Abstracts of the ASHS Southern Region 60th Annual Meeting

Lexington, Ky. **29–31 Jan. 2000**

J.B. Edmond Undergraduate Competition

Interactions Among Rooting Substrate, Phenological Stage of Cuttings, and Auxin Concentration Impact in In Vivo Rooting of *Cotinus obovatus*

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A study was conducted to determine the effects of substrate, phenological stage of cuttings, and auxin concentrations on the rooting of Texas smoke tree (*Cotinus obovatus* Raf.). Softwood, semi-hardwood, and hardwood cuttings were treated with either a 0, 5,000, 10,000, or 15,000 mg·L^{-1} (ppm) potassium salts of indolebutyric acid (K-IBA) and placed in either 50% peat : 50% perlite or 100% perlite rooting substrates. Cuttings were placed under an intermittent mist system in a greenhouse for 8 weeks. Softwood cuttings rooted in both substrates, but the 50% peat : 50% perlite substrate produced better-quality rooted cuttings. Rooting of softwood cuttings peaked with 8,000 to 10,000 mg·L^{-1} (ppm) K-IBA. Semi-hardwood and hardwood cuttings rooted only in the 100% perlite substrate. In 100% perlite substrate, the optimal concentration for semi-hardwood cuttings was ≈12000 mg·L^{-1} (ppm) K-IBA, while hardwood rooting was maximized at 15000 mg·L^{-1} (ppm) K-IBA or more.

Evaluation of Chilling Requirement of Southern Blackberry Cultivars

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Little research has been done to determine the chilling requirement for southern blackberry cultivars. However, field observations from areas where low amounts of chilling occur indicate that 'Navaho' requires more hours of chilling than does 'Arapaho'. The objective of the study was to determine a method for measuring chilling requirement using whole plants of two blackberry cultivars, Arapaho and Navaho. One-year-old bare-root plants of 'Arapaho' and 'Navaho' were field-dug and placed in a cold chamber at 3 °C. Ten single-plant replications of each cultivar were removed at 100-hour intervals up to 1000 hours. The plants were then potted and placed in a greenhouse (daily minimum temperature 15 °C) in a completely randomized design. Budbreak was recorded on a weekly basis. Data for budbreak was analyzed as a two-factor factorial (two cultivars and 10 chilling treatments) by SAS and means separated by LSD (P = 0.05). Data indicated that the chilling requirement for 'Arapaho' is between 400 and 500 hours. This is evident as a 6-fold increase, which was the largest increase between two chilling treatments, occurred between 400 and 500 hours. For 'Navaho', the largest increase (also 6-fold) occurred between 800 and 900 hours, which indicated a chilling requirement for 'Navaho' of 800 to 900 hours. These data support previous observations and indicate the method used was successful in determining chilling requirement for blackberries.

Members of the Family Leporidae Can Select for Onions with High Soluble Sugars and Low Pyruvates

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Over the past several growing seasons researchers at Texas Tech University have observed that certain onions appeal to rabbits more than other onions, meaning that rabbits tend to nibble on certain lines or varieties and leave other lines undisturbed. We were interested in determining the cahracteristics of the onions that rabbits seemed to like. Onions were planted at random in the TTU breeding nursery. During the growing season all onions were rated for rabbit appeal – those with chewed leaves and or bulbs were recorded as liked by the rabbits. All onions in each plot, whether disturbed or undisturbed by the rabbits, were tested for pyruvate concentration and soluble solids content after harvest. Pyruvates were measured by mmol/gram pyruvic acid and soluble solids content by °Brix refractometer reading. The most damage occurred in onion lines that had the lowest pyruvate levels. Soluble solids did not appear to affect the rabbits' nibbling.

A Student-driven Landscape Design for a New Academic Building

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Berry College offers a unique environment for learning with 28,000 acres of forests, meadows, lakes, and streams. This distinctly beautiful setting has encouraged environmental awareness among students and faculty on campus. The construction of an academic building to house the School of Math and Natural Sciences in a previously undisturbed, wooded site prompted students and faculty to become interested in the preservation of the site's natural characteristics. Students in the horticulture program worked closely with the Director of Horticulture and the Academic Dean to develop a plan to create a landscape that was both educationally and environmentally sound.

The plan consisted of a detailed landscape design as well as the identification of the steps necessary to implement the design. The design incorporated ornamental plants and geological features native to the southeastern region of the United States with the plant species that existed on the site. The design contains such features as a wildflower meadow, an aquatic garden, rock gardens, and various native trees, shrubs, and groundcovers. Plant materials were properly labeled and brochures are made available to guests, students, and faculty interested in learning more about indigenous geological features and plant materials while touring the building and its landscape. The success of this project is due to the cooperation and participation of faculty, staff, and students and represents a unique learning opportunity.

Norman F. Childers Graduate Competition

Fertilizer, Flower Bud Removal and Vegetative Pruning of *Echinacea* species (Purple Coneflower) Influence Biomass and Phenolic Content

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Purple Coneflower [*Echinacea* sp. (Asteracea)] is of great value to the horticultural, pharmaceutical, and herbal industry. More research is needed to determine cultural practices that will produce a plant high in biomass and phenolic content, the chemical used for testing the quality of the harvested plant on a percent basis of roots, flowers and vegetative parts. The objective of this experiment is to determine if biomass and phenolic content of *Echinacea purpurea* and *E. purpurea* 'Magnus' is influenced by fertilization after flower bud removal and vegetative pruning. The second objective of this study is to form an evaluation of the differences in biomass and phenolic content of five cultivars of *E. purpurea* and five species of *Echinacea*. Biomass and phenolic content will be evaluated to determine if exposing these plants to various treatments increases the quality of the plant over 1 and 2 years of growth. Differences in dry weights of *Echinacea* species and cultivars harvested after the first year of growth was determined. There was a significant difference in total dry weight between *E. purpurea* cultivars. *Echinacea purpurea* 'Bright Star' and 'Clio' significantly produced the most total dry weight compared to all other cultivars. There was no significant difference in root or flower biomass between cultivars. Biomass of *Echinacea* species was significantly different in root, vegetaive and flower parts. The total biomass of *E. purpurea* and *E. tennesseensis* was significantly higher compared to other species. *Echinacea pallida* and *E. paradoxa* were not significantly different from *E. purpurea* in root biomass, even though both species were small in above ground growth. *Echinacea tennesseensis* significantly produced 45% to 105% more flowers compared to other species. Differences in phenolic content between species and cultivars will also be presented.

The Effects of Heat Stress on Photosynthesis of *Coreopsis grandiflora* 'Sunray' and *Gaillardia* ×*grandiflora* 'Goblin'

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Herbaceous perennials are one of the fastest growing ornamental sectors in the United States. Current production recommendations do not address the effect of environmental factors, such as high temperature, on growth of herbaceous perennials. The focus of this research was to determine how supra-optimal temperatures effect growth and photosynthesis. Plants were exposed to a high temperature of 35 °C and photosynthesis measurements were recorded over a 6-week period at 1100, 1300, and 1500 HR. Results indicate that the time of day the measurements were taken made little difference on rate of photosynthesis and that there was a similar trend in photosynthetic rate over the 6-week period. Photosynthesis decreased as the plants began to flower and then increased until the onset of flower senescence. Plants grown at supraoptimal and optimal conditions had a similar trend and rate of photosynthesis throughout the 6-week period. Plant growth significantly decreased as the duration of high temperature increased for both species; however, *Gaillardia* was more heat tolerant then *Coreopsis*.

Genetic Diversity in Papua New Guinea Sweetpotato Germplasm

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The USDA gene bank currently maintains 668 accessions of cultivated sweetpotato and 219 accessions of related Ipomoea species. Information on the genetic diversity of the collection does not exist due to funding constraints. The development of a core collection would provide a subset of accessions that represent the genetic diversity of the main collection with a minimum of repetitiveness. The small size of the core collection would facilitate the evaluation of the accessions for economically important traits. The objective of this research is to develop a core collection of Papua New Guinea sweetpotato germplasm using the Amplified Fragment Length Polymorphisms (AFLPs) marker system. This approach to quantifying genetic diversity would later serve as a model for the development of a USDA sweetpotato germplasm core collection. The germplasm choosen for this study was collected from this crop's secondary center of genetic diversity based on its potential as a source of new traits. All genotypes were fingerprinted using four primer combinations that generated 224 markers. The molecular data was then analyzed using NTSYSpc 2.0 program to determine the relatedness of the genotypes. The molecular analysis showed a homogeneous genetic constitution. The extent of diversity among accessions was correlated with the geographic origin of the plant material.

Rooting Dogwood Microshoots

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Cultivars of flowering dogwood (*Cornus florida* L.) are commercially propagated by vegetative methods such as rooting cuttings or grafting. The results of these methods can be unpredictable. A reliable method of producing dogwoods through tissue culture would be very useful to rapidly produce many copies of important genotypes with horticulturally important characters such as resistance to diseases. One of the primary difficulties of propagating dogwoods (seedlings only) by axillary bud multiplication has been the low rooting efficiency of the microshoots. Various treatments were tried in order to enhance rooting. Eighty-three percent of microshoots harvested between 5 and 7 weeks and treated continuously with 4.9 micromolar IBA rooted after 4 weeks, whereas <20% of microshoots harvested before 5 weeks and after 7 weeks rooted after 4 weeks of continuous exposure to IBA. Differences were also observed in rooting potentials of microshoots that had reddish brown stems rooting at a higher frequency compared to those that had green stems. We hope to translate this method to the propagation of cultivars and potential new releases.

Identification of Molecular Markers that Segregate in a Simple Mendelian Fashion in a Controlled Cross of *Asimina triloba*

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The pawpaw [*Asimina triloba* (L.) Dunal] is a native plant found mainly in the southeastern and eastern United States, and its fruit has great potential as a new high-value crop in these regions. Although there are ≈45 named pawpaw cultivars, breeding for improvement of specific traits, such as fruit size and quality, is desirable. Our long-term goal is to utilize molecular marker systems to identify markers that can be used for germplasm diversity analyses and for the construction of a molecular genetic map, where markers are correlated with desirable pawpaw traits. The objective of this study was to identify random amplified polymorphic DNA (RAPD) markers that segregate in a simple Mendelian fashion in a controlled A. triloba cross. DNA was extracted from young leaves collected from field-planted parents and 20 progeny of the cross 1-7 x 2-54. The DNA extraction method used gave acceptable yields of ≈7 $\mu g \cdot g^{-1}$ of leaf tissue. Additionally, sample 260/280 ratios were ≈1.4, which indicated that the DNA was of high enough purity to be subjected to the RAPD methodology. Screening of 10-base oligonucleotide RAPD primers with template DNA from the parents and progeny of the cross has begun. We have identified two markers using Operon primer B-07 at 1.1 and 0.9 kb that segregate in

a simple Mendelian fashion in progeny of the 1-7 x 2-54 cross. Other primers and controlled crosses will also be screened.

Imbibition Rates in Film-coated *Shrunken*-2 Sweet Corn (*Zea mays*) Seeds

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Mutant endosperm associated with *shrunken*-2 sweet corn possesses a high osmotic potential that increases the rate of imbibition. Membrane damage associated with the rapid influx of water during imbibition can play a role in the poor emergence and seedling vigor associated with sweet corn germination. Film-coating as a seed treatment has been used to improve germination and vigor in sweet corn. This improvement may be associated with alterations in the kinetics of imbibition. Two seed lots of *shrunken*-2 sweet corn, low-vigor 'Even Sweeter' and high vigor 'Sugar Bowl', were treated with a polymer film-coating and evaluated for differences in water uptake. Imbibition curves were established for nontreated and film-coated seeds. Seeds were weighed every hour for 6 hours and showed a significant difference between the two treatments in fresh weight for both cultivars. This pattern continues throughout the imbibition phase of germination and continues into the lag period. Bulk conductivity tests resulted in no significant mean difference between untreated and film treated seeds after 24 hours. Film treatment assumes characteristics of a hydrophilic polymer. Electrolyte leakage is not reduced and imbibition rate increases by 18% for both varieties of film-coated seeds.

Extension

Evolution of the Southeast Greenhouse Conference and Trade Show

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The 8th annual Southeast Greenhouse Conference and Trade Show (SGCTS) will be held in June 2000. This meeting is the result of cooperative efforts among the Alabama Nurserymen's Association, Florida Nurserymen and Growers Association, Georgia Commercial Flower Growers Association, North Carolina Commercial Flower Growers' Association, South Carolina Greenhouse Growers Association, Tennessee Flower Growers Association, Virginia Greenhouse Growers Association; and the Cooperative Extension Services and Land Grant Universities of all seven participating states, including Auburn Univ., Clemson Univ., the Univ. of Florida, the Univ. of Georgia, North Carolina State Univ., Univ. of Tennessee, Virginia Polytechnic Institute and State Univ., and Virginia State Univ. Through pooling of efforts and resources, the SGCTS has become one of the major floriculture educational and trade show events in North America, and it has grown from an initial participation of 347 and a trade show of 89 booths in 1993 to 2407 participants and 398 booths in 1999. The SGCTS serves as an excellent example of cooperative partnering among grower organizations, Cooperative Extension, and faculty at Land Grant Institutions. It eliminates duplication of efforts among individual states, each historically holding their own state meeting. Proceeds from the conference support grower organizations, which in turn support research and educational programs at the cooperating universities. Over $55,000 were disbursed back to the state associations in 1999.

Development of a Multi-state Fruit Weed Extension Position

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Tree fruit researchers and extension specialists from North Carolina (NC), South Carolina (SC), and Georgia (GA) have been collaborating informally for many years. There has been a desire to formalize some of these arrangements, and in late 1998 planning was intiated to develop an extension specialist position to cover orchard and vineyard floor management in NC, SC, and GA. Wayne Mitchem, who had this responsibility for NC as well as serving as the coordinator for the regional IR-4 field research center at NCSU, presented us with the opportunity to create a three-quarters time extension specialist position dealing solely with the management of weeds in tree fruits and vineyards on a regional basis. The proposal was presented to Extension Directors from NC, SC, and GA in Oct. 1998, and over the following 6 months a memorandum of understanding was developed among the three states to establish the position. The position is located in NC at the Mountain Horticultural Crops Research and Extension Center, Fletcher, and each of the states agreed to share equally in funding the salary. None of the three states had this expertise in their faculty and if the position were not created, we would have had a void in this important aspect of orchard and vineyard maintenance. In addition to weed manangement, the position will have responsibilty for conducting residue trials for the IR-4 program as it pertains to the labeling of minor use pesticides for tree fruits and vineyards.

The Need for a Regional Small Fruit Center

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Working on the basic idea that the small fruit industries in Virginia, South Carolina, Georgia, Arkansas, and other states in the south have a great deal of growth potential, especially in strawberries, the Southern Region Small Fruit Center is now becoming a very focused collaboration between several land-grant institutions to develop a virtual small fruit center web site that will serve to keep specialists, agents, growers, and students well informed on the latest small fruit research and technical findings. It would also give instant access to a variety of small fruit extension publications, budgets, and crop advisories. The site, www.smallfruits.org, opened on 17 Sept. 1999, and was immediately utilized after Hurricane Floyd "hit" to post a series of berry info advisories on specific postplant management strategies to minimize further yield losses due to the extra week of delayed planting caused by Floyd's flooding. The main benefit of regional or multistate institutional approach is that it gives us the "extra horsepower" for tackling some fairly ambitious projects, like the creation of a virtual small fruit center. Recently, the center has begun to offer more in-depth regional training courses for agents and growers, such as the "Extension Strawberry Plasticulture" short course that was conducted on North Carolina State Centennial Campus, 1–5 Nov. 1999. We currently have a "critical mass" of some of the best small fruit research and extension workers you will find anywhere across the whole southern region, and by working together we can develop stronger, more economically viable small fruit industries.

The Agricultural Research, Extension, and Education Reform Act of 1998: Examining Its Key Provisions

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The Agricultural Research, Extension, and Education Reform Act of 1998 (AREERA) represents a concerted effort on the part of federal legislative leaders to rethink the manner in which agricultural research and extension programming are undertaken within the land-grant university system of our nation. For the first time ever, land-grant schools are being mandated to increase their energies in support of "multi" activities; namely, multiinstitutional, multidisciplinary, multifunctional, and multistate activities. The intent is to bring about greater efficiencies in carrying out the research and extension missions of our land-grant entities.

In this presentation, the key provisions of AREERA are outlined. These elements include: 1) the commitment of 25% of Hatch formula funds in support of multidisciplinary research involving another agricultural experiment station, Agricultural Research Service, or college/university that collectively are seeking to solve problems that concern more than one state; 2) the expenditure of Smith-Lever formula funds for support of multistate extension activities equivalent to 25% of these formula funds, or twice the level of resources devoted to such activities using FY97 funds; and 3) a directing of 25% of

Smith-Lever and Hatch funds received by an institution in FY2000 for integrated research and extension activities (or twice the level of effort committed to such efforts in FY97). It is further noted that while 1890 and 1994 institutions are required to engage in multidisciplinary, multistate, and integrated research and extension activities, they are not compelled to meet the 25% goal outlined in the AREERA legislation.

Aside from the resources that must be devoted to certain activities within the Agricultural Experiment Station and the Extension Service, AREERA makes quite clear the need to actively engage stakeholders in giving shape to the priority activities of these land-grant entities. Moreover, it notes the importance of documenting the impact of the institution's research and extension investments on the priority concerns of its stakeholders. Among the key questions that will be employed to evaluate the quality of an institution's efforts are the following: Did the program address a critical issue? Did it address the needs of underserved and underrepresented populations in the state(s)? Did the investments result in improved program effectiveness and/or efficiency? Indeed, AREERA changes the landscape for many of the South's land-grant institutions. However, if efforts undertaken to date are any indication, the leadership and faculty of the region's land-grant system will successfully respond to the challenges that AREERA poses for them.

Can Multi-state Extension Programming Succeed?

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With the current situation facing land grant universities of declining resources and a portion of federal funding being dependent upon multistate activities, the search for means to successfully address clientele needs may be handled through multistate activity. In the Southeast, the tree fruit programs, both research and extension, have been evaluating areas that could be addressed with multistate programming. To date, most of the tree fruit multistate activities have been informal in nature. The apple program was the first to look at multistate activity because of the heavy concentration of the industry in the mountains of NC, SC, GA, and TN. The formation of the Southeastern Apple Growers Meeting, which combined the annual educational meeting for apple growers in NC, GA, SC, and TN, was the first initiative. It proved to be very successful with the completion of the eighth joint meeting. In addition, the pest management guides for both apple and peach have been combined for many of the southeastern (five states) and southern states (11 states), respectively. Numerous working groups, workshops, tours, and field days are held on a regional scale as well. However, in order for multistate programming to succeed, our experience suggest the need for several key components. The technical competence in the program to be addressed, a supportive university administration, backing of the industry groups, and personnel that are neither territorial nor resistant to change must be present. From our experience multistate programming can be very successful!

Education

Plant Propagation Methods Course Developed for Delivery on the World Wide Web

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A plant propagation course was developed for delivery on the World Wide Web. Plant Propagation Methods is one of two foundation courses required of students with either a major or minor in horticulture. The course is accessed via the Texas Tech Univ. Horticulture website, www.pssc.ttu.edu. The delivery software is Web-CT Tutorial and access is password protected. The course has been offered two semesters, Fall 1999 and Spring 2000. Overall, student evaluations have been very favorable. The ratings for the first time offering were a 100% excellent rating was given for stimulating student interest and concepts pointed out; 67% excellent rating for effectiveness of the course, presents challenging ideas, stresses important points, uses visual materials, defines new terms, and provides an overview/objective. Students gave an overall rating of good for the organization of the course. The only negative response by the students was that they said the class was very hard because it was not in a structured classroom setting.

Posters

Scarification and Moisture Effects on Triploid Watermelon Seed Germination

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Triploid watermelon [*Citrullus lanatus* (Thunb.) Matsum & Nakai] consumption is increasing in the United States However, some of the original problems, poor and inconsistent germination, still exist. Seeds of several triploid and diploid watermelon cultivars were subjected to a variety of treatments to improve germination. Control and scarified seeds, by nicking, were incubated at 25 or 30 °C in either 5 or 10 mL H_2O or hydrogen peroxide (H_2O_2). Triploid seed germination was strongly inhibited in all cultivars when seeds were at 10 mL of H_2O or H_2O_2; both nicking and H_2O_2 increased germination but not equal to rate of the control in 5 mL H_2O or H_2O_2. Germination of diploid cultivars was unaffected by any treatment. Seed morphological measurments indicated that triploid seed has a smaller embryo with a large and highly variable (CV = 105%) air space surrounding the embryonic axis as compared with the diploid seed. These data suggests that triploid watermelon seed germination is not inhibited by the seed coat thickness alone. Seed moisture plays a significant role in germination, emergence, and stand uniformity.

Genetic Diversity Evaluations of Threatened Ozark and Allegheny Chinkapin Populations

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Chestnut blight, caused by the Asian fungus *Cryphonectria parasitica,* has severely affected chinkapin populations (*Castanea pumila*), especially those limited to the Ozark mountains (var. *ozarkensis*). Genetic diversity within and between geographic populations of the Allegheny (var. *pumila*) and Ozark chinkapin populations was evaluated for development of appropriate conservation strategies. Nuts or dormant buds collected from populations along the range of the species were analyzed using allozymes. A unique allele was detected in populations along the gulf of Mexico. Significant differences in genetic diversity were observed among Allegheny populations, but not among Ozark populations. High levels of genetic identity were detected among widely distributed populations from Florida to Virginia (Allegheny chinkapin populations) and Arkansas (Ozark chinkapin populations).

Effects of Nitrogen Application Rate and Supplemental Potassium on Fall Production of Nursery Crops

G. Stephen Crnko, Edward W. Bush, and Allen D. Owings,* Louisiana State University Agricultural Center

A study was initiated to determine the effects of fall fertilization, specifically N application rate and additions of supplemental K on the production of woody ornamental shrub species. The influence of two slow-release sources of K (4- and 8-month) in the form of K_2SO_4, three K application rates (0, 1, 2 lb/yd^3), and four incorporated application

rates of N (0, 1, 2, and 3 lb/yd^3) from Osmocote Plus+ 15–9–11were evaluated on the growth of 'Fisher Pink' Indian azalea, glossy abelia, and 'Tuscarora' crape myrtle. Growth of 'Fisher Pink' azalea, as determined by shoot height and shoot width, increased as N rate increased from 1 to 3 lb/yd^3 when compared to the control. The resulting growth index improved at the 2 and 3 lb/yd^3 N rate when compared to the 0 and 1 lb/yd^3 N rates. Height and width of glossy abelia at the 1 lb N rate with or without supplemental K applications increased when compared to some glossy abelia at the 3 lb N rate (primarily those with supplemental K). Glossy abelia at the 2 lb/yd^3 N rate with 2 lb/yd^3 N from 4-month 0–0–46 had significantly greater shoot dry weight when compared to the 3 lb/yd^3 N rate with 2 lb/yd^3 N from 8-month 0–0–46. The 1 to 3 lb/yd^3 N application rate had more of a response on growth index, visual quality, and visual color on 'Tuscarora' crape myrtle as compared to the 0 lb/yd^3 N rate. In this study, the potential influence of supplemental K applications on plant growth was mostly evident for glossy abelia at the 2 lb/yd^3 N rate and was not evident on azalea or crape myrtle.

A Comparison of Overhead Irrigation Scheduling and Switch Tensiometers

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Proper irrigation management is essential for producing quality container-grown woody ornamentals and reducing off-site runoff. Research has shown that tensiometers can be used as an effective tool to schedule irrigation for woody ornamentals. The objective of this experiment was to compare the effect of cyclic and tensiometric irrigation methods on growth of lantana. *Lantana camara* 'New Gold' liners were established in a 3 pine bark : 1 peat:1 mason sand (by volume) medium. Low-tension switch tensiometers were compared to scheduled overhead [one time a day (1×) at 0600 and cyclic irrigation three times a day (3×) at 0600, 1200, and 1800] for the production of 1-gallon lantana plants. Three low-tension tensiometers (1/block) were set at 7 cb and allowed to irrigate over a 12-hour period. Three separate planting dates occurred and then terminated after ≈7 weeks. Tensiometric irrigation increased root and shoot growth compared to scheduled irrigation for the 24 May 1999 harvest date. Cyclic irrigation produced plants with shoot and total root weights >1× and tensiometer treatments for the September harvest date. Tensiometers sharply reduced irrigation requirements compared to scheduled irrigation volume by at least 50% of the 1× and 3× treatments weekly. Analysis of nutrients in leachate for June indicated increased B and Fe concentrations in the 3× irrigation treatment. Lower concentrations of Ca, Mg, and Na were measured in August. Lantana growth was acceptable for all irrigation treatments and harvest dates.

The Effect of Prodiamine on Growth of Containerized Woody Ornamentals

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Previous research has shown the effectiveness of prodiamine (FactorÆ)as a preemergent herbicide. The objective of this experiment was to evaluate the efficacy and phytotoxicity of prodiamine applied to several woody ornamental and weed species. Phytotoxicity effects were evaluated on eight ornamental species: azalea (*Rhododendron indicum* 'Mrs. G.G. Gerbing'), dwarf yaupon (*Ilex vomitoria* 'Nana'), dwarf mondograss (*Ophiopogon japonicus* 'Nana'), ixora (*Ixora coccinea*), lantana (*Lantana camara* 'New Gold'), Southern live oak (*Quercus virginiana*), weeping fig (*Ficus benjamina*), and daylily (*Hemerocallis fulva*). Preemergent herbicide treatments (control–nontreated, 2 lbs aia Factor®, and 4 lbs aia Factor®) were applied to ornamentals twice during the experiment at twelve week intervals. There was a reduction in top dry weight for azalea and dwarf mondograss for both 2 and 4 lbs aia treatments. No significant growth reductions were measured for daylily, dwarf yaupon, ixora, lantana, live oak, and weeping fig. The efficacy experiment consisted of four weed species: barnyardgrass (*Echinochloa crusgali*), crabgrass (*Digitaria sanguinalis*), coffeeweed (*Sesbania exaltata*), and pigweed (*Amaranthus retroflexus*) and five preemergence herbicide treatments (control–nontreated, control-Rout® at 100 lbs/A, Factor® 1 lb aia, Factor® 2 lbs aia, and a tank mixture of Factor® 1 lb aia plus Gallery® 1 lb aia) applied to bark-filled containers. Twenty-five weed seeds of each species were broadcast over each container following herbicide applications. The high rate of Factor®, Rout®, and the combination of Factor®+Gallery® significantly reduced weed dry weight compared to the control. All preemergence herbicides significantly reduced weed counts and height in a similar manner.

Effects of SoilRich on growth of *Leucaena leucocephala* and *Hibiscus rosa sinensis*

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In a randomized complete-block design, two separate experiments were conducted to study the response of lead tree *Leucaena leucocephala* and *Hibiscus rosa sinensis* to the application of the organic fertilizer, SoilRich. Seedlings of both species were grown in pots filled with growing media containing sandy soil and SoilRich. SoilRich was added at the rates of 0%, 5%, 10%, or 15% (v/v). The obtained results indicated that the application of SoilRich significantly increased plant height, stem elongation, branch number, shoots fresh and dry weights, and enhanced root growth of both *Leucaena leucocephala* and *Hibiscus rosa sinensis*. Total nitrogen, phosphorus, and potassium percentages in the shoots were increased in both species as the applied rate of SoilRich was increased. SoilRich treatments increased the water holding capacity of the soil. Moreover, they increased organic matter, total nitrogen, phosphorus, and potassium percentages in the soil. The application of SoilRich at 15% gave the best results.

Growth and Performance of Some Woody Plants Grown under Salinity Stress

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Six woody plant species, (*Atriplex lentiformis*, *Acacia ampliceps*, *Conocarpus erectus*, *Conocarpus erectus* var. *sericeus*, *Laguncularia racemosa*, and *Thespesia populnea*) different in age, were grown in the field and irrigated with saline water (25 ppt). The physiological performance of these species was measured. Some macro- and micro-elements, carbohydrates, protein, proline, and photosynthetic pigments were estimated in the plants. The obtained results indicated in most cases, that age of plants has no effect on nutrients, protein, or carbohydrate concentrations. For each plant species, there were some differences in the chemical composition of the leaves and stems. No significant differences were detected in Mg and Mn concentrations in leaves and stems of all studied species. Photosynthetic pigments and proline concentrations were different depending on the plant species and age. The air and leaf temperature differentials, leaf conductance, and transpiration rate were also discussed. The overall growth and physiological performance of these plants was good.

'Green Pixie': A Green Cotyledon, Cream-type Southernpea

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The U. S. Department of Agriculture released the small-seeded, cream-type southernpea cultivar Green Pixie on 4 Mar. 1999. The new cultivar is homozygous for the *gc* gene conditioning the green cotyledon trait. 'Green Pixie' seeds can be harvested at the dry stage of maturity without loss of their fresh green color. 'Green Pixie' originated as a bulk of an F_9 ('White Acre' x 'Bettergreen') population grown in 1994. 'Green Pixie' has a high, bushy plant habit similar to 'White Acre'. It produces dry pods at Charleston, S.C., in ≈76 days, 5 days later that 'Bettergreen' and 5 days earlier than 'White Acre'. The rhomboid-kidney shape of fresh 'Green Pixie' seeds is quite similar to the shape of fresh 'White Acre' seeds, but very different from the ovate

to reniform shape of fresh 'Bettergreen' seeds. 'Green Pixie' seeds are quite similar in size to 'White Acre' seeds, but much smaller than 'Bettergreen' seeds (weight per 100 dry seeds: 'Green Pixie', 8.0 g; 'White Acre', 7.9 g; and 'Bettergreen', 10.2 g). The results of replicated field trials indicate that the yield potential of 'Green Pixie' is equal to that of 'Bettergreen' and 'White Acre'. 'Green Pixie' is the first cream-type, green-cotyledon cultivar to be developed that yields seeds that are similar in size and shape to 'White Acre' seeds. It is recommended for trial as a replacement for 'White Acre' when grown to produce raw product for a frozen pack.

Nitrogen Rate Response on 'Cape Fear' Southern Highbush Blueberry

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The southern highbush blueberry is a hybrid of *Vaccinium corymbosum* L. and one or more southern-adapted *Vaccinium* species.The southern highbush is advantageous to blueberry growers in the South since its fruit ripen 1 to 4 weeks in advance of traditional rabbiteye (*V. ashei* Reade) cultivars. Only limited research has been done on cultural aspects of southern highbush production. The objective of this study was to determine the optimum nitrogen rate for the southern highbush blueberry. A planting of pine straw-mulched 'Cape Fear' blueberry was established in 1994 at the Southwest Research and Extension Center, Hope, Ark. Nitrogen rate treatments (0, 67, 134, 202, 269 kg·ha^{-1} N) were applied annually over a 3-year period (1997–99) with urea as the N source. Soil samples were taken prior to N fertilization to determine if N applied the previous year influenced current soil analysis values. Foliar elemental composition, fruit yield and individual berry weight were also determined for each treatment. Soil analysis indicated that the carryover effect of N applications from previous years was minimal. However, a possible decline in soil pH, Ca, and Mg over time at the higher N rates indicated that these variables should be closely monitored. No consistent relationship was evident between N application rate and soil nitrate. Nitrogen application rate did not have any consistent impact on yield, berry weight or foliar elemental composition. However, based on foliar N, the data indicate that N rates of 67–134 kg·ha^{-1} N are adequate for southern highbush in mulched culture.

Oklahoma Proven—A Statewide Marketing and Evaluation Program

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Oklahoma Proven (OKP) is a plant promotion and evaluation program designed to help consumers choose plants appropriate for Oklahoma gardens. Aiding consumers with plant selection will lead to greater gardening success, enthusiasm, and increased sales for Oklahoma green industries. There are two major facets to the program: marketing, coordinated by Dr. Lou Anella, and evaluation, coordinated by Dr. Michael Schnelle. Plants to be promoted by OKP will be selected by an OKP executive committee based on recommendations from an OKP advisory committee comprised of industry professionals, cooperative extension specialists and educators, Oklahoma Botanical Garden and Arboretum affiliate members, and Department of Horticulture and Landscape Architecture faculty. Plants chosen for OKP must meet the following selection criteria: appropriate for gardens throughout the state of Oklahoma; readily available in the trade; limited input required, i.e. few pest or disease problems, tolerant of Oklahoma's diverse soil types and weather conditions; noninvasive; can be profitably produced. The OKP Advisory Board selected the following OKP Selections for 2000: *Taxodium distichum*; *Spiraea japonica* 'Magic Carpet'; *Verbena canadensis* 'Homestead Purple'; and *Scaevola aemula*. Promotional materials, such as posters and signs, will be available just after the first of the year, and the promotional push will begin in early March. Posters and signs will be distributed to retailers throughout the state free-of-charge and pot stakes and hang tags will be sold to wholesalers as a means of generating income for the Oklahoma Proven program. OKP plants will also be promoted through the television show "Oklahoma Gardening," extension newsletters, and the press.

Preliminary Observations on Particle Film and Mycorrhizae Use in Tomato Production

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Kaolin cover sprays and mycorrhizal inoculation of tomatoes at transplanting were evaluated for their efficacy in improving tomato plant water status and agronomic performance in a supraoptimal, semiarid environment. Seven-week-old 'Heatmaster' tomato plants (*Lycopersicon esculentum* Mill.) were transplanted with or without a vesicular-arbuscular mycorrhizal inoculant (*Gomes intaradices* Schenk & Smith) on 19 Feb. 99 into a Raymondville clay loam soil in Weslaco, Texas (lat. 26°12′). One-half of the inoculated and one-half of the uninoculated plants were sprayed between 16 Mar. and 1 June with seven applications of the kaolin-based particle film "Surround." The trickle-irrigated plots were 5.6 m^2 in size and treatments replicated four times in a RCB design. Commercial cultural practices were followed, but no fungicides were used. Results indicated that mycorrhizal inoculation tended to accelerate fruit maturation and that particle film applications delayed fruit development relative to the control treatment. Mycorrhizal (only) treated plants had the highest yields at the second (of eight) harvests compared to the other treatments. There were no significant differences between treatments in leaf temperature, diffusive resistance, transpiration rate, water potential, and soil profile moisture, except between sampling dates. Fruit mineral nutrients, pigments, dry matter, average weight, total marketable and total season yields were not significantly affected by any treatment. When fruits were sectioned into proximal and distal halves, 10 out of the 14 nutrients measured, in addition to dry matter, and total carotenoids were higher in the distal end.

Optimal Training of Apple Trees for High-density Plantings

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An experiment was initiated at the Univ. of Kentucky Research and Education orchard, Princeton, Ky., to determine the training practices needed to obtain early production and optimal fruit size from trees trained to either the slender spindle or the French axe system on vigorous sites. One-hundred-eighty trees (five rows, 32 trees per row) of 'Golden Delicious' on M.9 rootstock were planted in May 1997, in a randomized complete-block design with eight treatment combinations, consisting of two training systems and four levels of training intensity. Trunk circumference averaged 61 cm at planting and did not vary significantly among rootstocks. A trellis was constructed, and trickle irrigation was installed. All trees are currently alive. Each season, over half the total time spent training the trees was spent during the first 5 weeks the trees were trained. About 2 minutes per week was needed to train each tree during the first 5 weeks, but only 45 seconds per week was needed in the sixth through the 16th week. Trunk circumference, yield, and average weight per fruit did not vary significantly in the analysis of variance. Training per kilogram of fruit averaged 4.2 minutes.

The Georgia Advanced Master Gardener Training

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Georgia has about 6000 Master Gardeners in the state. Although the initial training received by these volunteers was excellent, there was a need for more in-depth, updated, specialty training. Advanced Master Gardener Training was developed to provide a higher level of educational training to veteran Master Gardeners. Thirteen specialty topics were developed to enhance volunteer knowledge in areas such as envionmental horticulture, turf grass, or xeriscape. Over 600 Master Gardeners have now gone through advanced training and have been certified. Pre- and post-testing has shown a significant increase in

knowledge gained at these trainings. Master Gardeners are required to attend five specialty trainings and pass the post-test before they are certified as "Advanced Master Gardeners." In return for the training, Master Gardeners are required to serve as resources in the topics of the programs they attend. They may be asked to write news articles, teach programs, or assist with future advanced training. A "second level" advanced training is being planned for 2001 with a stronger emphasis on water quality and envionmental horticulture.

Optimal Harvest Time and Effect of Storage Time on Quality of Apples Grown in Mississippi

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Maturity indices such as fruit size, firmness, fresh fruit weight, soluble solids content, titratable acidity, and juice pH of 'Earligold'/EMLA 7, 'Jonagold'/EMLA 111, 'Improved Golden'/EMLA 7, 'Improved Golden'/EMLA 111, 'Scarlet Gala'/EMLA 7, 'Jonafree'/Mark, 'Macspur'/M 7A, 'Royal Gala'/MM 111, and 'Williams Pride'/M 7A were monitored. Based on maturity indices analysis, the optimal harvest time for each scion rootstock combination was determined. 'Scarlet Gala'/EMLA 7, 'Williams Pride'/M 7A , and 'Earligold'/EMLA 7 were early cultivars, while 'Jonagold'/ /EMLA 111, 'Improved Golden'/EMLA 7, 'Improved Golden'/EMLA 111, and 'Macspur'/M 7A were late cultivars. After harvest, all cultivars were stored for 3 months under controlled conditions. Changes in fruit appearance, flavor, sweetness, tartness, and firmness were recorded. Fruit size, firmness, fresh fruit weight, soluble solids content, and juice pH were influenced by the cultivar/rootstock combination. Results of the sensory evaluation indicated that medium and late cultivars were preferred by panelists compared to the early harvested cultivars. 'Improved Golden'/EMLA 7, 'Royal Gala'/MM 111, and 'Jonagold'/EMLA 111 combinations maintained quality during storage, compared with the remaining cultivars/rootstock combinations, and had a longer storage life.

Effect of Temperature, Photoperiod, and Pretreatment Growing Condition on Floral Induction in Spring-bearing Strawberry

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'Chandler' strawberry plants (*Fragaria Xananassa* Duch.) were greenhouse grown under natural lighting and then placed into growth chambers at two constant temperatures of 16 and 26 °C and 2 daylengths of 9 h (SD) and 9-h photoperiod (NI) which was night interrupted with 3 hours of incandescent radiation at 30–45 $\mu mol \cdot s^{-1} \cdot m^{-2}$ PAR. Plants were given different numbers of inductive cycles in growth chambers and then moved to the greenhouse. Flowering and growth were monitored. Flowering was completely inhibited at 26 °C, regardless of pretreatment growing conditions such as pot sizes and plant ages, photoperiod, and inductive cycles. At 16 °C, SD promoted floral induction compared to NI under all inductive cycles except a 7-day induction. The minimum number of inductive cycles required at 16 °C for floral induction was dependent on photoperiod and prior greenhouse treatment. Flowering rate was also affected by greenhouse treatment, photoperiod, and inductive cycles. Runner production was affected by photoperiod and temperature × inductive cycle.

High CO_2 Storage Improves the Shelf Life of 'Arapaho' and 'Navaho' Blackberries

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Application of modified-atmosphere storage (MA) (high carbon dioxide and/or low oxygen) extends the shelf life of several fruits. This study was done to determine the effects of MA on quality and flavor of blackberries. 'Navaho' and 'Arapaho' blackberries were harvested in 1998 and 1999, precooled overnight at 2 °C, and placed in 0.5-L treatment jars. Treatments of 15% CO_2/10% O_2 or of air (0.03% CO_2/21% O_2) were applied at 2 °C for 3, 7, or 14 days. After treatment application, jars were held at 2 °C for an additional 11, 7, or 0 days, respectively. Seven and 14 days of application of CO_2 reduced the incidence of decayed and leaky berries by 10% to 20% for both 'Arapaho' and 'Navaho', but firm berries decreased 10% after 14 days of treatment. Titratable acidity was slightly lower, and pH higher, in control fruit but soluble solids content was not affected by treatment. Anthocyanin content was not affected by treatment in 'Arapaho' berries but was lower in 'Navaho' berries after 7 and 14 days of treatment. Samples taken for taste tests after 3 and 7 days of treatment had no off-odors or off-flavors. 'Arapaho' and 'Navaho' blackberries benefitted from high CO_2 storage, with a minimum of 7 days of treatment application needed to increase marketable berries by 10%.

Dwarfism in Rabbiteye Blueberry

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Although southern highbush (*Vaccinium* sp.) is replacing rabbiteye (*Vaccinium ashei* L.) blueberry, rabbiteye will continue to be grown on marginal soils of the southeastern United States. Dwarfism or short, compact growth habit is a trait that could be used to reduce labor costs in rabbiteye blueberry production. Parental backgrounds, and flowering and fruit traits were studied in seven Mississippi (MS) and five Georgia (T) selections. Six of the MS selections are available for propagation and bloom late enough that cold damage should not be a problem. Four (MS63, MS454, MS546, MS891) of the six have acceptable fruit quality and will be used in breeding. Ethel and MS134 were the only known dwarf ancestors, with Ethel, Myers, Black Giant, and Tifblue (Ethel x Clara) dominating the parental background. Based on the variation in growth habit and ancestries, it would appear that Ethel has several genes for dwarfism and multiple allelic interactions are involved, similar to what Garvey and Lyrene found (1987). Future breeding will include crosses of MS63, MS454, MS546, and MS891 with germplasm outside of the common ancestors, to broaden the genetic base of the dwarf rabbiteyes.

Yield and Economic Return Estimates for Eight Blueberry Cultivars Grown in Kentucky

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Yield data from a highbush blueberry planting established in 1993 at the Univ. of Kentucky Research and Education Center, Princeton, Ky., was collected over a 5-year period for eight cultivars. The economic impact of yield of each cultivar was calculated for each cultivar using a net present value model based on prevailing market prices and costs of production. These returns were compared across cultivars and an assessment of the economic potential for Kentucky growing conditions was considered. 'Duke' and 'Sierra' produced the most fruit over the 5-year period of this study. 'Duke' was also the earliest ripening cultivar in the planting, with 14.3% of 'Duke's fruit ripening during the first week of June. Sunrise also ripened early, with 7.7% of its fruit ripening during the first week of June. Picking for the other cultivars ('Sierra', 'Bluecrop', 'Blue Gold', 'Toro', 'Nelson', and 'Patriot'), began during the second week of June and was finished for all cultivars by the end of the fourth week of June. An exception was 'Nelson', which was picked through the first week of July. Despite relatively low yields observed in the first year of production, 'Duke' had the highest net present values for the assumed 12-year life of the planting. The ranking of the other seven cultivars from highest to lowest in terms of their respective net present values was: 'Sierra', 'Blue Gold', 'Bluecrop', 'Toro', 'Nelson', 'Sunrise', and 'Patriot'.

Water Use by Drip-irrigated Watermelons on Plastic Mulch

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Watermelon is grown under a range of moisture regimes from

rainfed to heavily irrigated, but water requirement patterns are not well documented. Drip irrigation and plastic mulch provide the opportunity to control water applications to optimize yield and quality. Water applied through subsurface drip irrigation was measured in two watermelon trials in 1998 (25 seeded and 20 seedless cultivars) and 1999 (26 seeded and 14 seedless cultivars) at Lubbock, Texas. Melons were transplanted in plastic-covered raised beds 13.6 m long spaced 2 m apart. Irrigation was applied when morning soil moisture tension measured by tensiometers exceeded 20 kPa. Watermelon yields ranged from 50 to 100 $t \cdot ha^{-1}$ with excellent quality. Weekly water use averaged 14 mm during the first 3 weeks of establishment then increased to 28 mm during the next 3 weeks as plants were running and blooming. During the 5-week fruit-enlargement period, water uptake averaged 57 mm, then decreased as full fruit size was attained. Similar uptake patterns in both years suggest that meaningful crop coefficients for scheduling watermelon irrigation could be based on phenological growth stages.

Determination of Optimal Storage Temperature to Maintain Viable Pawpaw [*Asimina triloba* (L.) Dunal] Seed

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Pawpaw is a native American tree fruit that has great potential as a new commercial crop. The USDA National Clonal Germplasm Repository for *Asimina* sp. is located at Kentucky State Univ. (KSU); therefore, germplasm collection and storage are important components of the research program. Recalcitrant seeds do not tolerate desiccation, have a relatively short period of viability, and tend not to tolerate subfreezing temperatures. Since pawpaw seed shows a moderate level of recalcitrance, the objectives of this experiment were to determine which storage temperatures (20, 5, –15, and –70 °C for 8.5 weeks) would maintain viable seed, and whether prior seed stratification (5 °C for 17.5 weeks) would influence survival at the various storage temperatures. Seeds were placed in ziplock bags in moist peat moss and subjected to the range of storage temperatures either before or after stratification. After storage and stratification treatments, seed germination rate was examined for 10 weeks at 25 °C on moist filter paper in petri dishes. Both stratification and storage temperature significantly affected seed germination rate. Seeds did not germinate after storage at subfreezing temperatures, regardless of stratification treatment. The best germination rate, ≈70%, was obtained with stratification followed by storage at 20 °C. However, for long-term storage of viable nongerminating pawpaw seed, stratification followed by storage at 5 °C would be most appropriate. Subfreezing storage temperatures were found to be lethal to pawpaw seeds.

Potato Seed Piece Treatments for Controlling *Rhizoctonia solani* Infections

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Rhizoctonia solani infection of potato causes seed piece decay and stem and tuber lesions, resulting in delayed emergence and uneven stands, low-vigor plants and unmarketable tubers. Rhizoctonia prevention effectiveness of three fungicide/fir bark dusts and nontreated tubers were compared on three varieties. Seedpieces of Viking, Atlantic and Norkotah 278 were treated and planted in separate commercial fields. A randomized complete-block design with four replications with four 26-foot rows per treatment plot included four treatments: 0.5 lb Maxim, 1.0 lb Tops MZ, and 1.5 lb Nubark Captan dust/100 lb seed. Plant stems, stolons and tubers were examined for *Rhizoctonia* infection at the tuber initiation stage and tubers were examined again at mature stage. Maxim and Tops MZ reduced stolon infection in Atlantic and Norkotah 278 and reduced stem infection in Norkotah 278. Plants from Maxim treated tubers produced more stems/plant in Norkotah 278 and produced more weight of tubers weighing less than four oz in all three varieties. Differences in seed tuber conditioning and mechanical damage in seed handling increase variability of treatment effects. Repeated testing of potato seed piece treatments in Texas High Plains conditions is the best way to confirm potential of beneficial effects of seed treatment.

Municipal Yard Waste as a Nutrient Source for Apple Trees

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The Environmental Protection Agency has developed regulations requiring municipalities to reduce the amount of solid wastes going into landfills. One potential outlet for yard waste is agriculture. This study was conducted during the first 6 years of orchard establishment to compare tree and fruit response of 'Fuji', 'Golden Delicious' and 'Red Delicious' apple trees to composted yard waste and other conventional fertilizers. Calcium nitrate and urea were applied at 16.8, 33.6, and 67.3 $kg \cdot ha^{-1}$ N per year. Composted municipal yard waste was applied at 1.3-, 2.5-, and 5.0-cm depths, within the sod-free strip of the tree row. Yard waste promoted growth compared to calcium nitrate and urea allowing the trees to fill their allotted space earlier. Yield and yield efficiency were generally similar across all forms of fertilizers. Foliar N was not affected by the form of nitrogen used, did not vary across the different rates of calcium nitrate and urea, and was well within the range considered sufficient (1.8% to 2.5%) for all treatments. It is concluded that the accelerated growth by yard waste was not due to N nutrition. Other foliar element levels were not consistently affected by fertilizer form or rates for the three cultivars. Fruit weight, length/diameter ratio, firmness, and soluble solids were generally not negatively affected by the yard waste, although some fruit were slightly softer and soluble solids slightly lower than fruit from trees treated with calcium nitrate and urea. This study demonstrates that municipal yard waste may provide benefits to a fertilization management system for apple orchards by promoting early growth.

Vegetable Crops

Consumer Evaluation of Selected Tomato Varieties

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Eight tomato varieties were evaluated in 1999 for consumer preference of appearance and taste. Fruits were collected from a tomato yield trial conducted at the Southeast Research and Extension Center at Monticello, Ark. Four of the varieties ('Mountain Spring', 'Celebrity', 'Better Boy', and 'Early Girl') were red-fruited. Three ('Bradley', 'Traveler 76', and 'Pink Girl') were pink-fruited. One variety, 'Mountain Gold', was yellow-fruited. Fruit evaluations were conducted on three separate dates. Varieties were ranked 1–8 by the taste panelists for both outward appearance and for taste. Appearance and taste were not correlated. 'Mountain Spring' was ranked best in appearance, followed closely by 'Pink Girl' and 'Celebrity'. However, the panelists ranked 'Mountain Spring' next to last (seventh) for taste. 'Pink Girl' was ranked first in taste, followed by 'Better Boy', 'Bradley', 'Celebrity', and 'Early Girl'. 'Mountain Gold' was ranked last (eighth) for both appearance and taste. These results indicate that consumers should not rely on appearance alone when purchasing tomatoes. The results also indicate that tomato producers should have a thorough knowledge of the market that they are serving.

Yield Response of Herbs to N and K Fertilizers and Compost Rates in Multiple Harvest

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Sweet marjoram [(marjoram) *Origanum majoranna*], Italian parsley [(parsley) *Petroselinum crispum*], Summer savory [(savory)

Satureja hortensis], and thyme (*Thymus vulgaris*) were evaluated for their yield potential during Fall–Winter–Spring (Oct.–May) 1998–99. The herbs were grown in a light sandy soil with the full-bed polyethylene mulch-micro(trickle) irrigation system. Experimental design was a split-plot replicated three times. Main plots were two N–P–K treatments: 0 N–P–K or N and K from a liquid 4–0–3.32 (N–P–K) fertilizer injected at 0.77 N and 0.64 K kg·ha^{-1}·day^{-1}. Sub-plots were four compost rates at 0x, 1x, 2x, and 4x (1x = 4.5 t·ha^{-1}). Early and seasonal total yields of marjoram and savory were similar with injected N + K and 0x compost to yields with compost and with or without injected N + K fertilizer. Yields of parsley and thyme increased with increasing compost rates and were best with compost plus liquid N + K. Postharvest soil concentrations of NO_3-N were lower in the parsley, than in the marjoram, savory and thyme plots. Residual concentrations of all other elements were similar with or without injected N + K or compost treatments.

Bed and Row Configuration Studies

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Two studies were conducted on bed and row configurations. The first compared erosion effects on stand count with single and double drill plantings; the second evaluated bed heights. Vegetables are usually planted on raised beds in the Deep South. Both single and double drills per bed are common. The double drills offer higher yields in some cases, but may be difficult to maintain because of erosion on the bed sides after heavy rainfall. A series of plantings of cabbage (*Brassica oleracea* L. Capitata group) and broccoli (*Brassica oleracea* L. Italica group) was made over a period of nearly a year to compare stands from single and double drills. Heavy rainfall did not occur after any of the 18 plantings, so bed erosion did not occur. Differences in percent stand were few, although in a few cases the double drill planting resulted in higher stands. A field study was conducted to determine the optimum bed height for leafy greens crops grown on shaped beds. Bed heights of 5, 10, 15, and 20 cm (2, 4, 6, and 8 in) were evaluated with crops of mustard [*Brassica juncea* (L.) Czerniak.] and turnip (*Brassica rapa* L. Rapifera group) during three crop seasons. Few significant differences in stand count, yield, or product quality resulted from the different bed heights. A trend toward lower yields, quality, and reduced efficacy of precision cultivation was noted with the 5-cm (2-in) bed height.

Trifluralin Rate Affects Cabbage Stands

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Difficulty in obtaining and maintaining an adequate plant stand in directly seeded cabbage led to the investigation of possible causes of plant loss. A series of experiments was conducted evaluating the effect of six rates (0, 0.28, 0.41, 0.56, 0.84, 1.12 kg·ha^{-1} a.i.) of trifluralin on cabbage stand. The treated area was irrigated immediately after planting; one-half of the area received overhead irrigation and the other half received furrow irrigation. Activated charcoal as a slurry was sprayed at the rate of 336 kg·ha^{-1} directly into the seed furrow on half the plots receiving the higher trifluralin rates. Plots treated with trifluralin at rates of 0.56, 0.84, and 1.12 kg·ha^{-1} had lower plant populations if activated charcoal was not applied. Grass, broadleaf, and sedge weed control was as effective with 0.28 and 0.41 kg·ha^{-1} of trifluralin as it was at the higher rates of 0.56, 0.84, and 1.12 kg·ha^{-1}. Plant population was not affected as much by trifluralin rates when furrow irrigation was used as compared with overhead irrigation. Producers should be careful not to exceed 0.41 kg·ha^{-1} of trifluralin on cabbage directly seeded into light-textured soils, because reduced stands can be expected.

Genome Mapping in *Citrullus Lanatus* Populations Segregating for Fusarium Wilt Resistance

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A linkage map was constructed of the watermelon genome using F2 and F2:3 populations segregating for resistance to race 1 and 2 of *Fusarium oxysporum* f. sp. *niveum* (FON 1 and 2). Sixty-four percent of the RAPD primers used in the parents and F1 detected polymorphism. In the F2, 143 polymorphic bands were scored, 60% of which exhibited the expected 3:1 segregation ratio. A 113 cM linkage map was constructed using Mapmaker version 3 and LOD of 4. DNA pools of Fusarium wilt resistant or susceptible F2:3 lines were created and bulked segregant analysis was used to detect molecular markers linked to FON 1 or FON 2 resistance. Four individuals per line were used to confirm linkages and construct an F2:3 linkage map. One large linkage group was detected in both generations. A large proportion of the RAPD and SSR markers were unlinked and many showed segregation distortion. Single-factor ANOVA for each pairwise combination of marker locus and resistance or morphological trait was conducted. RAPD markers with putative linkages to FON 1 and FON 2 and several morphological traits were detected.

Using Geospatial Techniques and GIS to Develop Maps of Freeze Probabilities and Growing Degrees

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Tennessee is located in an area of diverse topography, ranging in elevation from <100 m to ≈2000 m, with numerous hills and valleys. The physiography makes it very difficult to spatially interpolate weather data related to vegetable production, such as spring and fall freeze dates and growing degree days (GDD). In addition, there is a poor distribution of cooperative weather stations, especially those with 30 years or more of data. There are climate maps available for Tennessee, but they are of such a general format as to be useless for operational applications. This project is designed to use a geographic information system (GIS) and geospatial techniques to spatially interpolate freeze (0 °C) dates and GDD for different base temperatures and make the data available as Internet-based maps. The goal is to develop reasonable climate values for vegetable growing areas <1000 m in elevation at a 100 square km resolution. The geostatistics that we are evaluating include Thiessen polygons, triangulated irregular network (TIN), inverse distance weighting (IDW), spline, kriging, and cokriging. Data from 140 locations in and around Tennessee are used in the analysis. Incomplete data from 100 other locations are used to validate the models. GDD, which have much less year-to-year variability than freeze dates, can be successfully interpolated using inverse distance weighting (IDW) or spline techniques. Even a simple method like Thiessen produces fairly accurate maps. Freeze dates, however, are better off analyzed on an annual basis because the patterns can vary significantly from year to year. The annual maps can then be superimposed to give a better estimate of average spring and fall freeze dates.

Effect of Nitrogen Source and Bed Architecture on Yield of Southernpea Cultivars 'Quickpick', 'Texas Pinkeye', and 'Mississippi Pinkeye'

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Mississippi growers produce southernpea for the fresh market on raised beds using 20 to 30 lb/acre nitrogen. This study compared conventional production practices to alternative approaches in a 3 × 2 × 2 factorial arrangement in a randomized complete-block design with four replications. Three cultivars of southernpea, 'Quickpick' (QP), 'Texas Pinkeye' (T × PE), and 'Mississippi Pinkeye' (MsPE), were planted into either raised or flat beds using either 30 lb/acre ammonium nitrate without seed inoculation or no ammonium nitrate with Rhizobium seed inoculation. QP and T × PE were harvested with a one-row Pixall harvester and MsPE was hand harvested. All plots were harvested at the mature-green stage. Yields were reduced due to drought conditions during pod fill. MsPE was hand harvested only once due to dry conditions and less-than-ideal yields. QP produced significantly

greater yield (1208 lb/acre) than T × PE (962 lb/acre) or MsPE (981 lb/acre). The two nitrogen treatments were not significantly different. QP and T × PE were not affected by bed architecture, but MsPE on raised beds yielded significantly more than on flat beds. As with a similar study in 1998, also under nonirrigated conditions, MsPE had a significantly greater shellout than QP or T × PE. There were no significant interactions for yield or percent shellout.

Preliminary Evaluation of Float Bed Culture for Selected Salad Vegetables

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Float bed culture, common in the production of tobacco transplants, was investigated for the production of the salad vegetables leaf lettuce and radicchio. Experiments were conducted during Spring and Summer 1999. Seeds were planted on 61 cm × 61 cm, 2.54-cm-thick expanded foam sheets and floated on nutrient solution until plants were ready for harvest. Lettuce plants of the four cultivars evaluated were harvested 53 days after planting. Yields ranged from 99 to 181 g/plant. In the same experiment, aeration of the solution was compared with static solution with plants grown in aerated nutrient solution yielding significantly better than those grown in static solution. There was not a significant cultivar × aeration interaction for yield. Radicchio plants were seeded on expanded foam sheets at 20 plants per sheet. Plants were harvested 69 days after seeding. Those that had been aerated had significantly higher number of heads and leaf, head, and root weight than the nonaerated ones. There were no differences in total leaf weight among the five cultivars evaluated, but 'Red Treviso' had significantly fewer and lower weight heads and more root weight than the other four cultivars.

Phytotoxicity of Potential Postemergence Herbicides for Jalapeno Peppers

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Large weeds, particularly amaranths, are a serious impediment to mechanical harvesting of jalapeno peppers. Several herbicides were applied in 1998 and 1999 postemergence topical (PT) to commercial fields when peppers had four to six leaves, or postdirected (PD) with a shielded sprayer ≈1 month later, and evaluated for crop injury, weed control, and effects on yield. Treatments were applied to four-row plots 9 m long with a CO<subscript>2 backpack sprayer. PT treatments included pyrithiobac sodium at 0.036, 0.053, or 0.071 kg·ha^{-1} a.i. with nonionic surfactant or crop oil concentrate, metolachlor at 1.68 kg·ha^{-1} a.i., and oxyfluorfen at 0.14 or 0.28 kg·ha^{-1} a.i.. PD treatments consisted of the same rates of pyrithiobac sodium with nonionic surfactant only, and the same rates of oxyfluorfen. Pyrithiobac sodium PT caused significant chlorosis (reduction in SPAD chlorophyll) in new foliage and reduction in plant height after 1 week, but plants recovered with no effect on final plant height, chlorophyll, or yield. No significant difference was observed between the two adjuvants. Metolachlor had no measurable effect on pepper growth or yield. Oxyfluorfen PT killed young apical tissue and caused chlorosis of immature leaves. Plants recovered, but plant height was reduced by 14% to 28% and yield by 11% to 43%. PD treatments had no effect on pepper growth or yield. All herbicides provided adequate weed control under light pressure. Pyrithiobac sodium appears to have potential as a postemergence herbicide for control of amaranth in jalapeno peppers.

The Kentucky Tomato, Part II

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We conducted trials of vine-ripened, staked tomato cultivars in 1998 and 1999 to identify a variety suitable for marketing as a premium "Kentucky Tomato." Essential qualities of our ideal Kentucky tomato were determined in conversations with marketing specialists at the Kentucky Dept. of Agriculture and merchandising managers from the state's largest supermarket chain. A carefully selected group of 14 varieties (including 10 from the 1998 trial) was evaluated at two locations for yields, returns per acre, appearance, and quality in 1999. New varieties were compared with commercial standards 'Mountain Spring' and 'Mountain Fresh'. Yields of different sizes and grades of marketable fruit were multiplied by appropriate market prices for a given harvest date and summarized in a single "income per acre" variable for each variety. Although many varieties were in the highest 1999 income group ('Fabulous', 'Mountain Spring', 'Emperador', 'Florida 47', 'Sunleaper', 'Floralina', 'Mountain Fresh', 'SunGem', NC 98274, 'Enterprise'), not all were acceptable in terms of fruit quality and firmness. 'Fabulous' and 'Emperador' had higher percentages of fruits with radial cracks at one location in 1999 than in 1998. Consumer taste tests were conducted in 1998 and 'Mountain Fresh' and 'Floralina' were considered the best tasting among the six varieties tested. 'Sunleaper', 'Floralina', 'SunGem', NC 98274, and 'Fabulous' (for local markets) together with 'Mountain Fresh' were considered prime 'Kentucky Tomato' candidates and were recommended for further testing in farmers' fields in 2000.

Effect of Mulch and Shading on Bell Pepper Production in Alabama

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In 1999, two studies were conducted using bell pepper (*Capsicum annuum* L.) Study one evaluated the effect of three different mulch systems and bare soil (BS) on day and night temperatures encountered during the early growth, flowering, and fruit set period. Mulch systems were black plastic (BP), black plastic over white plastic (BOW), and minimum tilled rye (MTR). Study two evaluated the use of a 30% shade fabric on black plastic produced bell pepper. In study one, maximum daytime temperatures during the pre-flowering phase was significantly higher for MTR, 35.9 °C, compared to, 33.3, 32.5, and 32.1 °C for BOW, BP, and BS respectively. During early fruit set and fruit development, MTR was 36.9 °C, compared to 35.6, 34.9, 34.9 °C for BWP, BS, and BP respectively. Minimum nighttime temperatures were not significantly different between treatments. Bloom numbers and fruit set were adversely affected by MRT and were significantly lower than other treatments 23 and 15 days prior to harvest. Marketable weight and number of fruit per plot were significantly lower at harvest for MRT, 2.5 kg compared to 15.7, 14.5, and 11.6 kg for BWP, BP, and BS respectively. In study two, 30% shading 15 days prior to harvest resulted in 40% increase in number, 101 and 72, and weight, 21 and 15 kg, of marketable fruit for shaded area compared to nonshaded area respectively. Numbers of culls per plot, predominately sunburned fruit in non-shaded area, were reduced 72% by shading. The potential for developing systems to improve bell pepper production in Alabama are feasible based on these studies.

Potential for Carrot Production on Georgia Mountain Soils

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Carrots (*Daucus carota* L.) have become an economically important vegetable crop for Georgia. Currently the harvest season extends from December through May. One possibility for extending the harvest season would be to produce carrots in the cooler mountain area of Georgia during the summer months. This study was undertaken to examine the potential for fresh-market carrot production on Georgia mountain soils and to evaluate which varieties of carrots might be most suitable for this area. Ten commercially available carrot varieties were direct seeded into a Transylvania clay loam soil on 28 May 1999 in Blairsville, Ga. Plots consisted of three twin rows of carrots each 20 feet in length. The twin rows were each three inches apart and there were 20 inches between each set of twin rows. Each plot was replicated four times. Base fertilizer of 20 pounds of nitrogen, potassium, and phosphorous were incorporated into the plots prior to seeding. Sidedress applications of 15 pounds each of N, P, and K were applied at 3-week intervals throughout the season. Recommended pest control practices were applied. A three-foot section of the center twin row was harvested

on 23 Sept. 1999. The varieties 'Pacific Gold' and 'Topnotch' produced the highest marketable yield; however, all yields were below acceptable levels. Percent marketability was <60% for all varieties. Percent stand was extremely variable due to variability in seed size. All carrots had severe nematode damage although a nematicide was used preplant. The length of season for spring-planted carrots was too long for the life of the nematicide at the rate and method applied. Late summer–planted carrots would likely be a more viable option for this area.

Evaluation of Poultry Manure and Fertilizer N for Corn in a Strip Test

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Animal waste disposal from large operations is an increasing problem, and its value as a fertilizer needs to be determined. Strip tests often are unreplicated creating problems in analysis. In an unreplicated Georgia farm test involving a three manure (0, 1, 2 loads/acre) × 3 N (0, 70, 90 lb/acre) factorial on corn yield from the control plot was not included, making n = 8, and precluding the usual ANOVA and means comparisons. Partial budget analysis is compared to regression analysis and economic evaluation at varying input costs and corn prices. Best estimates were obtained by finding the N equivalent of manure [(56.4 lb N)/load] and regressing yield on sum of N (Nf + Nm), which estimated Y = –14.0 + 1.1724N – 0.00324NN, RR = .982, F = 136.38, $P > F = .000$, sye = 3.0 bushel/acre, from which N_{max} = 181, Y_{max} = 92.1 bushel/acre. N_{opt} varied from 139 to 172 bushel/acre with cost N varying from $0.14/lb (manure cost) to $0.40/lb, and corn prices from $1.50 to $2.50/bushel. Manure thus valued at 16.92 per load when costing $8.00, assuming 56.4 lbs/load N. Major point was estimation N equivalent of manure from yield effects and then regression yield on N. Equation easily converted to one in M.

Further Investigations on the Genetics of Resistance to Iron Deficiency in Cowpea

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Iron Deficiency Chlorosis (FeDC) is a problem in cowpea because it affects the ability of the plant to produce chlorophyll. Earlier studies indicated that FeDC was conditioned by a single gene. Pinkeye Purple Hull (PEPH), a susceptible variety, and Texas Pinkeye Purple Hull (TXPE), a resistant variety, were crossed and allowed to self for one generation. The F_1s were backcrossed to the parents. SPAD readings were taken on each population. SPAD measures the transmission of light through the leaves at a wavelength where chlorophyll absorbs and a wavelength where it does not. The SPAD reading is calculated based on a ratio of these two numbers. Thus, the SPAD value is unitless and is an indication of the relative amount of chlorophyll present in the leaf. Chlorophyll was extracted from leaves, and regressed on the SPAD readings from the same leaves. An R^2 of .9102 was obtained as well as a regression equation of y = 12.8x + 54.5. Thus, a SPAD value of 1 corresponds with a chlorophyll content of ≈67.3 µg chlorophyll/gfw. The data was analyzed using a bootstrap method, and indicated that FeDC is not controlled by a single gene. A *P*-value of .0004 showed a highly significant difference between the expected and observed segregation ratios in the F_2 plants. Narrow sense heritibility (Mather) was estimated at 0.3.

Evaluation of Plant-bed Fertility in Vidalia Onions

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In 1998–99, experiments were conducted to evaluate current fertility practices with plant-bed onions. In experiments in 1998 and 1999, a factorial experiment of preplant 5–10–15 and $CaNO_3$ sidedressing indicated that $CaNO_3$ had a significant effect on foliar nitrogen levels. $CaNO_3$ also had an effect on stand count in 1998, but not in 1999. $CaNO_3$ and 5–10–15 had an effect on plant height in both 1998 and 1999, with an interaction between 5–10–15 and $CaNO_3$ in 1999. In 1999, transplants were also evaluated on an acceptability scale with 5–10–15 and $CaNO_3$ rates resulting in significant differences in transplant acceptability. Postseedling applications of high phosphorus fertilizer were also evaluated. There were no consistent improvements in transplant growth with applications of high phosphorus fertilizers, such as 18–46–0 or 10–34–0, either on soils with very high residual phosphorus (242 lb/acre) or medium residual phosphorus (50 lb/acre). In addition, variety was not a factor in these responses.

Metam Sodium Use in Vidalia Sweet Onions

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Metam sodium has been evaluated on onions in Georgia since the mid-1980s for control of various soil pathogens in the production of transplants. Observations also indicated excellent weed control activity. Further work showed significant growth response of transplants, 90% or better weed control, and efficacy of *Phoma terrestris*, *Fusarium*, and *Pythium*. Results were better in comparison studies than found with methyl bromide, chloropicrin, and other fumigation combinations. This led to use of the product in field production of dry bulb onions. Seven years of studies revealed an average yield increase of 190 bushels per acre over the control, even where *Phoma terrestris* levels were minimal. Today, almost all transplant production includes the use of metam sodium and field use is beginning to be used by growers. With limited crop rotation being practiced in the Vidalia onion belt, metam sodium will continue to play a major role in controlling the ever-increasing levels of *Phoma terrestris* and maintaining profitability in onion production in Georgia.

Fruit Crops

Ripening and the Climacteric of Pawpaw

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Pawpaw (*Asimina triloba* L.), the largest tree fruit native to North America, has become the focus of a significant effort to develop its commercial potential. Due to the very short shelf life of the ripe fruit, a critical component of this effort is the establishment of appropriate harvest and postharvest storage techniques. Although it has been reported that the ripening of the fruit is climacteric, there is no published data to support this. Nor are there any reports on the response of the fruit to cold storage. Fruit were harvested and classified as unripe if no softening was evident or as ripe if softening had commenced. Fruit were held at room temperature or were stored at 4 °C for 28 days, then moved to room temperature. Ripe fruit exhibited respiratory and ethylene climacteric peaks within 3 days of harvest and 5 to 7 days after removal from cold storage. Unripe fruit exhibited climacterics 5 days after harvest and after removal from cold storage. A survey of drops indicated that they were postclimacteric. Thus, pawpaw is a climacteric fruit and cold storage delays the start but not the relative rate of ripening.

Firmness of 'Brightwell' Rabbiteye Blueberry in Response to Various Harvesting and Handling Procedures

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Experiments were conducted during 1999 at the Univ. of Georgia Research Farm near Alapaha with the rabbiteye blueberry (*Vaccinium ashei* Reade) cultivar Brightwell to determine how various harvesting and handling tactics influenced firmness. The research was facilitated

by availability of a mechanical harvester and a commercial packing line. Firmness was determined with a FirmTech II firmness tester on fruit samples before and after cold storage. Fruit harvesting methods included machine harvesting in bulk, hand harvesting in bulk, and hand harvesting directly into clam shell containers. Assessment of precooling effects were made by comparing firmness of fruit that were placed immediately over ice after harvest to fruit that remained at ambient temperatures for 24 hours after harvest. Additional measurements were made to discern the effects of grading and sorting on fruit firmness. The data overall indicated that 'Brightwell' fruit firmness was "acceptable" regardless of the harvesting and handling methods experienced. However, there were considerable firmness losses caused by the various procedures. The greatest loss in fruit firmness (20% to 25%) was caused by machine harvesting. This was followed by a 15% to 18% loss of firmness due to grading and sorting. Immediate cooling of fruit after harvest resulted in only a 8% to 12% increase in firmness as compared to keeping fruit at ambient temperature for 24 hours. These findings should be useful to growers and packers in targeting segments of their operations that can be manipulated to improve berry firmness and quality for fresh market sales.

New Seedless Table Grape Cultivars for the South

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Two new seedless grape cultivars were released in 1999 from the grape breeding program at the Univ. of Arkansas. 'Jupiter' is the fifth release from the program. 'Jupiter' is blue-fruited, has large berries, non-slipskin texture, and a mild muscat flavor. Yields of 'Jupiter' were very good in replicated trials, and hardiness is also adequate for production in all areas of the South. 'Jupiter' ripens 5 days later than 'Venus', but earlier than 'Mars' or 'Reliance'. 'Neptune' is the sixth release and first white-fruited cultivar from the program. It has medium-sized berries, large clusters, non-slipskin texture, and a mild, fruity flavor. Yields of 'Neptune' were moderate in replicated trials. 'Neptune' ripens 17 days later than 'Venus' and 3 days earlier than 'Mars'. Both cultivars were developed and evaluated with a commercial cultural system including routine fungicide applications, and fungicides will be required to reliably produce these cultivars. Neither of these cultivars has been tested in a Pierce's Disease region of the United States, and it is not anticipated that either will have resistance to this disease.

Effect of Scion-rootstock Combinations on Premature Fruit Drop in Mango

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Studies were conducted to determine the effect of scion-rootstock combinations on premature fruit drop. Ten-year-old trees of the varieties Parvin and Tommy Atkins grafted on Eldon, Malda, Colombo Kidney, Julie, and Cuban were used. The number of prematurely dropped fruits was counted weekly for eight consecutive weeks after flowering. A smaller fruit drop index was observed when Parvin was grafted on Malda, Julie, and Cuban than when grafted on Colombo Kidney. There was no significant difference in fruit drop index between Eldon and Colombo Kidney. Fruit drop index was greater in Parvin than in Tommy Atkins.

Matted-row Strawberry Production using Landscape Fabrics and Organic Mulch for Weed Control

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Three landscape fabrics, Magic Mat®, a heavy black plastic woven fabric with a fuzzy underside; Weed Mat®, a thin black plastic sheet with small holes; and Typar®, a dark gray spun bonded material, with and without a cover of organic oak bark mulch, were evaluated for weed control and ability of strawberry plant roots to establish through the fabrics over a 4-year period. Landscape fabrics reduced weed numbers for the first 3 years in comparison with the bare ground treatment. With few exceptions. the organic mulch did not improve the weed control capability of landscape fabrics. Fruit yield for the Weed Mat and Magic Mat treatments did not differ from the bare ground treatment, but was lower for the Typar treatment when averaged over organic mulch treatments. Fruit yield was higher where the organic mulch was used when averaged over all landscape fabric treatments. Fruit size was slightly larger for the bare ground and smallest for the Typar treatments during the first harvest season, but there was no difference in fruit size by the third year of harvest. Fruit size for the organic mulched plots was slightly larger than that for the unmulched plots the second year of harvest, but there was no difference for the first or third years. The number of strawberry runner plants that rooted and plant row vigor were greater for the Weed Mat, Magic Mat and plots without the landscape fabric than for the Typar plots, particularly in the second and third season. Rooting of runner plants and plant row vigor was better with organic mulch. Landscape fabric tended to reduce extent of rooting, especially in the first season, but it was improved by the application of organic mulch.

Study of Apple Cultivars on Dwarfing Rootstocks in North Mississippi

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This study was established to determine the influence of scion/stock combination on leaf area, yield efficiency, and fruit quality attributes in effort to identify the most suitable scion/stock combination for Mississippi. Twenty-nine scion/stock combinations were grown at the Pontotoc Ridge-Flatwoods Research and Extension Center, North Mississippi. The treatments were arranged in a completely randomized design (CRD) with six single tree replications. 'Jon-A-Red' on Mark produced the smallest leaf area, while the largest leaf area was produced by the combination of 'Royal Gala' on MM106 and 'Blushing Golden' on M7A. Scion/stock combinations significantly affected yield efficiency, fruit yellow pigment dvelopment, firmness and fruit mineral composition. Scion cultivars on Mark resulted in the highest yield efficiency, except 'Empire'. 'Ultra Gold' and 'Braeburn' on Mark and 'Blushing Golden' on MM111 led to yellow pigmentation in the highest category. Meanwhile, 'Braeburn' on Mark was among the scion/stock combinations that produced the firmest fruit. And fruit from trees on Mark consistently had high calcium (Ca) levels. After 7 years, 'Royal Gala' on Mark produced the highest yield efficiency. 'Braeburn' on Mark resulted in both the firmest fruit and the highest fruit Ca concentration.

Oxygen Radical Absorbance Capacity (ORAC), Phenolic, and Anthocyanin Concentrations in Fruit and Leaf Tissue of Highbush Blueberry

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Antioxidant capacity as measured by ORAC, total phenolic, and total anthocyanin concentrations were evaluated in fruit tissue of 86 highbush blueberry cultivars, and ORAC and phenolic levels evaluated in leaf tissue of the same materials. Average values for ORAC, phenolics, and anthocyanins in fruit were 15.9 ORAC units (1 unit = 1 micromole Trolox Equivalent), 1.79 $mg \cdot g^{-1}$ (gallic acid equivalents), and 0.95 $mg \cdot g^{-1}$ (cyanidin-3-glucoside equivalents), respectively. ëRubel' had the highest ORAC values, at 31.1 units. Values for ORAC and phenolics in leaf tissue were significantly higher than fruit tissue, with mean values of 490.4 ORAC units and 44.8 $mg \cdot g^{-1}$ in leaf tissue, respectively. No significant correlations were found between fruit ORAC and leaf ORAC, or between fruit ORAC and leaf phenolics. Investigation of ORAC values in a family of 44 'Rubel' x 'Duke' seedlings showed negative epistasis for ORAC values. However, an analysis of ORAC values vs. pedigree in plants from the 86 cultivar groups suggested that across cultivars, ORAC inheritance is generally additive.

Comparison of Chilling Requirement in 'Ta Tao' Budded Peach Trees by Shoot Forcing

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Peach trees exposed to 'Ta Tao' vegetative chip bud grafts have been shown to have physiological changes that include bloom delay, delayed maturity, reduced shoot vigor, and early autumn defoliation. 'Ta Tao' is known to be infected with the graft transmissible agent Peach Latent Mosaic Viroid (PLMVd). PLMVd has been associated with bloom delay and reduced shoot vigor. 'Coronet' peach trees planted in a high-density, Y-trained orchard system were treated with vegetative chip buds from 'Ta Tao'. Transmission of PLMVd was confirmed in the treated trees by cRNA probe hybridization. A shoot forcing study was set up to determine if exposure to 'Ta Tao' would alter the chilling requirement of 'Coronet' peach. Terminal fruiting shoots were collected periodically during the dormant season from 8 Jan. 1999 to 19 Feb. 1999, which represented a range of chill hour accumulation from 574 to 927, respectively. Shoots were forced in a greenhouse, and chilling requirement was considered complete when 50% of the flowers opened. Chilling requirement was not changed by exposure to 'Ta Tao' chip buds. The number of days required for shoots to bloom was significantly and consistently longer for the 'Ta Tao' treated trees. The number of shoots responding to forcing conditions was significantly less in the treated trees. The data suggest that the graft transmissible effects from 'Ta Tao' buds increased the growing degree hours required for 'Coronet' leaf and flower bud emergence after rest completion under greenhouse forcing conditions.

Importance of Organophosphate (OP) Insecticides in an IPM-based Peach Orchard Management System

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The Food Quality Protection Act provides for review of pesticide use on food products providing potentially significant challenges to orchardists. IPM should reduce pesticide use but not fruit quality. This project compares effectiveness of OP and non-OP insecticides used in an IPM peach management program and compares spray program efficiency in commercial peach orchards. OP vs. non-OP insecticide treatments (Guthion and Lorsban vs. Thiodan and Asana) targeting plum curculio (PC) and plant bugs (PB) were applied to 7-year-old 'Cresthaven' and 'Jayhaven' trees in a split-plot design. Insect damage to fruit samples from commercial orchards was compared to the IPM demonstration orchard. PC insecticide application was based on a threshold of 0.1 PC per trap per day from screen traps. 'Jayhaven' and 'Cresthaven' trees in the IPM demonstration orchard received three and four insecticide applications, respectively. Total fruit yield was not significantly different between OP and non-OP plots. Total PC damage from 'Jayhaven' trees in OP plots was 4.8% compared to 8.2% from non-OP plots. Less than 2% of fruit from 'Jayhaven' and 'Cresthaven' trees in OP plots contained PC larva compared to >6% from non-OP plots. PB damage to fruit was slightly higher in OP vs. non-OP plots. Insecticide applications in commercial orchards ranged from six to 12, resulting in PC damage ranging from 0% to 8.2%.

Refrigeration of the Root Zone to Delay Budbreak in Grapes

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Grapes grown in West Texas are especially susceptible to freeze damage during spring deacclimation and budbreak. This experiment was undertaken to evaluate whether refrigeration of the root zone would delay budbreak in two grape cultivars, 'Chardonnay' and 'Cabernet Sauvignon'. The experiment was conducted under greenhouse conditions using 1-year-old grafted plants planted into containers in water bath chillers to cool the root zone. Three root-zone temperatures were maintained: 7.2 °C, 1.7 °C, and a nonchilled control. The experiment followed a randomized split plot, with main plots being temperatures and the sub-plots being genotype, and the experiment was repeated once. Evaluation of budbreak was performed on a daily basis. Other data collected included shoot dry weight and root dry weight with soil, water, and air temperatures recorded using type T thermocouples (copper-constantan) attached to a datalogger. The experiments indicated that budbreak could be delayed in both varieties by the refrigeration of the root zone by an average of 1 to 2 days when comparing the 1.7 °C treatment with the nonchilled control. The refrigerated treatments of 'Chardonnay' also tended to show a prolonged budbreak over time. This finding may be significant since 'Chardonnay' generally exhibits budbreak relatively early compared to other grape varieties and a prolonged budbreak may allow some buds to escape spring frost injury.

Pine Pole and Post Peelings Have Potential as Blueberry Growing Media and Soil Amendment

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Growing southern highbush blueberries in milled pine bark beds ≈15 cm deep has become a popular fruit production system in Georgia and Florida. One of the primary limiting economic factors in this system is the cost of the growing media, which can exceed $10,000 U.S. per ha. In an effort to discover low-cost substitutes for milled pine bark, available waste or low-cost organic materials were screened for there suitability as growing media for southern highbush blueberries. Cotton gin waste, pecan shells, hardwood "flume" dirt, milled composted urban yard waste, composted urban tree trimmings, pine telephone pole peelings, and pine fence post peelings were evaluated. Only pine derived materials had a suitable pH (<5.3). Fresh pine telephone pole peelings (≈25% bark to 75% elongated fibers of cambial wood) and pine fence post peelings (≈75% bark to 25% elongated fibers of cambial wood) were evaluated for several seasons in containers and field trials. The growth index of blueberries in these materials was slightly less or equal to milled pine bark. Surprisingly, nitrogen deficiency was slight or not a problem. The results indicate that pine pole and post peelings may offer an excellent, low-cost substitute for milled pine bark for blueberry production.

Occurrence of Preharvest Peel Streaking Is Associated with Gummosis and Pesticide Usage in Peach

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The absence of red color in a streaked "Bleaching" pattern is periodically noted on late-season peaches in middle Georgia. The streaked pattern led to a hypothesis that accumulation of pesticides in the stem end of the fruit prevented anthocyanin formation. However, analysis of pesticide residues on affected and unaffected peel suggested this was unlikely. We observed that trees affected by fungal gummosis (caused by *Botrysphearia dithodia*) were most often affected by the "bleaching" phenomenon and that 'Summer Gold', the most fungal gummosis–susceptible variety, had the greatest incidence of the disorder. In a preliminary trial, we tested the hypothesis that fungal gummosis mediates "bleaching" by interfering with anthocyanin color formation in the peel of developing fruit. Tree gum/resin and pesticides were tested for their effect on peel color development. The gum/chemical preparations were dripped onto fruit prior to anthocyanin or red pigment formation in peach peel. After the anthocyanescent period, fruit were observed for bleaching. The gum mediated a negative effect by sulfur, captan, and carbaryl in peel color formation in peach. Fenbuconizole and phosmet had a less negative effect on color formation, although the effect was noticeable. The gum alone, propiconizole, and chlorothalonil did little to effect on peel color formation.

ReTain™ Improves Fruit Firmness in Postharvest Storage of Peach

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For peach fruit to withstand the rather vigorous postharvest handling during the packing and shipping process, growers pick them fairly early when they are very firm. Yet they soften very quickly, giving them a shelf life of generally 5–15 days. It may be desirable to allow fruit to remain on the tree longer, allowing them to increase in size, while improving in flavor and color. The fact that aminoethoxyvinyl glycine (AVG), ReTain™, interferes with ethylene synthesis was borne out by findings that AVG applications prior to harvest delayed ripening, increased fruit removal force in apple, and reduced preharvest drop. Seven-day preharvest application of 50 g AVG/100 gal to two peach varieties increased firmness from 12% to 54% and moved 7% of the harvest to a date 3–7 days after AVG treatment. The additional time to peak harvest may indicate that the fruit can hang on the tree for a longer period, allowing additional time for fruit expansion. Preliminary indications are that only a 2% to 4% size increase can be achieved. However, this appears to be enough to move 5% to 7% of the fruit into the next ring size.

Floriculture/Ornamentals

Effect of Plant Growth Regulators on Flowering and Postproduction of *Curcuma Alismatifolia* 'Chiang Mai Pink'

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Curcuma alismatifolia 'Chiang Mai Pink' is a tropical perennial from the *Zingiberaceae* family with attractive flowers that make it useful as potted plant. *Curcuma alismatifolia* produces a tall inflorescence resulting in an unmarketable plant due to excessive height. Rhizomes of *C. alismatifolia* were soaked for 10 minutes in GA at concentrations of 0, 100, 200 or 500 ppm. The same plants were drenched with paclobutrazol at 0, 2, 3 or 4 mg a.i./container when shoots were 10 cm. GA significantly delayed rhizome emergence and flowering and reduced flower height. Paclobutrazol significantly reduced height; however, greater concentrations must be applied to obtain a marketable plant height. Number of flowering stems, postproduction life, and postproduction stretching were not affected by GA or paclobutrazol. *Curcuma alismatifolia* had an excellent postproduction life (4.64 ± 0.28 weeks) with little postproduction stretching (2.27 ± 0.38 cm).

Species Responses to Accelerator Grower vs. Black Plastic Containers

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Five species of trees, *Fraxinus velutina* Torr., *Pistacia chinensis* Bunge, *Platanus occidentalis* L., *Quercus virginiana* Mill., and *Ulmus parvifolia* Jacq., were first grown in 0.45-L conventional black plastic liner containers, then transplanted to 25-L black plastic containers and grown to a marketable size. The same species were grown in similar-size, open-bottom, air-root pruning, cylindrical, aluminum (Accelerator) containers filled with the equal volumes of media. Plant growth characteristics, root-zone temperatures, and media moisture status were measured. Growth of *Q. virginiana* was reduced in Accelerator liner containers compared to conventional black plastic liners. Accelerator liners did eliminate circling and deflection of roots at the bottom of the liner containers. Growth of *U. parvifolia*, *F. velutina*, and *Q. virginiana* were similar in the larger 25-L Accelerator and black plastic containers, while growth of *P. chinensis* and *P. occidentalis* were greater in Accelerator containers than in conventional black plastic containers. Root-zone temperatures, particularly at the periphery of the rootball, were significantly reduced on warm days in Accelerator containers compared to those in black plastic containers. Media in Accelerator containers were slightly drier than that in black plastic containers.

The Evolution of Plant Evaluation and Introduction Programs at the JC Raulston Arboretum

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An historic feature of the JC Raulston Arboretum (JCRA) is to identify new and unusual ornamental plant materials for landscape use through an active program of observing landscape performance at the JCRA in Raleigh. Introduction of plant materials into commerce occurs primarily through programs conducted in concert with the North Carolina Association of Nurserymen and through a unique policy of "open access" for nurserymen. One program, The JC Raulston Selections Program, returns revenues to the general operations and maintenance functions of the JCRA; others are not revenue generating, and are provided as a service to the industry. To a lesser extent, the general public may participate in receiving new plants via a special program offered through JCRA membership. The JCRA is also an official trial garden site for the All America Selections program and seed companies. Elements of these introduction and evaluation programs will be discussed within the context of the past, present, and plans for the future for program maintenance and possible changes.

Integrating Plant Trials into Teaching and Graduate Research Programs

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Plant trialing and promotion programs have become popular in recent years with many state and some regional programs emerging. Successful implementation requires considerable labor, facilities, and monetary resources for evaluation of large numbers of taxa over several years to ensure that plants are well adapted to the region of interest. Research and development funds and cooperator commitment to trialing programs can be limiting during the early years of these programs prior to production of tangible benefits. Dedicated facilities for program activities are usually not available. Mechanisms for development of facilities and procurement of labor to augment trialing program resources, while enriching undergraduate and graduate teaching and research programs, will be presented.

Exotherm Characteristics and Cold Hardiness Mechanisms within the Buds of Some Deciduous Fruit Trees

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Exotherm characteristics of dormant apple, pear, peach, plum, grape, persimmon, and black walnut buds were investigated from late autumn to early spring. Differential thermal analysis indicated differences in the high-temperature exotherm (HTE) and low-temperature exotherm (LTE) among the fruit species and sampling dates. According to exotherm characteristics and cold hardiness, the species tested could be divided into two groups, those without LTE (apples and pear) and those with LTE (grape, persimmon, black walnut, peach, and plum). The latter group with LTE could be further categorized into two subgroups, those possessing three stages of hardiness development (peach and plum group) and those with five stages of hardiness development (grape, persimmon, and black walnut). In the peach and plum group, HTE and no LTE could be detected in the first and last stages when bud water content was >55%. In the second stage, both HTE and LTE could be detected when bud water content was between 40% and 50%. In the grape, persimmon, and black walnut group, the first stage with only HTE was from bud formation to deep supercooling initiation when bud water content was >52%. The second stage with both HTE and LTE was when bud water content was between 40% and 48%. The third stage when only LTE could be detected and

bud water content was usually <40%. The fourth stage was from HTE reappearance to LTE disappearance before bud swell. The fifth stage was from LTE disappearance to when only HTE could be detected. No detection of LTE in the buds of apple and pear and no detection of HTE in the buds of grape, persimmon, and black walnut were both closely associated with water status in the buds.

The University of Arkansas Plant Evaluation Program

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The Univ. of Arkansas initiated a statewide plant evaluation program in 1999. This trial will enable us to evaluate plants on a statewide basis, improve statewide marketing programs, and serve as a propagation source for nonpatented or non-trademarked material. Trees and shrubs will be evaluated for 5 years and herbaceous material for 3 years. Three test sites were established across the state, one in Fayetteville, Little Rock, and Hope, Ark. These sites correspond to the three USDA plant hardiness zones found in Arkansas (Zones 6, 7, and 8). A consistent planting protocol (e.g., distance between plants, irrigation system, bed width) is used at all three locations. Data collection consists of annual growth measurements and qualitative evaluations for factors such as time of flowering, length of flowering, and disease or insect problems. A standard protocol has been established for identifying future plants to be evaluated in the program. In the first year, 17 accessions were planted at each of the three different locations. Best plant growth on 15 of the 17 accessions occurred at the Little Rock site. This may be a reflection of the environment present at the sites in Hope and Fayetteville. Both of these sites are exposed, full-sun situations, whereas the Little Rock site receives some afternoon shade. Reception to this trial program has been favorable, with the Little Rock site gaining much attention from the Arkansas nursery industry.

Horticultural Trials: Balancing Academic Goals with Industry Support

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The horticulture research gardens at the Univ. of Georgia were initiated in 1983, and have significantly evolved in visibility and functionality. The gardens were designed to act as a research evaluation site for the industry, but also to be used as a teaching tool for classroom, and to encourage student experience in landscape plant maintenance. Performance evaluation is accomplished by gathering data every 2 weeks, and performance plots are drawn for each taxon at the end of the season. Data on performance of perennial plants are also recorded, and each taxa is summarized after its flowering period. All data is compiled, simplified, and disseminated by booklet, trade magazine papers, and the Internet. In the last 7 years, a major cornerstone of the garden has become the evaluation and introduction of new crops for the ornamental plant industry. At least a dozen new taxa have been introduced. New crop introduction programs will be discussed as a potential means of funding. The ability to initially raise funds for horticultural trials the maintenance of funding over the years will also be discussed.

Leaf Nitrogen Status on Yield and Quality of Roses

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The establishment of critical tissue N levels for greenhouse rose production has been primarily based on visual symptoms of N deficiency, with relatively less consideration to yield parameters. This work examined the relationship between rose leaf N concentration and flower yield and quality. Container-grown 'Royalty' rose plants were irrigated for 13 months with complete nutrient solutions containing N concentrations of 30, 60, 90, 120, 150 and 220 $mg \cdot L^{-1}$. Optimum flower and dry biomass yields, stem length, and stem weights were obtained in plants irrigated with 90 $mg \cdot L^{-1}$ N. Leaf N concentrations increased asymptotically with N applications, stabilizing at N concentrations >90 $mg \cdot L^{-1}$. Time of the year had an effect on overall leaf N concentrations, with higher values observed in the winter, and lower values in the summer. Leaf N concentrations were linearly, and significantly, correlated with leaf chlorophyll content and leaf color attributes (hue, chroma, and value). Quadratic relationships between leaf N concentration and rose plant yields were observed only for the second half of the experimental period, and depicted an apparent, and striking, plant control over tissue N status. In addition, these relationships indicated that optimum plant yields were possible during spring and summer with leaf N concentrations below the recommended critical level of 3% (as low as 2.4% to 2.5%). These results suggest that leaf N concentration per se is not a dependable indicator of rose productivity.

Effect of Systemic Deer Repellent Tablets and Liquid on Deer Browsing of Containerized Ornamentals

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Economic and aesthetic losses from deer browsing of ornamental plants in nurseries and landscapes has increased significantly during recent years. This, according to wildlife specialists, is primarily due to hunting restrictions in urban areas. There are numerous so-called "deer repellents" on the market, but most are foliar applied and can be washed off or diluted with rain or irrigation. This study evaluated the effect of a systemically absorbed deer repellent tablet, Repellex (trademarked product), on deer browsing of containerized ornamental plants. A foliar applied counterpart, Repellex liquid, was also evaluated. The 1.5-gm tablets are a 14–2–2 fertilizer containing denatonium benzoate, lactose, ammonium phosphate, hydrous magnesium, and potassium sulfide. Two to eight tablets, depending on the size of the container, are placed adjacent to the root ball of the plant and 2 inches below the media surface at time of transplant. Gumpo azalea, Indian hawthorne, daylily, and *Manhattan Euonymus* were used for the study. Plants treated with tablets were held 6 to 8 weeks, according to manufacturer recommendations, under nursery conditions, then transported to deer-holding pens at the Whitehall Forest Research Station at the Univ. of Georgia. The pens, 1/2- to 1 acre in size, contained seven to 12 deer, depending on the study. Growth measurements initially and at weekly intervals were used to assess the degree of deer browsing. Results varied by plant species. Generally, the tablets were ineffective in preventing deer browsing when compared to the control. The foliar applied liquid was effective in reducing deer for up to 6 weeks when compared to the control. Plants treated with a tablet at time of propagation and two additional tablets when transplanted were browsed to the container within 2 days of deer exposure.

Using Hanging Baskets and Containers in Garden Trials at the University of Tennessee

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Many new vegetative annuals are available in the floriculture market today. Their growth habits may be trailing or vigorous and more conducive to hanging basket or container garden culture. Today's gardeners are living busy lives and housing is sometimes confined, with little land on which to garden. These factors all contribute to the popularity of hanging baskets and container gardens. Whereas container garden trials are more common in industry, few universities have added container gardens and hanging baskets to their trial gardens. The objective of the hanging basket and container garden trials at Univ. of Tennessee (UT) initiated in Summer 1999 was to demonstrate and promote this timely trend to commercial growers, landscapers, and the public. An attractive brick walkway and wooden arbor were built by a UT landscape construction class to display the containers and hanging baskets. Several challenges had to be met: funding the purchase of expensive containers; planting and placing the heavy containers in the garden; combining plants within the containers; grouping containers together; labeling plants within the containers; displaying the hanging baskets; maintenance and pruning; and most of all, keeping the containers watered throughout the summer. The color wheel proved to be a useful tool for grouping plants and

containers. A handout was developed to guide visitors through the container garden. Despite the challenges, the container garden and hanging basket trials proved to be a successful demonstration and were popular among visitors.

The University of Tennessee Gardens and Herbaceous Plant Evaluation Program

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Many new plants and varieties are introduced into the market every year. Little information is generally available about the landscape performance of these plants. To take the guesswork out of their landscape performance in the Tennessee region, the Univ. of Tennessee Institute of Agriculture (UTIA) Gardens were established. Started in 1983 as an All-America Selections (AAS) Test Garden, on less than a quarter of an acre, the UTIA Gardens have grown to 5 acres and now include plant introductions from 25 commercial seed and plant companies. An average of 550 summer and winter annuals are evaluated annually in addition to an assortment of bulbs, perennials, herbs, groundcovers, ornamental grasses, aquatics, trees, and shrubs. Because of the volume of plants, evaluation criteria are in conjunction with industry requests and are not always replicated. In addition to university support, the gardens receive revenues from the sponsoring commercial seed and plant companies, the Tennessee green industry trade associations, a "Friends of the Gardens" support group, and gifts. As a result of the herbaceous plant evaluation program, the UTIA Gardens have grown to be a significant resource for the university, community, and green industry. A variety of university departments use the gardens in their teaching; community groups, including schools, tour and use the gardens; and open houses and field days assist commercial growers and landscapers in remaining current on new plant introductions and their performance.

Texas SuperStars: The Coordinated Educational Marketing Assistance Program in Texas

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The Coordinated Educational Marketing Assistance Program (CEMAP) is one of the oldest marketing assistance programs for ornamentals in the United States. The goal of this program is to identify outstanding plants for Texas and to provide support for the nursery industry, thereby making plants with superior performance available to the people of Texas. The CEMAP program is a cooperative effort between the Texas nursery industry and Texas A&M Univ. The CEMAP Executive Board has eight individuals representing extension, research, and teaching plus two administrative liasions and the Industry Advisory Board has ≈50 members from all segments of the ornamentals industry in Texas. Funding for the CEMAP program comes from direct industry support and from the public through the sale of plant tags or other promotional materials which bear the Texas Superstars logo. The logo is trademarked and licensed to printing companies who handle the administration of royalties to the program. The Executive Board makes the final decision about which plants are designated Texas Superstars. Promotional support for the plants is provided by CEMAP through point of purchase materials and publicity through print, radio, and television. In addition, the Texas Nursery and Landscape Association in cooperation with the Texas Department of Agriculture are conducting a publicity campaign to inform the public about Texas Superstars.

Earthworm Castings as a Media Amendment for Chrysanthemum Production

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Castings from earthworm (*Eisenia fetida*) when fed on sheep (SC), cow (CC), or horse (HC) manures were evaluated on growth of *Dendranthema* 'Miramar' cuttings. Castings were produced placing 100 L of manure and 1 kg of earthworms in a 212-L plastic container for each animal manure. Mixtures of peat moss and castings at 0:1, 1:3, 1:1, or 3:1 were evaluated for each animal waste with 100% peat and Sunshine Mix 1 used as the controls. Each media treatment was replicated eight times with each replication consisting of four cuttings per 1-L (15-cm diameter) plastic container. Leachate pH and nutrient content increased as the amount of castings in the media increased. Plant growth index, leaf area, and number of flowers were greatest in media consisting of SC at 1:1 and 3:1 peat:castings. Similar results for growth index and leaf area were obtained with CC at 3:1 and 1:1, respectively. Increasing the amount of castings in the substrate reduced the plant dry weight and increased shrinkage of the media.

Controlled Water Table Irrigation System Effect on Growing Medium Water Potential

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The CWT irrigation system consists of a capillary mat placed on a level bench so one side extends over the edge of the bench into a trough containing a nutrient solution maintained at a controlled distance below the bench. The nutrient solution is drawn by capillarity up to and over the bench surface. As plants use the nutrient solution or as water evaporates from the media, it is replaced from the trough. The automatic system maintains a constant air/water ratio in the growing media. Geraniums were grown in a peat based media in 15-cm pots at 0, 2, and 4 cm CWT. In a separate study, the water potential was determined in two media. Water potential was determined at the bottom, middle, and top of the container at 0, 2 and 4 cm CWT every 2.5 hrs during the light period. Geraniums at 0 and 2 cm had the greatest leaf area and dry weight. The 0- and 2-cm treatments were >25% greater than plants at 4 cm CWT. The roots of plants at 0 cm CWT were concentrated at 2–4 cm above the bottom of the container, whereas roots at 2 cm CWT uniformily extended from the center to the bottom. Water potential was about the same in each media within each CWT treatment. The water potential from top to bottom decreased slightly about midafternoon on a sunny day when water demand was the greatest. Media at 0 CWT at the container bottom had 0 water potential; whereas the water potential at 2 and 4 CWT had a lower water potential.

Ornamental Cabbage and Kale Cultivar Comparison Study: Growth Characteristics and Response to Daminozide and Uniconazole Sprays

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Twenty-six ornamental cabbage and kale (*Brassica oleracea* var. *acephala* L.) cultivars were transplanted into 20.8-cm (8-inch) pots in Fall 1998 to classify their foliage traits and determine their response to the plant growth regulator (PGR) daminozide. Daminozide foliar sprays were applied at 0, 2500, or 5000 $mg \cdot L^{-1}$ (ppm) 3 weeks after potting. Two cultivars treated with 2500 mg.L-1 and eight cultivars treated with 5000 $mg \cdot L^{-1}$ were significantly smaller in height when compared to the nontreated plants. Using the Range/LSD formula, the vigor of the cultivars was classified by height. Foliage characteristics were described and cultivars of ornamental cabbage, notched ornamental kale, and curly ornamental kale were selected based on the shortest number of days until a significant center color change and the largest center color diameter. In Fall 1999, recommended cultivars selected in 1998 were treated with daminozide at 5000 $mg \cdot L^{-1}$ or uniconazole at 5 $mg \cdot L^{-1}$ 14 days after potting, plus a nontreated control. All cultivars responded similarly to the PGRs with greater control being observed with daminozide with a smaller plant height of 13% as compared to 6% for uniconazole. For effective height control, PGR applications to ornamental cabbage and kale should be applied 2 weeks after potting.

Louisiana Select—Plant Promotion, Marketing, and Recommendation Efforts for the Nursery and Landscape Industry

Allen D. Owings, LSU Agricultural Center, P.O. Box 25100, Baton Rouge, LA 70894-5100.

The LSU Agricultural Center and Louisiana Nursery and Landscape Association initiated an ornamental plant promtion, marketing, and recommendation program in 1996. Called 'Louisiana Select', this program is intended to actively promote outstanding ornamental plants to Louisiana's gardening consumers. In addition, it provides county agents and industry professionals information on plants that should be recommended. The selection committee consists of an extension horticulturist, two county agents, a landscape contractor, a wholesale greenhouse grower, a wholesale woody ornamental producer, and two representatives from retail garden centers. Plants are usually promoted in the spring and fall of each year. Plants previously named as Louisiana Select recipients include 'New Orleans Red' (Red Ruffle) coleus, mayhaw, 'Henry's Garnet' virginia sweetspire, 'Homestead Purple' perennial verbena, 'Telstar' dianthus, bald cypress, 'New Gold' lantana, 'Confetti' lantana, 'Trailing Purple' lantana, 'Dallas Red' lantana, 'Silver Mound' lantana, 'Lady in Red' salvia, 'New Wonder' scaevola, 'Goldsturm' rudbeckia, and 'Foxy' foxglove. A theme ("Fall is for Planting Native Trees") has also been promoted. Point of purchase signs promoting the Louisiana Select program and individual plants are made available to garden centers. Significant sales increases ranging from 300% to 2500% have been reported for seelcted plants with annual bedding plants and perennial flowers enjoying the greater sales volume increases.

A Clonal Testing Program for Loblolly Pine Plantation Forests

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Forest products companies would like to grow clonal plantations of superior loblolly pine (*Pinus taeda* L.) to improve fiber yields. Feasibility depends on developing efficient propagation techniques and finding superior clones. Horticultural stem-cutting propagation methods and micropropagation techniques are being coupled to test, preserve, multiply, and ultimately deploy clones. Outstanding clones are being found through a series of field tests; each beginning with a superior full-sibling cross from a 40-year-old breeding program. Clones are first screened for rooting ability, and the top 25% to 35% of clones are then established on four sites. Since maintenance of juvenile phase tissue is critical to perpetuating high rooting rates and fast subsequent growth, each clone is preserved as a set of serially propagated hedges and as cold-stored microshoots. As field tests age, better-performing clones are multiplied gradually. Large-production stock blocks of juvenile hedges consequently may be established from both rooted cuttings and microshoots as soon as field tests end. Clones producing large numbers of long branches have been noted for their potential value as fast-growing ornamentals. Since such characters are opposite those desirable for forestry, these clones would need to be preserved, multiplied, and marketed separately from clones for plantation forests.

Plant Development Services, Inc., Collaborates with Plant Originators in the Evaluation and Introduction of New Ornamental Plants

Jim Berry and Aimee Coker,* Plant Development Services, Inc., 17325 County Road 68, Loxley, AL 36551

Plant Development Services, Inc. (PDSI), was organized in 1996 for the purpose of research, development and the marketing of new innovative landscape plants. PDSI focuses on discovery, evaluation and production of new clones that are superior in horticultural qualities to current ones in our industry. Some superior horticultural traits that PDSI looks for are disease and insect resistance, heat and cold tolerance, superior foliage, form, or flower, ease of propagation and cultivation, and marketability. All new ornamental plant introductions orginate from small producers, private breeders, or from our own research. PDSI offers new plant discoveries a place and method of evaluation, legal protection services, production and marketing. Our method of evaluation includes propagation and cultivation and can take varying lengths of time to complete. On an average, it can take 3 to 5 years of evaluation before final selections are made. Once we have a high confidence level on a particular variety we enter them into university trials. We also offer public gardens these new plants for public exposure and evaluation. This has given us valuable feedback on the performance of these new cultivars in different areas of the country. This exposure has also turned into promotion. As people notice these new plants established and performing well in landscapes, they become confident to try the plants on their own, often talking about them and sometimes writing about them. If a plant is patented, the patent belongs to the breeder and typically PDSI is the managing partner making decisions on royalties, promotion, production, and licensing. Royalties fund our program and are paid on a per plant basis, not per size.

The Auburn University Shade Tree Evaluation: Its Roots and Fruit

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Auburn Univ.'s shade tree evaluation is an ongoing study comparing a moderately diverse range of species, varieties and cultivars of larger-growing trees. Initiated in 1980, there were 250 tree selections planted in three replications located at the Piedmont Substation near Camp Hill, Ala. Among the published "fruits" of the evaluation have been critical comparisons of 10 *Acer rubrum* selections with respect to growth and fall color characteristics; growth rate and aesthetic characteristics of fourteen *Quercus* selections; growth and fireblight susceptibility of 10 *Pyrus calleryana* selections; and the best performing trees overall in the first 12 years of the study. The shade tree evaluation has served as an important precedent for initiation of six additional landscape tree tests in Alabama. Besides its benefits as a research project, the shade tree evaluation has provided a living laboratory for a wide range of educational audiences including landscape and nursery professionals, county extension agents, urban foresters, Master Gardeners, garden club members, and horticulture students. Knowledge gained from the shade tree evaluation has also been shared through presentations at many meetings and conferences.

East Texas Bedding Plant Pack and Garden Performance Trials: Master Gardeners, A Web-site and Publishable Data

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The East Texas Bedding Plant Pack and Garden Performance Trials are performed as an interaction between the plant material source companies, the plant producer companies, volunteers, and retail consumers. The Overton Trial Site is located near a concentration of bedding plant growers ($80 million annual wholesale value) which is part of the close to $500 million in ornamental plant production in northeast and north central Texas, about half of the state industry value. The spring and fall trials consist of two phases. The greenhouse phase consists of assessing production performance for use by the crop production industry. Crops are usually finished in packs (36 cells per flat), but larger size containers are used as needed according to species. Height control is a major issue and specific issues have been addressed. This is one way that publishable data can be generated by these trials. The garden phase consists of assessing garden performance in a replicated field setting at the Overton site. Garden performance is also assessed for many of the entries at sites at the Dallas Arboretum and Botanical Garden and the Texas A&M Univ. Agricultural Research and Extension Center at Dallas. An integral part of the trials are the volunteers who, as members of the Smith County Master Gardener Association, donate hundreds of hours of labor to the seeding, transplanting, and garden establishment phases of the trials. In addition, a web site has been initiated as the only

practical way to share the data and hundreds of images that are generated each trial season.

SERA-IEG-27: Nursery Crop and Landscape Systems; Plant Evaluation Program

Winston C. Dunwell, University of Kentucky Research and Education Center, P.O. Box 469, Princeton, KY 42445-0469

SERA-IEG-27, Southern Extension and Research Activities–Information Exchange Group–27, is sponsored by the Southern Association of Agricultural Experiment Station Directors. Thirteen states cooperate with Official Representatives from Extension and Research programs. The objective of the group is to identify, evaluate, select, and disseminate information on superior environmentally sustainable landscape plants for nursery crop production and landscape systems in the Southeast. Plants are distributed to those responding to a request for plant evaluation cooperation. Those that agree to cooperate are expected to grow a liner to landscape size, plant it in an landscape setting and evaluate the plant (numerically, a scale of 1–10 for insect damage, disease damage, cold damage, heat stress, growth rate, flower, fruit, fall color, production potential, landscape potential, invasive potential, and insect disease transmission potential, as well as plant height and width and time/duration of bloom). Following evaluation the group is to collectively and individually disseminate information gained from the plant evaluation system to a wide variety of audiences.

The SFA Mast Arboretum Plant Evaluation Program

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The SFA Mast Arboretum began as a landscape plant materials class project on the south side of the Agriculture building in 1985. In 2000, over 20 theme gardens now occupy 18 acres. The garden is computer mapped and an accessioning system is in place. Theme garden developments include daylilies, herbs, a rock garden, a xeriscape, plants for shade, wetland, and bog conditions, a line of vines, an Asian Valley, conifers and hollies, and numerous gardens that trial and display herbaceous perennials. Recent developments include a children's garden and, the biggest project to date, an 8-acre SFA Ruby Mize Azalea garden, with a grand opening in Apr. 2000. Theme gardens are utilized to display collections. Significant assemblages include *Rhododendron* (400 cultivars and selections), *Acer* (168 cultivars), *Camellia* (210 cultivars), *Loropetalum* (18 taxa), *Cephalotaxus* (43 taxa), *Magnolia* (47 taxa), *Abelia* (37 taxa), *Ilex* (73 taxa), and others. Plant performance and observational information is recorded. Second author Grant has numerous plant introductions in the past 5 years, many that are well represented in the nursery industry and recognized by TAMU's Coordinated Educational and Marketing Assistance Program (CEMAP) as "Texas Superstar" promotions (trademarked). SFA Mast Arboretum plants are promoted via distributions, trade articles, and the Arboretum's website: www.sfasu.edu/ag/arboretum.

Herbaceous Plant Trial Results—1999

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In 1999, LSU Agricultural Center landscape trials of herbaceous ornamental plants included zinnias, ornamental sweet potatoes, vinca, and perennial verbenas. Based on growth habit, flowering and disease observations from 1999 and previous years, 'Homestead Purple', 'Tiger Rose', 'Rose King', 'Taylortown Red', and 'Blue Princess' ('Biloxi Blue') are recommended perennial verbena cultivars for Louisiana landscapes. Zinnias evaluated included *Zinnia angustifolia* and *Z. elegans* cultivars. 'Crystal White', 'Profusion Orange', and 'Profusion Cherry' (all *Z. angustifolia* cultivars) were superior landscape performers. Major incidence of bacterial leaf spot was reported on all *Z. elegans* cultivars in 1999. Over the last several years, the Pacifica series of vinca had significantly improved visual quality ratings in landscape trials when compared to the Heat Wave and Cooler series. In 1999, Mediterranean Deep Rose had visual quality ratings similar to Pacifica but had increased incidence of disease problems. Ornamental sweet potato cultivars recommended for landscape use in Louisiana based on trials in 1999 are 'Blackie', 'Black Beauty', 'Margarite', and 'Pink Frost' ('Tricolor'). 'Summer Frost' is not recommended.

Postharvest/Biotechnology

Influence of Storage and Sanitizing Protocols on the Physiology of Fresh-Cut Watermelon

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Fresh-cut watermelon cubes stored at selected temperatures within the range of 1.1 to 14.5 °C had decreasing quality shelf life corresponding with increasing temperature. At lower temperatures there was a random occurrence of chilling injury symptoms in some cubes that was associated with the section of watermelon from which the cubes were cut. Cubes removed from the top side of the intact watermelon fruit were more susceptible to chilling injury than cubes from other sectors of the fruit. Sanitizing cubes with chlorine (40 $\mu L \cdot L^{-1}$) or ozone (0.04 $\mu L \cdot L^{-1}$) solutions caused an initial reduction in microbial count but during storage the effect diminished and became insignificant compared to controls. Overall quality was lower in cubes receiving aqueous sanitizing treatments, possibly due to mechanical injury occurring during centrifugation to remove excess solution. Overall quality of cubes exposed to UV light (≈250 nm for 1–5 min) was better than cubes receiving aqueous sanitizing treatment. The effectiveness of UV treatment in reducing microbial load was dependent on the amount of cube surface exposed to the light. The results emphasize the importance of preventing microbial contamination during processing of fresh-cut watermelon.

Quantification of Quercetin in Onion (*Allium Cepa*) after Domestic Processing

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The flavonol quercetin has been reported as having many health benefits, including a reduction in the risk of developing cardiovascular disease, stroke, and some types of cancer. The overall content of quercetin in onion was examined in four yellow varieties ('Rio Rita', 'RNX 10968', 'Predator', and 'Tamara') and one red variety purchased at a local grocery store. Each bulb was quartered, with one quarter saved as a control and the other three quarters subjected to three cooking treatments that simulated common domestic processing methods of preparing onion. The treatments included sautéing in sunflower oil for 5 minutes at 93 °C, baking for 15 min. at 176 °C, and boiling for 5 minutes in distilled water. Samples were frozen in liquid nitrogen, ground to a fine powder, blended with 80% EtOH, and filtered for quercetin extraction. The filtrate was then analyzed with a spectrophotometer (uv 374 nm). Quercetin concentrations were obtained in mg quercetin/kg fresh weight of tissue by regressing spectrophotometer readings onto a standard curve. Significant differences between varieties were found when examining fresh samples alone with the red variety containing the highest content of quercetin. Results of cooking showed that sautéing produced an overall 27% gain in quercetin concentration (significantly higher than the fresh control), baking produced an overall 4% gain in concentration (insignificant from the fresh control), while boiling produced an overall 18% loss in quercetin concentration (significantly lower than the fresh control).

Measuring Blackberry Firmness Rapidly: A Comparison of Subjective Ratings and Instrumented Compression Measurements

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Firmness of blackberries greatly determines shelf life for fresh market. Firmness in blackberries appears to be due to a combination of skin toughness and internal receptacle to permit large sample size measurements. Subjective rating of fruit require consistent evaluation by raters over harvest dates and years, and is subject to fatigue error. The FirmTech2 firmness tester was developed to provide rapid compression measurements and has been successfully used in determining the firmness of cherries and blueberries. Blackberries from a large number of clones ranging in firmness from rock-hard to squishy were measured with the FirmTech2 using a deformation range of 25 to 100 g. Additionally, blackberries were placed in storage at 2, 5, and 2/20 °C to monitor effects of storage temperature on blackberry firmness. Berries were subjectively rated and then placed on the Firmtech for measurements. A comparison of firmness readings for fruit only in the "1" (firm) category was made. Differences found among fruit readings agreed with observed differences in field subjective ratings. Stored fruit that had become soft and mushy could not be statistically differentiated from firmer fruit in quantitative readings. In conclusion, the Firmtech2 allowed rapid evaluation of breeding lines before storage.

Effect of Explant Resource and Growth Regulators on Somatic Embryogenesis and Plant Regeneration in Sweetpotato

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This study was carried out to optimize conditions for plant regeneration of sweetpotato [*Ipomoea batatas* (L.) Lam] using shoot tips, petioles, and leaves of Selection 75-96-1 as explants in Murashige and Skoog (MS) with several growth regulators at different levels. Callus initiation and callus proliferation media were 9.0 μM 2,4-dichlorophenoxyacetic acid (2,4-*D*) and 9.0 μM 2,4-*D* + 1.1 μM N_6-benzyladenine (6-BA) in protocol I; 8.1 μM α-naphthaleneacetic acid (NAA) + 1.2 μM kinetin (KIN) and 5.4 μM NAA + 4.6 μM KIN in protocol II; 0.9 μM 2,4-*D*, and 0.9 μM 2,4-*D* + 1.2 μM *N*-isopenylamino purine (2iP) in protocol III; NAA (8.1 μM) + KIN (1.2 μM) and 2,4-*D* (0.9 μM) + 2ip (1.2 μM) in protocol IV, respectively. In protocol I and II, shoot tip, petiole, and leaf were used, but only petiole and leaf in protocol III and IV. In the protocol I and II, somatic embryos were obtained only from shoot tip explants; in protocol III and IV, only from petioles. The frequencies of somatic embryo development were 33.3% in protocol I, 42.1% in protocol II, 21.2% in protocol III, and 10.3% in protocol IV, respectively. The leaf explants failed to produce somatic embryos in all the experiments. In protocol I, somatic embryogenesis occurred through the well-known sequence of globular-, heart-shaped-, torpedo-, and cotyledon-type embryos. However, in protocol II, the structures resembling plumule and radicle were observed before the emergence of torpedo/cotyledon type embryo clusters. The somatic embryogenesis in protocol III and IV was similar to that in protocol I. Growth regulators influenced somatic embryo development. Further, this study showed that explant resource and growth regulators affected the frequency of plant regeneration in sweetpotato.

Analysis of (*Allium cepa* x *A. fistulosum*) x *A. cepa* Fourth-generation Backcross Populations for *A. fistulosum* Introgression

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(*Allium cepa* x *A. fistulosum*) x *A. cepa* breeding lines have been established to the fourth generation. The aim is to develop an *A. cepa*-like bulbing onion carrying *A. fistulosum* genes. Seven populations were characterized for morphological traits and three isozyme markers. Each bulb from the populations was characterized for maturity, soluble solids content, bulb shape, and bulb color. All the populations produced *A. cepa*-like bulbs. Significant variation was observed within each population for each morphological trait. All the bulbs were screened for the presence of *A. cepa* and *A. fistulosum* alleles of alcohol dehydrogenase (Adh-1), esterase (Est), and phosphoglucoisomerase (Pgi-1). *Allium cepa* Adh-1, Est, and Pgi-1 alleles were observed in all the populations. One population, 951026-8, contained plants heterozygous for *A. cepa* and *A. fistulosum* Pgi-1 alleles. Recovery of these fourth generation Allium backcross plants demonstrates introgression of the *A. fistulosum* genome into an *A. cepa*-like bulbing onion.

Changes in Antioxidant Activity in Developing and Ripening Strawberry Fruit

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Strawberry fruit (*Fragaria ×ananassa* 'Chandler') were evaluated at five different stages of growth and development for changes in the senescence process in fruit tissues. Levels of total antioxidant activity, hydrogen peroxide (H_2O_2), lipid peroxidation product, malondialdehyde, and ethylene production were determined. Total antioxidant activity (TAA) was measured in terms of in situ antioxidants to scavenge the ABTS.superscript +superscript radical cation. With the progression of ripening and senescence, there was a significant decline in TAA that coincided with increased concentration of H_2O_2, lipid peroxidation and increased production of ethylene. Our results illustrate that the senescence process in strawberry fruit is associated with the decline of TAA and the potential initiation and accumulation of reactive oxygen species. These results are additionally discussed in terms of potential processes associated with abiotic and biotic environmental stresses. Moreover, although strawberry fruit are typically classified as nonclimacteric, this study illustrates that the free radical mediated senescence process is similar to that of climacteric fruits.

National Sweetpotato Collaborators

Seed Germination Inhibitors in Cortex Tissue of Sweetpotato

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After removal of the periderm, cortex tissue of the sweetpotato cultivar Regal was collected. Polar extracts of this tissue strongly inhibited germination of proso-millet seed. C_{18} preparative, step-gradient chromatography ($H_2O \rightarrow$ 100% methanol) gave some 50+ fractions, all of which were assayed for inhibitory properties. Analytical HPLC, using diode array detection and signal processing, showed the presence of chlorogenic, p-coumaric and caffeic acid, scopolin and some unknown phenolic acids. Most fractions were inhibitory to some degree; however, the least polar ones (in 90% and 100% methanol), containing unknown compounds, were most inhibitory. Semi-prep HPLC of these fractions produced eight major peaks (λ_{max} at 210–213 nm, λ_2 at 281–284 nm). In our bioassays, the compounds produced 50% inhibition of proso-millet seed germination at ≈60 ppm. It is likely that these compounds contribute significantly to the allelopathic properties of sweetpotato.

Sweetpotato Insect Management in North Carolina

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The 199 sweetpotato growing season was one of extremes: early high temperatures, cool temperatures at planting, drought early and extended, and then hurricane floods. Insect species and population levels were highly variable. Thrips early and armyworms late. Insect control tactics and management strategies were used and include the following. Insect presentations and handouts were made at field days, annual meeting and at several county meetings. A sweetpotato insect field guide was prepared to assist fieldmen with insect scouting. Insect scouting schools were held in several counties to show insects, their damage, and traps to use in detecting their presence and numbers over time. Control studies with insecticide formulations and rates along with timing studies were conducted and prepared for the annual report. Spintor and Admire received registations for worms late and for early season insect control. Aphid vector studies centered on aphid suction traps, yellow sticky traps, and aphid identifications. Foliar and soil insecticides were discussed as to their use and impact. Insecticides of the future were presented and discussed. Cooperative studies and long term plans were discussed.

Evaluation of Selected White-tailed Deer Repellents on Sweetpotato

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With an estimated white-tailed deer population of >25 million in the United States and 1.7 million in Alabama, deer feeding damage has become a serious problem for vegetable growers. Typically, deer feed on foliage during plant growth or dig roots near harvest time. Because there is currently no method available to control deer feeding damage to sweetpotatoes, studies were conducted with both confined and free-ranging white-tailed deer to determine the effectiveness of several commercial deer-repellent products on 'Beauregard' sweetpotato. In 1998, testing was conducted at the Alabama Agricultural Piedmont Substation in Camp Hill, Ala., with free-ranging deer. Treatments included Deer Away (egg-based spray and powder), Tree Guard, Garlic Barrier, Thiram (a commercial fungicide), as well as a nontreated control. Damage was rated on a 0 to 4 scale (0 = no damage; 4 = 100% damage). In 1999, testing was continued with confined deer at the Auburn Univ. Deer Research Facility in Auburn, Ala. Havahart egg-based spray, Hinder, Grant's, XP-20 (Thiram), and Ro-Pel were applied to potted 'Beauregard' plants. Nontreated plants were also included. Pots were placed in 2 one-acre pens, each containing six adult deer. Damage was rated on a 0 to 3 scale (0 = no damage; 3 = plant eaten to pot line or uprooted). Significant ($P < 0.05$) differences were found among products. The most effective products in 1998 were Deer Away powder, Garlic Barrier at 3× the manufacturer's recommended rate, and Deer Away spray. In 1999, Havahart egg spray provided the highest level of protection, followed by XP-20. Although no product provided complete protection to sweetpotato, egg- and Thiram-based products were most effective in 2 years of testing. None of these products are labeled for use on food crops at this time.

Web-based Resource for Accessing Vegetable Variety Trial Information

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Vegetable variety trials are of interest to the entire vegetable industry from breeders, seed companies, growers, consultants, researchers, to Extension personnel. The Auburn Univ. vegetable variety trial results have been made more accessible and user-friendly by becoming available online at http://www.ag.auburn.edu/dept/hf/faculty/esimonne. Users can point and click through a completely searchable database by selecting one of the following categories: 1) explanation of rating system and database, 2) list of vegetable crops, 3) description of variety types of crops, 4) contacting seed companies and web sites, 5) vegetable variety trial team members. For additional information about vegetable variety production, a link to horticulture extension publications has been included. The database gives each vegetable crop tested by Auburn Univ. a rating and allows a search for varieties. For each crop, the five options available to search the database are "rating," "variety name," "variety type," "seed company," and "type." The Web page is primarily intended to be a quick, practical reference guide to growers and horticulture professionals in Alabama. Variety performances presented are based on small-scale research plots and test results may vary by location. It is always recommended to perform an on-farm trial of several varieties before making a large planting of a single variety.

Missing Plants in Sweetpotato

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Three treatments were used to evaluate the effects of missing plants on sweetpotato yield: a single plant missing, two adjacent plants missing and two plants missing separated by a single plant. Individual plant yields of the four plants in the same row in each direction from the missing hill were taken. Yields were also taken from corresponding plants in the rows on each side of the row with the missing plant. A plot therefore consisted of three rows with the center row containing eight or nine plants and one or two missing hills and the other two rows containing nine to 12 plants. A single missing plant tended to increase yield of all grades of the plant in the same row next to the missing hill, but differences were nonsignificant. Two missing plants did not result in individual plant differences, but did increase overall plot yield of jumbo and cull grades. The single plant between two missing hills produced a greater number of small-sized No. 1 roots. No. 1 yield of plants in adjacent rows across from the single plant produced lower No. 1 yields.

Evaluation of Sweetpotato Cultivars to Root-knot Nematodes

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This study was conducted to determine whether the type of pot used for the evaluation affected the resistance response of the sweetpotato plants, and to assess the resistance response to different root-knot nematode species. Five sweetpotato [*Ipomoea batatas* (L.) Lam] cultivars, 'Beauregard', 'Exce'l, 'Jewel', 'Hernandez', and 'Porto Rico', were screened for *M. incognita* (race 3), *Meloidogyne arenaria* (race 2), and *M. javanica*, in both 10-cm-side, square pots and 4-cm-diameter, cone pots. Gall index, necrosis index, and number of nematode eggs per gram of root were used to estimate nematode-resistance reaction. Mean of all indices between the 2 pot types were not significantly different ($\alpha = 0.05$). Gall and necrosis indices were not correlated in any of the cultivars. Resistance response depended on cultivars and nematode species for all variables analyzed. 'Beauregard' was the most susceptible to *Meloidogyne*. 'Hernandez' and 'Excel' were found to be the most resistant cultivars to the *Meloidogyne* species.

Subsoiling and Its Effects on Root Yield and Quality of 'Beauregard'

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Five studies were conducted from 1997 to 1999 to determine the effects of subsoiling on root quality (i.e., root length and shape) and on yield of 'Beauregard' sweetpotato. The statistical design for all five studies was a completely randomized block design with six replications (four in Goldsboro in 1997). All studies were conducted on Norfolk fine sandy loam soils. Two studies were done in 1997, one in Kinston and the other in Goldsboro, N.C.; two studies in 1998, one in Kinston and the other in Goldsboro; and one in 1999 in Kinston, N.C. Common treatments in the studies consisted of no subsoiling, V shank

subsoil, 30 cm below row (56 cm from peaked ridge) and V shank subsoil, 46 cm below row (71 cm from peaked ridge). Roots were longer, had more creases, and were more misshapen due to ripping (regardless of subsoiling depth) in the 1997 Kinston test. No differences were detected in root quality due to subsoiling in the other four tests. Marketable and total yields were increased in both tests in 1997 with subsoiling; however, a similar yield increase was not obtained with subsoiling in 1998 and 1999. Jumbo yields were increased in Kinston in 1997 and Goldsboro in 1998 with subsoiling; the better response was obtained with 30-cm-depth subsoiling. Jumbo yields in 1999 were the same regardless of treatment. Canner and cull yields were similar in all tests across treatments. Yields may be increased with subsoiling in certain circumstances (i.e, drought or soils with hard pans), and can result in more off-shape roots and longer roots. It appears from these studies that yields may be increased with subsoiling; however, more off-shape roots may be produced, especially under dry conditions or where fields are not routinely subsoiled.

Climatic Effects on Sweetpotato Yield in Southern Ontario

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Sweetpotato (*Ipomea batatas* L) was one crop chosen for development in Ontario in response to demand for alternative crops to tobacco and increasing demand for nontraditional vegetables. A wide range of vegetable crops can be grown in the sandy soils on the north shore of lake Erie. In 1999, there were ≈75 acres of sweetpotatoes grown in Ontario. Lack of an early cultivar to fit a short, warm season was a factor limiting production of sweetpotatoes in southern Ontario. Over an 11–growing season period, cultivars of sweetpotato from several breeding programs in the United States were evaluated for suitability to Ontario climatic conditions. Planting to harvest date season totals for heat units, precipitation, vapor pressure deficit (VPD), potential evapotranspiration, and solar radiation were calculated. Yield was regressed on these climatic variables using multiple linear regression. Of the cultivars evaluated, 'Beauregard' replaced 'Jewel' as the local industry standard after one season's evaluation. Of the numbered lines evaluated, NC9317 appears suitable for commercial trials. Yields varied greatly among years, and the seasonal VPD explained the largest amount of variation in year-to-year yield. Cultivars vary in their response to seasonal VPD. Yield of 'Beauregard' increased with increasing seasonal VPD while NC9317 decreased. Cultivars require ability to yield in a short season and the ability to consistently produce under a range of atmospheric VPDs dictated by interannual climatic variation.

Watermelon Research Group

Quantification of Watermelon Lycopene Content and Correlation with Colorimetric Measurements

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The red flesh of watermelon contains lycopene, a pigment with antioxidant properties that help prevent certain types of cancers. This experiment was done to determine cultivar variation in lycopene content, and the effectiveness of colorimetric measurements for predicting lycopene content. Ten ripe melons per cultivar of hybrid, open-pollinated, and triploid types were selected from field plantings at Lane, Okla. Melons were cut transversely and color measured with a colorimeter at three heart and three locule sites, in a counterclockwise rotation starting at the ground spot. For lycopene content, a 100-g sample of heart tissue was removed, extracted with a hexane-acetone-ethanol mixture, and lycopene concentration measured spectrophotometrically at 503 nm. Lycopene content varied among cultivars, from 33.96 $\mu g \cdot g^{-1}$ in 'Crimson Sweet' to 66.15 $\mu g \cdot g^{-1}$ in 'Crimson Trio'. Chroma and "a" colorimeter values were highly correlated with lycopene content ($P < 0.001$). Linear and quadratic regression of lycopene against colorimeter values yielded an R^2 of 0.55. Results indicate that, like tomatoes, watermelon cultivars vary widely in lycopene content. Colorimeter readings did not adequately predict lycopene values.

Germinating Triploid Watermelon Seeds—The Basics

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The successful germination of triploid watermelon seeds depends largely upon three factors; moisture control, planting depth, and temperature control. The planting medium must be moistened until it is humid, but not wet enough for free water to be squeezed from a handful. This level of humidity must be maintained until germination is complete. The planting depth should be 1.25 to 2.5 cm. This reduces the number of seeds that "push" themselves from the medium and also facilitates correct moisture maintenance. Seeded trays should be placed in a germination room and held 48–72 hours at a temperature of 30 to 32 °C and a relative humidity of 90% to 95% until germination begins. When germination is complete, the plants can be watered normally.