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Floral Notes Newsletter

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Stockbridge School and the UMass Soil Test Lab Have a New Home

On September 1 the Stockbridge School of Agriculture and the UMass Soil and Plant Tissue Testing Lab moved to newly renovated Paige Lab. Paige is located near Stockbridge Hall and was formerly the home of Animal Science. In addition to Stockbridge School offices and the Soils Lab, modern labs have been provided for Stockbridge faculty needing up-to-date space for their research. The "new" facility is a wonderful and exciting replacement for the much older buildings which housed plant agriculture at UMass far too long.

The UMass Soil and Plant Tissue Testing Lab is located on the 1st (ground) floor of Paige. Orders sent to the old address will automatically be forwarded to the brand new lab for a while but the new address is: UMass Soil and Plant Tissue Testing Lab, 203 Paige Laboratory, 161 Holdsworth Way, Amherst, MA 01003-9286.

Please be aware that turnaround time on samples may be delayed by this transition at first but should return to normal soon. We thank you in advance for your patience and understanding. As always, if you need to contact the lab, we can be reached by phone at (413)545-2311, or by email at soiltest@umass.edu

Greenhouse Vegetable Production in Containers

Wednesday, December 10, 2014 - 9:30am to 3:45pm

Publick House, Sturbridge

9:00 – 9:30 Registration, Coffee and Pastry

9:30 – 10:30 **Growing Greenhouse Tomatoes and Greenhouse Cucumbers in Containers**
Rich McAvoy, University of Connecticut

10:30 – 10:45 Coffee Break

10:45 – 11:45 **Perfecting Biocontrol in Greenhouse Vegetables**
Carol Glenister, IPM Laboratories, Locke NY

11:45 – 12:45 Lunch on your own (see options)

12:45 – 1:45 **Growing Bench-top Greens** Brian Krug, University of New Hampshire.

1:45 – 2:00 Break

2:00 – 2:45 **Diseases and Disorders of Greenhouse Tomatoes, Cukes and Greens**
M.Bess Dicklow, UMass Extension, Plant Disease Diagnostic Laboratory

2:45 – 3:45 **Grower to Grower Panel**
Brad Clegg, Four Town Farm, Seekonk, MA
Dave Volante, Volante Farms, Needham, MA

Two contact hours for pesticide recertification have been requested.

Lunch options: Bring your own, or purchase lunch there or build your own sandwich buffet (roast beef, turkey, ham, vegetable), potato salad, chips, desert, drink pre-purchased ($13) from Publick House at check-in or eat in the Publick House restaurant. Fast food is also available at restaurants within a short drive.

Registration: $40 per person or $35 per person for 3 or more from same business. Registration includes morning refreshments, breaks and handouts.

For more information call Tina Smith, (413)545-5306, tsmith@umext.umass.edu

2015-2016 New England Greenhouse Floriculture Guide Available Soon – Discount Price!

The 2015-16 New England Greenhouse Floriculture Guide will be available at the 2014 Northeast Greenhouse Conference and Expo at a special conference price of $30 per copy. After the conference, it will be available for $40 per copy via the Northeast Greenhouse Conference website (www.negreenhouse.org), and from the Extension publication offices of the Universities of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

The New England Greenhouse Floriculture Guide is updated every two years by floriculture faculty and staff from the six New England State Universities, and is published by New England Floriculture, Inc.

Greenhouse growers in New England and New York have long relied on the guide, for its unbiased, detailed information about insect and mite management, disease prevention and management, weed control, and plant growth regulation.

Greenhouse Cleanup

It is best to clean greenhouses as they become empty rather than to wait until just prior to the spring growing season. Cleaning early will eliminate over-wintering sites for pests and reduce populations for the next crop cycle. Greenhouse pests will overwinter in weeds and protected areas in unheated greenhouse, especially if the winter is unseasonably warm. Remove leftover plants and debris and clean the floor of soil, organic matter and weeds. Clean areas around furnaces and along the side walls where small weeds are usually found. Use weed barriers, repair tears in worn weed barriers and do not use stone on top. Stone will trap soil and moisture and create an ideal environment for weeds, diseases, insects and algae. It is also a good time to correct any drainage problems and low spots in greenhouses.

Many growers are now using an acid based cleaner such as GreenClean Acid Cleaner® or Strip It™ to thoroughly clean surfaces prior to using a sanitizer. These products remove mineral deposits, fertilizer buildup and algae.

Next, disinfect the growing and plant handling areas, and irrigation system. There are several different types of disinfectants that are currently used in the greenhouse for plant pathogen and algae control including quaternary ammonium compounds (Greenshield®, Physan 20® KleenGrow™), hydrogen dioxide (ZeroTol 2.0®, Oxidate 2.0®), hydrogen peroxide plus peroxyacetic acid (SaniDate 12.0) and sodium carbonate peroxydrate (Green Clean Pro®). All these products have different properties, so read and follow label directions. Chlorine bleach (10%) may be used for pots or flats, but is not approved for application to walls, benches or flooring. If possible, disinfectants should be used on a routine basis both as part of a pre-crop clean-up program and during the cropping cycle.

Organic growers have limited options for disinfectants. Oxidate 2.0®, SaniDate 12.0 and PERpose Plus are currently listed by the Organic Material Review Institutes (OMRI), see www.omri.org. Ethyl or isopropyl alcohol is also allowed under the organic standards, although not used as a general disinfectant (flammable), it is used by growers to disinfect propagation tools. Organic growers should always check with their certifying organization before using any material new in their growing practices.

Weed Control: There is a new pre-emergence herbicide, indaziflam (Marengo®) labeled for use on greenhouse floors in **empty greenhouses**. You must wait 24 hours before introducing plant material into the empty greenhouse after applying this material. *Tina Smith, UMass Extension and Leanne Pundt, UConn Extension*

Cleaning Containers

While some growers clean and re-use pots, trays and flats and it is important to do it properly. Plant pathogens such as *Pythium, Rhizoctonia* and *Thielaviopsis* can survive in root debris or soil particles on greenhouse surfaces. If the previous crop had a disease problem, then avoid re-using those containers. It is also a good idea to avoid planting crops that are prone to *Thielaviopsis* problems, such as calibrachoas, in containers that have been previously used.

All containers should be washed thoroughly to remove soil particles and plant debris before being treated with a greenhouse disinfectant, even if there was no evidence of disease in the crop. Debris and organic matter can protect pathogen spores from coming in contact with the disinfectant solution.

There are several products available for disinfecting surfaces including quaternary ammonium products (Greenshield®, Physan 20®, KleenGrow™), and hydrogen dioxide (ZeroTol 2.0®, OxiDate 2.0®). Follow label directions for these products - labels indicate how long that pots must be soaked to be fully effective. A 10 percent solution of household chlorine bleach (one part bleach to 9 parts of water) may be used for pots and flats, but the solution has a shorter activity period than other disinfectants, losing half its strength in 2 hours. Chlorine bleach is also phytotoxic to some plants, and must be used in a well-ventilated area to protect workers. *Tina Smith, UMass Extension and Leanne Pundt, UConn Extension*

Thoughts on Using Organic Fertilizers for Greenhouse Plants

Douglas Cox
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For a number of years I've studied the use of organic fertilizers for growing commercial greenhouse crops. To start I chose to evaluate fertilizers that could be mixed and applied using methods familiar to growers using traditional water-soluble or granular slow-release chemical fertilizers.

Right now I recommend Nature's Source 3-1-1 liquid fertilizer and Sustane 8-4-4 granular slow-release fertilizer. Both of these are readily available, cost effective, OMRI-certified, and have good label directions for greenhouses. I've also evaluated or am currently trialing other organic fertilizers and these are listed with comments in the table accompanying this article. Two liquid fertilizers which may have promise one day are Bombardier 8-0-0 and Espartan 2.0-3.03-2.6 manufactured by Kimitec in Spain. At this time these have limited availability, are rather expensive, and the labels are not written for greenhouses. Nature's Source, Bombardier, and Espartan are plant extract fertilizers and Sustane is made from poultry wastes.

My work has led me to recommend using different organic fertilizers in combination rather than relying on one fertilizer. I suggest using Nature's Source and Sustane together to take advantages of each fertilizer's strengths. This would be done by incorporating Sustane in the growing medium at planting and then fertilizing on a regular basis with Nature's Source starting about 4 weeks after planting. Combinations should be considered regardless of what brands or types of organic fertilizer are being used.

Here are some more important specific recommendations on how to use organic fertilizers to grow greenhouse plants.

1. Mixing and application. The fish fertilizers and plant extract fertilizers are sold as concentrates and they must be diluted in water to be safe for plants. Nature's Source, Bombardier, and Espartan have a pleasant "beery" aroma as concentrates, but within 7 days of being mixed with water they "spoil" and develop very unpleasant odors. The odor, however, is not as bad as fish fertilizer. The nutrient value of spoiled fertilizer is unknown and the colonies of bacteria which develop may plug irrigation lines, so diluted fertilizer solution should be used as soon as possible after mixing.

Fish fertilizer has the thickest and least consistent solution and should be agitated before mixing with water. Bombardier and Espartan concentrates are "syrupy" but mix well with water. Nature's Source is the thinnest concentrate and it mixes well with water and can pass fertilizer injectors.

Sustane is a granular fertilizer which would be mixed with the growing medium before planting. It is the easiest organic nutrient source to use in combination with the liquid types.

2. Fertilizer analysis. Some organic fertilizers supply only one or two of the NPK elements; an example is Bombardier which is 8-0-0. So a grower using Bombardier would have to use other fertilizer(s) to supply P and K. I recommend Sustane which has an 8-4-4 analysis or some other complete NPK granular organic fertilizer.

Organic Fertilizers Evaluated or Currently Under Trial at UMass Stockbridge School

Fertilizer	Type	Analysis	Comments
Neptune's Harvest Organic Fish fertilizer	Liquid emulsion	3-1-5	Fish fertilizer has been widely used organic fertilizer for many years. The emulsion needs to be well mixed to give a consistent material for dilution and application. Once mixed with water it spoils and develops a bad odor. Mix fresh and use immediately. Leaf chlorosis, probably due to ammonium toxicity, is common. OMRI listed.
Plant Natural alfalfa pellets		5-1-2	Alfalfa is a legume and therefore is rich in nitrogen. The pellets are often used as animal feed and are similar in size and shape to wood pellets used in pellet stoves. Ppellets supported the plants for about 40 days and then are exhausted of nutrients. Also, they swell when water is added greatly increasing the volume of medium in a pot. Limited potential for this fertilizer.
Kimitec Bombardier	Liquid	8-0-0	Bombardier is a plant extract fertilizer made from fermented sugar beet molasses. It works well with Sustane which supplies the absent P and K. Some plants develop interveinal chlorosis due to ammonium toxicity. Chlorosis is lessened or eliminated by combining with Sustane. Dilute solutions spoil within 10 days. Quite expensive and limited availability. USDA/NOP approved.
Kimitec Espartan	Liquid	2.0-3.03-2.6	Espartan is a plant extract fertilizer made from fermented sugar beet molasses. Some plants develop interveinal chlorosis due to ammonium toxicity and growth medium EC is rather high. Chlorosis and EC are lessened or eliminated by combining with Sustane. Dilute solutions spoil within 10 days. Quite expensive and limited availability. USDA/NOP approved.
Sustane	Granular	8-4-4	Granular slow-release fertilizer made from turkey litter, feather meal, and potassium sulfate. Release time is 45 days, but nutrients may run out a little sooner. Excellent fertilizer to combine with liquid organics especially those with no phosphorus or potassium. OMRI listed.
Nature's Source	Liquid	3-1-1	Despite the low nutrient analysis Nature's Source is currently the best liquid organic fertilizer. It is made from oilseed extract. Container has dilution rates expressed in familiar terms for greenhouse growers. I have seen no foliar chlorosis yet with this fertilizer. Nature's Source is widely available and a great improvement over its predecessor Pinnacle. OMRI listed.
Verdanta EcoVita	Granular	7-5-10	I am currently testing this granular slow-release fertilizer. It has a release rate of 100 days. The granules are composed of bone meal, soybean meal, cocoa shell meal, feather meal, and fermented sugar cane and sugar beet molasses. I see potential for this one and it's available from Griffin. OMRI listed.
Verdanta PL-2	Liquid	2-0-6	I am currently testing this fertilizer made from fermented sugar cane and sugar beet molasses. It should be a good supplement to use in combination with other organic fertilizers low in N or K. Available from Griffin. OMRI listed.
Ferti-Nitro Plus	Soluble powder	13.6-0-0	I am currently testing this fertilizer as a supplement to use in combination with other organic fertilizers low in N. It is made from hydrolyzed soybean protein and is soluble. Google this one on the web. OMRI listed.

3. Nutrient disorders. Plants may develop an overall light green or yellowed color caused by a general nutrient deficiency or, more likely, just N deficiency. For example, if Sustane is used alone the symptoms might occur about 45 days after planting, the end of its release time. This can be prevented by applying an organic liquid fertilizer supplement about 30 days after planting.

Interveinal chlorosis sometimes occurs about halfway through cropping time if plants are fertilized with some liquid organic fertilizers alone starting at planting. This chlorosis is most likely caused by an accumulation of too much ammonium-nitrogen in the plant, so-called "ammonium toxicity". Most greenhouse crops do best with a combination of ammonium and nitrate nitrogen. Unfortunately organic fertilizers generally don't contain nitrate-nitrogen. The best approach is to rely on Sustane as the sole source of nutrients for the first month after planting and then start applying Nature's Source or another liquid organic fertilizer.

4. Organic fertilizer effects on growth medium soluble salts (EC). Sustane is a slow-release fertilizer and its use results in low EC, and potentially a deficient level after 45 days. As for the liquid organics, at the same N level the lowest EC results from Nature's Source (similar to chemical fertilizer) and then Bombardier. Espartan results in an EC significantly higher than the other liquid organic fertilizers which might be an aggravating factor in ammonium toxicity. In short, from the standpoint of EC, Nature's Source is the best.

5. Overcome reduced size caused by organic fertilizers. Many growers who have used organic fertilizers have observed size reductions compared to what they are used to with chemical fertilizers. Some growers say "raise the rate (ppm)" of organics to compensate. If you have done this and it works, carry-on! Otherwise give it a try starting with increases of 20% at a time. Increasing the rate in 20% increments is likely to be partially successful, but because of a nutrient imbalance, ammonium toxicity, or some unknown factor results may be disappointing or worse.

6. Plant species-specific responses. It seems that plants may respond differently to organic fertilizers. For example, marigolds and petunia grow as well fertilized with a combination of liquids and Sustane as they do with chemical fertilizer, but seed geraniums do not and are very prone to chlorosis from too much ammonium. At this point in the development of organic fertilizers for commercial greenhouse use, use them with caution on plants you know have exacting nutrient requirements or those prone to foliar chlorosis. Fertilizers should always be tried first on a small number of plants.

7. Best uses. The fertilizers discussed in this fact sheet are probably best for short-term crops of less than 6 weeks duration when environmental conditions are most favorable for plant growth (e.g., April-September). Bedding plants, herbs, and vegetable transplants are good candidates for trying organics. Assuming the plants are of good quality and color, reduce or stop using the fertilizer within a week or two of planned marketing. This practice will reduce the chance of ammonium toxicity symptoms.

Greenhouse Heat Distribution

John W. Bartok, Jr.,
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Heat is one of the several factors that control plant growth. Getting the heat from the furnace or boiler firebox where it is generated so that each plant is uniformly warm is a challenge that faces the heating system designer. With many systems to choose from the decision can be difficult.

Hot air systems

Furnaces are usually less expensive than boilers. They directly heat the air in the greenhouse. Distributing the heated air is largely dependent upon some means of air circulation. Systems include unit heaters, perforated inflated tubes and horizontal air flow circulation.

Unit heaters

Unit heaters, either floor mounted or suspended from the frame, have a fan or blower that moves the greenhouse past the heat exchanger. A single unit will work well in a small free-standing greenhouse up to about 60' long. In larger greenhouses either two heaters or some other means of moving the air is required.

Poly tube

By connecting a perforated poly tube to the outlet of the furnace heat can be moved and distributed over a larger area. This generally requires a blower rather than a fan to get the higher pressure needed to overcome the friction loss in the tubing. Tube diameter, hole size and spacing are critical to get uniform distribution from the tube. The tubes can be placed on the ground between rows of plants, located under benches or suspended above the crop.

Horizontal air flow

HAF utilizes circulating fans to create a horizontal air pattern of air movement within the greenhouse. The system uses 12" – 20" diameter, $1/15^{th}$ horsepower fans to move the air down one side of the greenhouse and back the other. The fans, which operate continuously, mix the air from roof to floor and provide uniform temperature throughout the growing space. They are usually located above head height and spaced from 40' to 50' apart down each side of the greenhouse. The heat source can inject the air anywhere within the air stream. The air moves at 50 to 100 feet per minute. Fan cost is about $200 each installed.

Infrared systems

Infrared systems, properly installed, can transfer heat energy to crops without the necessity of air circulation. The system is usually located near the peak of the greenhouse so that it can radiate heat to the crop. Sizing the system should be done by the supplier. Air circulation may be needed to get uniform heat on tall or dense crops.

Furnaces have the advantage that the greenhouse can be closed during the winter without having to drain a series of water pipes as is the case with a boiler system.

Hot water systems

In larger greenhouses, hot water is a better medium of heat distribution than air. Its advantages include energy saving temperature modulation for different seasons of the year, different water temperatures for

air and root zone systems and more constant and uniform heat. Providing a different temperature in adjacent bays or sections of the greenhouse is easier as circulating pumps controlled by separate thermostats supply heat as needed. Heat from water can be distributed by bare steel pipe, fin radiation, root zone heat or water to air unit heaters.

Bare steel pipe

Bare steel pipe is rarely used in U.S. designed greenhouse heating. Its low heat output, large volume of water and space requirements are disadvantages. It has been replaced by fin pipe.

Fin pipe

Fin pipe is best located along the perimeter walls. The walls behind the pipes should be insulated with an inch or two of board type insulation with an aluminum foil facing. Fin pipe can also be installed under gutters where it can be controlled manually to melt snow. Fin pipe with numerous thin plates radiate heat away from the pipe and increase heat output by 5 to 10 times. The diameter of pipe and size and number of plates determine the heat output. A 1¼" pipe with 38 4¼" square fins/foot has an output of about 1200 Btu/hr per linear foot with 180ºF water.

Low output fin pipe (two or five linear fins) with 100 to 200 Btu/hr per linear foot is a good choice for under bench heating. It is easy to install as sections are connected with rubber gasketed couplings or high temperature rubber hose. Low output fin is also used overhead instead of bare steel pipe and for gutter heat.

Root zone heat

Root zone heat is popular as it warms the root zone rather than the air. It can be installed on or under the benches or in the floor. Commercially available systems use EPDM rubber or cross-linked polyethylene (PEX) tubing either as single tubes or as multiple tubes attached to a web. The tubing is connected to plastic or copper headers. Hot water can be provided by a hot water heater or boiler. Most growers that used this system operate with a water temperature of 100ºF to provide a75ºF soil temperature. A remote bulb thermostat or sensor located in the soil controls the supply water circulating pump.

Water to air unit heaters

Water to air unit heaters convert hot water to hot air. Circulation within the greenhouse is by HAF fans. Available in outputs from 12,000 to 700,000 Btu/hr, unit heaters are low cost and easy to install. Supply pipes should be insulated to reduce heat loss. Unit heaters work well as a supplement to root zone heat by providing the extra heat needed on cold nights.

Achieving uniform temperature throughout the greenhouse will allow the thermostat to be set lower. For each one degree that the thermostat is lowered, there is an approximate three percent savings in fuel.

Interesting Talks: Down to Earth Summer Conference & Trade Show

Tina Smith
Extension Educator
UMass Extension
Amherst

Beautiful weather, a plethora of flowering plants, soft turfgrass and knowledgeable speakers all played well together to make the Massachusetts Nursery and Landscape Association (MNLA) and Massachusetts Flower Growers Association (MFGA) annual summer meeting a huge success. UMass Extension coordinated the educational program bringing in a variety of speakers and topics for the landscape, nursery and greenhouse industries. Here is summary of some the topics that were presented.

Chris Kennedy, third generation owner of Kennedy's Country Gardens in Scituate and MNLA past-president reviewed what was new with exhibitors in his talk "What's New Under the Big Tent". Among the new selections were several landscape plants that have been selling well with branding and marketing. These included:

- *Hydrangea* 'Bloomstruck', the newest addition to the Endless Summer® Collection of reblooming *hydrangeas* which has a great blue flower.
- *Hydrangea paniculata*, 'Bobo' white Proven Winner growing to a height of about 40".
- *Echinacea* 'Cheyenne Spirit' is a seed strain of first-year flowering Coneflowers that are sturdy, compact, and drought tolerant. Plants produce an abundance of blossoms in purple, pink, scarlet, yellow, cream, or white surrounding a central cone.
- *Ratibida* or the Mexican Hat plant which is a butterfly magnet.
- *Diervilla sesslifolia* 'Cool Splash', a variegated dwarf bush honeysuckle that is deer resistant.
- Green velvet boxwood is a favorite for formal looking landscaping.
- Sourwood (*Oxydendrum*) should be used more, a great plant with spectacular fall foliage.
- *Lobularia* 'Snow Princess' is heat tolerant, so flowers just keep on coming.
- *Evolvulus* 'Blue my Mind' loves hot weather and is drought and humidity tolerant and blooms all summer.

David Fiske, Garden Curator, Massachusetts Horticultural Society brought over 75, 12" patio pots from the trial gardens at Elm Bank in Wellesly, MA to show in his "Flower Trial Talk". The container plants are an example of each plant in the ground beds to show how the plants perform in containers. The New England Trial Garden was established at Elm Bank in 1996 as a cooperative effort between the University of Massachusetts, the Massachusetts Flower Growers' Association and the Massachusetts Horticultural Society. Breeding companies from all over the world contribute the newest and best varieties of annuals to the New England Trial Garden for viewing by amateur and professional gardeners. This garden also tests new and unreleased varieties competing for All-America Selections (AAS) awards, displays previous winners, and grows hundreds of cultivars submitted for evaluation by commercial plant breeders. David is an official AAS Judge. He conducts three different trials in the garden; the annual and perennial performance trials, and the official AAS trial. The AAS has two trial categories; the flower trial and the bedding plant trial. This year's trial consisted of 91 Performance trial plants, 12 AAS trial plants and their comparisons, 47 over wintered plants, 20 new perennials, 182 - 12" patio pots. The garden was planted May 19 - June 13. David's top 12 list: *Begonia* 'Pegasus' Proven Winners (PW); *Euphorbia* 'Diamond Delight' PW; *Verbena* 'Endurascape Red', 'Endurascape Blue' Ball; *Petunia* 'Shockwave Denim' Ball; *Impatiens Hawkeri* 'Infinity Red'

PW; *Coleus* 'Marquee Box Office Bronze' Burpee Home Garden; *Coleus* 'Kong Lime Sprite' Pan American Seed; *Impatiens* 'Big Bounce Red' Ball Selecta; *Supertunia* 'Morning Glory Charm' PW; *Cuphea* 'Vermillionaire' PW.

He suggested seeing the trials firsthand from start to finish to observe the progress of the plants. "It is a great way for growers and retailers to see how those plants perform, know which plants are available and make your own opinions about the plants." The Trial Gardens at Mass Hort are open seven days a week, dawn to dusk. David can give personal tours Monday through Friday, 7:30-3:00, just give him a call, (617)-835-6365 dfiske@masshort.org Check their web site for all the trial garden scores for this summer, available at end of Aug: http://www.masshort.org/MHS-Gardens

Dr. Michael Dirr. The educational session ended with keynote speaker, Dr. Michael Dirr, internationally-recognized expert in plant materials and UMass graduate, on the topic "The Future of Plant Materials". He is the author of numerous books on woody plants that have become staples on our desks, including his most celebrated *The Manual of Woody Plants*, *Dirr's Hardy Trees and Shrubs*, *Hydrangeas for American Gardens*, and *Viburnums: Flowering Shrubs for Every Season*. Attendees had the opportunity to purchase signed books at the show. He showed examples and talked about many of the newer trees and shrubs best adapted to the Northeast. Here is a brief summary of "the future of plant materials…according to Dirr":

- Branding will continue to accelerate.
- Plants must have the WOW factor to enhance impulse purchases.
- Color to the 9th power is critical when marketing in garden centers and for landscapers.
- Color in every plant part: flowers, fruits, leaves, stems.
- Reblooming (remontancy) is a coveted trait (*Hydrangea macrophylla*, *Syringa* Bloomerang®, *Weigela* Sonic Bloom™)
- Extended seasons of aesthetic qualities.
- Compact habits for smaller landscapes and containers.
- Heat, drought, wet, cold, and pest tolerances.
- Plants must look spectacular in a 3-gallon bucket.
- Low chemical and maintenance inputs are important from the customer standpoint.
- Ease of propagation, production, and shipping are important for growers.

He concluded his presentation by talking about the importance of selecting plants for disease resistance using the example of American Elm and cultivars with various degrees of resistance to Dutch Elm Disease.

UMass Greenhouse Crops and Floriculture Extension Program

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