

Abstracts of the ASHS Northeast Region Annual Meeting

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Posters

Lessons in Sunflower Marketing: Results of a Consumer Preference Study in Cape May County, New Jersey

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Thirteen varieties of sunflower (*Helianthus annuus*) were cultivated for sale as cut-flowers at two different farm stands and one community farmers market in Cape May County, NJ. The gross mean economic yield per acre of cultivated land during the tourism season was approximately \$4000. The varieties selected were 'Double Quick', 'Joker', 'Magic Roundabout', 'Moonshadow', 'Peach Passion', 'Prado Red Shades', 'Pro Cut Bicolor', 'Pro Cut Yellow Lite', 'Sunbright', 'Sunny F1 Hybrid', 'Sunrich Lemon', 'Sunrich Orange Summer', and 'Tiffany'. All were advertised as pollen-less and having smaller heads suitable for cut-flower use. According to the percentage of displayed-sunflowers-purchased, varieties with yellow ray flowers and dark brown disc flowers were preferred by customers, with average sales percentages between 84.08 and 87.15. Varieties least purchased (preferred) by customers were the novel and unusual types with percent of display sales ranging from 33.62 to 66.13. Although varieties tested within the "Pro Cut" series have a more traditional appearance, they were reported by both growers and the research station to exhibit a drooping characteristic shortly after harvest, regardless of postharvest environmental conditions. Customers began to refuse additional purchases of 'Joker', reportedly due to nuisance pollen. The volume of sales based on pricing provides evidence that sales frequency increases when flowers are bunched. The highest sales frequencies were attained with bunches priced at \$3.50, with anywhere from 4 to 20 flowers per bunch. Growers concurred on the potential to further increase income by extending the marketing season into the fall, as illustrated by the data revealing fair volume of sales at either end of the tourism season.

Perimeter Trap Crop Evaluation for Cucumber Beetle Control in Pumpkin

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Field research was conducted to determine if 'New England Blue Hubbard' (*Cucurbita maxima*) would attract both striped cucumber beetles (*Acalymma vittatum* Fabricius) and spotted cucumber beetles (*Diabrotica undecimpunctata howardi* Barber) away from a main crop of pumpkin when planted as a perimeter trap crop. Cucumber beetle is the main insect pest of cucurbit crops in New Jersey and can greatly reduce plant survival due to the transmission of the bacteria *Erwinia tracheiphila* that causes the disease bacterial wilt of cucurbits. A demonstration was conducted at the Rutgers Agricultural Research and Extension Center in Bridgeton, NJ, in Spring 2007. The pumpkin variety 'New England Pie' was seeded on 5 June at a spacing of 3 ft between plants in a row and 6 ft between rows with 16 rows 120 ft in length. On the same date, two rows of hubbard were seeded at the same in row and row spacing around the field of pumpkin. In an adjacent field

separated from the PTC field by a 60-ft buffer 18 rows of pumpkin, 120 ft long at the same spacing, were seeded also on 5 June. Field scouting of pumpkin seedlings began twice weekly on 5 July and ended on 16 July. The first scouting event showed no cucumber beetle in the pumpkin crop with the perimeter trap crop. Highest numbers of cucumber beetle were found in the hubbard throughout the scouting period. This study showed cucumber beetles are more attracted to 'New England Blue Hubbard' than 'New England Pie' pumpkin.

Five-Year Performance of Three Dwarf Apple Rootstocks with Cameo™ Apple

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The objective of the experiment is to compare the growth and performance of two commonly planted commercial apple rootstocks, M.9 NAKBT337 and B.9, with the new rootstock G.16. All stocks had Cameo™ (cultivar Caudle) as the scion. The experiment was planted in 2002 at two locations, the University of Massachusetts Cold Spring Orchard Research and Education Center in Belchertown, MA, and the Rutgers Snyder Research and Extension Farm in Pittstown, NJ, as part of the NC-140 Regional Rootstock Research Project, <http://www.nc140.org>. Experimental design is a randomized complete block with 10 replications and trees spaced at 1.2 m (MA) and 2.4 m (NJ) between trees by 3.6 m between rows. Over both states, G.16 produced the largest tree by trunk area, and B.9 the smallest. M.9 had the most root suckers. Although in 2006 there was no difference in yield per tree between the rootstocks, from 2003–2006, cumulative yield was greatest on G.16 across both states. And, fruit harvested from M.9 were larger than those from G.16 while B.9 fruit size was the same as M.9.

Rutgers NJAES Snyder Research and Extension Farm—Master Gardener Involvement in Research, Extension, and Community Outreach

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Rutgers NJAES Cooperative Extension of Hunterdon, Morris, and Somerset counties and the Rutgers Snyder Research and Extension

Farm have utilized Rutgers Master Gardeners since 1997 to assist researchers and farm crew as farm volunteers. The county programs recruit and train Master Gardener volunteers to support Extension in research and educational outreach. Master Gardeners gain horticultural expertise in a unique learning environment by assisting researchers and the farm crew in data collection, staffing annual events and registrations, assisting in maintaining educational teaching gardens, crop planting, crop maintenance, and harvesting produce for food bank donations. Since 1997, Master Gardeners have contributed 9,262 hours, valued at \$153,749, to the research and extension farm and harvested 581,774 pounds of food to be donated to local food banks, or approximately \$872,660 of produce at \$1.50 per pound.

Chemical Fruit Thinning of Asian Pears Using Cytokinin

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Asian pear fruit quality and price is determined by fruit size. Large fruit are highly desired and bring excellent market price. The objective of this study was to evaluate a cytokinin (6-benzyladenine formulated as MaxCel) as a chemical thinner for Asian pears. The experiment was conducted in a commercial orchard in Franklin Township, NJ, in 2007. Spray applications of MaxCel at 200 and 250 ppm were applied at 12-mm average fruit diameter to 'Hosui' Asian pear trees along with an untreated control. Treatments were applied in 100 GPA of water at 80 psi with a handgun sprayer. Both rates significantly reduced fruit set as compared to the untreated control, but 200 ppm was not different from 250 ppm. Hand thinning was required to adjust crop levels in all trees. Time required for hand thinning was significantly reduced from 30 to 15 minutes per tree in trees treated with 250 ppm. Fruit size near time of harvest was significantly larger in trees treated with the higher rate of MaxCel. Both MaxCel treatments increased fruit diameter. The potential of MaxCel as a chemical thinner for Asian pears is excellent. Chemical names: 6-benzyladenine (MaxCel).

Creation of a Junior Master Gardener Program® for Home Schooled Youth in Gloucester County, NJ

Mary Cummings, Rutgers, New Jersey Agricultural Experiment Station, Cooperative Extension of Gloucester County, Clayton, NJ 08312

In Fall 2007, Rutgers, NJAES Master Gardeners of Gloucester County started a Jr. Master Gardener program for home schooled youth. The youth range in age from 5 to 13 years old. Some families are members of home school groups while for the others this is their first time in a group session, providing not only education but also a chance for socialization. The group meets twice a month with each session lasting for 2 hours. The curriculum being used was developed by Texas A&M University. The curriculum is designed to teach horticulture with the use of recycled household materials. Initial reaction has been positive. Future evaluation will be done to determine success. This program has prompted interest in an after school program in conjunction with the county library system.

Genetic and Phytochemical Variation in the Medicinal Plant Wild Tarragon (*Artemisia dracunculus* L.)

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In laboratory tests, ethanolic extracts of *Artemisia dracunculus* L. (Russian tarragon) have shown significant results in treating diabetic

related illnesses. Ongoing research is utilizing amplified fragment length polymorphisms (AFLPs) to examine the genetic variation and distance within and between wild plant populations in North America. Phytochemical analyses utilizing liquid chromatography/mass spectrometry (LC/MS) are being conducted to evaluate the presence and relative ratio of six bioactive flavonoids in leaf extracts prepared from plants collected from a range of wild populations and from propagules of the same individuals grown under uniform environmental conditions. Regression analyses will be used to assess the correlation of genetic distance and phytochemical diversity in the cultivated material, as well as the relationship between geographic factors (latitude, longitude, altitude) specific to each germplasm source location.

Assessing the Genetic Diversity of an *Ex Situ* Germplasm Collection of Dawn Redwoods (*Metasequoia glyptostroboides* Hu et Cheng)

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According to the World Conservation Union (IUCN) Red List Database, the dawn redwood (*Metasequoia glyptostroboides* Hu et Cheng) is critically endangered in its native habitat. In 1990, seeds from 52 parent trees, in the Hubei, Hunan, and Sichuan provinces of China, were planted in an *ex situ* collection at Rutgers University, New Brunswick, NJ. To assess the genetic diversity of the collection, an analysis using amplified fragment length polymorphisms (AFLP) was conducted. Preliminary results show 186 polymorphic loci in the 40 trees sampled. The mean Shannon's information index was 0.319 and the mean expected heterozygosity was 0.197.

Effect of Shade on Water and Nutrient Use in Greenhouse Tomato

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Shading a greenhouse may have a time-dependent effect on growth, and water and nutrient use in tomato plants, due to acclimation to light, and a dependence on stored carbohydrate and nutrients. Simultaneous comparisons were made among greenhouse sections that were either not shaded, or covered with reflective aluminized shade cloth that attenuated 0.15, 0.30, or 0.50 of direct sunlight. In two years in the northeastern United States, shade cloth was applied at the start of warm weather in June and the houses were shaded until late August. The amounts of water, nitrogen, and potassium supplied per day, and the amounts in solution drained from the crop, were calculated for intervals of 21 days after shade was applied, and compared to the rate of fruit production. There were significant effects of shade density, duration after application of shade, and cultivar on water use. All of these factors also affected nitrogen and potassium uptake. Water, nitrogen, and potassium use declined in a linear manner with increasing shade density. Within each 20-day interval, water and nutrient use under 0.5 shade density was 20% to 30% less than under no shade. Nitrogen use declined by 40% and potassium use declined by 30% over fruit production, regardless of shade treatment. Fruit production was not affected by shade within 21 days of application, but after more than 42 days, it was 30% less under 0.5 shade density than under no shade. Because the effects of shade on fruit production differed over time compared to those on water and nutrient uptake, radiation, water, and nutrient use efficiencies increased with shade density immediately after shade was applied. This effect of shade on water and nutrient use efficiencies disappeared within 21 to 42 days after shade was applied.

Photosynthesis and Chlorophyll Content of Cranberry under Salt Stress

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Photosynthetic activity decreases when plants are grown under saline conditions leading to reduced growth and productivity. Leaf gas exchange and chlorophyll content of cranberry var. Stevens were

measured in response to increasing NaCl concentration. Cranberry was grown in a sand-based culture under greenhouse conditions. The NaCl concentrations in complete nutrient solution were 0 (control), 82, 164, and 246 mg·L⁻¹. Interacellular CO₂ concentration in leaf cell increased with increase in salinity ($r = 0.72$, $P \leq 0.01$, but stomatal conductance, transpiration and net CO₂ assimilation were not significantly affected by salinity. Interacellular CO₂ concentration decreased with increase in transpiration. Stomatal conductance had a negative correlation with intercellular CO₂ concentration ($r = -0.53$, $P \leq 0.10$). The ratio of chlorophyll a to chlorophyll b was 1 to 2 except at 164 mg·L⁻¹ NaCl whose ratio was 1. The insignificant correlation between stomatal conductance and net CO₂ assimilation seem to suggest that other physiological factors were responsible for limiting photosynthesis under salt stress.

Rutgers NJAES Master Gardeners in Somerset and Hunterdon Counties, NJ: Impacting Lives and the Environment Since 1992

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Since 1992, Hunterdon and Somerset counties have collaborated to train and certify 355 Master Gardener volunteers. Rutgers Master Gardeners of Hunterdon and Somerset counties extend Cooperative Extension's community outreach through many and varied horticultural programs for adults and children. Major programs include partnering with non-profit organizations to provide horticultural therapy and education. The Master Gardeners volunteer at the Rutgers NJAES Snyder Research and Extension Farm, where produce harvested is donated to local food banks. The Speaker's Bureau has reached over 4000 individuals since 2002 with over 25 original horticultural related presentations. Master Gardener volunteers have worked with county facilities to map invasive plant species and provide expert advice. Master Gardener volunteers have contributed a total of 186,533 volunteer hours from 1992 through 2006, estimated to be worth \$2.9 million to both counties.

Anthocyanin Variations of Camellia Cultivars and Their Application on Cultivar Classification

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The compositions and content of anthocyanins in 56 traditional Chinese camellia cultivars were analyzed with HPLC. The results showed that there were 24 types of anthocyanins found in these cultivars, 10 of which have been identified for their chemical compositions. The 14 other types remain to be identified. Principal component analysis (PCA) revealed that 87.0% of total cultivar information can be interpreted by the first eight principal components (PC). The first PC is positively correlated with the pigment of Cy3G5G; the second is negatively correlated with the pigment of Dp; the third is negatively correlated with the pigment of Cy3GGpC; the fourth is negatively correlated with pigment 26; the fifth is positively correlated with pigment 1 and 60 pigment 12; the sixth is positively correlated with the pigment 19; the seventh is negatively correlated with the pigment of Cy3pCG; the eighth is positively correlated with the pigment of Cy3G5GpC. Based on PCA with consideration of the pigments derived from their parents, these 56 cultivars have been classified into six cultivar groups, i.e., *C. reticulata*

Group, *C. japonica* Group, *C. chekiangoleosa* Group, Hybrid Group between *C. japonica* and *C. reticulata*, Hybrid Group between *C. reticulata* and *C. saluenensis* and Hybrid Group among multiple camellia species. *C. chekiangoleosa* Group is recommended for this classification because it was a debatable species until its special petal pigment, Cy3G or Cy3Ga, was identified.

Seed Dormancy and Germination of *Sinojackia dolichocarpa* C.J. Qi

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Sinojackia dolichocarpa, a small ornamental tree known for its loaded white flowers and spindle-shaped fruits, is a threatened species, only distributed in the western part of the Hunan Province in China. Since no regeneration in the wild has been observed, reproducing this plant is an essential step in its conservation and cultivation. Seeds were collected from Shimen, Hunan, and stratified in a sulfuric acid and gibberellic acid (GA₃) soak, then sowed outside before winter. Duration of temperature lower than 4 °C in this winter was 10 weeks. No germination was found for directly sowed seeds (control). All stratification seeds had germination rates from 3.3% to 46.7%. Seeds soaked in 99.9% sulfuric acid for 2 days had much higher germination rates than those that were soaked for 3 and 4 days. The highest germination rate (46.7%) was observed in seeds soaked in sulfuric acid for two days, and then 500 mg·L⁻¹ GA₃ for one day. The results concluded that seeds of *S. dolichocarpa* had a combinational dormancy (physical and physiological dormancy). The testa was very thick, which accounted for 91.9% of the seed dry weight. The hardseededness and water-impermeability of the seed could be overcome by acid erosion. Seeds soaked in sulfuric acid for four days had 44.5% of its testa (by dry weight) removed. Physical dormancy of *S. dolichocarpa* seeds could be partially released from acid soak. GA and subsequent lower temperature treatments could overcome the physiological dormancy. Further studies should focus on better germination rates and some asexual regeneration methods.

Producing for the Ethnic Consumers on the East Coast: An Assessment of Demand for Specialty Products

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The general objective of this USDA-NRI study is to document the available opportunities for east coast farmers to grow ethnic crops from a market demand perspective. Economic opportunities have arisen in the last decade for specialty crop agriculture catering to the ethnically diverse consumers of the United States. U.S. Census 2000 data show significant rises in ethnic populations ranging from 3% to 8%. The first generation ethnic composition of New Jersey, New York, Massachusetts, and Florida are 18%, 21%, 11%, and 17%, respectively. The four largest ethnic groups along the eastern seaboard account for just under 6 million residents and grew by 23% (Puerto Rican), 218% (Mexican), 59% (Chinese), and 105% (Asian Indian) between the 1990 and 2000 U.S. Census surveys. Community mapping by the Rutgers Food Policy Institute highlights clusters of recent ethnic immigrants. Over 75% of ethnic consumers surveyed indicated they reside within 10 miles of an ethnic grocery store. A bilingual survey of these four major ethnic

groups allowed produce preferences to be ranked by each group from a total list of 42 vegetables. Considering this documented market demand, university collaborators from Florida, New Jersey, and Massachusetts refined this list from a horticultural perspective to select a range of potential crops for commercial production trials. This World Crops project is compiling horticultural fact sheets, web resources (worldcrops.org) and other outreach materials to connect researchers, growers and consumers with these emerging markets. Our initiative bridges the supply–demand gap in an attempt to sustain the economic viability of the East Coast vegetable industry while expanding food crop diversity and contributing to the nutritional and health needs of regional consumers.

Symposium—Horticulture and the Urban/Rural Interface

Horticultural Science Engagement on the Urban Fringe

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Connecting horticultural science better with urbanized lifestyles, to maintain public funding support, involves considering changed values society puts on horticulture's outputs, and acting on changes. In urban settings horticulture may be more per capita prosperity dependent than population density dependent. In urban fringe horticulture, the value of managed landscapes, ornamentals, and annual value of services far exceeds the values attached to plant production, where researchers concentrate most effort. Urban fringe populations in the U.S. interact with horticultural science results in ways that are transactional, experiential, and product oriented. People are health and well-being conscious; more interested in how they feel about horticultural interaction than in the calories it provides. They prefer a sense of exclusivity, even in interaction with horticultural outputs. Horticultural scientists improve connections with urban fringe populations by increasingly gaining skills for incorporating public events into their activities, by seeking more plant patents and use patents over physiological advances to retain value, and by adopting private industry product development so their research results are carried through to marketable products. As noted by the USDA Under Secretary for Research, Education, and Economics, "Research is good, but it has to be good for something."

Developing New Woody Ornamental and Edible Landscape Plants at Rutgers

Thomas J. Molnar*, John M. Capik, Elwin Orton, and Joseph C. Goffreda, Plant Biology and Pathology Department, Rutgers University, 59 Dudley Road, New Brunswick, NJ 08901

Rutgers and the New Jersey Agricultural Experiment Station (NJAES) have a long history of success breeding woody ornamental and fruit species. The great impacts of superior cultivars, such as those of the Stellar® series of hybrid dogwoods, demonstrate the large contribution a commitment to long-term plant breeding can have on horticulture and society in general. Plant breeding is a process that builds upon previous generations of genetic improvement. As such, Rutgers and the NJAES are in a great position to continue making substantial progress. Advanced generation hybrids are being developed based on many previous decades of intensive germplasm collection, evaluation and breeding. Work continues in the genus *Cornus* and *Ilex* to develop novel, highly attractive, and disease resistant superior ornamental cultivars, while increased efforts are being placed on developing edible ornamentals that are both highly attractive and produce an edible and tasty product. These include plants in the genus *Corylus*, *Prunus*, and *Vaccinium*.

Restoring Native Plant Communities to Urban Areas: The Search for Proper Species and Varieties

Steven N. Handel, Department of Ecology, Evolution, and Natural Resources, Rutgers University, New Brunswick, NJ 08901-1582

Field experiments to restore native vegetation to degraded urban lands such as landfills, brownfields, and parks built on construction

debris have shown that some critical mutualisms can be quickly reestablished. Birds visit the plantings, bringing in seed of many woody species, and bee pollinators of many species quickly discover and exploit nectar sources, leading to heavy seed set. However, the atypical and degraded soil and hot, polluted surrounding lands suggest that nursery varieties selected and grown on high quality agricultural land will not perform well in these conditions. Plants collected from urban areas (railroad sidings, landfills, and brownfields) are being grown in urban test plots to determine site specific needs to direct breeding programs. Initial tests with *Panicum virgatum*, *Solidago canadensis*, and *Euthamium graminifolia* show high variance in growth parameters among species and plots. Wide variation of urban conditions may require a wide group of accessions for sustainable populations.

Human Issues in Horticulture: People–Plant Relationships

Joel Flagler*, Rutgers Cooperative Extension of Bergen County, One Bergen County Plaza, 4th Fl., Hackensack, NJ 07601-7076

People respond to plants in many more ways than we are immediately aware of. Plants and gardens can have subtle but significant effects on human behavior and emotions. We are only beginning to understand the mechanisms at work. The five aspects of human issues in horticulture as recognized by the Human Issues in Horticulture working groups in ASHS and other professional associations include 1) plants and the individual; 2) plants and the community; 3) plants and human culture; 4) horticultural therapy; and 5) research and implementation. A growing body of research is focusing on the people–plant response. Investigators are looking at the ways plants affect us in diverse settings, including hotels, airports, hospitals, urban neighborhoods, offices, and more. The goal is to develop a greater understanding of the psychological, physiological, and social responses of people to plants in their environment. Then we can apply this knowledge toward improved physical and mental health for individuals and communities.

Oral Sessions

Characterizing Variability in *Anisogramma anomala* Populations

Sara N. Baxer*, Jo Anne Crouch, C. Reed Funk, Thomas J. Molnar, and Bradley I. Hillman, Department of Plant Biology and Pathology, Rutgers University, New Brunswick, NJ

One of the main components of our hazelnut breeding program at Rutgers University involves the incorporation of resistance to eastern filbert blight (EFB) caused by the obligate fungal pathogen *Anisogramma anomala*. Recent greenhouse and field studies have shown the breakdown of several sources that have provided long-term resistance to *A. anomala* in the Pacific Northwest, where the entire U.S. hazelnut crop is currently produced. To study variability among populations of the fungus, we have collected and are evaluating 185 isolates of *A. anomala* from 37 sites across North America. Sequence analysis at four gene regions (ITS, EF-1 α , BT2, CAL; 1865 nucleotides) revealed an extremely low level of genetic variation among the isolates examined. Preliminary analysis of eight sequences representing transposable elements shows a significant amount of variability among the sequences and no evidence for repeat-induced point mutation (RIP), despite the fact that *A. anomala* is only known to reproduce sexually. Further characterization of these retrotransposons should enable us to develop useful markers for our population studies.

Promotion and Inhibition of *Monilinia fructicola* Sporulation by QOI Fungicides

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Brown rot is the most devastating disease to peach orchards around the world. In the eastern United States it is caused by the fungal pathogen *Monilinia fructicola*. Fungicide application is the only

effective means of controlling the disease, as no natural resistance occurs. DMI fungicides are most commonly used, but due to the threat of fungicide resistance other chemistries are being incorporated into spray programs. Three QoI fungicides, azoxystrobin (Abound), pyraclostrobin (Cabrio), and trifloxystrobin (GEM), were examined in vitro to determine their effects on the sporulation and colonization of *M. fructicola*. The fungus was plated on cornmeal agar, amended with 15% dextrose plus a concentration of fungicide ranging from 1× to 0.0001×, and incubated at 23 °C for 7 days. Colony diameters were measured while spores were washed and counted to determine the spore density. Data were analyzed to determine a linear regression and ED₅₀ for the colony area and spore density of each fungicide relative to the control. The analysis showed the only fungicide that had a significant effect on colony size was pyraclostrobin ($P = 0.0118$). The spore density curves were all significant ($P < 0.05$) and had high R² values ranging from 70 to 99, suggesting a fungicide concentration effect. Spore density was lowest at the 1× concentration of fungicide; however, at the 0.0001× concentration of each fungicide tested, the spore density was higher than the control. These results suggest that low levels of QoI fungicides may promote, instead of inhibit, the production of spores of *M. fructicola*.

Anatomical Study to Determine Vessel to Fiber Ratio along Norway Maple (*Acer platanoides*) Branches

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Trees balance photosynthesis, hydraulics, mechanics, and reproduction over time. Increased investment in one function leads to reduced investment in others. Angiosperms utilize vessels to supply water for photosynthesis and fibers for mechanical support. Vessels have large lumens to allow for efficient water movement; however, they come at a cost to mechanical support. The perennial nature of trees suggests that balancing hydraulics and mechanics is important to survive successive years. A change in the ratio of vessels to fibers (V:F) suggests a shift in investment toward either hydraulics or mechanics. Tissue samples were obtained from five locations along norway maple (*Acer platanoides*) branches; 5 cm distally (P1) and proximally (S1) to the recent bud scale scar, branch midpoint (S2), point of branch attachment (S4), and halfway (S3) between S4 and S2. Samples were mounted on slides, photographed under a dissection microscope and vessel radii, area of vessel and ray measured. V:F, percent area of vessel, ray and fiber were calculated. Vessel radii were found to be larger in S2–S4 and smaller in S1 and P1. This is consistent with pipe flow theory for conduit tapering to maintain hydraulic pressure along the branch. V:F and percent area vessel were lower in both P1 and S4 than the middle sections of the branches (S1–S3). Indeed P1 and S1 were 10 cm apart, yet the presence of vessels increase with the onset of radial growth in S1, suggesting hydraulics is more important than mechanics, presumably to supply the lateral branches.

Identification of QTL Associated with Drought Tolerance in Creeping Bentgrass

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Quantitative trait loci (QTL) are identified in order to allow for locating a given trait(s) of interest and for future marker-assisted selection for breeding. Since drought stress is a major issue worldwide and severely limits plant growth and productivity, identification of QTLs for drought tolerance traits is essential for the advancement of breeding for species with improved drought tolerance. Creeping bentgrass (*Agrostis stolonifera* L.) is a species that is widely used as a turfgrass, and currently available cultivars could benefit from marker-assisted selection and breeding for enhanced drought tolerance. Thus, this study aimed to identify QTLs for drought tolerance traits including relative water content, osmotic adjustment, water use efficiency, turf quality, and electrolyte leakage using a bentgrass mapping population. Seven possible QTLs were found on four linkage groups on the map of the drought-tolerant parent.

Can Population Genetics Studies of *Spartina alterniflora* (Smooth Cordgrass) Affect Marsh Restoration Horticultural Practices?

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Spartina alterniflora is a leafy perennial grass that can grow to 3 m in height. It is native to tidal salt marshes along the Atlantic and Gulf coasts from Newfoundland to Florida to Texas, where it dominates the intertidal zone or low marsh. It has been planted extensively on the east coast of the United States in the restoration of tidal wetlands. Little attention has been given to the provenance of *S. alterniflora* propagules but recently there has been a call to plant local genotypes in marsh restoration. In order to inform marsh restoration in Jamaica Bay, Queens, NY, we have determined population genetics of *S. alterniflora* in the New York metropolitan area. We sampled 11 marshes from New Jersey to Rhode Island and genotyped the samples based on 15 microsatellite loci. All samples showed unique microsatellite profiles indicating a high degree of genetic diversity among clones in *S. alterniflora* marshes. AMOVA analysis indicated that differences among individuals accounted for approximately 90% of genetic variation whereas differences among sampling locations accounted for approximately 10% of variation. A Mantel test determined that geographic distance was not significantly correlated to genetic difference. Our study suggests that population structure of *S. alterniflora* may result from raw drift that is not countered by spatially patterned gene flow. Though this study reveals important details of salt marsh genetic structure, it cannot by itself endorse or refute the practice of using local genotypes in marsh restoration. The extent and spatial scale of local adaptation must first be determined before any recommendation on propagule provenance can be made.

Urban Tree Planting and Mortality Statistics in the Boroughs of NYC

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Between 1999 and 2004, 43,500 street trees were planted by request by the New York City Parks and Recreation Forestry Department through contracts. The data were analyzed to 1) compare stocking plans with current diversity recommendations, 2) check transplant success in second-year contract release inspections, and 3) develop mortality figures to assess plant selection choices. Initial treatment broke the data into borough and land use type on record at time of planting. Data were also organized to provide previous behavior expectations and conditions for a Bayesian analysis approach on a 12,000 tree subsample inspection conducted in 2006, 2007, sampled by borough and stratified by initial listed land use type. Species diversity in the original dataset was compared against the Santamore maximum urban canopy stocking percentage recommendation: 10 species, 20 genus, 30 family. Overall tree survival at time of second-year inspection was 92.05%. Specific plant species, land use, year planted, and borough show impact on survival. Some species with high mortality occurred in single site contracts, limiting general viability observations on many species that showed poor performance. Initial stocking level diversity was generally in line with recommendations across all boroughs; however, there was an observed disconnect between initial species listed for planting and species present on-site during later inspection. The initial presumption has been contractor substitution for availability and lack of data correction from field inspection reports. The 117 species codes were entered in the original data set. Six species from five genera (*Pyrus*, *Tilia*, *Prunus*, *Gleditsia*, and *Zelkova* in order of occurrence) were present at greater than 5% of total population and accounted for 51% of the total tree population. The collective presence of *Quercus* spp. was larger than zelkova. Queens was the most diversely planted borough with 17,149 trees from 99 species and enjoyed the highest survival rate at 94.08%.

Population Diversity of *Primula denticulata* Smith ssp. *sino-denticulata* (Balf.f. et Forr.) W.W. Smith et Forr. as Revealed by AFLP Markers

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Primula denticulata ssp. *sinodenticulata* is a famous alpine flower from southwestern China. Its natural distribution has been fragmented and several recorded populations cannot be located. To better conserve and utilize this plant for our future breeding and introduction, 300 plants from 10 populations were collected and their genetic diversity was analyzed using AFLP fingerprinting. Six AFLP primer combinations produced 223 markers between 200 to 3200 bp; 94.17% of them were polymorphic. Nei's genetic diversity at population level was from 0.19 to 0.30 and Shannon's information index ranged from 0.33 to 0.48, which indicated that the genetic diversity was high for this subspecies. An analysis of molecular variance (AMOVA) revealed 83.04% of genetic variations occurred among individuals within populations. Genetic differentiation among 10 populations was moderate; about 17% of the genetic diversity could be attributed to variations among populations. Genetic variations of 6.12% were detected among two population size groups, exceeded and below 100 m². An UPGMA cluster based on Nei's genetic distances using AFLP data grouped the sampled populations into two clusters and correlated them with the AMOVA test. Pairwise genetic distances (ΦST) among populations varied between 0.13 and 0.24 and the gene flow (Nem) at population level was 1.27. High genetic diversity and moderate genetic differentiation were ascribed to its outbreeding system. The AFLP technique is an effective tool for evaluating molecular variation and differentiation. These findings are a key reference for carrying out effective conservation and further breeding strategies for this great ornamental plant.

Yield Evaluation of Powdery Mildew Resistant Zucchini and Yellow Summer Squash Varieties

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Field research was conducted with seven green zucchini (GZ) and yellow summer squash (YSS) (*Cucurbita pepo*) varieties to evaluate yield and quality under field conditions in 2007 at the Rutgers Agricultural Research and Extension Center in Bridgeton, NJ. Varieties were chosen based on past performance from disease evaluation trials conducted in 2005 and 2006 at the same location. Through the research done in 2005 and 2006, the varieties were determined to have intermediate resistance to powdery mildew. In the 2007 study, squash was planted in two seasons. The first planting was seeded into raised beds with black plastic mulch and drip irrigation on 30 Apr., and the second planting on 27 July. Harvests began on 11 June and were conducted 3 times weekly for 4 weeks for the spring crop. For the fall crop, harvests began on 7 Sept. and took place 3 times weekly for 3 weeks. Varieties with the highest marketable yield in spring included 'XPT 1832 III' YSS, 'Judgement III' GZ, and 'Patriot II' YSS, respectively. In fall the highest marketable yields were seen with 'Judgement III' GZ, 'Wild Cat' GZ, and 'Tigress' GZ, respectively.

Evaluation of the Mother Stalk Method of Asparagus Culture in New Jersey

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The "mother stalk" method of asparagus production holds tremendous promise for harvest season extension, an opportunity of great potential economic benefit to growers in temperate latitudes. To test the feasibility of this method under eastern North American growing conditions, two genetically distinct asparagus clones were contrasted with respect to overall yield in mother stalk vs. traditional

harvest methods over the 2007 growing season in southern New Jersey. The experimental field consisted of 15 × 6 m rows of mature crowns of all-male clones 501B and 335G, respectively, selections from 'Jersey Giant' and 'Jersey Centennial'. The field configuration was 0.30 m between crowns in the row, 1.5-m row spacing, and a planting depth of 0.18 m. Drip irrigation was applied weekly from 26 June through 30 Sept., and the canopy of each row was staked in an upright position. Control treatment rows were harvested for approximately 7 weeks, with all spears removed during this period. Thereafter, spears were allowed to mature into the canopy for the remainder of the growing season. Two regimes were contrasted that employed the mother stalk (MS) method: 1) the first three spears per crown allowed to comprise the canopy, then all new spears harvested through 26 Oct. 2007; and 2) all spears harvested beginning from the start of the growing season and continuing for 2 weeks, then the next three spears per crown allowed to elongate and comprise the canopy, then all new spears harvested through 26 Oct. 2007. Resulting harvests were accumulated for ~1 week then graded into three classes according to standard commercial size and weighed. For both clones, the modified MS method gave the highest overall average yield, expressed as kg/row m (1.38 and 1.30, respectively, for clones 501B and 335G), followed by MS (1.19 and 1.07), then the control (0.94 and 0.68). Both MS methods exhibited similar harvesting dynamics: high yield spikes in the spring and fall, with an intervening period of low yields during the mid summer (1 July–15 Aug.). The yield of size classes mostly followed a similar dynamic to the total yield, but clone 501B had higher yields of jumbo spears than did clone 335G for all treatments. Since labor costs associated with the MS method are higher (per unit yield) than the control, and harvests must persist through the periods of low yield in midsummer to make high yields possible in the fall, it is not yet clear whether the method is commercially feasible for the eastern U.S. The experiment will be repeated in 2008 to determine whether the method has a deleterious effect on the long-term productivity of crowns, to estimate additional growing and harvesting costs associated with the MS asparagus culture method, and to determine whether the method is economically feasible.

Titrateable Acidity and pH of Expressed Juice from Fruit of the Hybrid Tomato Variety 'Ramapo' and Constituent Inbred Parents

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Fruit acidity and simple sugars are major determinants of overall tomato fruit flavor. Consequently, breeding has been employed substantially in efforts to achieve desirable levels of fruit acidity and soluble solids, although environmental conditions can also affect these levels. Most of this research, however, has been conducted in processing tomatoes, and it is not clear whether inheritance in fresh market tomatoes will be similar. The F₁ hybrid variety 'Ramapo' was developed and released by the New Jersey Agricultural Experiment Station in 1968, and has gained a reputation anecdotally as one that has excellent overall flavor. In the present study, titrateable acidity (TA), soluble solids (SS; °Brix), and pH of raw expressed fruit juice were determined to calculate correlation coefficients. If pH is correlated with TA, it may be possible to use the more simple and inexpensive method as a breeding tool. Also, TA and SS were compared among fruit maturity stages of 'Ramapo' and its constituent parental inbreds ('KCA' and 'Abbie') to determine the inheritance of phenotypic differences and which of the parents would be a suitable gene donor of high TA and SS. Among a panel of diverse commercial fresh market varieties, 'Ramapo' was relatively high in TA and low in pH of expressed juice, but intermediate in SS. In the first of two experiments comparing the inbreds and F₁ hybrid, the inheritance of both fruit TA and SS appeared to be heterotic, but the extracts were contaminated with particulate matter. In the second experiment, where centrifugation was employed to further clear the extracts, the inheritances of both high TA and low SS appeared to be dominant, with the 'KCA' inbred at a similar levels as 'Ramapo'. The dynamics of organic acid and SS levels in different ripening states in tomato fruit agreed with earlier observations:

concentrations spike during intermediate stages (pink and light red), then decrease in fully ripe red fruit. TA, SS, and pH of expressed tomato fruit juice were not correlated in this study.

Horticultural Crops for Ethnic Markets

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USDA's National Research Initiative (NRI) funded this study to document consumer demand and reveal opportunities for East Coast farmers to grow and cooperatively market ethnic crops. The four largest ethnic groups in this region—Chinese, Indian, Mexican, and Puerto Rican—account for just under 6 million residents. Approximately 60% or more of each of these ethnic populations lives in the mid-Atlantic region, with the exception of the Mexican group. More than 65% of the Mexican population resides south of Maryland. A bilingual survey ranked produce preferences by each group from a total list of 42 vegetables. A range of potential crops for production trials was selected from this list for horticultural assessment during the 2006, 2007, and 2008 growing seasons in New Jersey, Massachusetts, and Florida. Field data of various crop characteristics was collected from replicated plots for vining and trellised cucurbits (calabaza squash, bottle gourd, smooth and ridged luffa gourd, and bitter melon), hot and sweet peppers (nine jalapeno, three ancho, two serano, one habanero, and three aji dulce cultivars), several cilantro cultivars, two eggplant cultivars, leafy greens, batata, and many others. This World Crops project is generating horticultural, production, and marketing data for these preferred food vegetable crops to be compiled into factsheets, web resources (worldcrops.org), and other outreach materials to connect researchers, growers, and customers with these emerging markets.

Headspace Gas Composition following Variable Storage of Asparagus Spears and Pre-cut Vegetables in Sealed Micro-perforated Film Package Designs

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Packaged whole and pre-cut vegetables are a rapidly growing sector in both retail food and food service businesses. Packaging presents an entirely new set of postharvest challenges and food safety issues as compared to non-packaged vegetables. The opportunities for value-added products and brand identity, however, are immense. Growers and packers of perishable food commodities in the eastern U.S. face enormous competitive challenges as products from around the world are shipped into local markets. Many have turned to value-added packaging as a way to capture local freshness and quality. In the present study, headspace gases and product quality were measured following the storage of whole and pre-cut vegetables in a set of advanced microperforated barrier film packages. Vegetables included asparagus, broccoli florets, and various mixtures of organically grown products. Oxygen and CO₂ were observed to have a strong negative correlation, as would be expected from the outcome of respiration and previous studies. As storage temperature increased from 2 to 8 °C, higher levels of CO₂ were observed in all packages, but lower in those with greater microperforation densities. In general, the best postharvest results were obtained with Mylar® films and 36/package microperforation density, which resulted in a consistent CO₂ level in the 5% to 10%

range following storage at 2 to 8 °C. The targeted asparagus product is microwave-cooked in the package, so the best film product for these applications was high-mil polyethylene (e.g., SteamFast® with a pressure-activated steam vent). Experiments with commodity mixtures yielded some unpredictable results, i.e., headspace composition of mixtures was not always predictable from known values of individual components. In experiments and in product test markets, antifog coatings were found to be absolutely essential to prevent water from condensing on the inner surface of the film.

Development of New Strawberry Varieties at NJAES—Rutgers University

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The objective of our strawberry breeding project has been obtaining new varieties suitable for cultivation in the annual system of production in New Jersey. The fruits should be of superior quality and competitive on the fresh fruit market in the greater metropolitan area. Other particular horticultural characteristics are: productivity and resistance to major strawberry diseases and pests. For the annual system of production, the planted propagules should develop very rapidly an elaborate root system, enlarge the size of their crown which then divides to produce multiple clusters of flowers and thus high productivity. Only a few most vigorous selections actually have such growth and developmental patterns. The fruit quality consists of many elements, but texture, taste, and aroma is most difficult to recover in the same plant with vigorous growth and high productivity. We have been trying for the past few years to achieve this objective, by screening more than 35,000 hybrid seedlings and testing over 500 selections. It appears that these two attributes of strawberry plants are antagonistic. We are in the process of testing a large pool of promising selections three of them are being propagated for commercial release. Some of their horticultural values will be shown.

Blueberry Fruit Quality and Yield as Affected by Fertilization

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The effects of timing of fertilizer applications on fruit quality and yield of highbush blueberry (*Vaccinium corymbosum* L.) cultivar Duke were evaluated during the summers of 2000 to 2003. Treatments included a split application of 10–10–10 when uptake is more efficient, i.e., early petalfall and preharvest and were compared to the control, a split application of 10–10–10 at bud swell and post-bloom. Additionally, fertilizer applications were made via trickle irrigation (fertigation) from early petalfall through preharvest and compared to the standard 10–10–10 application at bud swell and post-bloom. Fruit size, fruit firmness, and leaf nutrient levels and yield were analyzed utilizing a randomized complete-block design. Fruit was harvested once a week. The 2002 data showed that yield was significantly increased with both the petalfall/preharvest and the fertigation treatments when compared to the control. In addition, there were significant differences in fruit firmness between treatments. Leaf nutrient levels indicate a greater efficiency of uptake with the treatments initiated later than the control. Additionally, berries that were fertigated were 14% firmer than control berries. These results, coupled with fertilizer recommendations based on leaf analysis and a greater awareness of the role of the proper soil pH, have changed the way highbush blueberries are fertilized in New Jersey.

Digital Visualization of Decay in Oak Species Five Years after Pruning

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While pruning is a common practice on urban trees for varied reasons, it does initiate a wound response. Reduction pruning as defined by ANSI A-300 standards reduces a growth axis to a lateral branch which assumes the terminal growth axis role in future growth. The CODIT model for wound response does not directly provide for

a description of this type of wound. Three dimensional visualizations of 3- to 11-cm-diameter reduction cuts on branches of *Quercus virginiana* and *Quercus schumardii* were created with Mercury Computer Systems' Aviso software to enable viewing of internal branch anatomy and data collection. Visualizations were derived from high resolution scans of 1cm thick transverse serial sections of branch segments through the pruning wound and resultant discoloration/decay zones present five growth seasons after pruning in Gainesville, FL. Linear interpolation was used to fill in the resulting 1-cm-thick voids in data between images and facilitated the three dimensional visualizations. Once digitized, the form can be dissected in x, y, and z planes to measure and describe decay or discoloration forms in relation to wood organization features such as growth rings. Pertinent linear, angular, and volumetric measurements were taken as a means to quantify and describe the attenuation and compartmentalization of decay, and to facilitate hypothesis testing on the 76 harvested branches. In the majority of branches, decay and discoloration had not spread into the remaining branch adjacent to the reduction cut. Decay and discoloration was repeatedly limited by the interface of the xylem growth rings from the initial growth axis and the lateral branch trace. Thus, the specialized anatomy within the branch protection zone, thought to function in hydraulic segmentation and limit decay from lost lateral branches into the main growth axis may work at some level, if only as a surrogate Wall II location for reaction zones in the existing C.O.D.I.T. model attenuating the discoloration-decay column as growth axes converge.

Plant Available Moisture in Designed Soils for Pavement Systems

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Stone-soil mixtures have been advanced in recent years as a designed material for support of urban trees and pavement surfaces in shared spaces to provide a rooting zone for sustainable canopy establishment in limited urban soil spaces. A series of three studies investigated the hydraulic properties of varied stone soil materials in terms of compacted porosity, hydraulic conductivity, infiltration ability, and plant available moisture. Plant material was established in compacted mixtures of 80% aggregate and 20% soil by weight. The mixtures varied by stone and soil components. Predawn water potential was measured during a dry-down sequence and linked to gravimetric moisture measurements to develop soil moisture desorption curves, to determine plant available moisture content. Compacted porosity in normal aggregate systems was found to be 25% to 26% at expected densities of 1.97–2.00 Mg·m⁻³ (30% to 32% at expected densities of 1.16–1.28 Mg·m⁻³ in Stalite aggregate blends) with a high percentage in gravitational pores (over 30% of total porosity in all cases) draining within 3 to 12 hours. Plant available water capacity was measured at 7% to 11% by volume, varying by compaction effort, stone type, and soil choice. Porous, heat-expanded slate offered additional plant available moisture held at low tension and total porosity. Differences in soil choice were manifest at field capacity, but were no different at 12–15 MPa matric tension. Infiltration capacity was in excess of 60 cm·s⁻¹ in compacted field installations. Laboratory samples compacted to peak standard density provided a measured hydraulic capacity of 0.02–0.03 cm·s⁻¹, similar to clean well-graded sand in laminar flow.

Direct Marketing Sunflowers: Variety Characteristics and Consumer Preferences in New Jersey

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Fourteen varieties of sunflower (*Helianthus annuus*) were evaluated as cut-flowers at two commercial farms in Cape May County, NJ

and at the Rutgers NJAES Snyder Research and Extension Farm in Hunterdon County, NJ. The varieties included were 'Double Quick', 'Joker', 'Magic Roundabout', 'Moonshadow', 'Peach Passion', 'Prado Red Shades', 'Pro Cut Bicolor', 'Pro Cut Yellow Lite', 'Starburst Panache', 'Sunbright', 'Sunny F1 Hybrid', 'Sunrich Lemon', 'Sunrich Orange Summer', and 'Tiffany'. 'Joker' was only grown in Cape May, while 'Starburst Panache' was only cultivated at the research station. The plots at the research station and one of the commercial farms were on 7-ft centers, direct seeded by hand into quadruple rows (4 inches apart) in raised beds on black plastic mulch. The other commercial farm planted in double rows on bare ground using a cole seeder. In two separate plantings at the Snyder farm, 'Sunrich Lemon' had the lowest mean germination rate (25%) while 'Magic Roundabout' had the highest (71%). A mid-season hail storm in Hunterdon County destroyed the first planting prior to data collection, and severely damaged the newly emerging second planting. Through irrigation and fertilization, the second planting survived but produced shorter stems than the first planting. 'Peach Passion' exhibited the smallest average sunflower head diameter (8.81 cm) while 'Tiffany' had the largest (22.85 cm). Varieties exhibiting 'traditional' characteristics of yellow ray flowers and dark brown disc flowers were preferred by customers, while less common types such as the maroon-colored 'Prado Red Shades' and the white 'Moonshadow' were not. The "Pro Cut" series, despite their "traditional appearance," were not favored and exhibited a drooping "shepherd's crook" appearance shortly after harvest, severely diminishing marketability.

The Use of Television, Newspaper, and Internet to Promote Local Agriculture, Extension, and Sound Horticulture

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Rutgers Cooperative Extension of Middlesex County promotes diverse educational programs, projects, and activities through the use of television, newspaper and internet web sites. The "If Plants Could Talk" (IPCT) television program is produced by Extension staff, and 18 episodes have aired to over 8 million potential viewers throughout New Jersey and parts of New York, Pennsylvania, Connecticut, and Delaware. Programs air on statewide PBS and regional cable television stations. In addition, several 30-minute television programs have been aired on regional cable stations to promote activities at the new Extension EARTH Center. The accompanying IPCT website has received over 18 million hits over the past 7 years. The program and website promote local agricultural, extension, and university research and programs as well as environmentally sound horticultural practices for the general public. Weekly newspaper columns are written by Extension staff for three major newspapers that reach over 480,000 potential readers throughout New Jersey. Newspaper articles invite readers to visit the statewide Cooperative Extension website and the IPCT web site produced by Middlesex County Extension Staff. As a result of all media efforts, Extension programs and services have increased by over 50% in Middlesex County.

Jersey Fresh Surveys and Direct Marketing Trends for Agriculture in Middlesex County, NJ—2007

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Surveys on consumer preferences for local agricultural commodities, sold as direct marketed "Jersey Fresh" products, were conducted at the Middlesex County Fair and EARTH Center Open House in Aug. 2007. Surveys provided information on consumer attitudes and actions for product purchases. Consumers were also asked to provide information on changes that would encourage them to buy more products

from local farmers. A few questions covered individual purchasing preferences such as type of produce, locality and convenience. The strong influence of organic produce as well as the availability of produce are the most notable factors. An effort was made to advertise the health benefits of consuming fruits and vegetables and promote “Jersey Fresh” with the aid of brochures describing the active principles within various products. Participants were provided with samples of local “Jersey Fresh” products including sweet corn, tomatoes, peaches, cantaloupe, and watermelon. Over a period of 4 days, 405 people between the ages of 12 and 76 participated.

Eco-Ventures at the Earth Center: An Environmental Program for Youth

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“Eco-ventures” is a 3-day environmental program for youth entering grades 5 through 7. Throughout the program, youth participate in educational activities and discussions concerning environmental awareness and stewardship, and energy conservation. Some activities, such as vermi-composting and construction of model landfills, focus on solid waste reduction. Other activities like pond and woodland explorations focus on ecosystem diversity and invasive species. During the last day of the program, youth worked in teams to develop and film public service announcements, in order to promote environmental awareness within their own communities. Youth are given pre- and post-tests to evaluate the effectiveness of the activities and increase in knowledge of subject matter. Youth are also asked to develop short- and long-term goals toward environmental conservation at home and in their communities. Progress is recorded through a 3-month follow-up phone survey.

The Potential of Former Poultry House Pad Soils for Use as Horticultural Amendments

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There are over 2400 derelict poultry houses covering 400 ha that are out of production on the Delmarva Peninsula. Poultry houses are built over soil pads that accumulate mineral nutrients through diffusion from manure in litter over a 30–50 year period. This includes significant amounts of nitrate nitrogen (NO₃-N). Once production ceases, houses are often demolished or left to slowly deteriorate. Exposed pads are subject to leaching from rainfall and high amounts of NO₃-N can enter the groundwater. Research is underway to study nutrient loading at these sites and methods to recover nutrients, particularly nitrogen (N). Remediation strategies being explored include co-composting of pad soils to create synthetic soils, use of pad soils directly as a fertilizer, using pad soils for enriched topsoil products, and use of salt tolerant plants as bioremediators that would then be composted. Potential uses of these products as horticultural amendments will be discussed. Challenges include variability in nutrient content at sites, high salt levels, inconsistency in soil particle sizes, and weight of the material.

Expanding Bean Production on Maryland's Eastern Shore

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Field beans (*Phaseolus vulgaris*) are traditionally grown in the midwestern region of the United States. Agronomic crops grown in support of the poultry industry constitute the majority of agriculture on the Eastern Shore of Maryland. In hopes of creating a value-added, niche crop for small market farmers, CSAs or traditional bean farmers looking to diversify their operations, five varieties of soup beans were

grown in Berlin, MD, on a transitionally organic farm. ‘Calypso’, ‘Agate Pinto’, ‘Black Turtle’, ‘Ken Early’, and ‘Money’ were the varieties planted in 30-inch rows. Weed control was managed through cultivation, and despite a severely dry year, the beans produced marginally well. Shattering was the overall cause for yield reduction and preliminary work on the use of organically approved desiccants will be researched in 2008.

Storage Time Affects Postharvest Quality and Carotenoid Levels of Squash (*Cucurbita maxima* Duch. and *Cucurbita moschata* Duch. ex. Poir)

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Carotenoids are an important class of nutrients as precursors to vitamin A and as anti-oxidants implicated in protective functions against certain cancers, cardiovascular disease, cataracts, and for enhancement of the immune system. High levels of carotenoids and variability in proportions of lutein and β-carotene, two nutritional important carotenoids, have been observed in diverse cultigens of *C. moschata* and *C. maxima* squash. Nonetheless, there has not been a concerted effort to identify specific cultivars or breed selected cultivars for high content of specific carotenoids. Research has been initiated at the University of New Hampshire to document carotenoid levels and types of carotenoids in specific cultivars and breeding lines. In Summer 2007, we compared percent dry weight (DW), soluble solids (SS), and relative carotenoid contents of mesocarp tissue in five breeding lines and three OP cultivars of *C. moschata* and seven breeding lines of *C. maxima*. Entrees were grown either at the Woodman Horticulture Farm in Durham, NH or the Kingman Research Farm in Madbury, NH, using randomized complete-block designs and three replications. Fruits were tagged at anthesis, and harvested at 60 to 64 days after pollination (DAP). Fruits were either sampled at harvest or stored for either 30 or 60 days at 15 °C. Carotenoid contents were visually estimated using a Roche egg yolk color fan. Additional samples were frozen at –80 °C for later quantitative analyses. In *C. moschata*, average DW among cultigens ranged from 16.5% to 23.3% at harvest. Among cultigens of *C. moschata*, SS varied from 7.0% to 8.7% at harvest, from 8.8% to 11.3% after 30 days of storage and from 10.7% to 11.5% at 60 days. Using Roche color fan values from 1 (light yellow) to 15 (dark orange), *C. moschata* color values among cultigens ranged from 7.7% to 11.3% at harvest, and increased progressively in all cultigens during storage to a range of 10% to 13% after 60 days. Moisture losses in fruit as reflected in reductions in fruit FW after 60-day storage varied from 9.4% to 18.5%, and may have affected Roche color fan values. Average DW among *C. maxima* breeding lines ranged from 25.5% to 37.7% at harvest. Soluble solids in *C. maxima* varied from 9% to 11% at harvest, from 10.3% to 14% at 30 days of storage and from 9% to 13% at 60 days. Roche Color Fan values for *C. maxima* ranged from 8% to 12% at harvest. In breeding lines showing high carotenoid levels at harvest, carotenoid values did not change appreciably during storage. For those lines with low carotenoid values at harvest, increases in Roche color values occurred primarily during the 30-day storage period. Moisture loss in *C. maxima* fruit after 60 days of storage was less, 1.4% to 8.8%, than in *C. moschata*.

Sweetpotatoes for Northern New England

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With diverse colors, excellent flavor and nutritional value, sweetpotato (*Ipomoea batatas*) may make a nice addition as a specialty crop for northern growers. In 2006 and 2007, we evaluated 16 varieties of sweetpotato at the University of New Hampshire in Durham. Twelve varieties were evaluated in both years. Our objectives were to determine which varieties produced high yields of good-tasting marketable roots in northern New England and to evaluate the importance of postharvest curing. Yields ranged from 0.2 to 2.5 lbs per plant in 2006, and 0.3 to 1.6 lbs per plant in 2007. The highest yielding varieties in both years included ‘Beauregard’, ‘Georgia Jet’, ‘Carolina Ruby’, ‘O’Henry’, and ‘White Yam’. In both years, ‘Vardaman’ received the

highest flavor ratings, whereas 'White Yam', 'O'Henry', and 'Beau-regard' were among the four lowest rated. Brix (percent soluble solids) varied between varieties, with average ratings ranging from 8.5% to 11.5%. After harvest, Brix values steadily and clearly increased during storage, increasing approximately 4% during 39 days after harvest. Brix and flavor ratings were correlated, which suggests that eating quality will improve dramatically during storage. Curing time (0, 4, or 8 days) did not appear to affect final Brix levels, or rate of sugar increase during storage.

Tomato Yields in High Tunnel Production Influenced by the Number and Placement of Drip Lines in Soilless Bags

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Tomatoes are a high-value crop to grow in high tunnels, but if grown directly in soil, disease will develop in approximately 3 years. Soilless mix culture is a standard production system in greenhouse production. Using soilless mix in high tunnels, the objective of this study was to determine whether one or two drip tapes and the placement of those tapes significantly affected yields. The cultivar Applause was transplanted 18 Apr. 2007 in two 17 ft × 34 ft high tunnels with plots arranged in a randomized complete-block design with two replications (blocks) in each house. Each yield plot consisted of four (Fafard 30-qt bag) bags with two plants per bag spaced 18 inches between plants and 42 inches between rows. Treatments were either one or two drip lines inserted through the bags for the length of the plot at 3 or 5 inches from the plants (four treatments). Fruit was harvested at the breaker stage or ripener from 18 June until 14 Aug. 2007 for a total of 15 harvests. After harvest, the fruit was graded into marketable fruit sizes (2.25–2.75, 2.75–3.5, and over 3.5 inches). When evaluating the data for total yield for all harvests, it was observed that the yield response in block one to line placement and number of drip lines was opposite compared to the other three blocks. No important interaction effect or main effect of line position was observed. Two lines increased marketable yield whether block one was omitted or not. Apparently there was another process that caused the variation in block one to be anomalous, but it was not identified. Therefore, data were analyzed both with and without the data from block one and the results were substantively the same. When blocks 1–4 were analyzed for line number $Pr > F = 0.0699$ and when blocks 2–4 were analyzed $Pr > F = 0.0001$. P values for line placement (3 or 5 inches) were 0.6180 and 0.2588, respectively.

Seed Treatments to Improve Germination of Purpletop [*Tridens flavus* (L.) Hitchc.]

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Purpletop is incorporated into native eastern U.S. grass (Poaceae) seed mixes for use in ecological restoration. However, germination of purpletop is delayed by seed dormancy, resulting in slow stand establishment. This study evaluated seed treatments including stratification (using 0.2% potassium nitrate incubation at 5 °C for 2 weeks), seed priming at –1.5 MPa (using 4% potassium nitrate incubation at 22/11 °C under 10/14 h light/dark for 7 days), scarification (using coarse sand paper), seed density separation (low density caryopsis = 0.81 mg/seed; high density caryopsis = 0.91 mg/seed) or combinations therein. Treated and nontreated caryopses were incubated at 30/20 °C under 10/14 hour light/dark until no further germination (having a visible coleoptile) occurred. Nontreated caryopses had a time to 50% germination (G_{50}) of 21 days and days between 10% and 90% germination (G_{10-90}) of 19 days. Combined treatments using stratification (ST), seed priming at –1.5 MPa (SP), and scarification (SC) treatments reduced G_{50} to 4.7 and 6.2 days and G_{10-90} to 5.2 and 8.3 days for high and low density caryopses, respectively. High density caryopses accounted for 90% of the seed lot and had reduced G_{10-90} compared to low density caryopses when treated with ST alone or with

ST/SP combination. Cryosectioning and confocal microscopic analysis indicated that reduced G_{50} and G_{10-90} were concomitant with increased embryo length, embryo width, and radicle length. No mitotic activity was observed in embryos; thus, most or all embryonic growth prior to emergence was due to cell expansion.

Pollen Morphology of Section *Camellia* in Genus *Camellia*

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Observation of pollen morphology is an effective method when researching plant classification and evolution. Pollen morphology is not readily affected by environmental factors and developmental stages; the exterior of the pollen grain continues to represent its genotype. The pollen morphology of 28 species and one variety of sect. *Camellia* in the genus *Camellia*, based on Chang's taxonomic system, was observed under light microscopy (LM) and scanning electronic microscopy (SEM). The results indicate the pollen size of sect. *Camellia* is large. The average length of its longitudinal axis ranges from 48.2 to 72.1 μm. The shape of its regular pollen is usually prolate or perprolate, though a few species express a subprolate shape. Some irregular pollen grains were observed in species *C. brevipetiolata*. From longitudinal views, regular pollen grains were trilobate-circular, trilobate semi-circular, and trilobate, but ovate to ellipse from transverse views. Trema is tri-colp-orate. Four major exine sculpture types, rugulate-fossulate, rugulate-ripple, rugulate-ripple to granulate, and granulate were observed. The differences of exine sculpture provide important information for plant classification and evolution. Pollen characteristics support the combination of *C. liberistamina*, *C. crassissima* and *C. chekiangoleosa* into one species, called *C. chekiangoleosa*, and *C. lapidea*, *C. villosa* and *C. delicata* system into another species, called *C. mairei*. Other arguable species, such as *C. brevipetiolata*, *C. bailinshanica* and *C. brevicolumna* should be independent species based on the pollen evidence. Pollen morphology also concluded that sect. *Camellia* is a natural group.

Supplementing Diammonium Phosphate Fertilizer with Phosphite Foliar Sprays for Lowbush Blueberry

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Diammonium phosphate (DAP) has corrected leaf N and P deficiencies in lowbush blueberry and has stimulated linear growth and branching. Increased flower bud formation has been attributed to increased branching and number of shoot tips. To further enhance flower bud formation, two foliar-applied phosphite formulations were evaluated in conjunction with preemergent applications of DAP at 448 kg/ha. Potassium phosphite (TKO-Phosphite, Growth Products Ltd, White Plains, NY) and calcium phosphite (Vigor-Cal-Phos (VCP™), Agro-K Corporation, Minneapolis, MN) were foliar-applied at the equivalent of 4.48, 8.96, or 13.44 kg P₂O₅/ha on 23 June 2006 to 1.8 m × 15 m plots. The experiment was replicated 6 times using a randomized complete-block design. Rain shortly after VCP application prompted us to split the plots and reapply the VCP treatments on 26 June to randomly selected 7.5-m subplots. Leaf tissue samples taken at tip dieback (10 July 2006) and analyzed for leaf nutrient concentrations indicated that leaf N in control plots were above the 1.6% standard concentration. DAP treatments raised the leaf N concentration but phosphite treatments had no effect, compared to DAP alone. Leaf P was deficient (<0.125%) in control plots (0.119%) and was raised by DAP treatments to 0.140%, well above the sufficiency level. Plots receiving two applications of VCP-Phosphite at the highest rate had leaf P concentrations significantly higher than DAP alone. Soil samples, taken after leaf sampling, indicated soil pH was lowered from 5.00 (controls) to 4.88 and soil P was raised from 6.6 to 10 ppm, when DAP was applied. Because phosphites have been reported to have fungicidal properties, leaf spotting in each plot was assessed in early September, 2006 using a scale of 1–5, where 0 was no leaf spotting and 5 was severe

leaf spotting with significant leaf drop. DAP reduced leaf spotting, compared to the control. DAP plus TKO- Phosphite or VCP-Phosphite reduced leaf spotting even more than DAP alone; the double application of 8.96 kg P₂O₅/ha VCP-Phosphite was most effective. Stems were sampled from four randomly placed 0.03-m² quadrats in each treatment plot in Nov. 2006 for determination of stem density, stem length, branching, branch length, and flower bud formation. Branching and stem length was increased by DAP and little affected by phosphite treatments. Berry yield in Aug. 2007 was increased 79% by DAP, compared to the controls. Yields were even higher for treatment plots receiving DAP plus the VCP-Phosphite; especially the 8.96 P₂O₅/ha rate, that was 154% higher than the control.

Chemical Thinning Apple Trees with CPPU and Several Adjuvants

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CPPU, as a chemical thinner of apple, causes lopsided fruit at concentrations that are also effective for thinning. In this study, CPPU

was applied at a rate of 6 mg·L⁻¹ alone or with several adjuvants, which were Silwet™ at 0.05%, Latron™ at 0.05%, petroleum oil at 0.5%, or Erase™, a plant-based oil, at 0.5%. These treatments were applied 1 week past petal fall (PF) to 'Pioneer Mac/B.9 apple trees. CPPU was also tested as lower rates applied more frequently, 2 mg·L⁻¹ applied at PF and 1 and 2 weeks past PF, or 3 mg·L⁻¹ applied at PF, and 1 week past PF. All CPPU treatments thinned to a crop density of 5.6 to 7.8 fruit per cm² trunk cross-sectional area (TCA) compared to unthinned trees which had a crop density of 12.4 fruit per cm² TCA. There was no difference in crop density between any of the CPPU treatments. There was a small number of naturally occurring lopsided fruit, 8%, measured in the unsprayed control. All CPPU treatments increased the number of lopsided fruit. CPPU at 2 mg·L⁻¹ applied 3 times resulted in the greatest number of lopsided fruit, 45%. CPPU with Latron or Silwet resulted in a similar number of lopsided fruit, 26% and 35%, respectively, and was also similar in number to CPPU alone, 29%. Petroleum oil and Erase resulted in significantly fewer lopsided fruit, 17% and 16% respectively, than with either surfactant, but more than the unsprayed control.