Soil Characteristics Correlated with Stroke Incidence Rates

Scientific attempts to make correlations between soil characteristics and human health usually focus on particular pathogens, so the study reported below, looking at correlations between broad features of soil ecosystems and the incidence of stroke for people living where those ecosystems are found, is certainly provocative. Gardeners and farmers (and their families) are often in close contact (literally!) with their local soils. Might that put some of them at higher risks for certain health problems than the “baseline” risks to nongrowers? Much more research will be needed to answer that question! Here is just the first chapter in a real-life detective story; that story’s eventual outcome could be of great personal importance to growers.

The following is excerpted from “Possible Links between Soil Microbial Communities and Stroke Risk,” by Ann Perry, which originally appeared in the August 2013 issue of Agricultural Research, from the U.S. Department of Agriculture’s Agricultural Research Service (ARS).

“A big part of our ARS culture is cross-talking with outside researchers,” says ARS soil and water scientist Patrick Hunt. “Partnerships are what we do.”

So one day in 2011, Hunt called Medical University of South Carolina professor Daniel Lackland to discuss a paper Lackland had published about stroke risk in the state. South Carolina is part of the U.S. “Stroke Belt,” where residents have a significantly higher incidence of stroke than the rest of the U.S. population. South Carolina counties with the highest rates of stroke—between 89 and 115 cases per 100,000 residents—are found within the Southern Coastal Plain, which “buckles” the Stroke Belt.

Lackland had determined that South Carolina stroke victims in the state’s Pee Dee region—located in the Stroke Belt “buckle”—were on average 10 years younger than stroke victims outside the Belt. His studies also indicated that individuals born in the Stroke Belt have an increased risk of stroke in their lifetime, a risk that remained even if they moved away from the Stroke Belt later. He had identified some very intriguing trends, but he did not understand what might be driving those trends.

“Over the past 30 years, I’ve been involved with research projects focused on racial and geographical disparities in stroke risk,” Lackland says. “One of the major objectives of these investigations is to identify factors associated with the high stroke risk in this part of the country. Unhealthy lifestyle and the southern diet are often proposed as reasons for the disparities. But similar high-fat and high-carbohydrate diets are seen in other parts of the country. So we must study other factors.”

Mapping the odds

As a result of their initial talks, Lackland and Hunt began to collaborate with ARS microbiologist Tom Ducey and ARS soil scientist Jarrod Miller to support Lackland’s epidemiological research with some environmental expertise. The three ARS scientists work at the ARS Coastal Plains Soil, Water, and Plant Research Center in Florence, South Carolina. Retired ARS soil scientist Warren Busscher, who worked at the Florence laboratory, also contributed to the project.

“Lackland’s results indicated that stroke risk was not just related to diet or lifestyle choices,” says Ducey. “They strongly suggested that an environmental factor was at work as well.” So the team designed a study to determine whether certain soil characteristics in the region’s sandy Carolina Coastal Plain soils could serve as risk markers for stroke and whether those characteristics could be pinpointed by geostatistical analysis.

“Looking at soil patterns and stroke patterns was a reasonable place to start,” Lackland says. “In addition, we were able to assess the links using data that were already available, which was a very efficient use of existing resources.”

To identify associations between stroke risk and soil characteristics, the researchers obtained 10 years of South Carolina inpatient and emergency room discharge data that listed stroke as a primary diagnosis and compared it to state soil data from the U.S.D.A. Natural Resources Conservation Service Soil Survey Geographic database. The soil characteristics evaluated in the research included cation exchange capacity; hydrologic soil group; sand, silt, clay, and organic matter content; saturated hydraulic conductivity; depth to water table; septic suitability; soil surface acidity; drainage class; and flooding frequency.

In their initial analysis, the team found that stroke rates were significantly correlated with depth to water table and soil drainage class. Stroke rates were higher in counties where soil depth to water table was between 20 and 50 inches, which is often the case for shallow water tables in the Coastal Plain. (Soils with water tables less than 20 inches deep are usually found in flood-prone areas near streams, rivers, or wetlands—sites that are generally unsuitable for residential use.) Links between stroke rate and soil drainage were also significant. Well-drained soils had a negative correlation (fewer strokes), while poorly drained soils were positively correlated (more strokes).
"These links," Ducey comments, "give the scientific community a good foundation for developing further studies of the geographic distribution of stroke risk."

The team then focused their investigation on soil characteristics in South Carolina counties with the 10 highest stroke rates—all within the Coastal Plain—and those with the 10 lowest stroke rates—all in the Blue Ridge/Piedmont region. Findings from this part of the study indicated that soils with a depth to water table from 20 to 59 inches continued to be strongly correlated with stroke rate, while soils with a depth to water table of more than 79 inches were negatively correlated.

Moderately well-drained to poorly drained soils were also positively correlated with stroke rate, while well-drained soils had a negative correlation. In addition, strongly acidic soils had a negative correlation.

In short, soil characteristics with strong positive correlations to stroke risk were all typical of Coastal Plain soils. "I had a suspicion this is what we would find," Ducey said. "It was clear that the Stroke Belt map aligned with the Coastal Plain soils map and that the distribution of stroke rates didn't show any real links to the location of the hilly and rocky Piedmont soils."

"In general, soil maps show the location of very broad categories of soil characteristics," Miller adds. "So given the broad nature of the data, it was very interesting that we found any correlations at all between soil characteristics and stroke risk."

Risky terrain

There are two classic factors that affect the makeup of soil microbial communities: soil moisture and soil acidity. A different diversity of organisms can be found in moist, acidic soils than in drier, more alkaline soils. Based on this, the researchers hypothesize that Coastal Plain residents might be at higher risk for stroke because of the prevalence—or perhaps lack—of specific microbes in the region's moist, acidic soils. The scientists all strongly concur that this hypothesis needs more testing and validation before it can be confirmed.

Discussions about how these soil microbes could specifically affect human health, including stroke risk, are just beginning. But researchers in a range of disciplines are now exploring how health and disease can be affected by the large numbers of bacteria, viruses, and other microbes that live in the human body. This impressive assortment of microbes, which is called a "microbiome," varies from person to person, depending on what each person is exposed to—and when the exposure occurs—throughout a lifetime.

Based on their findings, the South Carolina scientists hypothesize that an early-life exposure to the specific microbial mix in Coastal Plain soils might affect microbiome development in a way that leaves some individuals more vulnerable to cardiovascular events like stroke. Although this effect would vary from person to person, depending on other environmental and genetic factors, it might help explain the puzzling regional patterns of stroke risk.

"I'm not totally surprised by these results, but I was surprised by the magnitude of correlation between soil characteristics and stroke risk," says Lackland. "This is a preliminary study, and it needs additional follow-up and confirmation. But if other studies have similar results, it could provide new information about risk factors for strokes and allow us to develop new interventions that could help reduce stroke rates in this region."

Because of data constraints, the study was restricted to South Carolina. But the Southern Coastal Plain extends from Virginia through the Carolinas, Georgia, and the Flori-da panhandle, as well as into Alabama, Mississippi, [and] Louisiana...

The Natural Resources Conservation Service currently doesn't collect data on the distribution of soil microbial populations, so there are no clues about which microbes might be the environmental link between Coastal Plains soils and stroke risk. Ducey contends that information about soil microbe communities could be acquired using new biotech instruments in laboratories such as the ARS lab in Florence...

"A microbial map of South Carolina could be developed from approximately 300 to 400 soil samples. This could allow microbial populations to be looked at in future studies," Ducey says....

"Is It Safe to Eat Produce from Flooded Gardens?"

That's the title of a University of Wisconsin Cooperative Extension news release, dated July 15, 2013, from which we excerpt below.

Many gardens were underwater as a result of recent flooding in Wisconsin. When flood waters subside, is the produce safe to eat?

"The answer depends, to a large degree, on how 'clean' the flood water was, whether it was likely to have been contaminated by sewage, river water, farm runoff, or industrial pollutants," says Barbara Ingham, food science specialist with the University of Wisconsin Extension.

"The most conservative answer—and the one that eliminates any and all risks—is to discard produce that was touched by flood water," Ingham says.

In general, produce that was touched—even splashed—by flood waters presents a potential risk.

But ... people might try to salvage some garden crops. Ingham offers tips below on what to discard and what's okay to use.

- Cook your produce thoroughly to ensure safety—especially if anything touched by flood water will be served to those who might be seriously harmed by a foodborne illness, such as young children, pregnant women, or someone with a compromised immune system.
- Leafy vegetables, such as spinach or lettuce, cannot be consumed raw. The ridges and crevices in the leaves make them impossible to scrub clean.
- Soft fruits that are ready to harvest, such as strawberries and raspberries, must also be cooked. Their bumpy surfaces make it impossible to ensure they’re clean.
- Early season crops that remained above flood water and that are scheduled for harvest within the next few weeks should be safe if cooked or peeled. "Examine any produce carefully before harvest," says Ingham. "If it’s soft or has cracks, bruises, or open fissures, throw it out." To clean, begin by rinsing produce with clear tap water (do not use soap) followed by a two-minute soak in a weak chlorine solution of two tablespoons of bleach to one gallon of water. Rinse in cool, clean tap water. Peel or cook thoroughly before eating, and take care to prevent cross-contamination in the kitchen.
- Tomatoes, broccoli, cauliflower, or other plants with flowers or fruits that have set are an unknown risk. Before you consume them raw, consider the source of the flood water, the time since the contamination occurred, and the food’s appearance. Discard any tissue that is bruised, cracked, or blemished. Wash fresh produce with clear water, followed by a brief soak in a solution of two tablespoons of bleach to one gallon of water. Then rinse or peel to help reduce remaining risk.
- Underground vegetables such as beets, carrots, and potatoes that were flooded when still immature (four to eight more weeks of growth) should be safe if harvested when mature. Root crops, such as new potatoes, that will be consumed within the month (after flooding), should be washed in water, rinsed, and sanitized in the bleach/water solution described above before cooking thoroughly. Beets can be peeled after cooking.
- Do not consume melons and other fruits that you would eat raw. Recent outbreaks of foodborne illness suggest that these low-acid fruits might not be safe even when their surfaces are sanitized.
- Late-season vegetables from flowers that develop after flood waters subside should be safe. This could include tomatoes, peppers, eggplants, squash, or cucumbers. To be safe, cook them thoroughly or at least wash well and peel before eating.
- Do not can or preserve garden produce that is otherwise fit for eating. And because home dehydrators do not get hot enough to destroy high numbers of bacteria, don’t attempt to dehydrate produce from flooded gardens.
- “Never sell produce from a flooded garden at a farm market or stand until you’re sure that all contamination has been removed from the garden—usually at least one month after the last flood,” says Ingham.

**“Why Are Some [Midwest] Trees Changing Color Already?”**

The following is excerpted from a University of Illinois Extension news release dated August 19, 2013.

Have you noticed many plants already starting to turn fall colors? According to Rhonda Ferree, Horticultural Educator with U of I Extension, early fall color almost always means that trees are exhibiting symptoms of stress.

Ferree says this is likely due to last summer’s severe drought. “The trees probably had enough reserves to make it this far since we had good spring rains, but this recent dry spell has caused many trees to lose enough reserves to go into survival mode.”

Last summer’s severe drought will impact trees for another three to five years. In addition to early coloring, some trees leafed out later than usual, have sparse canopies, or have shoot dieback. Some trees in survival mode produce more seeds than usual, such as maple samaras..., cones on conifers, and pods on redbuds.

Unfortunately, drought also makes trees more susceptible to insect and disease infestations. “Stressed plants just don’t have enough energy to fight off most pests,” says Ferree. “Stress also prevents the tree from making defensive chemicals it needs to fight.”

The University of Illinois Plant Clinic expects an increase in many plant diseases over the next several years, especially cankers, wilt, and scorch problems....

“Insect borers and some scale insects are likely to be more numerous than normal on trees for the next several years,” says Phil Nixon, U of I Extension Entomologist. “During extended dry conditions, trees lose root mass, resulting in a reduction of sap flow and dieback of branches. The reduced sap flow provides opportunities for borer attack that would not be present otherwise.” Nixon expects increasing tree and shrub borer problems until about 2016, then decreasing levels until reaching normal levels around 2018.

Can you do anything to help these struggling trees? Ferree recommends watering plants that are stressed during dry periods to encourage recovery growth and root revival.

“Apply enough water to penetrate deeply within the drip line. Never overwater.” To prevent plants from sending out succulent, frost-susceptible growth, avoid fertilizing or pruning until the plants are dormant in late fall. “The added water will not reverse the early coloration, but it will better prepare the plant for winter and possibly less future decline.”...

**In Texas, Extension Support for Urban Food Production**

We wish that more states would follow the lead of Texas in actively publicizing and providing helpful information on producing food in urban areas. The recently held Houston Urban Food Production Conference deserves to be emulated in cities throughout the country! Below we excerpt from a news release provided by the Texas A&M AgriLife Extension Service; it is dated August 22, 2013, and its author is Kathleen Phillips. You should show the release to your own extension workers as a not-so-subtle hint that they need to be adjusting their education and outreach programs to reflect the rapidly increasing nationwide interest in city-produced food!

Urban sprawl is about to get dirty.

Amidst the asphalt, brick, mortar, and penthouse views, green acres are popping up at the hands of city farmers, municipal organizers, educators, and politicians—all hoping to feed the hungry, add household income, and encourage a healthier lifestyle.

Getting dirty is easy. Yielding fruit, vegetables, and animal products is harder. But a state agency long associated with “cows and plows,” the Texas A&M AgriLife Extension Service, has teamed up with Houston-area leaders to teach interested urbanites how to grow food.

“What we’ve done in rural areas throughout our 100-year history is easily translated into urban centers,” said Dr. Doug Steele, AgriLife Extension director, of College Station. “Everybody is concerned about their food sources, their food supply, and the health aspects of their food. What a great opportunity for AgriLife Extension to come together with our urban audiences and urban partners to talk about the benefits and value of locally grown food systems.”

Steele addressed the recent Houston Urban Food Production Conference, a first of what promises to become an annual event in the city, organized by AgriLife Extension’s Harris County office. More than 200 people attended to learn about everything from how to grow fruit, nuts, poultry, and goats to marketing options, funding support, and how to get organic certification.

“What we are attempting to do is to provide a linkage between the producers here and some of the local government agencies that provide regulation and such,” said Dr. Allen Malone, AgriLife Extension agriculture and natural resources agent in Harris County. “We hope that this conference will help bridge the gaps and open up an opportunity to start some dialogue that will allow for safe, affordable production....

“Healthy eating should be available to everyone,” said Robert “Skip” Richter, AgriLife Extension horticulturist in Harris County. “Not everyone can easily access or afford the kinds of fresh produce that we need in our diets, but everyone can grow things where they live.”

Richter said AgriLife Extension has educational resources to help anyone in the greater Houston area grow healthy food at home, whether in a traditional garden, in flower beds, or in five-gallon buckets filled with a growing mix.

“If you want to grow food we can help you succeed,” he said. “Our assistance is just a phone call or e-mail away, and we offer free classes and open garden days for people wanting to learn how to garden.”

Filling that need is personal for Texas Representative Boris Miles, who told the group about his childhood in the
southern Houston community of Sunnyside, where fresh fruits and vegetables were not widely available, yet he saw these items in stores when he visited relatives elsewhere. “As an urban kid growing up, I did have concerns about the lack of proper nutritional values in the inner city,” Miles said. “Houston has one of the highest rates of diabetes, obesity, and malnutrition in the nation. Through efforts such as this ... we are able to educate the community on how important it is and what they can produce for food inside the community.”

Miles said the urban food conference was a “breath of fresh air” for the congressman, who has devoted a portion of his legislative activity trying to pass bills aimed at encouraging more urban farming and to educate “the entire body of 149 colleagues” in the Texas House on what urban farming is. “In the direction in which this country is going, we have to be more self-sustaining, especially when it comes to health and resources of our own. This is going to be the start of something big across this country,” Miles said. “When things get tough and times get hard, we just go right back to the basics of what got us here. And if farming the earth got us where we are, then we need to go right back to it. I’m excited about that.”

**Increasing Interest in Camelina Oil**

Last month (page 93), we reported that an organic family farm in Minnesota is producing and marketing edible oil from *Camelina sativa*. Camelina oil is attracting attention elsewhere, as well. Here are excerpts from a news release provided by Ohio State University Extension, written by Mauricio Espinoza and dated July 15, 2013:

“Oilsed seed crops such as flax and camelina are growing and blooming again at the Mellinger Farm in Wooster, thanks to an OSU research project that seeks to evaluate their many uses, including as animal feed and biofuel, and their potential to help diversify Ohio farms and boost their sustainability. The 324-acre farm, established almost two centuries ago by Wayne County pioneer Benedict Mellinger, was donated in 2002 to the Ohio Agricultural Research and Development Center by ... descendants of Mellinger. It is located just six miles west of the Wooster campus of OARDC ...

Also including canola and sunflower, this project represents the first research plots established on the working farm since it was donated, said Casey Hoy, Kellogg Endowed Chair in Agricultural Ecosystems Management, director of OARDC’s Agroecosystems Management Program and principal investigator in this project ...

The crops will be evaluated in terms of their growth characteristics, yield, oil content, and animal feed quality. They will also be studied for their benefits to ecosystems, including floral resources for pollinators, biocontrol for pests, and soil conditioning.

“Oilsed crops could offer many benefits to diversified farms,” said Hannah Whitehead [phone 330-263-3725], the research assistant co-ordinating the project. “They have the potential to add complexity to crop rotations, provide valuable ecosystem services, and deliver additional value chains in the form of on-farm biodiesel, cooking oil, and highly nutritious feed for animals.”

Flax was one of the staple crops grown by Mellinger and his family, who arrived in Wayne County in 1816 ...

A less common crop, camelina has only recently received research interest as it is being rediscovered for its nutritional value and potential as a biofuel. A cool-weather crop long cultivated in Eastern Europe, camelina was maligned elsewhere in Europe and in the U.S. as a weed that grew voluntarily in flax fields. “European farmers probably brought camelina to the New World accidently, mixed in with their flax seed,” Whitehead said. “It is likely that Benedict Mellinger complained about the ‘false flax’ on his farm.”

The oilsed demonstration and evaluation project is being conducted in collaboration with Organic Valley/CROPP Cooperative (www.organicvalley.coop), which is collecting complementary data in plots on its research farm in La Farge, Wisconsin. The cooperative is especially interested in longer crop rotations with more diverse crops in them for its member farms, as well as the additional on-farm value that oilsed crops could offer, Whitehead said. In September, Organic Valley will bring its mobile oil press to the Mellinger Farm to press the harvested seeds and offer a workshop for its Ohio members and other interested farmers. The oil, pressed meal, and fiber will then be analyzed by OARDC researchers ...

Also, researchers at England’s Rothamstead Research facility have enumerated (in the paper referenced below) several appealing features of camelina. It is “adaptable to marginal land and has been shown to surpass yields of ... flax ... under drought-like conditions.” And it has “a moderate-to-low requirement for nutrients, a low seeding rate, and rapid growth cycle (reaching maturity in only 110 days enabling use in double-cropping systems with winter wheat).” For better or worse, genetically engineered camelina cultivars might proliferate, because

*C. sativa* is amenable to *Agrobacterium*-mediated transformation by simple floral dip infiltration under vacuum. This method permits the generation of transgenic *C. sativa* lines in six to eight weeks allowing high through-put testing of improved seed quality and agronomic traits with minimal technical expertise.

We would appreciate hearing from any readers who know of commercial sources of (even small quantities of) camelina seed for planting.


**Heat vs. Citrus Greening**

The following is excerpted from “Prescription for Curing Citrus Greening: Apply Heat and Wait,” by Dennis O’Brien, which originally appeared in the August 2013 issue of *Agricultural Research*, from the U.S. Department of Agriculture’s Agricultural Research Service (ARS). We think its findings could be useful to backyard growers as well as commercial producers.

Huanglongbing (HLB), or citrus greening, is the most serious threat to the Florida citrus industry in its history and is costing millions of dollars each year. Working with the Florida Department of Agriculture and Consumer Services (FDACS), Yongping Duan and his ARS colleagues in Fort Pierce, Florida, have found a formula for curbing HLB, offering the industry a glimmer of hope.

Duan has published details of work showing that heating potted citrus seedlings in greenhouses kills off the HLB bacterium and can rid the seedlings of citrus greening symptoms. Monitoring efforts show that the benefit can last for at least two years.

In a separate field trial, Duan has also found that heating HLB-infected trees in the sun by encasing them in plastic “tents” can prolong their productivity. Results of the field
trials have yet to be published, but Duan says heating trees in solar tents might offer relief to growers whose citrus groves are being devastated. “We can’t guarantee 100 percent elimination, but it can keep production up for longer periods,” Duan says.

When a citrus tree is infected with the HLB bacterium, the pathogen resides inside the tree’s phloem tissues and blocks the passage of nutrients through its vascular system, making the tree unproductive. Infected trees can survive for three to five years, but fruit that doesn’t fall to the ground prematurely is often misshappen and sometimes will only partially ripen, making it unmarketable. There is no known cure for HLB and no commercially viable, effective treatments. It remains a threat not only to the citrus industry in Florida, where it was discovered in 2005, but to citrus-producing states nationwide.

**Three temperature settings, same results**

In the greenhouse experiments, Duan and his ARS colleagues Michele Hoffman, Melissa Doud, David Hall, and Ed Stover, along with FDACS scientists, exposed 30 HLB-infected citrus seedlings to different levels of heat in growth chambers for periods ranging from two to 10 days. The seedlings were about two and one-half years old, about two feet in height, and were growing in one-gallon containers. They were divided into three groups and heated to 104°F, 107°F, or 113°F. Fluorescent lamps provided light for 12-hour “days” and were turned off for 12-hour “nights.”

For comparison, the researchers also applied the heat treatments to citrus budwood and periwinkle, which is also susceptible to HLB. They used PCR technology, which amplified the pathogen’s DNA, to measure the HLB pathogen levels in the trees, budwood, and periwinkle. Infection levels were measured a week before heat treatments began and again 30, 60, and 270 days after they ended.

The researchers quickly learned that constant exposure to temperatures of 113°F or higher would defoliate citrus seedlings. But if they interrupted the steady onslaught of intense heat by dropping temperatures down to about 80°F for five hours each day, the leaves stayed alive.

Two experiments were set up: Heating citrus seedlings to a minimum of 48 hours of temperatures of 104°F to 107°F significantly reduced, and often eliminated, HLB infection. All of the heat treatments were equally effective, regardless of temperatures and exposure times. The researchers continued to test the seedlings, and two years after heat treatments, they have remained free of HLB.

“This application would be useful for nurseries and greenhouses and rescue of germplasm that’s been infected,” Duan says.

By contrast, exposing newly grafted budwood to alternating temperatures of 102°F and 86°F for up to four months did not reliably cure it. The heat controlled the HLB in periwinkle, but the periwinkle plants were more heat tolerant than the citrus trees and required more prolonged heat for infection levels to be reduced.

**Heating trees in tents**

Another approach to controlling HLB damage might have wider application by prolonging the productivity of full-grown citrus-producing trees. Florida citrus grower David McKenzie, working with Duan, has been encasing citrus trees in opaque plastic (PVC) “tents” to heat them up for about a week, then removing the tents and trimming off the top 10 or 12 inches of the trees that have been “browned up” by the solar heat.

The results have been striking. Within short periods of time, leaves stunted by HLB begin to flourish, and by the time the fruit is ready for harvest, its quality is noticeably improved.

“The flush (leaf growth) after the tents are removed is phenomenal. The leaves start to flush about two to four weeks after the tent is removed, and that flush will peak after about six weeks,” McKenzie says.

McKenzie has been using the tents for about a year and a half, applying them from April to September. He has covered about 1,000 of his 130,000 trees, working in alternating 20-acre blocks and tenting about five trees at a time in each block. He selects trees with moderate HLB symptoms (smaller, shriveled fruit and stunted leaves) that are about three to six years old and six feet high. He uses cinder blocks to hold the tents in place and positions the tents so their tops are near the tops of the trees and they drape closely around the tree circumference. That way, by mid-afternoon the temperature in the tents reaches about 125°F near the tops and about 110°F near the bases.

“Once trees reach a certain size, maybe to where they have a 25-foot circumference, that’s about the maximum size for using the tent. What is important is for the top of the tent to be close to the top of the tree, so you have heat at the top,” McKenzie says.

Tents can be reused, and McKenzie estimates that with labor, the system costs about $45 per tent. He says the results are worth the effort.

“We’re finding that the trees we tented last year don’t need to be tented this year. Trees with major symptoms before the treatment have minor symptoms after treatment, and the trees are producing normal fruit where they were producing small fruit before,” McKenzie says....

“It works better if the infection is in its early stages and the bacteria have not yet reached the plant root,” Duan says....

Growers are beginning to consider the approaches, where practical, and McKenzie is enthusiastic about the results. “Do I think it works? Absolutely I do. It makes me think that with all the damage we’re seeing from citrus greening in Florida, we’re staying in the game,” McKenzie says.

**From the 2013 ASHS Annual Conference**

Abstracts of papers and posters presented at the 110th Annual Conference of the American Society for Horticultural Science (1018 Duke St., Alexandria, VA 22314), held July 22-25, 2013, at Palm Desert, California, are available for viewing at the web site http://ashs.confex.com/ashs/2013/webprogram. We provide brief synopses below of some of the papers and posters, based on the information given in their abstracts.

“Physiology of Solanaceous Scion and Rootstock Seedlings for Grafting in Low Temperature Storage under Low Light Intensity,” Diana Vercillo (University of Arizona, Tucson, AZ), Hans Spalholz, and Chieri Kubota. Grafting of vegetable seedlings for improved stress tolerance and yields is now becoming a widespread practice. The window of opportunity for grafting could be lengthened if seedlings used as scions and/or rootstocks could be stored beforehand. The researchers report that tomato, pepper, and eggplant seedlings stored for up to three weeks under low light at 50°F retained high quality; storage for one month resulted in visible chilling damage on the seedlings of most cultivars in the trial. The researchers conclude that a storage period of up to two weeks should result in negligible loss of quality of solanaceous seedlings.

“Storage Time of Pine Wood Chip Aggregates Affects Phytoxicity and Plant Growth,” W. Garrett Owen, Brian Jackson
(Horticultural Science, North Carolina State University, Raleigh, NC), and William C. Fonteno. Motivated by reports of phytotoxicity due to fresh (as opposed to aged) pine wood chips in growing mixes, the researchers grew radish, cucumber, celosia, and impatiens in a mix containing peat moss and either freshly harvested pine wood chips or pine wood chips stored for five months (the ratio of wood chips to peat was either 20 percent or 30 percent). A mix containing 20 percent peat moss and 80 percent perlite served as a control. Radish germination was best with aged pine wood chips, and radish seedling dry weights after two weeks of growth were lowest with fresh pine wood chips. Cucumber germination was best with pine wood chips (fresh or aged), but cucumber seedling dry weights after two weeks of growth were lowest with pine wood chips (fresh or aged). Dry weights of celosia after four weeks were higher with aged pine wood chips than with fresh pine wood chips. Dry weights of impatiens after four weeks were about the same regardless of growing mix. It appears that some plants are sensitive to fresh pine wood chips while others are not, but the researchers recommend aged pine wood chips to ensure best growth.

“Use of Plastic Trays to Reduce Irrigation Demand of Biocontainers,” Andrew Koeser (Crop Sciences, University of Florida, CREC, Wimauma, FL), et al. Biocontainers, made from organic materials, generally have high porosity, unlike plastic growing containers, and so plants growing in biocontainers need more frequent irrigation. The researchers tested commercially available plastic filling/carrying trays for reducing water losses of biocontainers. The trays were found to reduce losses by as much as 40 percent (for straw biocontainers), but plastic containers lost even less water.

“Evaluation of Bioplastic-Coated Fiber Containers for Greenhouse Grown Plants,” James Schrader (Dept. of Horticulture, Iowa State University, Ames, IA), et al. Addressing the same water-loss problem of biocontainers as Koeser, et al. in the previous report, the researchers dip-coated coir, paper, and wood-fiber containers with polyamide, polyactic acid, polyurethane, or tung oil. Polyurethane was the least expensive of the coatings and could be used with water as a solvent (the other coatings needed a potentially dangerous organic solvent). Degradation of the containers was slowed by the coatings. Quality of plants (marigolds, petunias, sages, peppers, and tomatoes) in paper and coir containers was about equal to that of plants in plastic containers. The researchers rated polyurethane-coated paper containers as particularly promising, costing about the same as plastic containers.

“Field Chili and Sweet Pepper Cultivar Evaluation in Central Missouri,” Steven Kirk, Catherine Bohnert (Lincoln University, Jefferson City, MO), and Sanjun Gu. In 2012, 58 chili pepper cultivars and 11 sweet pepper cultivars were evaluated at Jefferson City, Missouri. The weather was unusually hot and dry, resulting in blossom end rot of most sweet peppers. Greenhouse-raised seedlings were transplanted in raised beds with black plastic mulch. Cultivars with best yields were these: red-fleshed, ‘Sweet Delight’, ‘Palomar’, ‘Millionaire’, and ‘Crispy Red’; yellow-fleshed, ‘Buttercup’.

“Field Performance of Transplants Grown Using Light-Emitting Diodes (LEDs),” Meriam Karlsson (University of Alaska, Fairbanks, AK) and Cameron Willingham. The researchers grew sunflower and snap bean seedlings in a greenhouse with either natural light plus high-pressure sodium supplemental lighting or light from LEDs (red and blue, white, or multi-colored). Their results suggest that LED lighting is not significantly different from natural lighting for greenhouse-grown seedlings, at least with regard to plant performance after transplanting outdoors.

“Economics of Growing Microgreens for the Local Food Market,” Gary R. Bachman (Mississippi State University, Biloxi, MS) and Christine Coker. According to the researchers, production costs for (various) microgreens amount to about $2.50 per square foot, and microgreen yields are typically 1.5 ounces per square foot to over four ounces per square foot. Market prices vary from $2 to $5 per ounce, so that the profit margin is approximately 35 percent to 75 percent.

“Production of Ligustrum japonicum in Composted Algae,” Joseph P. Albano (U.S. Horticultural Research Laboratory, Fort Pierce, FL) and James Altland. Concerns about rising costs and decreasing availability of peat and bark utilized in growing mixes have spurred searches for alternative mix ingredients. The researchers tested composted algae as a growing mix for privet. The algae resulted in significantly faster growth than did a conventional peat-based growing mix, and also in greener foliage at a lower fertilizer application rate, suggesting that less fertilizer is needed when algae is used.

“Nutrient Uptake and Removal by Christmas Tree Harvest,” Gladis Zinati (Rodale Institute, Kutztown, PA), Joseph R. Heckman, and Mark Vodak. Freshly harvested Christmas trees (Norway spruce, Canaan fir, and Douglas fir) from commercial growers in New Jersey were analyzed for nutrient content. Based on typical row spacing resulting in about 1740 trees per acre, clear-cutting would remove (per acre) approximately 560 pounds of nitrogen, 55 pounds of phosphorus, 151 pounds of potassium, 219 pounds of calcium, and 34 pounds of calcium. No significant differences in nutrient content for the three tree species were seen.

“Impact of Container Media on Substrate Heat Buildup in an Outdoor Nursery,” Robert L. Geneve (Horticulture, University of Kentucky, Lexington, KY), et al. Boxwood plants were grown in #1 (four-quart) containers, including polyethylene pots, pulp pots, experimental keratin pots supplied by the Horticultural Research Institute, and Root Pouches™. Irrigation was supplied twice daily to offset water use. Thermocouples were used to log substrate temperatures. Average substrate temperatures in black plastic containers were higher than in the other containers by 11-16°F one inch from the container walls and by 4-7°F at the centers of the containers during August outdoors in Kentucky. Substrate temperatures exceeding 100°F were reached for more than three hours on 15 days in black plastic containers, on about nine days in keratin containers, and on no days in wood pulp and fabric containers. Evaporative cooling helped to prevent excessive heating in containers other than the plastic pots.

“Attractive Plants for Minimally Irrigated Landscapes in Colorado,” Ronda Koski (Dept. of Horticulture and Landscape Architecture, Colorado State University, Fort Collins, CO), James E. Klett, and Pat Hayward. At CSU, in cooperation with the Plant Select® program (http://plantselect.org/), many plants
capable of being grown in the Central Rocky Mountains have been evaluated for their performance at very low irrigation rates. Among the species showing high survival rates with minimal supplementary water (amounting to less than five quarts per established plant during the entire growing season) were Penstemon wilcoxii (70 percent survival rate); Tetranereis scaposa (formerly Hymenoxys scaposa, 80 percent survival rate); Penstemon fruticosus and Salvia multiaculis (90 percent survival rate); and Allium altaicum, Globularia punctata, Sanguisorba tenuifolia, and Centaurea bella (all 100 percent survival rate).

“Green Roof Substrate Durability: Particle Size Distribution of Five Mature Mid-Atlantic Green Roofs,” Whitney Gaches (University of Maryland, College Park, MD), et al. There are concerns that because current standards for growing substrates of (University of Maryland, College Park, MD), et al. There are concerns that because current standards for growing substrates of ge (vegetated) roofs apply at installation time and not after a period of service, performance could degrade over time. The researchers analyzed samples of substrates from ge roofs in the Mid-Atlantic region that had been installed three to seven years previously. They discovered that the weathered substrates showed particle size distributions that did not meet the standards (“particle diameters were much smaller than recommended”), meaning that the root aeration, and hence, performance of plants growing in the weathered substrates, would probably be diminished. The researchers also performed an artificial weathering experiment by simulating 30 freezing and thawing cycles, and they found that the ratio of small particles to large particles was increased by the freezing and thawing. They call for the development and application of green roof substrate performance standards that promote adequate aeration and water holding capacity over a long period of time.

“A Trial Study of 11 Kordes Rose Cultivars Grown under Low Maintenance Conditions,” Pamela Collins (Plant and Soil Sciences, Mississippi State University, Mississippi State, MS), Ekat erina Jeliazkova, and Dennis Rowe. Eleven cultivars (‘Cerise Flower Circus’, ‘Cream Flower Circus’, ‘Coffee Frutillia’, ‘Cos mos’, ‘Escimo’, ‘Fortuna Vigorosa’, ‘Lions Fairy Tale’, ‘Pink Flower Circus’, ‘Red Ribbons’, ‘Sunrise Vigorosa’, and ‘Sweet Vig orosa’) were evaluated for two years. They were irrigated during establishment only; other care “was limited to fertilization, mulching, and weed control.” No pest control sprays were applied, and the plants were neither deadheaded nor pruned. The cultivars ‘Lions Fairy Tale’ and ‘Escimo’ were most vigorous. “No clear differences among cultivars were seen for blackspot resistance, and there was no strong correlation between blackspot resistance and any growth or quality measurement.” The researchers concluded that ‘Lions Fairy Tale’, ‘Escimo’, and ‘Cos mos’ showed “more potential than the other cultivars in a low maintenance environment of a subtropical climate, such as found in east central Mississippi.”

“‘Nocturne’ Blueberry: A Winter-Hardy Hexaploid Hybrid with Ornamental Fruit and Superior Quality,” Mack Ehlenfeld (U.S.D.A. Agricultural Research Service, Marucci Center for Blueberry & Cranberry Research, Chatsworth, NJ) and Lisa J. Rowland. This highbush-type selection has glossy green leaves and fruits that are “vivid” red-orange when ripe and become “large, dark, sweet, [and] interesting-flavored” when ripe. Despite its origin in a southern rabbiteye blueberry breeding program, ‘Nocturne’ has winter hardness similar to that of northern highbush blueberry cultivars, setting crops “reliably” in Mid-Atlantic states. It will be patented and licensed for commercial sale.

“Commercial Food Grade Cinnamon Products Inhibit Mycelial Growth of Four Fungi in Vitro,” Shane Walsh (College of Agriculture, Louisiana State University, Baton Rouge, LA) and Charles E. Johnson. Ground cinnamon bought at a supermarket considerably reduced mycelial growth on agar (as used for tissue culture propagation of plants) of Rhizoctonia, Fusarium, Phytophthora, and Colletotrichum, which can contaminate tissue culture. Around 20 grams of ground cinnamon added per liter of agar was quite effective, but cinnamon oil (also bought at a supermarket) at up to 40 milligrams per liter of agar was not effective at all against Phytophthora and only slightly effective against the other fungi. The researchers suggest that ground cinnam on could be “an effective, low-cost fungicidal amendment to tissue culture media.”

“Initiating a Hop Breeding Program at the University of Minnesota,” Charles L. Rohwer (Southern Research and Outreach Program, University of Minnesota, Waseca, MN), John R. Thull, and Vincent A. Fritz. Recently, commercial growing of hops for beer has become established in several states with much different climates from that of the Pacific Northwest, the traditional source of hops in the U.S. The hop breeders at the University of Minnesota will be making and testing crosses especially suited to the Upper Midwest.

“Potential Non-GMO Genetic Solutions to HLB for Sustainable and Profitable Citriculture in Florida,” Jude W. Grosser (Citrus Research and Education Center, University of Florida, CREC, Lake Alfred, FL), Fred G. Gmitter, Jr., and William S. Castle. Elsewhere in this issue of HortIdeas is a report on utilizing heating to reduce symptoms of huanglongbing (HLB, also known as citrus greening disease), which is devastating Florida citrus groves. Here is another approach to mitigating HLB. University of Florida researchers have identified some apparently HLB-resistant trees “still thriving” despite being surrounded by trees with “severe symptoms.” One promising tree: “a sweet orange-like triploid hybrid that contains approximately eight percent trifoliate orange parentage ... this hybrid produces seedless fruit that is not easily distinguished from true sweet orange, and its pasteurized NFC (not from concentrate) juice has a flavor pro file in the range of ‘Hamlin’ and ‘Valencia’, the two most important processing oranges in Florida. The tree is productive and has yet to show any HLB symptoms, whereas adjacent trees have been devastated by HLB.” This hybrid will be used to breed HLB-resistant cultivars.

“Citizen Scientist Master Gardeners Conduct Landscape Plant Variety Trials,” Kelly M. Young (Plant Sciences, University of Arizona, Phoenix, AZ) and Karl Wyant. Beginning in 2010, Extension Master Gardeners in Maricopa County, Arizona, were recruited to plant, monitor, and report on three newly released ornamental cultivars. Seven out of the 13 Master Gardens originally recruited submitted monthly reports; four of them continued to submit reports through 2012.

“What Are the Economic Costs and Benefits of Home Vegetable Gardens?” Gail Langelloto (Oregon State University, Corval lis, OR). Based on “published data,” the “average” home vegetable garden was estimated to yield $677 worth of produce “above and beyond the cost of $238 worth of materials and supplies” (not including the market value of the labor required).

“Identification of Host Resistance to Basil Downy Mildew (Peronospora belbahrii),” Robert Pyne (Rutgers University, New Brunswick, NJ). Sweet basil (Ocimum basilicum) cultivars are quite susceptible to downy mildew, which has been causing crop losses in the U.S. The researchers tested three commercial basil cultivars for their resistance to downy mildew by inoculating the plants with mildew. The results: O. basilicum ‘DiGe nova’ showed “complete” susceptibility to mildew; O. ameri canum ‘Spice’ showed no symptoms of mildew infection; and O. citriodorum ‘Sweet dani’ showed decreasing symptoms of mildew infection over time as development progressed from cotyledon to first and second true leaf stages.
“Urban Tree Selection in a Changing Climate,” Bert Cregg (Michigan State University, East Lansing, MI) and Dana Ellison. The researchers are attempting to find street tree cultivars with “a high potential to acclimate to potential climate change” (meaning increased global ambient temperatures, exacerbated locally by heat island effects in cities). So far, they have tested several street tree cultivars (Acer rubrum ‘Frank Jr.’, A. sacharum ‘JFS-Caddo2’, A. trucatum × platanoides ‘Warrenred’, Carpinus betulus ‘Fastigiata’, Gleditsia triacanthos ‘Skycole’, Liriodendron tulipifera ‘IFS-Oz’, Pyrus calleryana ‘Glen’s Form’, Quercus bicolor, and Ulmus propinqua ‘JFS-Bieberich’) for acclimation to high temperatures (9°F or 18°F above ambient). The trees, in containers, were grown in a greenhouse for two months and then tested for photosynthetic assimilation rates. Quercus bicolor exhibited the best acclimation to increased temperatures, with “relatively high” assimilation rates even at 18°F above ambient.

“The Presence of Genetic Modification in U.S.D.A. Organic Certified Corn and Soy Food Products,” Ryan Phelps (Western Kentucky University, Bowling Green, KY), et al. The researchers bought foods (including seeds meant for garden planting) containing corn and soybeans that were labeled U.S.D.A. Certified Organic and/or Non-GMO Project verified from stores in Kentucky and Tennessee, and from online sellers. Then they tested DNA from the products for a viral 35S CaMV promoter and a bacterial NOS terminator sequence, which provide “evidence of genetic modification.” Our results indicate the presence of genetic modification in some of these foods.

“Identifcation of Phytohormones Present in Vermicompost Tea and Their Effect on Growth and Yield of Tomato,” Abira Selvaraj (University of California, Riverside, CA), Milton E. McGiffen, Jr., and Carol J. Lovatt. By using radioimmunoassay techniques, the researchers detected plant growth regulating chemicals—iso-pentenyladenine (IP), indole-3-acetic acid (IAA), and high concentrations of abscisic acid (ABA) in commercial vermicompost teas. This is the first time that such chemicals have been found in vermicompost teas. Their presence helps to explain the plant growth—promoting ability of vermicompost teas, but there is evidence that additional chemicals in the teas also enhance (perhaps to a greater degree than the plant growth regulators) plant growth. The researchers note that attempts to make good use of the plant growth regulating chemicals in vermicompost teas are complicated by the fact that it is difficult to produce teas with predictable concentrations of the chemicals.

“The Optimal Time to Establish Late-Summer Cover Crops in the Great Lakes Region,” Carolyn Lowry, Joseph W. Sholl, Jr., Daniel C. Brainard, and Thomas Bjorkman (Dept. of Horticulture, Cornell University, Geneva, NY). Monitoring sequential plantings in Michigan and New York, the researchers determined the best planting date range in the Great Lakes Region for sudangrass and mustards used as cover crops after vegetables have been harvested. Sudangrass was found to need, minimally, 700 growing degree days (50°F base temperature) prior to frost in order to produce “meaningful” biomass and suppress weeds, while ‘Idagold’ and ‘Tilney’ mustards were found to need 1,700 to 2,200 degree days (32°F base temperature) prior to frost. The optimal timing “window” for planting mustards was determined to be about two weeks in early to mid-August in the northern parts of the region and in late August in the southern parts. Earlier sowing of mustard seed resulted in about the same amounts of biomass but also an increased risk of seedling, leading to volunteer mustard seedling problems. Additional trials showed that several other crucifer cover crops (radishes, brown mustard, forage rapeseed, forage turnip, and winter canola) have the same optimal planting window in the Great Lakes Region.

“Effect of Late Summer Cover Crops on Weed Management in Organic Vegetables in the Great Lakes Region,” Thomas Bjorkman (Dept. of Horticulture, Cornell University, Geneva, NY), et al. The researchers conducted trials in New York, Michigan, and Illinois to test the effects of late-summer-planted cover crops (with or without incorporation into the soil in the fall) on weeds in the next year’s crop (of beans). Fall tillage, whether or not cover crops had been planted, “substantially” reduced bean stands the following spring. Cover crops (sudangrass or buckwheat) “strongly” suppressed fall weeds in some cases, but the suppression was inconsistent. Fall drought conditions limited weed suppression by sudangrass.

“Participatory Evaluation of Broccoli Varieties Grown under Organic Conditions in Western North Carolina,” Emily R. Bernstein and Jeanine M. Davis (Horticultural Science, North Carolina State University, Mills River, NC). In 2012, seven organic farmers in western North Carolina grew and evaluated numerous broccoli cultivars transplanted into raised beds with white-on-black plastic mulch and drip irrigation. Several cultivars had higher yields than the market standard ‘Packman’. Bead uniformity and head smoothness (indicating heat tolerance) received high ratings for ‘Bay Meadows’, ‘Gypsy’, and ‘Belstar’. Taste tests ranked ‘Belstar’, ‘Batavia’, and ‘Bay Meadows’ higher than ‘Packman’. Overall, highest-rated cultivars were ‘Bay Meadows’, ‘Batavia’, and ‘Belstar’. Among “usual” (romanescos, rapinis, and sprouting) cultivars in the trial, ‘Tipoff’, ‘Atlantic’, and ‘Purple Peacock’ were the highest rated.

“Effectiveness of Some Plant Extracts to Bacterial Speck Disease on Tomato,” Kubitlal Kurbas Bastas (Dept. of Plant Protection, Faculty of Agriculture, Selcuk University, Konya, TURKEY). Extracts from leaves and/or stems of Persian walnut (Juglans regia), eucalyptus (Eucalyptus globulus), thyme (Thymus vulgaris), rosemary (Rosmarinus officinalis), sumac (Rhus coriaria), moringa (Moringa oleifera), wild bishop (Bifora radians), hops (Humulus lupulus), corekotu (Nigella sativa), black carrot (Daucus carota), and olive (Olea europea) were all found to inhibit growth of Pseudomonas syringae pv. tomato, which is responsible for bacterial speck of tomato. In greenhouse experiments with plants inoculated with the disease organism, sumac and thyme extracts resulted in the greatest reductions in severity of symptoms.

“Non-Irrigation Alternatives for Freeze Protection of Strawberries in Florida,” Bielinski M. Santos (Gulf Coast Research and Education Center, IFAS, University of Florida, Wimauma, FL), Ixchel M. Hernandez-Ochoa, and Craig Stanley. The alternatives tested were “heavy” row covers (weighing 0.9 ounce per square yard) and “light” row covers (weighing 0.6 ounce per square yard), either lying on the plant foliage or supported by mini-hoops. The row covers were installed on the afternoons of each day when freezing temperatures were forecast (18 days total at the test site). Minimum ambient temperatures were as low as 21°F, but minimum temperature “directly above” the plants (either weight covers, with or without hoops) was 34°F. Compared to plots protected by irrigation (which required lots of water), plots protected by row covers had higher early and total marketable strawberry yields; with irrigation, fruit weight was about 20 percent less.

“The Effect of Biochar on Sweet Corn Production,” Ajay Nair (Horticulture, Iowa State University, Ames, IA), Laura Weineneth, and Vince Lawson. Biochar was disked into ‘Temptation’ sweet corn plots a few days before the corn was seeded at application rates up to several tons per acre. Soil pH tended to rise slightly as more biochar was applied; soil temperatures a few inches below the surface were similar regardless of biochar application rate. The highest rates of biochar resulted in statistically
significant reductions in numbers and weights of marketable ears. There were no significant differences in sweetness. The researchers comment that some previous studies of the effects of biochar on row crop production have reported reduced yields with biochar in the first year followed by increased yields in subsequent years.

“Biochar Added to a Potting Mix Decreased Bell Pepper Transplant Size, While Increasing Nutrient Retention,” Brandon Carpenter (Horticulture, Iowa State University, Ames, IA) and Ajay Nair. The researchers added biochar to commercial growing mix (Jiffy Mix® Growers Choice #901) at rates (on a weight basis) of 0, 20, 40, 60, and 80 percent. Bell pepper (‘Paladin’) seeds were then grown in cell flats (three sizes: 50, 72, and 98) using the growing mix plus biochar. Results: seedling height and biomass went down as the percentage of biochar went up and as the cell size went down. Leaching of nitrates from the growing medium was reduced when 60 or 80 percent biochar was added, possibly affecting plant growth.

“Can Living Mulches Reduce Weed Seed Banks in Fresh Market Tomatoes?“ Kevin D. Gibson (Purdue University, West Lafayette, IN). In an attempt to reduce growth of late-emerging weeds, especially between crop rows, buckwheat and red or crimson clover were seeded between tomato rows between six and eight weeks after the tomato plants had been transplanted. The resulting living mulches were moved to reduce their competition with the tomatoes. Buckwheat living mulch did not reduce tomato yields, but clovers did. All living mulches cut weed seed production, resulting in reductions in weed seed banks or weed emergence the next year.


“The People’s Garden Initiative: Case Studies on the Mississippi Gulf Coast,” Christine E. Coker (Mississippi State University, Biloxi, MS), et al. The People’s Garden Initiative, named after Abraham Lincoln’s characterization of the U.S. Department of Agriculture as the “people’s department,” was started in 2009 as a challenge to U.S.D.A. employees to establish gardens at U.S.D.A. institutions throughout the country. It has broadened to include establishment of community and school gardens by hundreds of organizations. All People’s Gardens are mandated to benefit communities (for example, by providing recreational space or donating food to a local food bank). They also must be collaborative, based on partnerships of local individuals, groups, or organizations. And they are required to use sustainable methods. According to the authors of this report, the currently “slow” economy and “food deserts” in many locations provide two reasons why now is the right time for establishing People’s Gardens. They point to several examples in southern Mississippi that are providing benefits to local people.

“Biocontainer Use in Petunia × hybrida Greenhouse Production—A Cradle-to-Gate Footprint Assessment of Secondary Impacts,” Robin Brunfield, Andrew Koesser (Crop Sciences, University of Florida, GREC, Wimauma, FL), Sarah T. Lovell, and J. Ryan Stewart. The researchers accounted for material and energy inputs and outputs resulting from the production of a widely grown annual ornamental bedding plant, namely the petunia, in plastic containers. However, pot manufacturing inputs and outputs were not included, because of proprietary limitations on the data. Given that limitation, the study estimates that approximately 17 percent of total carbon dioxide equivalent emissions (with regard to the atmospheric greenhouse effect resulting in global warming) is due to petunia production in plastic pots is due to the containers, while more than 44 percent of total emissions is due to electricity use for supplementary lighting and irrigation. The researchers note that improving lighting efficiency could result in the greatest reduction in greenhouse gas emissions from bedding plant production.

“Field Establishment and Vigor of Kentucky State University Pawpaw Advanced Selections,” Sheri C. Crabtree (Kentucky State University, Frankfort, KY), Kirk William Popper, Jeremiah Lowe, and Brandon May. A pawpaw (Asimina triloba) trial including three commercially available cultivars (‘KSU-Atwood’, ‘Mango’, and ‘Sunflower’) and seven advanced selections was begun in June 2011 at Frankfort, Kentucky. After two growing seasons, overall survival was 65 percent (100 percent of the ‘KSU-Atwood’ trees survived, but survival rates of some of the advanced selections were below 40 percent, although others had survival rates above 75 percent). Some of the advanced selections have exhibited high vigor.

“Searching for the Next Pawpaw Cultivar: Unique Germplasm Selections at Kentucky State University,” Kirk William Popper (Kentucky State University, Frankfort, KY), Sheri Crabtree, and Jeremiah Lowe. At the National Clonal Germplasm Repository for Pawpaw (at KSU), three advanced selections have been identified as having “unique fruit types and promising new characteristics.” Selection H17-5 has large globular fruits with orange flesh, H14-1 has very large fruits with orange flesh, and H16-1 has moderately large fruits with dark orange flesh “that would be excellent for processing.” Propagation is being done via chip budding onto seedling rootstocks for yield trials.

“Phenolic Content and Antioxidant Capacity of American Persimmon Teas,” Hideko Kobayashi (Kentucky State University, Frankfort, KY), George Anotinous, Changzheng Wang, and Kirk William Popper. A tea is made in Asia from the leaves of kaki persimmons (Diospyros kaki). The leaves are air-dried in shade and then in some cases steamed, or else steamed and roasted without previous drying. According to the researchers, the tea “has anti-allergy, anti-cancer, anti-inflammatory, and anti-oxidant properties, and contains phenolic constituents.” They suggest that tea made from the leaves of American persimmon (D. virginiana) might be similarly beneficial for human health and could be developed as an alternative to green tea, which is valued for its phenolics. They steamed and roasted or oven-dried the leaves from five American persimmon cultivars harvested in the spring. The anti-oxidant capacity of tea made from the steamed and roasted teas was much higher.
than that of tea made from oven-dried leaves, and about equal to that of green tea.

“The 40 Gallon Challenge: A Simple Effective Educational Tool,” Ellen Bauske (University of Georgia, Griffin, GA), Paul Pugliese, Melanie Biersmith, and Emily Pitts. In response to recent severe drought in the Southeast, a web site was created at www.40GallonChallenge.org to encourage voluntary pledges to personally save 40 gallons of water each day by instituting conservation techniques. The site provides estimates of water savings resulting from various techniques, which include horticultural practices such as composting and use of rain barrels. The Challenge has been adopted by some Extension Master Gardeners as a teaching tool; the researchers suggest that it can serve as a model for other horticultural educational topics—“It is flexible and easy to use. It encourages personal reflection on educational messages.” About 85 percent of site users who responded to a follow-up survey claimed that they fulfilled at least 75 percent of their pledges.

“Identification of the Rose Rosette Disease Agent,” Patrick Di Bello, Thien Ho, and Ioannis Tzanetakis (Plant Pathology, University of Arkansas, Fayetteville, AR). The cause of rose rosette disease has been a mystery for decades. The researchers are confident that they have finally discovered the infectious agent responsible for the disease: an Emaravirus that can be spread by the eriophyid mite Phylocoptes fructiphilius. When mites infected with the virus were transferred onto virus-free roses, the roses showed rossette symptoms two months later. No other viruses were detected in the plants. Rose rossette symptoms include mosaic and mottling of foliage, reddened new shoots, extra thorns, and witches’ broomings.

“Microgreens: Assessment of Nutrient Concentrations,” Gene E. Lester (U.S.D.A., Agricultural Research Service, Beltsville, MD), Zhenlei Xiao, Yaguang Luo, and Qin Wang. The researchers measured the concentrations of vitamins A, C, E, and K1 in 25 commercially available microgreens. The vitamin concentrations varied “widely,” but they were “generally ... significantly higher” than in “mature leaves from the same plant species.”

“New Jersey’s Agricultural Plastics Recycling Program,” Wesley L. Kline (Rutgers Cooperative Extension, Millville, NJ) and Karen Kritz. Since 1991, this program has recycled around 10 million pounds of nursery and greenhouse film. Some growers in the program use special balers to remove plastic film from structures quickly while keeping the film clean. The program also includes pesticide container recycling; in 2012, approximately 110,000 containers were recycled. In New Jersey, over 10,000 acres utilize plastic film for vegetable production. Work is proceeding on two facilities to clean agricultural plastic to keep it out of landfills.

“Incorporating Wool-Waste into Compost to Develop Alternative Compost Products,” Tina Wallczek Cade (Texas State University, San Marcos, TX), Erica Jane Meier, and Gwendolyn Hustedt. Wool, when added to soil, has been shown to boost water-holding capacity and serve as a slow-release fertilizer. In Texas, which produces more wool than any other state, ample low-quality wool is available that could be used as an inexpensive soil amendment. The researchers added waste wool to compost piles that utilized various other starting ingredients, such as manure, livestock bedding, food waste, and landscape trimmings. Composting took longer with highly compacted wool added. Decomposition of wool fibers was aided by adding more water to the piles than usual without wool and by starting with a low carbon-to-nitrogen ratio. The finished composts were analyzed by a testing laboratory. Results: the composts were judged to be of “high quality.”

“The Effect of Nutrient Ratios on Plant Height,” Laura A. Wiser (University of Guelph, Guelph, Ontario, CANADA) and Theo J.M. Blom. The researchers examined whether plant height can be controlled by adjusting the proportions and forms of N, P, and K. The motivation was to develop a way to control plant size without relying on synthetic growth regulating chemicals. Numerous hydronic nutrient solutions were used to grow sunflowers, marigolds, and tomatoes. Nutrient ratios did not produce consistent changes in plant heights as long as the electrical conductivity of the nutrient solutions was similar.

“Container Grown Lavender Affected by Oxygenated Irrigation Water,” S. Evan Wilson, Diana Cochran (Plant and Soil Sciences, University of Tennessee, Knoxville, TN), and Amy Fulcher. By using a portable oxygenator to approximately double the dissolved oxygen concentration in irrigation water, the researchers significantly boosted potted lavender root growth (but not shoot growth) as measured after nearly six months.

“Jujube (Ziziphus jujuba Mill.) Cultivars in the United States,” Shengru Yao (Dept. of Plant and Environment Sciences, Sustainable Agriculture Science Center at Alcade, New Mexico State University Alcade Center, Alcade, NM) and Steve Guldan. Since jujube cultivars were first brought to the U.S. in 1908, the number of cultivars in this country has grown to a total of 60-70, but there are still relatively few commercially available cultivars. Jujubes are best adapted to the South and Southwest in the U.S., but trees are growing in Indiana, Illinois, and Pennsyl- vania. The Alcade Center brought more than 30 jujube cultivars from China to the U.S. in 2011. The researchers call for regional cultivar trials to meet growing demand for jujubes in the U.S.

“Investigating Vermicompost as the Primary Fertilizer Source in Organic Vegetable and Flower Transplant Production,” Stephanie Beeks (Dept. of Horticulture, Cornell University, Ithaca, NY) and Neil Mattson. The researchers tested the ability of dairy manure vermicompost (worm-processed compost), marketed by Worm Power, Avon, New York, to supply adequate nutrients quickly enough for vegetable (pepper and tomato in the trials) and flower (petunia and snapdragon) transplants. First, they determined that up to 12 percent vermicompost (by volume) in the peat and perlite growing mix did not significantly affect germination percentages. Adding 8 or 12 percent vermicompost boosted dry weights of tomato, petunia, and snapdragon plants, relative to weights with no vermicompost added. Adding 8 percent vermicompost boosted dry weight of pepper plants, relative to weight with no vermicompost added. If the vermicompost was topdressed two weeks after seeding, plant growth was generally boosted with just 4 percent vermicompost. Transplants in four-inch containers showed increased dry weight with 10-30 percent vermicompost added to the growing mix for tomatoes and peppers and with 10 percent added for petunias and snapdragons; for the flowers, more than 10 percent vermicompost resulted in reduced dry weight.

“Making Meaning Out of Science: Using Nature’s Notebook to Engage Citizens in Exciting and Relevant Research,” Peter Warren [Pima County Cooperative Extension, University of Arizona, Tucson, AZ] and LoriAnne Barnett. Nature’s Notebook is a citizen science program of the USA-National Phenology Network that gathers ongoing observations from participants around the country on seasonal changes in plants (such as first appearances and flowering). For more information, see the March 2013 issue of HortIdeas, page 30. The researchers utilized Nature’s Notebook training materials in their county’s Extension Master Gardener training to determine whether phenology observations fit the needs of Master Gardeners. They concluded that at least some Master Gardeners became convinced that phenology is highly relevant for them.
“Evaluating Extended Season Head Lettuce Production in West Virginia,” Lewis Jett (West Virginia University, Morgantown, WV). The researcher is attempting to develop techniques for growing lettuce year-round in West Virginia. In 2012, 30 cultivars were evaluated in high tunnels located in central West Virginia. Plugs were transplanted on black or white plastic mulch on May 6, August 6, and November 7. Shade cloth (50% black) was used during the summer for some cultivars, and row covers were used during the winter. Cultivars that “performed very well” for all planting dates were ‘Australe’, ‘Buttercrunch’, ‘Coastal Star’, ‘Dancine’, ‘Helvius’, ‘Nancy’, ‘Regina delle Ghiacciole’, ‘Rex’, ‘Rouge Grenoblois’, and ‘Sierra’. ‘Parella Rosa’, ‘Passion Brune’, ‘Bruno D’Hiver’, ‘Regina di Maggio’, and ‘Quatro Stagioni’ bolted quickly in the summer.

“Workshop: Contributions of Luther Burbank: Plant Breeding Artist and Legend.” This workshop includes several papers by academic and U.S. Department of Agriculture horticulturists in honor of Burbank (1848-1926). In the past, Burbank’s accomplishments have sometimes been devalued because of his rather unsystematic methods. He is called an “artist” rather than “scientist” in this workshop’s title, yet the workshop participants appear to be quite impressed by the range of his work, especially the diversity of his selections.

“Luther Burbank: Plant Breeding Artist, Horticulturist, and Legend,” Jules Janick (Dept. of Horticulture and Landscape Architecture, Purdue University, West Lafayette, IN). According to Dr. Janick, Burbank is “the best-known horticulturist in the United States.” He singles out the ‘Burbank’ potato, the ‘Santa Rosa’ plum, and the ‘Shasta’ daisy as Burbank’s “most famous” cultivars, out of 800+ in all. “Burbank was not a scientist.... He performed no experiments in the classical sense ...” yet he “is justly famous.” “Above all he had an eye and feel for plants.”

“Russet Burbank: No Ordinary Potato,” Charles K. Brown (U.S. Department of Agriculture, Agricultural Research Service, Prosser, WA). This was the “most important potato cultivar of the 20th century” that became “the backbone of potato genealogy in the late 19th century.” Even today, ‘Russet Burbank’ accounts for more acres than any other potato cultivar in North America. Brown touts it as “the best fryer out of long-term storage.” Despite Burbank’s passion for potato breeding in order to combat human hunger, none of his other potato cultivars have been nearly so important as ‘Russet Burbank’.

“A Vast Array of Beauty: The Accomplishments of the Father of American Ornamental Plant Breeding, Luther Burbank,” Neil O. Anderson (Horticultural Science, University of Minnesota, St. Paul, MN) and Richard T. Olsen. Burbank bred many ornamental cultivars and “pioneered” in breeding ornamental edibles (such as spineless cacti). He charged very high prices for some ornamental cultivars—for example, $1.55 per bulb for amaryllis. In the early years of the 20th century, Burbank’s work with cactus led to a speculative bubble. Unfortunately, “most” of his ornamental cultivars were lost.

“Luther Burbank’s Plums,” Daniel A. Karp (Dept. of Botany and Plant Sciences, University of California, Los Angeles, CA). Burbank released more than 100 plum cultivars; Karp claims that they are “arguably the most significant of his horticultural accomplishments.” Burbank’s plums provided a starting point for much of the later developments in breeding plums for commercial production. “His crowning achievement,” ‘Santa Rosa’, apparently got its disease resistance from the American plum. In his crossings, he utilized “at least 11 plum species.” Some of his cultivars are still highly valued by amateur orchardists; his “best tasting” plum, ‘Inca’, is an example.

“21st Century Approach to Improving Burbank’s ‘Stoneless’ Plum,” Ann Callahan (Appalachian Fruit Research Center, U.S. Department of Agriculture, Agricultural Research Service, Appalachian Fruit Research Station, Kearneysville, WV), Chris Darick, and Ralph Scorza. The researchers are using a “nearly stoneless” plum that probably originated in a breeding program of Luther Burbank to map genes responsible for the stoneless trait, which will enable accelerated breeding.

“Luther Burbank’s Contributions to Walnuts,” John E. Preece (National Clonal Germplasm Repository, U.S. Department of Agriculture, Agricultural Research Service, Davis, CA) and Gale H. McGranahan. Burbank crossed the eastern black walnut (Juglans nigra) with the northern California black walnut (J. hindsi) to produce his ‘Royal’ walnut. Then he crossed the Persian walnut (J. regia) with the northern California black walnut to produce his ‘Paradox’ walnut. A tree on the University of California campus that is supposedly grafted from wood from an original ‘Paradox’ tree has been micropropagated and is on trial.

“Luther Burbank’s Berries,” Kim E. Hunter (U.S. Department of Agriculture, Agricultural Research Service, National Clonal Germplasm Repository, Corvallis, OR), Chad E. Finn, and Michael Dossett. Burbank called small fruit the “Cinderella of the pomological family” because it was so little developed in comparison to tree fruit. He made “wide crosses within and between” many small fruit species from around the world, resulting in the release of blackberry, raspberry, strawberry, and grape cultivars. According to the researchers, some of Burbank’s small fruit cultivar descriptions “were exaggerated ... for promotion or public recognition.” He also gave new common names to some small fruit species, such as balloon berry for Rubus ilceobрусus and mayberry for R. palmatus, to aid market appeal. “However, his amazingly keen observations of thornlessness, pigment diversity, and recognition of repeat flowering and fruiting in blackberries, raspberries, and strawberries were insightful of future industry.”

Superweeds: How Biotech Crops Bolster the Pesticide Industry

This 19-page report is available free as a PDF file at the Food and Water Watch web site (www.foodandwaterwatch.org). It documents in great detail, and with copious references, how the rise of genetically engineered crops has been accompanied by increased herbicide use and development of herbicide-resistant weeds. The authors of Superweeds recommend the following changes in federal government policy:

- The United States must reform the approval process for biotech crops. The U.S.D.A., Environmental Protection Agency, and the Food and Drug Administration should more rigorously evaluate the potentially harmful effects of GE crops and linked chemicals before commercialization, to ensure the safety of humans and the environment.
- The U.S.D.A. should support and encourage cultivation of non-chemical strategies for long-term weed control.
- The U.S.D.A. should educate and encourage farmers to adopt non-chemical strategies for long-term weed control.
- The U.S.D.A. should mandate research dollars to developing alternatives for sustainably managing herbicide-resistant weeds.
- The U.S. government must improve the collection and distribution of weed resistance and agricultural pesticide application data.

There are several eye-opening—and discouraging—facts and statistics included in Superweeds. Here is just one revelation:

Total 2,4-D use declined after glyphosate-based herbicide was widely adopted, but its use has increased since glyphosate-resistant crops became widespread, growing 90 percent between 2000 and 2012. 2,4-D application on corn could easily increase by nearly three-fifths within two years of 2,4-D-tolerant corn’s introduction. [This new kind of GE corn is currently being developed.]
BOOK REVIEWS


This is a superb book for all growers who want to conserve water. Not only does it provide basic information on gathering and efficiently putting to use every last drop of precipitation, there are also abundant highly detailed instructions and data to enable highly sophisticated optimization of water use. In short, this book can educate the complete novice on effective water conservation to an expert level. (And there are two additional volumes in the series, which we expect—though we haven’t read them—continue the education far beyond the expert level. Volume 2 focuses on water-harvesting earthworks, and Volume 3 on roof catchment and cistern systems.) But don’t get the idea that the education provided herein is boring. With plenty of drawings and photos, and illustrative anecdotes throughout, you’ll be eager to keep learning from the book!

The chapter titles provide a good idea of the coverage: The Man Who Farms Water and the Rainwater-Harvesting Guidelines: Assessing Your Site’s Water Resources and More; Overview: Harvesting Water with Earthworks, Tanks, or Both; Integrated Design; and An Integrated Urban Home and Neighborhood Retrofit. There are also nine appendices, amounting to more than 100 pages: Patterns of Water Sediment Flow with Their Potential Water-Harvesting Response; Water-Harvesting Traditions in the Desert Southwest (by Joel Glanzberg); Water-Harvesting Calculations; Example Plant Lists and Water Requirement Calculations for Tucson, Arizona, Plus a Sonoran Desert Foods Harvest Calendar; Worksheets: Your Thinking Sheets; Resources; Sun Angles and Paths; Wind Harvesting: Basic Airflow Relationships, Site Selection, Wind Pumping and Wind Power, Natural Ventilation, Windbreaks, and Snow- and Biomass-Drift Harvesting; and Water-Energy-Carbon Nexus. Yes, there is certainly a lot packed into Rainwater Harvesting! A lot that makes a whole lot of sense!

In his Foreword, Gary Paul Nabhan of the University of Arizona calls Brad Lancaster “the Patron Saint of Water Democracy,” based on Brad’s “lifelong passion for practical, ecological, and aesthetically pleasing solutions to our water woes.” Such woes used to be concentrated in arid regions, but in the past few years they have been spreading farther and farther. Landscape is a pioneering leader who should have followers in every state! Those who heed his message will not be convinced by authoritarian rhetoric, but instead by hard (in some cases, very hard) facts, cogent logic, workable designs, and, definitely not least, a teaching style that is anything but dull.


This is by far the most useful book on invasive plants that covers the entire U.S. The first section provides a very well-thought-out overview of what “invasive” means, where invasives come from and how they are distributed, what gardeners and landscapers can do to help stop the spread of invasives, and general (chemical and organic) methods of controlling invasives. The author makes it quite clear that particular invasives can have both good and bad features (which can be different, at least in emphasis, for different people!), so that the equation “invasive” = “obviously needs eradication” doesn’t always apply.

Most of the book is devoted to providing useful information on invasives, grouped for ease of identification into broad categories (water and bog plants; annuals, biennials, and tropical perennials; herbaceous perennials; grasses and bamboos; vines; shrubs; and trees). We personally take issue with the book’s arbitrary (at least so it seems to us) classification of all “successful” (that is, able to spread without human help) plants that were not in this country when settlers from Europe first arrived as plants that should be eradicated. We would never want to destroy the beautiful ox-eye daisies, Queen Anne’s lace, bee balm, and various other introduced wildflowers that bloom profusely along the sides of the gravel road that runs through our farm. And we think that folks who demand “pure grass” lawns without, for example, introduced white clover are perpetuating a problematic suburban ideal responsible for increased use of energy and chemicals, not to mention wasted time. With climate change’s negative effects increasing in severity, who can say for sure that, in the not-so-distant future, we won’t be welcoming at least some invasive plants as replacements for the natives that are struggling to survive (and not because they are being outcompeted by exotics!).

Regardless of our philosophical differences with the author, as a practical matter, we can unreservedly recommend that if you have invasive plants that you want to eradicate, this is the book to consult. For each of the many plants covered, there is a clear color photograph and a concise written description, so you are unlikely to make a mistake in identification. These are followed by succinct advice under these headings: Problem, Reproduction, Origin, Notes (including, in some cases, culinary and/or medicinal uses), Noninvasive Alternatives, Less-Toxic Controls, and Chemical Controls. The Less-Toxic Controls information is especially useful for organic-committed growers such as ourselves, because they make clear the sometimes considerable difficulties involved in manual removal of plants. At the end of the book is a list compiled from multiple databases that names plants considered to be invasive in particular states.


Jane Goodall is best known for her work with chimpanzees, but her love for plants, the motivation for this book, is nothing less than enormous, dating from her childhood when she had her own special tree in the family garden. Here, she shares her lifelong fascination with all things botanical, as well as—after all, this is Jane Goodall the uber-conservationist!—her dismay about how plants have fared in the modern world and her hope that the resilience of plants will overcome environmental setbacks.

Seeds of Hope has many fascinating chapters about both common and little-known aspects of botany, for example ancient trees, plant hunters throughout history, carnivorous plants, the wonders of seeds, medicinal plants, food crops (and the issues raised by genetically modified organisms), orchids, plantations and slavery, and biopiracy. All of these topics are brought to life by anecdotes about Goodall’s personal experiences and numerous illustrations, many in full color. We wish that more bibliographic information were provided—unfortunately, there is no list of references.

The last part of the book, titled “The Way Forward,” reports on several current worldwide crises involving plants and describes efforts to address the situations (including efforts sponsored by the Jane Goodall Institute). Sustainable farming, climate change, feeding the world’s growing population ethically, promotion of nonindustrial farming, saving forests, providing wildlife corridors, and more are discussed. The final, delightful chapter includes amazing stories of trees that have survived despite incredible adversity.

This is truly an inspiring, hopeful book for gardeners, who should be extremely proud of their own roles in working with and aiding plants to promote change for the better.