Cycocel because there is a chance of phytotoxicity.

References

New England Greenhouse Floriculture Guide 2013-2014. New England Floriculture, Inc.

Smith, T. and D.A. Cox. 2013. Preventing or rescuing overgrown plants. *Floral Notes* 25(4):5-8.

Greenhouse APPS for Mobile Devices

Tina Smith
Extension Educator
UMass Extension
Amherst

Website apps for mobile devices (Mobile optimized website app to be used with your browser on smart phones and other devices)

- **Greenhouse Pest Guide** from UMass Extension and UConn Extension
  See: http://greenhousepestguide.umass.edu/

  Created by Tina Smith, UMass Extension and Leanne Pundt, UConn Extension. This mobile optimized website app is a pest management reference guide that contains options for using biological control and pesticides. Partial support for this project was provided by the New England Florist Association Floriculture Applied Research Fund.

- **Greenhouse Disease Guide** from UMass Extension
  See: http://greenhousediseaseguide.umass.edu/

  Created by Bess Dicklow, UMass Plant Diagnostic Lab and Tina Smith, UMass Extension. This mobile optimized website app is a disease management reference guide that contains options for using biological control, organic and conventional pesticides. Partial support for this project was provided by the New England Florist Association Floriculture Applied Research Fund.

- Four grower tools**: AlkCalc, DLiCalc, FertCalc and PGRCalc** from Univ. of New Hampshire
  See: http://extension.unh.edu/Greenhouse-Floriculture/Grower - Tools2

  AlkCalc - This calculator provides the recommendations for the amount of acid to add to irrigation water in order to modify the pH and alkalinity levels. It also provides the amount of added phosphorus, nitrogen, and sulfur that the corresponding acids will provide, plus an economic comparison of each acid.

  DLiCalc - Estimates DLI from supplemental light sources and estimates hours of lamp operation

  FertCalc - An on-line spreadsheet capable of calculating fertilizer formulations for water soluble fertilizers for up to four injectors.

  PGRCalc - Web based calculator for plant growth regulator mixing rates.

- **Back Pocket Grower** from University of Florida
  http://Backpocketgrower.com

  Click "tools" for calculations for chemicals, fertilizers, pesticides and PGRs

  Click "Guides" for production information for spring greenhouse plug production

APPs from ITunes, Google play

- **Greenhouse Scout** from Cornell University (ITunes)

Summarizes information on biocontrol of common greenhouse insect pests and an interactive interface for collecting, organizing, and presentation of scouting data, and product application for insect management.

- **Gro Getter** (ITunes) from Ball Horticultural Co.

Plant search and information for commercial growers and retailers for many horticulture crops.

- **PGR Calculator, OHP Inc.** (Free, ITunes)

Provides current PGR rates in ppm for spray or drench applications and calculates the amounts of solution and product needed.

- **PGR Mixmaster** (Free ITunes, Blackberry; Android)

PGR calculator available from University of New Hampshire Extension

- **Pesticide Side Effects App, Biobest** (Free, ITunes, Android and Blackberry platforms) Allows user to find pesticides compatible with specific biologicals.
- **Plant Diagnostic App** (Free, ITunes)

Users select which diagnostic lab they would like to submit samples to, fill out relevant information and submit up to six digital images to be sent to the diagnostician via email. Participating Universities include UConn, Purdue, University of New Hampshire, Ohio State University, Auburn University, University of Illinois, University of Kentucky, and Michigan State University. All types of plants and plant problems can be submitted. Images can be submitted for plant or insect identification and for disease diagnosis. Some labs may charge a fee.

- **Purdue Perennial Flower Doctor, Purdue Annual Flower Doctor** (ITunes, Google play) See: https://www.purdueplantdoctor.com/
- **Trial Tracker - Greenhouse trials** (ITunes, Google play) from Extreme Technology Corporation

Enables tracking of all trial activities, from plant measurements, crop data points, plant treatments, and more.

Resource - slide show: "The Greenhouse Grower List of 15 Apps for 2015", Janeen Wright, www.greenhousegrower.com!business-management!the-greenhouse-grower-list-of-15-apps-for-2015-slideshow!

UMass Greenhouse Crops and Floriculture Extension Program

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Six monthly issues of *Floral Notes By email* are published yearly.
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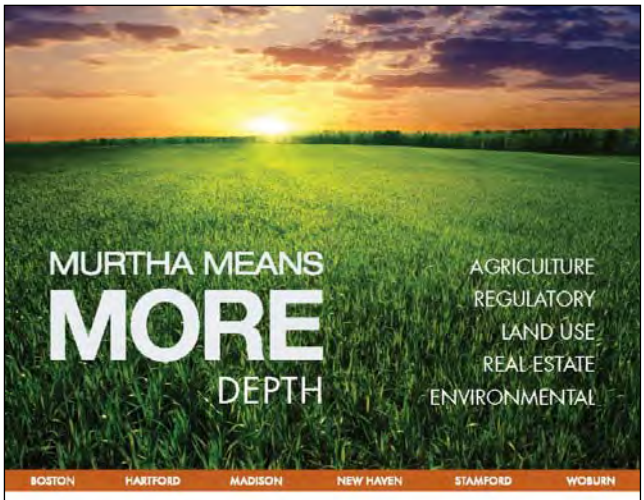

MURTHA CULLINA

CELEBRATING 75 YEARS

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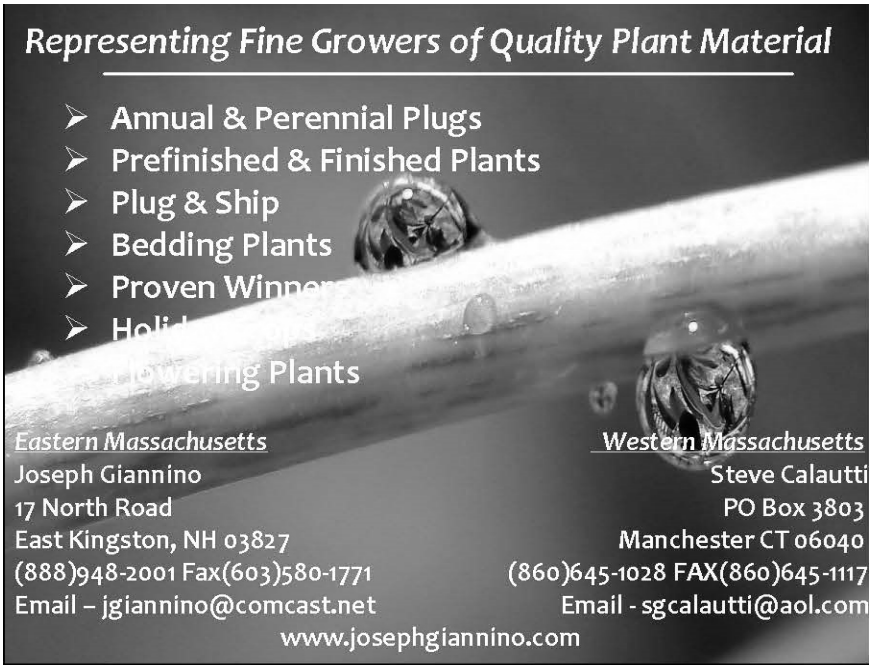

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