

ASSOCIATION NEWS
Marianne McGloin
Executive Director, D.A.N.

Summer has passed and another year is winding down. How quickly time flies. The D.A.N. had another successful Summer Turf and Nursery Expo on August 14. The D.A.N. appreciates the generosity of the Wick Family. They put on an excellent nursery tour and are willing to host future shows. I would also like to thank Sue Barton, Jay Windsor, Naomi McCafferty, David Coker, Al Sonchen, John Ellingsworth and Bruce Paulish for their efforts during the show.

The next Certified Nursery Professional exam will be October 21, at the Department of Agriculture, Dover, DE. It is never too early to prepare for the exam. We now have 57 CNPs in the state. Help us reach 100! Manuals are available at the D.A.N. office and short courses are provided by Delaware Cooperative Extension. Please call Marianne McGloin at the D.A.N. office (677-1895) or Sue Barton (831-1375) for more information.

The American Association of Nurserymen is now the American Nursery and Landscape Association. This name change took place in July at the Nashville Convention. It was unanimously accepted.

The Delaware Farm Bureau has advised the D.A.N. of a special conference addressing the state efforts to control land use. The state would like to impose laws and regulations that would restrict the use of private property. This affects all aspects of the agriculture industry. They are urging everyone to attend. The conference will take place on November 5, 1997 at the Sheraton in Dover. Please call the D.A.N. office with any questions.

The D.A.N., along with Cooperative Extension will be conducting a Turfgrass Workshop on

November 11 at the New Castle County Extension Office. The cost of the workshop will be \$20 and includes lunch. A flyer will be mailed shortly. Don't miss this exciting workshop. Pesticide credits will be available.

The D.A.N. has received five landscape award applications. The winner will be announced in October and honored at the Hort Industry Expo in January. Good luck to all the participants.

Just a reminder that the Delaware Horticulture Industry Expo will be January 15 and 15 at the Sheraton in Dover. There will also be a preconference workshop on Nursery Production on January 13. This workshop is sponsored by Maryland Cooperative Extension. Flyers will be mailed in early November.

Quote for the Quarter:

Each of us is given a pocketful of time to spend however we may. We use what we will. We waste what we will. But we can never get back a day.

Roger Wilcox, quoted by Brad Wilcox in New Era

Marianne

WELCOME NEW MEMBERS

Associate Members

National Seed Company of New Jersey
Ken Griepentrog
18-B Jules Lane
New Brunswick, NJ 08901
(732) 247-3100

Sam Brown Wholesale Nursery
Tim and Cynthia Sterling
366 Paoli Pike
Malvern, PA 18355
(610) 647-5947

U OF D NEWS
Susan Barton
Extension Specialist

Have you seen our asters? If not you are missing it. They look stunning. North Creek Nurseries donated over 45 different species and cultivars to the UDBG (in Newark) and Research and Experiment Station (in Georgetown). We planted them this May. We have weeded and watered them all summer. A few tall varieties were pruned once in June. Most are in full bloom right now. Bob Mulrooney was excited to notice both rust and powdery mildew on some varieties. He and I will be taking disease ratings before the end of September and we will note which species could benefit from more pruning. We will publish that information, so you too can learn about these different cultivars and which might work best in the landscape. I highly recommend visiting one of the sites so you can see for yourself. The plants are labeled and there is a map of the layout in a mailbox by the UDBG beds.

Our new turf establishment plots are up and growing. During the first week of September, we planted tall fescue into soil that had been treated in four different ways—raked to expose soil, tilled, amended with one inch of compost, and amended with compost then tilled. All treatments were seeded, fertilized, rolled, covered with straw and watered as needed (approx. 1" per week). The turfgrass germinated within one week. I have been taking data weekly. All plots are growing but the germination is more sporadic in some. We will be following this study to see how well each plot becomes established. This demonstration is also repeated in Georgetown at the Research and Education Center.

We had a great Plant Propagator Tour on Wednesday, September 17. Professionals came

from all over the mid-Atlantic region and toured the tissue culture labs, UDBG, Fischer greenhouse, Beneficial Insects Research Lab, research plots and had a virtual tour of the UDBG on the internet. I want to thank Steve Castorani for providing this opportunity for the Plant & Soil Sciences Department to "show its stuff."

We are trying something new with the Turfgrass Conference this year. Instead of our traditional meeting in Hockessin, we will conduct a one-day workshop in the New Castle County Extension Office (across from Pencader Plaza on Route 72). We will use two decision cases to stimulate active discussion about turfgrass establishment problems and the use of pesticides on turf. Rather than participating in a passive day of watching slides and listening to lectures, you will solve problems and lead discussions. We think you will learn a lot from each other.

I just got back from an excellent Urban Forestry Conference (partially funded by the Delaware Community Forestry Council--Thanks!). I have written one article from the conference for this issue of the D.A.N. News and I hope to share more with you in the future.

Results from the nursery industry survey many of you helped with this spring have been compiled. The summarized results are included in this issue. I have also submitted an article to *HortTechnology*. It is interesting to note that printed materials are still the most useful source of information for the industry. But those of you who have electronic capabilities are interested in that type of communication as well. As more people acquire email addresses and access to the world wide web, we will use this new technology more for communications. Remember the D.A.N. has a web page and the D.A.N. News is posted on that page.

**DE DEPT. OF AGRICULTURE
PLANT INDUSTRIES NEWS
Lynn Harrison, Sr. Entomologist**

AAN UPDATE
September 29, 1997

Nursery stock field inspections are nearing completion. Retail inspections are ongoing due to seasonal plant material. You may receive a visit from the nursery inspector at any time of the year, or several times a year as your inventory changes. We have been receiving inquiries from business owners who are concerned about not receiving their new certificates. Don't worry--your current certificate or license does not expire until October 31, 1997 and you will receive a new one before then.

The Christmas tree sales season is just around the corner. Many of you are in the process of purchasing trees. We cannot stress enough the importance of choosing your tree source carefully. In the past year, the number of pine shoot beetle quarantined counties has increased tremendously. The Plant Industries Section has an ongoing inspection for pine shoot beetle at all of its tree growing fields. It is not present in Delaware and we would like to keep it out.

Trees in states with quarantined counties must be inspected and found to be free of pine shoot beetle before shipping. If you buy trees from any quarantined area, you must be presented with a "Pine Shoot Beetle Free" inspection certificate from the owner to prove the trees were found to be free of pine shoot beetle.

The Dept. of Agriculture keeps a current list of states and counties that have pine shoot beetle. If you are unsure whether your supplier is in one of these states or counties, give us a call. For more information contact the Department of Agriculture, Plant Industries Section at (800)282-8685 (DE only), (302)739-4811, by fax at (302)697-6287 or E-mail at lynn@smtp.dda.state.de.

Congress has passed, and President Clinton has signed, an historic balanced budget agreement that includes a \$95 billion net tax cut accompanied by spending cuts. Some of the major provisions impacting grower, landscape and retail firms are as follows:

Estate Tax - Current exemption of \$600,000 from federal estate taxes increases gradually to \$1 million by 2006. Exemption for family farms and small businesses will be \$1.3 million in 1998. Although ANLA prefers outright repeal, this estate tax victory is a positive and welcome first step.

Capital Gains - Retroactive to May 7, the following applies: (1) Tax gains on assets held for less than 12 months at ordinary income tax rates with a top rate of 39.6% as is the case under current law; (2) Tax gains on assets held between 12 and 18 months at the current top rate of 15% for those in the 15% income tax bracket, and 28% for all other taxpayers; (3) Tax gains on assets held for more than 18 months at 10% for individuals in the 15% income tax bracket and 20% for all other taxpayers; (4) Tax gains on assets bought after 2000 and held for at least five years at a top rate of 18%

Self-employed Health Insurance - The deductibility of health insurance premiums for the self-employed rises to 100% by 2007.

Child Tax Credit - A \$400 per child tax credit starting in 1998 and rising to \$500 per child in 1999 and thereafter for families with children younger than 17. Single parents with annual incomes less than \$75,000 are eligible, as are couples making up to \$110,000.

Wage Credits for Welfare - A wage credit for employers who hire former welfare recipients

worth 35% of the first \$10,000 in wages in the first year of employment and 50% on \$10,000 of wages in the second year of employment.

The Internal Revenue Service has issued proposed and temporary rules for the application of section 263A to farming, and specifically to the production of nursery crops. Of particular interest to nursery growers in the new rules is the definition of "farming." The rules raises two distinct issues. First, it suggests that plants grown or raised, in part by another, are not capable of further cultivation and development. Second, it suggests that plants grown in containers are not capable of further cultivation and development. Both practices are widely used by the nursery industry, and excluding such practices from the definition of "farming" would significantly limit the number of nursery growers eligible for the appropriate non-inventory/non-capitalization tax status.

ANLA has enlisted the willing leadership and support of the chairman of the Senate Small Business Committee, Senator Kit Bond (R-MO), to formally request the IRS to withdraw the rules because the agency "has either ignored or grossly misunderstood its statutory obligation when reviewing the new regulations." The IRS did not conduct the necessary analysis on the small business impacts of these new rules under a new law enacted last year.

Meanwhile, ANLA will formally request an IRS hearing to present the nursery industry's steadfast position that these rules are wholly inappropriate and misguided. ANLA will also file official comments before the IRS in a multi-pronged drive to force the IRS to remove these rules. Legislative or legal action is premature at this time, but the ANLA is laying the groundwork with our congressional allies in the event that such an attack becomes necessary.

DEGREE DAY MODELING **Using weather records to better** **manage your turf** **Jim Morris**

Using weather as their guide, turfgrass researchers are refining new methods to predict - and ultimately reduce - pest outbreaks.

Through detailed scientific and statistical analysis, predictive models are often confirming what good turfgrass managers have learned by carefully observing the weather's effect on their turf. Because of their predictive ability, these models have also become a useful - though often underused - tool of Integrated Pest Management. Researchers are also looking toward new models to further reduce unnecessary pesticide use.

"Pest management is a lot about gathering the right information to make the right decision," said Mike Fidanza, whose research at University of Maryland included predictive models for weeds and diseases.

Degree days models are perhaps the best known of the predictive models, and they have been developed with varied levels of precision, reliability and acceptance for weed, disease and insect problems.

Although most turfgrass-related degree day models have been developed in the last 15 years, the principal behind the models was established as early as 1735 by French scientists Rene A. F. de Reaumur. He found that a given amount of heat, or a thermal constant, was required for plants to reach maturity, and the thermal constant varied by species.

Most disease, insect and weed pests are ectothermic, which means they are heated from the outside, and, therefore, their body temperature depends heavily on surrounding

temperatures. Below a certain minimum threshold, growth and development are minimal. Increasing surrounding temperatures above that threshold triggers growth until it reaches a maximum threshold, where growth slows dramatically or stops completely. This direct relationship between growth and surrounding temperatures does not hold for endotherms, such as mammals and birds, which regulate body temperature internally.

To more accurately measure the effect of temperature on growth, scientists developed the "degree day" as a unit of measurement. In its most basic form, a degree day can be calculated by recording the daily minimum and maximum temperature and then dividing by two to calculate the average daily temperature. The minimum threshold temperature, or baseline temperature, is then subtracted from the average temperature to calculate the number of degree days.

For example, a degree day model to predict summer patch disease establishes the baseline temperature at 60 degrees, measured at a two-inch soil depth. In the field, if the minimum recorded temperature was 62 degrees and the maximum was 68 degrees, the average daily temperature would be 65 degrees. The number of degree days would be 65 minus 60, or 5, for that day.

This example oversimplifies the precision of most turf-related degree day models. In collecting data for the summer patch model, for example, researchers at Rutgers University recorded temperatures every 15 minutes and used hourly averages to produce their degree day estimates.

With equipment that provides continuous temperature monitoring and with commonly available computer software, the models can be further refined by generating a curve that

approximates the daytime rise and nighttime fall of daily temperatures. Using calculus, the total area under the curve between the minimum and maximum thresholds can produce a more precise measurement of degree days.

So how do these models translate to managing turf on a day-to-day basis? Take the summer patch model, for instance. The Rutgers researchers found that applying a fungicide before reaching 85 degree days generally will produce little effect. That information may save a golf course superintendent from making an unnecessary early fungicide application, said Bruce Clarke, Director of the Center for Turfgrass Science at Rutgers. "It's useful because it will delay the first application until its needed. It prevents people from jumping the gun," he said.

Experts agree that the models are most valuable for pests that are both hard to detect in their early stages and difficult to control once their symptoms appear. That's why degree day models are a useful tool of Integrated Pest Management, said Wendy Gelernter, research director at the PACE Research Institute in San Diego who is developing a degree day model for Black turfgrass atenius, an insect that feeds on plant roots in its larval stage and often goes unnoticed until it inflicts heavy damage.

Mike Fidanza, field development representative for AgrEvo USA Co., helped develop a degree day model in Maryland to predict crabgrass germination. Using a baseline soil temperature of 12 degrees Celsius at a one-inch depth and a start date of April 1, the model predicts that 25 percent of the total crabgrass population will have germinated by the time 310 degree days have been reached.

"It's useful if you can use degree days to time your applications more effectively," he said. "Sometimes people will come out too early with

their pre-emergents, and then they think the application didn't work."

The developers of the models caution turf managers to use degree day predictions for guidance rather than relying on them slavishly.

"I would use our numbers as a ballpark. I would adapt to your own site by observing it over a few years," Fidanza said. "If you can get in the habit of making observations when the crabgrass emerges, then go back and look at the data and you can fine tune the program."

Regional differences affect some models, particularly for applying models developed in Northern climates to areas that do not experience winter, Galernter noted. In fact, she is developing her insect model because the original degree model developed in Ohio predicts two generations of the black turfgrass atenius in a year, yet PACE Institute researchers have found as many as five generations in southern California.

Regional climatic differences are only one of many factors that may affect the accuracy of the model. Even within small sites, microclimates can produce significant temperate differences that need to be considered, said Bruce Branham, an associate professor at University of Illinois. Branham developed a degree day model to predict seedhead production in annual bluegrass to provide guidelines for control using a plant growth regulator (PGR).

"The larger issue is how do you implement these models once you have them," Branham said. "It's not an absolute predictor. It's a guideline that tells you 'under ideal conditions, this is when you should be looking.'"

In addition, the growth of many pests depend on more than temperature alone. Clarke noted that a combination of three variables helped predict

the emergence of brown patch, a disease that can be difficult to detect early and devastating if caught too late. The risk for brown patch is high if the minimum nighttime temperature exceeds 59 degrees Fahrenheit, if the relative humidity at the turf surface reaches at least 95 percent or above for 10 consecutive hours, and if any combination of rain or irrigation exceeds one-tenth of an inch within the past 36 hours, he said. If those three conditions are met, Clarke recommends a fungicide application if one hasn't been applied in the last 15 days.

Monitoring and recording instruments can make this data gathering routine and effortless. To further automate the process, predictive models can be built into the monitoring equipment. The Envirocaster, developed by the Neogen Corporation, for example, relies on predictive models to produce warning of high, moderate or low risk for anthracnose, pythium blight, brown patch and annual bluegrass seed formation, said Charlie Swieringa, who helped developed the product for Neogen.

Ironically, even as the models become more precise, their acceptance has been slow and sporadic among turf managers, according to several turfgrass researchers and superintendents. Acceptance has been hampered by a lack of understanding of how the models work as well as an reluctance to invest the time to follow degree days for different turf pests, Galernter said.

Many turf managers use short cuts that approximate the results of the models. For the summer patch, 85 degree days can be estimated when temperatures reach 65 degrees for five consecutive days, measured at a two-inch depth between 2:00 and 3:00 p.m., Clarke said. For predicting crabgrass germination, Fideanza's research showed that minimum soil temperatures of 54 to 55 degrees for three to four consecutive days was a reasonable estimate.

Fidanza also noted that many turf managers rely on indicator plants, such as the withering of the flowers of the forsythia or the flowering of dogwoods as the beginning of the germination and emergence period of crabgrass. Developers of the models agree that their predictions can provide useful information to supplement decisions, but they cannot replace the need for careful observation and site-specific judgment that makes turfgrass management an art as well as a science.

"The idea of modeling may tend to take away some of the management skills that has to be applied. An experienced superintendent often knows exactly what will appear in what spot," Branham said.

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REPORTS FROM CITIES BY NATURE'S DESIGN - URBAN FOREST CONFERENCE

**Susan Barton
University of Delaware**

The 8th National Urban Forest Conference was held in Atlanta from Sept. 17 through Sept. 20. Among the excellent speakers, I heard Nina Bassuk from Cornell University and Don Marx from Plant Health Care, Inc. present some excellent technical information.

Structural Soil Mix

Foremost for the health of urban trees is the need to find sufficient soil volume to support plant growth. Unfortunately, engineers require that sidewalk subgrades be compacted to a density far beyond that which will allow tree roots to penetrate. If tree roots do break out into the surrounding soil, they do so in the top six inches and cause problems with sidewalk heaving.

Research at the Urban Horticulture Institute at Cornell has shown that two cubic feet per square foot of crown projection is needed to support normal tree growth. To get that kind of volume in an urban system, trees need to use the soil volume below the sidewalks and other paving. Nina Bassuk and her colleagues have developed a creative solution to this problem. By developing a product called structural soil, she has shown how cities can use the entire space between the curb and building space for tree rooting.

Structural soil is a rigid matrix of gravel and soil. The gravel component consists of 3.4 to 1 1/2 inch crushed stone (no fines). The crushed stone is coated with a sticking agent (hydrogel) to promote uniform mixing. The large pore space between the stones are then filled with usable soil. This mix can be compacted to the

specification required for paving subsurface (95% proctor density) but since the stones are resting on stones, they bear the load and soil remains uncompacted in the large pore spaces.

The ratio of soil to gravel is critical. If there is too much gravel, tree roots won't be able to access sufficient soil. If there is too much soil, the rigid structure of the stone to stone contact will be destroyed and the mix will be compacted like any other soil mix. The right ratio appears to be about 4 to 1 or 5 to 1 (stones to soil). Bassuk uses a fairly heavy clay soil in the mix to maximize nutrient and water holding capacity.

You can either mix the structural soil in a concrete mixer or on a flat paved surface with a front-end loader. Ideally, use 24 to 36 inches of the structural soil below paving. Dump in eight inch lifts and compact between each lift. The only added expense for the city when using structural soil is excavation. The structural soil mix itself is actually cheaper than topsoil.

In the research plots at the Urban Horticulture Institute, Bassuk has found that roots grow down deeper into structural soil than normal soil below paving. It seems that hot pavement heats the soil and when roots have the option they grow deeper into the cooler soil. Therefore the use of structural soil may result in much less sidewalk heaving. Several municipalities are trying this new soil mix. Once it becomes more widely accepted, this promising new product may make a huge difference in the lifespan of a typical urban tree.

Mycorrhizae in Association with Trees

Forest trees are dependent upon a complex soil system to provide water and nutrients necessary for growth. Nutrient matter is cycled through the forest floor litter layer. Microorganisms are present to mix in this organic matter. And trees have microbial partnerships to help them get

nutrients from the system.

Trees can only absorb nutrients that are water soluble, so microbes are required to transform insoluble nutrients to a soluble form. Water must be present in order for the nutrient to go into solution and the nutrients must be located near the root.

Mycorrhizae are fungi that grow in association with roots. They are dependent on trees and trees are dependent on them. These specialized fungi inhabit plant roots, they do not grow on decomposing organic matter. These fungi are always present in natural settings. But are often absent in the borrowed subsoil usually found in urban sites. When we remove plants from natural settings they often lose their mycorrhizal associations.

Ectomycorrhizae occur primarily on trees. They grow on the outside surface of tree feeder roots. These fungi produce mycelia that can grow tremendous distances in the soil, providing a huge network to explore much more of the soil volume. Ectomycorrhizae expand the root system; absorb and accumulate essential nutrients faster; absorb more water; increase plant tolerance to drought, high soil temperature, soil toxins and extremes of acidity; deter feeder root disease and maintain root juvenility. Mycorrhizae also create a fungal bridge between nearby plants. Through these fungal bridges, trees are connected and can share sugars. Smaller trees, shaded by a larger tree canopy can receive photosynthate from surrounding trees.

Mycorrhizae can be reintroduced into the urban soil. Plant Health Care, Inc. markets several products that can be used to inoculate soil in the hopes of establishing a new mycorrhizae population. Since they grow in association with trees roots, roots must be present prior to inoculation. For more information, contact

<http://www.planthealthcare.com>

THE 'LOW DOWN' ON LIMING: A FEW FACTS ABOUT CHANGING THE pH OF CONTAINER MIXES

John D. Lea-Cox

Nursery Research and Extension Specialist
University of Maryland

I've recently had a number of questions and discussions with various people about incorporating liming materials in container mixes. From these discussions, it has become apparent that there is a great deal of confusion out in the industry about when and how much to adjust pH in organic mixes, the type of material to use, and the variability of materials that are used for this purpose.

General Facts:

- Many potting mixes based on bark, peat, coir (coconut husk) and other organic materials have more than 50% organic matter. The link between pH and nutrient availability is **different** for these substrates compared to nutrient dynamics in mineral soils. The range for maximum micronutrient availability in organic mixes is between pH 5.0 and 5.8, based on a saturated paste extract. This is a full pH unit below the 'ideal' for mineral soils.
- Maximum micronutrient availability occurs at pH's less than 5.0. Many plants can grow very well at pH 4-5 without any micronutrients added, but they may respond to micronutrient additions above pH 6.0.
- The effect of pH on nutrient availability is much more important when the supply of nutrients is **poor**. This is **not** usually the case in most well-managed nurseries.
- Plant roots change the environment immediately around them. Hydrogen ions

are released when cations such as ammonium (NH_4^+), Calcium (Ca^{2+}), Magnesium (Mg^{2+}) and Potassium (K^+) are taken up by the plant.

This makes the substrate more acid with time. Bicarbonate (HCO_3^-) ions and other organic anions are released by roots during the uptake of anions such as nitrate (NO_3^-) and sulfate (SO_4^{2-}). This, over time, makes the substrate more alkaline. The final pH depends upon the source and type of fertilizer being used, the relative amounts of cations and anions being absorbed by the plant, and the buffering capacity of the substrate.

- Plants vary greatly in their abilities to extract nutrients from the soil substrate. Some are poisoned by high levels of soluble Mn in acid soils; others cannot get enough Fe from alkaline substrates. This variation comes from a plant's adaptation to different ecosystems.
- Changing the pH of a substrate will not automatically mean an ample supply of nutrients. If a substrate contains too little of a particular (essential) element, it will **still** become the limiting factor for plant growth. On the other hand, if a substrate contains a large amount of a nutrient, it may be enough to maintain adequate plant growth at an unfavorable pH.

Liming Facts:

- Any material that will remove H^+ ions from the soil solution will raise the pH of a substrate. Caustic soda (NaOH) will do this, but it is **never** used, because of the residual effects of Na^+ on plant growth and soil structure. So we use compounds that supply useful cations, as well as something to soak up H^+ . This means we usually use

compounds that contain calcium, magnesium and potassium.

- Compounds of Ca and Mg are much cheaper than those of K, so we use limestone, (calcium carbonate, CaCO_3), or dolomitic lime, consisting of calcium and magnesium carbonates ($\text{CaCO}_3 \cdot \text{MgCO}_3$). Both materials are never pure, limestone usually containing some MgCO_3 , silicate minerals and other materials in minor amounts. These other materials reduce the effectiveness of the limestone.
- The Ca^{2+} and Mg^{2+} of the liming materials take the place of H^+ on exchange sites. The strength of the liming material depends on its ability to remove H^+ ions, this ability varying as follows: O^{2-} (oxides) > OH^- (hydroxides) > CO_3^{2-} (carbonates). Sulfates (SO_4^{2-}), such as gypsum have no liming value unless they are contaminated with carbonates.
- It is also possible to use Calcium oxide (CaO , 'quicklime') and Calcium hydroxide ($\text{Ca}[\text{OH}]_2$, 'Builder's lime'), but they are usually much more expensive.

Therefore,

The **liming value** of a commercial limestone or dolomitic lime will depend on:

- 1? The purity of the source and,
- 2? The particle size (which determines the reactivity)

The **amount** of liming material to be incorporated into a substrate will depend on:

- 1? The initial pH of the substrate
- 2? The buffering capacity of the substrate
- 3? The final pH required
- 4? The neutralizing value (reactivity) of the liming material to be used

The **time** taken for a liming material to affect pH depends on:

- 1? The particle size of the liming material (usually the finer the grade, the higher the cost)
- 2? The particle size of the substrate
- 3? The temperature of the substrate
- 4? The water holding capacity of the substrate
- 5? The Mg content of the material (lower percent Mg increases the rate of pH change).

Consistency is the key to achieving reproducible results in the nursery!

Recommendations:

- Get a reputable laboratory to analyze your potting substrate for pH, electrical conductivity (EC) and a basic nutrient analysis **before** adding any liming material.
- Ask the laboratory for a liming recommendation, bearing in mind that this recommendation will change according to the liming value of the material that you use
- Try and obtain a consistent source of liming material that meets your individual criteria (magnesium content, particle size, release time etc.) and match that to the pH requirements of the particular plant species that you are growing.
- Recognize that manufacturers often change sources of base materials, so keep an eye out for change on bag labels, and in any changes in EC and pH readings taken on a routine basis throughout the nursery

Following these guidelines may not solve all your pH problems, but they should help preempt some of the more common disasters that occur.

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SHORE FLIES NOW COMMON GREENHOUSE PESTS

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Purdue University

Shore flies have become common greenhouse pest. They are predominantly a nuisance pest, but they have been implicated in the transmission of fungal pathogens. Shore flies are often confused with fungus gnats. The following descriptions will help to identify larvae and adult stages of shore flies.

Larvae are opaque yellowish-brown with no head capsule and about 1/4 inch long when mature. Adults look like small house flies. They are 1/8 inch long, and are black in color. They possess dark wings with approximately five light-colored spots on each wing. Antennae are shorter than their head and the legs are small. Shore flies are stronger fliers than fungus gnats.

Damage. Shore flies are primarily a nuisance pest, as large numbers of flies can reduce crop marketability. Shore fly damage involves excrement (“fly specks”) left on the foliage of bedding plants and other ornamentals. Shore flies also have the potential to transmit fungal pathogens such as pythium root rot and black root rot. They can only damage plants indirectly by injuring plant root hairs. In most cases, shore flies generally feed only on algae.

Biology. The shore fly species commonly encountered in greenhouses are *Scatella stagnalis*. Shore flies have a life cycle consisting of an egg stage, three larval stages, pupal stage, and an adult stage. A generation can be completed in 15-20 days. Females lay eggs in areas where algae accumulates such as medium surfaces, benches, and greenhouse floors.

A single female can lay 300 to 500 eggs. Eggs hatch in 2-3 days, giving rise to maggot-like larvae. Larvae are found just under the top layer of medium, where they feed on algae. Usually, the body is located in the medium and the head in the algae. The larval stage lasts approximately 7-10 days, after which they pupate. Pupation occurs in the soil. Adults emerge in 4-5 days and live about 3-4 weeks. Adults move very rapidly on medium and leaf surfaces. The rate of development depends on temperature.

Management

Quarantine - Inspect all incoming plant material for the presence of adults or larvae. If possible, hold plants in an isolated area for approximately one week. Place yellow sticky traps among the crop to detect the presence of adult shore flies. Apply insecticides to control any shore flies that are present.

Proper Sanitation - Shore flies breed in algae, so eliminate algae in pots, propagation areas, on benches, under benches, and on greenhouse floors to greatly reduce shore fly populations. Areas under benches can be treated with copper sulfate, bromine, or quaternary ammonium salts.

Proper Fertilization - Use the minimal optimum levels of fertilizers for plant growth and avoid excess fertilizer levels to reduce algae blooms. Any fertilizer that leaches through the pot and accumulates on floors can serve as a breeding site for algae and shore flies.

Eliminate Excess Moisture - Minimize all free-standing water on solid benches, on walks, and under benches by not overwatering plants. Also, be sure to repair all irrigation leaks.

Monitoring/Record-keeping - Shore fly infestations can be monitored effectively by counting adults on yellow sticky traps. Place

sticky traps near the medium surface and/or about 1 inch above the crop canopy. Move sticky traps in relation to plant growth. Inspect sticky traps weekly using a 10X hand lens and record the number of adults per trap. Keep records on areas in the greenhouse where shore flies occur. Be sure to note plant species infested and the type of medium used.

Chemical Control - Insecticides that are labeled for shore flies are Azatin (Azadirachtin), Citation (Cyromazine), Precision (Fenoxycarb), and Adept (Diflubenzuron). Adept is the newest material available. It is an insect growth regulator that inhibits the formation of chitin. It is applied to a soil drench, and has approximately 30-60 days of residual activity. The material should be applied before fly population build-up. It has been shown to be highly effective against shore fly. Azatin, Citation and Precision are also insect growth regulators. Always check label for application rates and crops that these materials can be used on.

Biological Control - Biological control of shore flies involves the use of the soil-predatory mite, *Hypoaspis miles*. *Hypoaspis* attacks shore fly larvae and is able to control shore flies if there is no standing water; shore fly larvae can survive in standing water, whereas *Hypoaspis* cannot. Make releases soon after shore flies are detected.

If you want to attempt biological control, use the following guidelines:

- Start on a small scale. Don't try to convert the entire operation to biological control until the system has been tested and proven effective.
- Find a reliable source of predatory mites and order at least 2 weeks before application.
- Release biological control agents upon delivery. Delaying reduces effectiveness.

- Monitor and record the number of pests (shore flies) present before and after release.

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TREE SIZE AFFECTS ROOT REGENERATION AND TOP GROWTH AFTER REPLANTING

Gary Watson

Slow growth of trees over 4 inches dbh, following transplanting, is often a source of concern for arborists and landscape contractors. Growth of these trees is often stagnant for several years. Smaller 1- to 3-inch trees, transplanted at the same time, will often equal in size or surpass them before larger trees regain their pre-transplanting vigor. In spite of these difficulties, larger trees continue to be transplanted for the immediate advantages they can provide in landscape design.

All newly transplanted trees are subject to an initial period of reduced vigor, but the duration of this period varies. This period is often referred to as transplanting shock. Neither researchers nor practitioners have been able to identify any single, specific cause for the prolonged period of transplanting shock experienced with large transplanted trees. Various physiological stresses are often implicated. All transplanted trees are subject to varying degrees of water stress because the root system is drastically reduced (Watson and Himelick, 1982a). Water stress can reduce photosynthetic activity (Kozlowski and Keller, 1966), potentially diminishing carbohydrate reserves and reducing growth. Recent work has shown that levels of carbohydrate reserves are not reduced in transplanted trees when they are watered adequately following transplanting (Watson and Himelick, 1982b), and may only play a role in cases of severe or prolonged water stress. Stressed trees are often susceptible to a wide variety of insect and disease problems

which can result in reduced vigor, distortion of shape, and death (Schoeneweiss, 1981). The causes of transplanting shock are complex and relate to the reduced size of the root system of the transplanted tree. The root-shoot imbalance created by transplanting appears to be the primary cause of transplanting shock with other physiological and pathological problems acting as secondary agents. Until the natural root-shoot balance of the tree is restored, some degree of transplanting stress will exist.

It is the intention here to show the relationship between the duration of stress from transplanting and the length of time necessary to replace that portion of the root system lost during transplanting. When standard nursery practices are used to determine the size, the root ball is proportionate to the crown for both large and small trees (Himelick, 1981). It is important to remember that as the size of the tree increases, the lateral spread of the original root system increases. Although a consistent percentage of the root system is left behind, a greater mass and length of roots is lost from the large tree and these must be replaced at the new site. If the roots of both the large and small trees grow at the same rate, the root system of the larger tree will take much longer to regenerate. This point is illustrated in the following model.

Figure 1 illustrates a model of a small (4 inches dbh) and a large (10 inches dbh) transplanted tree of the same species transplanted at the same time. It shows the reduction in the root system at the time of transplanting and the regeneration of the root system during the succeeding years. The model incorporates several aspects of root development which should be thoroughly understood in order to fully comprehend the mode

1. The natural root distribution of shade trees is very shallow and widespread. Little, if any,

root growth occurs below 48 inches in most soils. Fine roots are heavily concentrated in the top 4-12 inches of soil. Structural or sinker roots penetrate deeper, but seldom below 48 inches. Tree taproots are rare or absent for most tree species. Actual depth of the roots is highly influenced by soil type at the site.

2. Root regeneration occurs laterally from the perimeter of the root ball. The rate of growth of regenerated roots is essentially the same for both large and small trees of transplantable size, if unstressed. Lateral growth out from the soil ball of 18 inches per year is average for a well-maintained tree transplanted in friable, well drained soil. In previous studies, lateral root growth ranged from 12-27 inches per year (Watson and Himelick, 1982b).
3. As roots grow, exploitation of the soil by the fine roots is uniform throughout the lateral spread of the root system. Seldom are there large areas of soil in which the roots do not grow unless the soil conditions are unfavorable.

The model is based on the concept that as long as the roots and aerial portions of the tree are out of balance, the vigor of the tree will be reduced. The roots cannot supply sufficient quantities of water and mineral nutrients to the upper portion of the tree for vigorous growth until the natural balance has been restored. The greater the imbalance, the slower the resultant growth. In the model, the root system of the 4-inch tree had a diameter of approximately 45 feet before transplanting. The above and below-ground portions of the tree were in natural balance. During transplanting this balance is grossly distorted and the root system may be reduced by as much as 98 percent (Watson and Himelick, 1982a). New roots are initiated from callus formed near the cut end of the roots at the

edge of the root ball. This occurs soon after transplanting. By using 18 inches per year as an average annual root growth, the smaller tree will replace its original root system in less than 5 years. Since the top of the tree has continued to grow slowly during this period, it may take it

different tree species grow at varying rates. Soil conditions have a profound effect on root growth rates. Promoting vigorous root growth is the best way to minimize the severity and duration of transplanting shock for trees of any size.

slightly longer to restore the original root-shoot balance. After 5 years the regenerated root system of the 10-inch tree will be only about 25 percent of its original size, and the tree remains stressed. As Figure 1 illustrates, a period of 13 years or more is required to restore the original balance of the 10-inch tree. At this time, the root system of the smaller tree is nearly as large as that of the larger tree. Since the root systems are nearly equal in size, it follows that the above-ground portions are also nearly equal. Since the small tree has been growing vigorously for several of the 13 years while the larger tree has been under at least some degree of stress, it is possible for the original 4-inch tree to be larger than the 10-inch tree by this time.

The model can be used to understand the concepts involved in root regeneration and transplanting shock, and to predict the timing of events. It is difficult to model all of the factors that influence root regeneration. Roots of

The soil environment must be favorable to optimum root growth. Most importantly, moisture, aeration, and nutrient levels must be favorable. When used as backfill, heavy, compacted soils should be modified to improve drainage and aeration. Soil conditions are usually most favorable for the fine root development in the top 4-6 inches of soil, especially in the disturbed clay soils often encountered in urban areas. The deeper soil layers are often waterlogged and oxygen deficient. Modification of this surface soil around the root ball would promote more rapid root regeneration in the early years following transplanting. A large planting hole with the sides sloping at a shallow angle would accomplish this and also provide a large interface between the backfill and the native soil (Whitcomb, 1979). Mulching the surface would further improve the rooting environment and increase root growth. Litzow and Pellett (1983) have published a review on this subject.

Rooting hormone treatments may also be useful in increasing root generation during the initial period of establishment (Prager and Lumis, 1983; Lumis, 1982).

Summary

The model shows why large transplanted trees are likely to have reduced growth for many years following transplanting due to the length of time required to regenerate the roots lost during the transplanting process. The above-ground portion of the tree must be in balance with the root system for proper growth. The size of the above-ground portion of the tree is controlled by the size of the root system. When the root system is reduced or restricted, the growth of the trunk and branches will also be reduced. Since the spread of the regenerated root system of the large and small transplanted trees differs only by the relatively small difference in size of the original root balls, it follows that the growth of the above-ground portions of the trees must eventually be similar if the root-shoot balance is to be maintained. Trees transplanted into poor sites, may never regain proper root-shoot balance and normal vigor.

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SURVIVING THE WINTER: A LOOK AT PLANT DORMANCY

Koreza Burris

Acclimating plants to winter weather mainly is influenced by three environmental factors: temperature, light and moisture. Another factor that should be considered is the stage of development of the plant when acclimation begins. These factors, and others, effect various species and cultivars in different ways.

Acclimation Stages: The process of acclimation or hardening off is reached in three stages. The first stage is normally induced by short days and warm temperatures resulting in partial hardiness. The second is instigated by exposure to low temperatures resulting in partial hardiness. Fully acclimated plants require exposure to temperatures between 40 and 32 F to promote dormancy development. This second stage of acclimation, which preferably begins at vegetative maturity, is a nonreversible stage.

The third stage is promoted by temperatures lower than 30 F. This stage of acclimation is reversible and will increase or decrease hardiness depending on the temperature. "Stage three is where you can have many problems, and the roots are always in stage three," says Leslie Fuchigami, professor of horticulture at Oregon State University.

During dormancy development, cold acclimation is dependent on stages one and two and plants generally do not lose hardiness. The rate of hardiness development, however, is slow at warm temperatures and increases with decreasing temperatures. After dormancy is broken, or when the chilling requirement is satisfied, cold acclimation is in stage three. Plants then gain or lose hardiness in response to cold or warm temperatures. In general, maximum hardiness occurs in early to mid-

January, and after this date the rate of deacclimation increases with rising temperatures.

Dealing With Container Stock: With containerized nursery stock, as opposed to field stock, low temperature injury is much more prevalent. Plant roots in containers are more exposed to air temperatures because they are above ground and don't have the insulating value of the ground. "Growers need to know that the roots don't acclimate. Roots are very different from the rest of the plant." says Fuchigami.

Much of the injury is seen through the root system because root tissue is more susceptible to low temperature injury compared to other plant parts. In contrast to leaves and stems, root hardiness is controlled by temperature and not daylength. Because roots do not acquire dormancy, acclimation and deacclimation is a reversible process.

Damage to containerized stock can be reduced by implementing some precautions

The best way to prevent winter injury, says Hannah Mathers, British Columbia provincial nursery crops industry specialist, is to ensure maximum acclimation by optimizing the growing conditions during the growing season and minimizing stressful conditions. Don't try to overwinter weak or diseased plants because these plants will already be under stress when cold weather arrives and will most likely not survive.

Nitrogen is known to induce plant growth, therefore its use may delay plants from the cold acclimation process. "Nitrogen prolongs growth and delays dormancy and winter acclimation," Fuchigami says. "It is advisable to cut back on nitrogen fertilizer in early August."

Some growers decrease the rate of nitrogen application by nearly half in mid- to late-August. Growers using fertilizer immediately available to the plant need to begin withholding fertilizer approximately six weeks before the average first frost date. The amount of nutrients, timing of application and availability of moisture for plant uptake also are significant factors in the hardening off process.

Moisture withheld in the summer can induce terminal bud set and increase hardiness, but stress caused by lack of water should be avoided. Both too much and too little water during the latter part of the growing season can affect plant maturity and growth, thus reducing winter hardiness of nursery crops. However, reducing soil moisture so plants are a bit on the drier side is suggested for inducing growth cessation.

To maintain a higher soil temperature during the winter, place plant pots tightly together. This reduces the surface area of pot sides that are exposed and gives the plants protection from the wind. Insulate the exposed edges with sawdust or another form of insulation for increased protection.

"Take advantage of the ground heat," Fuchigami says. He advises that containers should be placed directly on the ground with no medium between the pots and the ground.

Don't forget to take precautions against rodents and diseases. Rodents can cause significant damage to container-grown nursery stock during winter storage, both indoor and outdoor. Plants covered for the winter may also be attacked by fungal diseases. Thus, they should be treated with a fungicide prior to covering and as needed during storage.

Covering Plants For Protection: Various types of plant covers can be used to increase

temperatures around the plant. Fuchigami suggests growers choose plastic covers that are not clear. Clear plastic causes the radiation from the sun to penetrate during the day, thus warming the plant tissue, causing hardiness loss. At night, the radiation passes through the clear plastic and the plant tissues lose heat. Choose from a nontransparent plastic, either white, opaque or black. This keeps the temperature more stable than clear covers. The use of covers creates fluctuating temperatures that may reduce or undo the hardening off process. To prevent delay of acclimation, Fuchigami suggests that growers use the plastic cover only when necessary.

Covers can be attached to structures, such as polyhouses and tunnels, or can lie directly on plants. Some common materials used for coverage are:

Polyethylene. The more commonly used coverage, polyethylene is available in both clear and white. However, since polyethylene traps so much solar energy, it is critical that there is sufficient ventilation to reduce fluctuating temperatures. Inflate your polyethylene to the proper pressure. Check it with a manometer.

Microfoam. This closed-cell foam has high insulating value, but it is expensive. It also needs to be used within a structure or held in place with a sheeting material, such as polyethylene, because of the wind.

If you are using polyhouses or any other overwintering structures, temperatures should be allowed to naturally decrease in the fall. Make sure there is adequate ventilation. Recover as late in the season as possible.

Growers need to take precautions early to minimize stock damage. Any factor that slows down the growth in plants is favorable in preventing winter damage to container stock.

Reprinted from *The Digger*, October, 1996

BACTERIAL LEAF SCORCH

Gary W. Moorman

Penn State University

Leaf scorch describes the death of tissue along the edge of the leaf. Sometimes called marginal leaf burn, this symptom develops when water needed by the plant cells at the edge of the leaf does not reach those cells in adequate amounts to replace what is lost during transpiration and growth. This can occur 1) if there is insufficient moisture in the soil, 2) if weather conditions are such that water is lost too quickly to be replaced adequately, 3) if roots are killed by plant pathogens, excavation, compaction, or other factors, and the plant is unable to take up moisture, or 4) if fungi or bacteria invade and plug or destroy the xylem (water conducting vessels) in the plant.

One of the living organisms found to invade plants, inhabit the xylem, and cause leaf scorching is *Xylella fastidiosa*. These bacteria are small (0.25-0.5 X 1.0-4.0 um), stain gram negative, have no flagella, do not form a spore, have a thick, rippled cell wall, and do not grow on conventional bacteriological media. When grown in culture, it may take 2 to 4 weeks for a colony to become visible. Because these bacteria are difficult to grow in the laboratory and are found in the xylem, they were first called fastidious, xylem-limited or xylem-inhabiting bacteria (FXLB's or FXIB's).

Xylella has been associated with leaf scorch on oak, elm, sycamore, mulberry, red maple, and sweetgum, and, Pierce's disease on grapevine, phony peach disease, plum leaf scald, periwinkle wilt, almond leaf scorch, alfalfa dwarf, and ragweed stunt. Phony peach disease was first reported in California in 1890 and Pierce's disease on grapevines (*Vitis vinifera* L.) was reported in 1892 in California. Elm leaf

scorch has been observed in the Washington, D.C. area since the 1950's. Leaf scorch of oak, elm, sycamore, mulberry, and red maple probably all occur in Pennsylvania.

Symptoms

Red maple leaf scorch: Leaf scorch occurs on localized, individual branches and more branches are affected each year. While leaves appear normal early in the season, leaf discoloration begins at the leaf margin and migrates with an undulating front toward the midrib and base of leaf beginning mid to late July. The light brown dead tissue along leaf margin is frequently bordered by narrow to wide zones of dark reddish brown tissue. The dead tissue is separated from green tissue by a narrow but distinct yellow border or halo. Premature defoliation can occur in late August. This disease may make affected trees more sensitive to damage caused by site-related stresses such as deicing salts and limited growing space.

Elm leaf scorch: Leaf margins die and have a distinct yellow border separating the dead tissue from the green tissue. Scorching begins on leaves at the base of the tree and moves upward through the canopy. Leaves on branches that were affected during the previous season appear normal in the Spring but later show symptoms. Some premature defoliation may occur. Affected trees are very attractive to elm bark beetles and are much more susceptible to Dutch elm disease than trees free of leaf scorch.

Oak leaf scorch: This disease affects primarily pin and red oak but has also been found in white oak. Leaf margins die and have a distinct yellow border separating the dead tissue from the green tissue. The symptoms progress toward the base of the leaf in an undulating front. Defoliation is not usually a symptom on red oak. However, water sprouts or epicormic shoots do develop on red oak as this disease progresses.

In Georgia, the bacteria were successfully isolated from twigs November to January but not from February through July.

Sycamore leaf scorch: In late June or July, olive green discoloration of leaf margin develops and the margin dies. Affected leaves remain attached. The leaves at branch tips are the last to scorch or may not scorch at all. Trees with a history of scorch are slow to leaf out and develop fewer leaves and smaller leaves than scorch-free trees. Branch dieback and tree death eventually occurs.

Mulberry leaf scorch: A marginal, undulating leaf burn with a yellow halo progresses on leaves from the base of the tree upward and from base of limbs outward. Severely scorched leaves fall, leaving tufts of leaves at branch ends. Branch dieback occurs. This disease has been identified in Virginia, Maryland, Pennsylvania, New Jersey, and New York City. *Xylella* pathogenic on mulberry is also pathogenic on sycamore and vice versa.

Spread

The spread of *Xylella* has not been studied in Pennsylvania. In Florida and California, nymph and adult spittlebugs and leafhoppers are known to be very efficient in carrying *Xylella* from plant to plant. In the Delaware River valley, New Jersey researchers have implicated a small, unidentified leafhopper as a carrier. Once the bacteria are picked up, they are in some cases immediately transmittable or, in other cases, have a 2 hr. latent period before they are transmittable. The insect will continue to carry the bacteria until it molts.

Diagnosis

Although the symptoms seem distinctive, it is difficult to be certain of the cause of a marginal leaf burn. There is a commercial diagnostic

service which can confirm the presence of *Xylella*. Contact the author for further information.

Management

Too little information is available on disease development to recommend an effective control measure. In most cases, plants are not killed. The bacteria may be so widespread in the wild plant population that removal of infected trees may not prevent the spread of the bacteria to neighboring trees. The antibiotic oxytetracycline hydrochloride, when injected into an infected tree, will temporarily alleviate the symptoms. However as the tetracycline breaks down in the tree, symptoms will reappear. For that reason, this very expensive treatment is not recommended nor has tetracycline been registered for such use.

PESTICIDE NEWS

Insecticides:

CONSERVE (spinosad) - Dow Elanco - Received EPA registration to use on turf and ornamentals. It controls leaf-eating insects such as leaf miners, thrips and lepidoptera insects. On turf it is used to control sod webworms, armyworms and cutworms.

MACH 2 (halofenozide) - Roh Mid - Registered on turf to control grubs and other soil borne pests. The granule may be used on all turf sites including home lawns, golf courses and industrial sites. The liquid may be used on golf courses and commercial landscapes.

ACCOLADE (buprofezin) - Agr Evo - Being developed for usage on greenhouse grown ornamental plants to control white flies.

DAZA (Dihydroazadirachtin) - Thermo Trilogy - EPA approved an application to register this new active ingredient for indoor/outdoor use on ornamentals, turf, agricultural and horticultural crops.

SUNSPRAY ULTRA FINE OIL (petroleum oil) - Sun - As a result of the IR-4 Project they can now add 16 new ornamental species to their label.

Fungicides:

KOCIDE 2000 (copper hydroxide) - Griffin. The signal word has been changed from danger to warning.

DACONIL ZN (chlorothalonil) - ISK Biosciences - this product is now labeled to control blue green algae in turf areas.

RTU Copper Soap (Copper octanoate) - W. Neudorff Grub H. - Applied to EPA to register

this new active ingredient to use to control diseases on vegetables, fruits and ornamentals.

PRIMASTOP (*Gliocladium catenulatum*) - Kemira Agro Oy - Proposed to EPA to register this biofungicide on vegetables, herbs, spices, ornamentals, tree and shrub seedlings, and turf in the home garden. It controls diseases such as damp off, seed rot, root and stem rot and wilt diseases.

RONILAN (imclogolin) - BASF - EPA has deleted all residential uses as well as turf in parks, school grounds and recreational areas from their label.

CYGNUS (kresozim-methyl) - BASF - A new fungicide being developed for use on greenhouse ornamentals to control powdery mildew.

MEDALLION (fludiozinil) - Novartis - A new product to control root and stem diseases caused by Rhizoctonia, Botrytis and Alternaria on ornamental plants. Used as a foliar spray or a soil drench.

Terraclor 75% WP (PCNB) - Uniroyal - Added to their label the usage on vegetable bedding plants in containers and added additional ornamentals to their label.

Herbicides:

TURFLON ESTER (triclopyr) - Dow Elanco - added to their label the suppression of bermudagrass in cool season turf.

Miscellaneous:

CYCLCEL (chlormequat chloride) - American cyanamid - Added to their label for this growth regulator. The usage on marigolds and gardenias.

RESEARCH BRIEFS

Propagation:

Propagating Clematis by stem cuttings. The best media for propagation of clematis were sand and perlite. Sand is used predominately in the industry. This study shows that perlite is an acceptable alternative. IBA application to the base of the cutting may be useful on difficult-to-root cultivars or species only. (J.E. Erwin, D. Schwarze and R. Donahue)

Excerpted from *HortTechnology* 7(4), October-December 1997.

Promoting hosta offsets with BA. Hostas are conventionally propagated by tissue culture (costly) or crown division (slow). The synthetic cytokinin, BA can be used to stimulate offset production, increasing the speed of propagation. The effectiveness of BA is cultivar dependent, but all cultivars in this study responded to BA treatment with increased offsets. The optimum rate for half the cultivars tested was 1250 ppm and 3750 ppm for the remaining half. BA may reduce costs and accelerate production for a wide range of cultivars, including cultivars that are slow to produce offsets. But rates will be cultivar dependent. (J.M. Garner, G.J. Keever, D.J. Eakes and J.R. Kessler)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Seed propagated landscape tree growth varies with regional adaptation. When non-improved, regional seed-propagated sycamore were compared with genetically improved seedlings from another region, regional seedlings grew better. Nurseries targeting local markets have the opportunity to select genotypes for better growth in the container nursery and for subsequent performance in local landscapes. (L.J. Shoemaker and M.A. Arnold)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Forcing softwood shoots from dormant stock plants for stem cuttings. Stem sections should be 12 to 16 inches long. Stem sections were placed in black plastic bags and stored at 4C for 2 days. Subsequently stems were placed horizontally in flats filled with horticultural grade perlite. Sections were pressed into medium so approximately ½ the stem was covered. Softwood shoots can then be harvested every 12 to 13 days. This technique has the potential to reduce the heavy spring workload associated with propagation tasks and increase the length of a crops first growing season. (P.H. Henry and J.E. Preece)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Container Production

Container size and fertilizer affect pot-in-pot shade tree growth. Green ash, honey locust, and European white birch were grown in 10 and 20 gallon pot-in-pot containers and in the field. They were fertilized with slow release (Nutricote 20-7-10) and liquid (28-14-14) fertilizer. The trees grown in larger containers supplied with slow-release fertilizers were consistently larger than field-grown trees or trees receiving other fertilizers. (C.L. Murray, G.P. Lumis and C. Chong).

Excerpted from *American Nurseryman*, March 15, 1997.

Styrene-lining improves container-growth of dogwood. Dogwoods are particularly sensitive to high root zone temperatures when grown in containers. Styrene-lined containers had a greater percent surface root coverage and less root dieback during the first and second growing

season and a greater growth in height during the second season. Plants originally grown in styrene-lined containers had more trunk diameter growth and a higher percent of surface root coverage after being repotted in #7 containers than those grown in non-lined containers. (T.J. Brass, G.J. Keever, C.H. Gilliam and D.J. Eakes)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Growth of viburnum and lilac in coir dust-based substrates. Coir can be successfully used as a substitute for peat when producing container-grown viburnum and lilac, and presumably other woody plants. (M.R. Evans and J.K. Iles)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Field Production:

Twenty-nine annual and perennial wildflower seeds were evaluated for sod development based on ratings for appearance, root mat density, stability following undercutting and storage, and performance after planting. Species selection was based on the lack of a large taproot, adaptability to the southeastern climate, flowering period, and potential for surviving root undercuttings. Species were seeded in fall and spring, and leaf area and root mass samples were compared. Wildflower sod was undercut at 2 inch depth in March (fall-seeded plots) and May (spring-seeded plots) and then stored on clear plastic for 7 weeks and replanted. Fall-planted species had a higher survival rate than spring-planted species. Species selected for sod development were *Achillea millifolium*, *Chrysanthemum leucanthemum*, *Coreopsis lanceolata*, *Coreopsis tinctoria*, *Gaillardia aristata*, *Monarda citriodora*, *Rudbeckia hirta* and *Verbena tenuisecta*. To reduce damage to

aerial growth during harvesting, paclobutrazol, daminozide, and uniconazole were tested on eight greenhouse-grown wildflower species. uniconazole had limited growth control over *Rudbeckia hirta*, *Monarda cirtiodora*, *Coreopsis lanceolata* and *Coreopsis tinctoria*. (A.M. Johnson and T. Whitwell)

Excerpted from *HortTechnology* 7(4), October-December 1997.

Greenhouse Production:

Composted urban waste improves growth of dianthus and petunia. The best growth was observed in the medium with 60 % composted biosolids and yard trimmings. Petunia and dianthus were larger when plants were grown in media containing compost as compared to plants grown in peat, vermiculite, perlite medium. (K.A. Klock)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

MCP, a new ethylene inhibitor, shows promise. Ethylene is a gas that causes premature wilting in many flowers and accounts for 25 to 35% of all floral crop shrinkage. STS (silver thiosulfate) has been show to be effective in preventing ethylene damage but treatment is a cumbersome two-step process. MCP (1-methylcyclopropene) shows promise as a postharvest treatment for both potted plants and fresh cut flowers. MCP is a gas and could be applied in closed greenhouses before harvest, in storage or display coolers, truck trailers or shipping containers. MCP was as effective as STS for most crops tested except gypsophila (offered some protection for fully opened flowers but not for buds that develop later). MCP will be commercially produced by Biotechnologies, Inc. Product release is pending EPA approval (expected in early 1998). (A. Mayers, J. Newman, M. Reid and L. Dodge)

Excerpted form *GrowerTalks*, August 1997.

Lighting reduces the time to flowering for pansies and violas. A 14 to 18 hour photoperiod would probably increase plant quality, could be used for programming flowering and would be more economical than 24-hour lighting. The most critical time to light the pansy and viola varieties studied (Delta Pure Rose and Sorbet Yellow Frost) was for weeks 2 to 6 after germination. Short day treatments may be useful to delay flowering and stimulate branching when growing pansies and violas for basket and container sales. Summer-germinated pansies and violas may bloom too early, when too small, because they're initiating flowers before plants have adequate size. (J. Erwin)

Excerpted from *GrowerTalks*, July 1997.

Growth of *Dieffenbachia maculata* 'Camille' in Coconut Coir Dust. Coir dust appears to be more than an adequate substitute for peat moss in the three growing mixes tested in this study. The mixes tested were 50 coir dust (cd) or sphagnum peat (sp): 25 vermiculite (v): 25 perlite(p), 40 cd or sp: 30 v: 30 pinebark (pb), 50 cd or sp: 50 pb. (R.H. Stamps and M.R. Evans)

Excerpted from *HortScience* 32(5), August 1997.

Flowering of *Campanula carpatica* 'Blue Clips'. Consumers want to purchase this popular herbaceous perennial when it is in flower. *C. Carpatica* 'Blue Clips' is an obligate long-day plant that does not require a cold treatment for flowering. Exposure to 5C reduced time to visible bud and flowering by no more than 10 days and had little effect on flower count or plant height. Plants forced at 26 C flowered about 21 days earlier than those forced at 16 C. Flowers were most abundant and

largest at 16 C. (C.M. Whitman, R.D. Heins, A.C. Cameron and W.H. Carlson)

Excerpted from *HortScience* 32(5), August 1997.

Growth of poinsettia and geranium in substrates containing shredded rubber.

While previous research has shown acceptable growth of several species in substrates containing as high as 25% shredded rubber, this study demonstrated that geranium and poinsettia growth was reduced in substrates containing shredded rubber as compared to a peat:perlite:loam substrate. (M.R. Evans and R.L. Harkess)

Excerpted from *HortScience* 32(5), August 1997.

Landscape Installation and Management:

Wound wrapping. When a tree receives a wound that destroys bark and exposes the xylem, there is usually some dieback of cambial tissue adjacent to the wound. Dieback is a result of the desiccation of cells around wounds that increases the size of wounds and lengthens the time required for wound closure. This increases the amount of time the xylem is open to microbial invasion. When stem wounds of aspen and maple were covered with polyethylene plastic the day they were wounded, dieback was significantly reduced and the formation of callus tissue was enhanced compared to untreated wounds. Reducing dieback can minimize the impact of wounds on trees and hasten their recovery. The benefits of plastic wrap can be realized by wrapping wounds for only 1-2 weeks. Covering wounds with polyethylene plastic is an easy, inexpensive, and effective method of reducing dieback associated with tree wounds.

Excerpted from *Journal of Arboriculture*, 22(5);

206-210

Stress tolerance of hollies. Results from this study indicate that *I. rugosa* was the most heat sensitive species as indicated by a low temperature optimum for photosynthesis and a low photosynthetic capacity at its temperature optimum. *Ilex aquifolium* and *I. cornuta* had greater heat tolerance as indicated by their higher temperature optima. However, *I. cornuta* also had the greatest potential photosynthetic capacity at 40 C and saturating CO₂ indicating superior metabolic tolerance to high temperatures.

Excerpted from *Landscape Plant News*, Volume 8, no. 2, Spring 1997.

Insect and Disease Control:

Compost enhances disease resistance.

Beneficial microorganisms in compost induce disease resistance in plants. Cucumber seeds were germinated in a pinebark compost mix and a peat mix, then transplanted by the split-root technique in which half of each root system was placed in either identical peat mixes, identical compost mixtures or peat and compost mixtures. Half the pots were inoculated with pythium. Regardless of growing medium, plants germinated in compost had the overall best health. Root rot was much less severe for roots growing in disease-inoculated peat if the other half of the roots were growing in compost. This shows that a plant communicates with itself. (H. Hoitnick, W. Dick and W. Zhang)

Excerpted from *American Nurseryman*, April 1, 1997.

Control of eriophyid mites on callery pear.

The pearleaf blister mite has become a problem on ornamental callery pear cultivars. Control of this mite is difficult. The overwintering adults hide under the bud scales where contact with

dormant oils is nearly impossible. They emerge in spring around budbreak. One or two applications of UltraFine Spray oil (2% rate) starting at budbreak provided control such that 29% of the foliage was injured as compared to 72% injured on untreated trees. The applications of oil reduced injury to 20%. (S. Gill)

Excerpted from *Free State Nursery News*, February 1997.

Ozone susceptibility of Buddleia cultivars.

All cultivars tested showed some sensitivity to acute ozone exposure. The most common injury was stippling on the upper leaf surface. With increased exposure, stipples coalesced into larger discolored areas on the leaf surface. 'Empire Blue' and 'Opera' were most tolerant to ozone while 'Black Knight', 'Nanho Blue', 'Pink Delight' and 'Royal Red' appeared more sensitive. (D.A. Findley, G.J. Keever, A.H. Chappelka, C.H. Gilliam and D.J. Eakes)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Susceptibility of Chinese juniper, rocky mountain juniper and eastern redcedar to four Juniper diseases. Cultivars of Chinese juniper were resistant to all four diseases. Most eastern redcedar cultivars were susceptible to cedar-apple rust but moderately to highly resistant to the other diseases. In contrast, rocky mountain juniper cultivars were moderately to highly susceptible to Kabtina and Cercospora blights and Botryosphaeria canker and probably should not be used in low maintenance landscape plantings. Nursery managers should avoid heavy pruning or shearing of junipers susceptible to Botryosphaeria canker in late May or June (peak spore release period) to reduce chances of infection. (N.A. Tisserat and J.C. Pair)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Cultivars of honeylocust differ in susceptibility to honeylocust plant bug.

Honeylocust plant bug can cause severe injury from egg hatch in April through adult feeding into June. 'Summerlace' is resistant to honeylocust plant bug, while 'Halka' and 'Skyline' are susceptible. (D.R. Smitley and N.C. Peterson)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Role of stress in predisposing trees to insect colonization. The presumption that there is a simple index between vitality and stress, and that stressed trees are predisposed to colonization, may not always be true. Tree susceptibility to insect colonization does not increase continuously with stress. Mild stress may improve tree defenses and a plant health care strategy aimed at maintaining rapid growth may not reduce susceptibility to insects. (J. Ball and M.J. McLeod)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Weed Control

Herbicide-coated fertilizers are an effective delivery mechanism for preemergence weed control in containers. Nursery Special (12-6-6), Osmocote (17-7-12) and Polyon (24-4-12) were coated with Ronstar 50WP at four concentrations and compared to spray-applied Ronstar 50WP and broadcast Ronstar 2G. Ronstar-coated fertilizers applied at the recommended rate or higher provided similar weed control to broadcast- and spray-applied pre-emergence herbicides. Ronstar-coated Polyon consistently provided superior weed

control compared to Osmocote. This method of delivery dramatically reduces non-target herbicide losses that could contribute to herbicides in runoff water from container nurseries. (C.K. Crossan, C.H. Gilliam, G.J. Keever, D.J. Eakes, G.R. Wehtje and W.A. Dozier, Jr.)

Preemergent control of common vetch and black medic. Excellent preemergent control of common vetch and black medic was obtained for 12 or 16 weeks with Snapshot TG (not labeled for turf but tank mix of Gallery at 1 lb ai/A and Surflan at 3 lb ai/A would be equivalent). Good to excellent preemergent control of black medic could be expected for 12 to 14 weeks with Pendulum at 4 lb ai/A. (J.G. Norcini, J.H. Aldrich and F.G. Martin)

Excerpted from *Journal of Environmental Horticulture* 15(3), September 1997.

Publications

13th edition of Book II on Herbicides, Thomson Publications \$24.95 plus tax and shipping.

The 1996 American Standard for Nursery Stock is now available for \$15.00 each plus \$5.75 UPS shipping and handling. (Order # A-43300). Order from American Nursery & Landscape Association, 1250 I Street, N.W., Suite 500, Washington, DC 20005; (202) 789-2900 or Fax (202) 789-1893.

Compendium of Chrysanthemum Diseases. 1997. R. Kenneth Horst and Paul E. Nelson (ed.). APS Press, 3340 Pilot Knob Rd., St. Paul, MN 44121-2097. \$35, softcover. ISBN 0-89054-177-9.

Iris: A Practical Gardening Guide. 1977. Karen Glasgow. Timber Press, 133 S.W. Second Ave., Suite 450 Portland, OR 97204-3527. \$19.95 plus \$5.50 shipping, softcover. ISBN 0-88192-373-7.

Kalmia: Mountain Laurel and Related Species. 1997. Richard Jaynes. Timber Press, 133 S.W. Second Ave., Suite 450 Portland, OR 97204-3527. \$34.95 plus \$5.50 shipping, hardcover. ISBN 0-88192-367-2.

Weeds of the Northeast. 1997. Richard H. Uva, Joseph C. Neal and Joseph M. DiTomaso. Cornell University Press, Sage House, 512 E. State St., Ithaca, New York 14851-0250.

1997 New England Management Recommendation Guide for Insects, Diseases, and Weeds of Shade Trees. 1997. University of Massachusetts, Bulletin Distribution Center, Draper Hall, Box 32010, Univ. of Massachusetts, Amherst, MA 01003-2010. \$15.00, softcover.

Calendar

October 8, 15, 22, 29 - Longwood Gardens - Continuing Education, Fall. Evergreens II, Six sessions. Guided Plant Walks, Wed., Oct. 15 and Oct. 29. Location: Visitor Center Auditorium, (use main entrance), fee \$119. For more information, call: (610)388-1000, ext 516, FAX:(610)388-2908.

October 8 - December 12 - Professional Grounds Management School, A course of instruction in basic grounds management. **Oct. 8**, 9:00-4:00, Soil, Lime & Fertilizer. Location: Neshaminy Manor Center. **Oct. 15**, 9:00-4:00, Plant Science. Location: Fire School Training Center. **Oct. 22**, 9:00-4:00, Weeds & Herbicides. **Oct. 29**, 9:00-4:00, Turfgrass Management. Location: Neshaminy Manor Center. **Nov. 5**, 9:00-4:00, Equipment Use and Maintenance. Location: Neshaminy Manor Center. **Nov. 12**, 9:00-4:00, Understanding Pesticides. Location: Fire School Training Center. **Nov. 19**, 9:00-4:00, Pruning Woody Plants. Location: Neshaminy Manor Center. **Dec. 3**, 9:00-4:00, Insects, Diseases & Weeds. Location: Neshaminy Manor Center. **Dec. 12**, 9:00-4:00, Grounds Manager's Winter Seminar. Location: Warrington Motor Lodge. For information & registration contact: Penn State Cooperative Extension-Bucks County, Neshaminy Manor Center, Doylestown, PA 18901. Fee: \$125 includes all lunches & reference manual.

October 9-10 - Pennsylvania Community Forestry Conference., The Atherton Hotel, State College. PA. Contact 844-865-8301.

October 9, 16, 23, 30; Nov. 6, 13 - Longwood Gardens - Continuing Education, Fall. Includes six sessions: Ground Covers, (optional exam Nov. 20). Included, guided plant walks. Location: Visitor Center Auditorium (Use main entrance) Fee \$119.00. For more information, contact:(610)388-1000, ext 516.

October 14, 15 & 16 - Nursery and Garden Center Tour, Maryland & Virginia nurseries and garden centers. Contact Dave Suchanic (610)489-4315.

October 15, 1997 - Professional Course Schedule- Topic: Uses for Constructed Wetlands, Environmental Concern, Inc. (EC) - Patuxen NWVC, Laurel, MD. 9:30 am - 5:30 pm. Cost \$135. For more information please call: (410)745-9620; fax: 410-745-3517.

October 20-23 - Meeting. International Plant Propagators' Society, Eastern Region. Hotel Viking,

Newport, RI. Call:(860)429-6818 or FAX:(860)429-6665.

October 20-24 -1997 Professional Course Schedule- Topic: Wetland Delineation, Environmental Concern, Inc. (EC) - Patuxen NWVC, Laurel, MD. 9:30 am - 5:30 pm. Cost \$500. For more information please call: (410)745-9620; FAX: 410-745-3517.

October 20-24 - Tree Climbing School, Penn State Cooperative Extension Office, 20 Paper Mill Road, Smedley Park, Delaware County, PA. Sponsored by: The Pennsylvania State University Cooperative Extension, The Morris Arboretum of the University of Pennsylvania and International Society of Arboriculture Penn-Del Chapter. Registration fee: \$160.00 (includes text materials and morning breaks) Class limited to 36. Mail to: Delaware County Cooperative Extension, Smedley Park, 20 Paper Mill Road, Springfield, PA 19064-2705. Tel: (610)690-2655, FAX: (610)690-2671.

October 21 - CNP exam. Delaware Department of Agriculture, Dover, DE. Contact Marianne McGloin (301)677-1895.

October 21 - Annual Business Meeting of the First State Branch of the Professional Grounds Management Society. For more information, contact: PGMS, First State Branch, Box JF96, Winterthur, DE 19735

October 21-22 - The "Sure Fire Can't Miss This Stuff Really Works," Garden Center Marketing and Management Seminar. The course will begin at 1:00 PM on Tuesday 21 and end at noon on Wednesday 22. Cost \$195 first person, \$175 each additional person from the same company. For more information, contact: The California Assoc. of Nurserymen, Tel.:(916)928-3900, FAX:(916)567-0505.

October 24-26 - Mid-South Native Plant Conference. Lichterman Nature Center. Christian Brothers University, Memphis, TN. Call: (901)680-9756 or FAX:(910)682-3050.

October 27 - University of Maryland's Center for Agricultural and Natural Resources Policy is hosting a conference at the Inn and Conference Center at the University. The registration fee is \$65 and must be paid by October 10th. For more information about the policy conference or to register, call Liesl Koch (301)405-0057, at the center for Agricultural and Natural Resources Policy.

October 29-31 - 6th Annual Better Composting School. Ramada Hotel, Hanover, MD. Contact 301-405-1198.

November 1 - Seminar: "Bringing the Forest to the City."
Long Island Arbicultural Association Inc. Planting
Fields Arboretum State Historic Park, Oyster Bay, NY.
Call or FAX: (516)454-6550; e-mail
Liaatrees.com@aol; World Wide Web
<http://www.516web.com/arbor/liaa.htm>.

November 5 – Delaware Farm Bureau Conference on
State Land Use. Sheraton Inn, Dover. Contact Lisa
Williams, 800-273-0012.

November 5, 12, 19, 26 - Quality Management Training -
The First State Branch of The Professional Grounds
Management Society, 6:00 PM - 9:00 PM, cost \$50,
dinner included. For more information, contact: John
Feliciani (302)888-4865.

November 11 - Delaware Turfgrass Workshop, New
Castle County Extension Office, Newark, DE. Contact
Marianne McGloin (302)677-1895.

November 13 - Natural Habitats, Creating & Maintaining
Commercial & Public Landscapes, 7:30am-4pm, Holiday
Inn, Kulpsville, Montgomery County, PA. A workshop
planned by: Penn State Cooperative Extension,
Montgomery Count, Recycling Education Program and by
Montgomery County Planning Commission. Registration
cost before Nov. 6-\$40, after \$45. Information contact:
Natural Habitats, Montgomery County Cooperative
Extension, 1015 Bridge Rd., Suite H, Colledgeville, PA
19426-1179.

November 14 - ANLA American Garden Awards Entry
Deadline. Contact 202-789-2900.

November 14 – Landscaping Under Stress: Making the
Most of Tough Conditions. Morris Arboretum. Call
Education Department (215) 247-5777.

November 14-15 - Preserving Crop Biodiversity and
Saving Seeds in the Northeast, Toftress Resort and
Conference Center, State College, PA. Conference fees:
Individual-\$45, Student-\$30, Lunch extra. For more
information, contact: Dr. Carolyn Sachs, Dept. of
Agricultural Economics/Rural Sociology,
Phone:(814)863-8641, FAX:(814)8653746, E-mail:
csachs@psu.edu.

November 14-18 - Conference and Expo. Professional
Grounds Management Society sponsors conference; expo
sponsored by Associated Landscape Contractors of
America, Professional Grounds Management Society and
Professional Lawn Care Association of America.

Charlotte Convention Center, Charlotte, NC.
Call:(410)584-9754 or FAX:(410)584-9756.

November 15-18 - PGMS Annual Meeting Charlotte,
North Carolina. For more information, contact: PGMS,
First State Branch, Box JF96, Winterthur, DE 19735.

December 2-3 - Quarterly Pesticide Applicator Training,
Sussex County Extension office, RD #6, Box 48,
Georgetown, DE. Contact: Susan P. Whitney (302)831-
8886, FAX:(302)831-3651.

December 9-10 - Quarterly Pesticide Application
Training, Kent County Extension, 2319 S. Dupont
Highway, Dover, DE.(exam at Delaware Dept. of
Agriculture on Dec. 10th). Contact: Susan P. Whitney
(302)831-8886, FAX:(302)831-3651.

January 5-7 – 1998 MANTS Show, Baltimore
Convention Center, 800-431-0066.

January 10, 17, 24, 31; Feb., 7 - Longwood Gardens -
Continuing Education, Fall. Garden Design Studio, five
sessions. Location: Acer Room, fee \$109. For more
information call:(610)388-1000, ext. 516, FAX:(610)388-
2908.

January 13-15 - Delaware Horticulture Industry Expo,
Sheraton, Dover, DE. Contact Marianne McGloin, 302-
677-1895.

January 19-22 - The 1998 Professional Horticulture
Conference of Virginia, Ltd and Trade Show, Virginia
Beach Pavilion & Hotel, Virginia Beach, VA. Contact
Polly Garden, Registration Coordinator (757)523-4734,
FAX: (757)366-9604 for questions about the conference.

February 24 - 1998 Annual Dinner Meeting and Trade
Show, Hockessin Memorial Fire Hall, 4:00 PM - 9:30
PM. For more information, contact: David Birk, Chair
(302)888-4622, FAX:(302)888-4945

