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National Sweetpotato Collaborators Group

AN IN-DEPTH SURVEY OF SWEETPOTATO PACKING AND HANDLING PROCEDURES IN NORTH CAROLINA

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Methods of packing and handling sweetpotatoes are important for mitigating postharvest losses due to decay. The goal of this work is to take a critical look at the packing and handling processes in North Carolina (NC) sweetpotato packinghouses. Similar surveys are being conducted in Louisiana and Mississippi as part of a multi-state project. The survey is inclusive of all packingline operations including sequence of machinery components, length and speed of the packingline, decay control products/strategies used, and impact (bruising) measurements. Packingline impacts are quantified and characterized using a SmartSpud. This instrumented device is placed on the packingline where it is conveyed alongside sweetpotatoes, measuring the impact forces exerted and sending the data via a radio signal to a handheld personal digital assistant (PDA). The information on the PDA is downloaded onto a computer where the results can be displayed in more detail and analyzed. Packinghouse personnel respond well to this visual display and willingly spend one hour being interviewed, discussing the results of the survey, learning about the trouble spots on their lines, and getting advice on how to reduce potential injuries. About 15 out of 30 NC packinghouses have been surveyed (this includes all of the high-volume packinghouses). We typically found the largest impacts (30–70 G) occurring during dumping and at unprotected conveyor changes. Packinglines vary in length from 88 ft to 277 ft with run time varying from 3.5 min to >10 min. Lines all share the same basic components (dump, eliminator, brushbeds, sizer, etc.) with layout and design modified to suit individual needs and space requirements. A variety of decay control methods are in use with about one half of packers surveyed routinely applying the fungicide Botran.

EFFECT OF ALTERNATIVE POSTHARVEST DIP TREATMENTS ON RHIZOPUS SOFT ROT OF SWEETPOTATO

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Most sweetpotato packers use the fungicide Botran (dicloran) to reduce losses caused by Rhizopus soft rot. However, certain markets are no longer accepting Botran-treated sweetpotatoes and packers are searching for suitable alternatives. We evaluated 12 products applied as dip treatments for their ability to control Rhizopus soft rot. Sweetpotato roots ('Hernandez') were wounded and artificially inoculated with a Rhizopus spore suspension (10^6 spores/mL). Roots were dipped for 30 sec. in treatment solutions and stored at about 65 °F. After 10 days, roots were evaluated for incidence of decay. The inoculation method produced 100% decay in nontreated roots. Bio-Save 11LP and Pristine, a biopesticide (strain of *Pseudomonas syringae*) and reduced-risk chemistry respectively, both provided very high levels of decay control. Other products such as Biosave 10LP (a different strain of *P. syringae*), Scholar and Freshgard 25 were marginally effective, while copper ionization, bleach, and Storox were ineffective against Rhizopus soft rot.

USING GIS TO ANALYZE SWEET POTATO WEEVIL TRAP DATA IN LOUISIANA

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The Louisiana Department of Agriculture and Forestry (LDAF) conducts sweetpotato weevil (SPW) (*Cylas formicarius* Fabricius) monitoring as part of the statewide SPW quarantine program. This activity involves a statewide pheromone-based trapping program that monitors sweetpotato beds and production fields. We conducted GIS analysis of SPW trap data, collected over three years, to assess the potential use of publicly available GIS tools in managing and interpreting the data. Trap data was mapped to specific beds and fields in each of three years, generating layers that clearly showed fields and parishes that reported high trap counts. GIS analysis showed potential SPW hotspots in each year, indicating that certain beds or fields are predisposed to SPW infestation than others. This information can be useful in planning SPW management strategies by growers and other stakeholders. The GIS database also provides the foundation for the development of descriptive and predictive models of SPW occurence not only in Louisiana, but in other states where SPW is a potential pest. For example, using presence data for Louisiana and Genetic Algorithm for Rule Set Prediction (GARP), a GIS-based ecological niche modelling tool, we were able to generate predicted distribution using mean minimum temperature for January as the predictor variable. Although additional work is needed to identify other predictor variables and verify the models, the results demonstrate the potential use of GIS-based tools for generating warnings or advisories related to SPW.

A WEB-ACCESSIBLE GEO-REFERENCED DATABASE OF SWEETPOTATO ACCESSIONS FOR TANZANIA AND KENYA

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One of the secondary centers of genetic diversity for the sweetpotato [*Ipomoea batatas* (L.) Lam.] is located in Africa. We have developed a geo-referenced database of sweetpotato accessions for Tanzania and Kenya that is accessible by stakeholders and other users. Public domain base maps and other files were used to generate the underlying GIS components. DIVA-GIS was used to convert existing spreadsheet-based accession and passport data into GIS-compliant files. ALOV Map, a public domain Java application for publishing vector and raster maps, was used to provide the framework for a web-accessible GIS database. This demonstrates that the availability of publicly available software requiring minimal or flexible licensing costs provide a cost-effective alternative to institutions that are considering developing GIS databases as well as enabling web accessibility to such resources. DIVA-GIS was also used to predict potential distribution of sweetpotato germplasm in Sub-Saharan Africa using the built-in ecological niche modelling tool. We describe procedures, software, and other applications that we used to develop a publicly accessible web interface to a GIS database of sweetpotato germplasm collections in Kenya and Tanzania.

CHARACTERIZATION OF RESISTANCE TO ROOT-KNOT NEMATODES IN SWEETPOTATO

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Thirteen sweetpotato (*Ipomoea batatas*) genotypes were characterized for resistance to *Meloidogyne incognita*, *M. javanica*, *M. hapla*, and *M. arenaria* races 1 and 2 in greenhouse tests. The following sweetpotato genotypes representing a range of reactions to *M. incognita* were evaluated: U.S. Plant Introduction (PI) 399163 (highly resistant = HR), Sumor (HR),

Nemagold (HR), Excel (HR), Tinian (HR), Hernandez (resistant = R), Jewel (R), Regal (R), Porto Rico (intermediate = I), Centennial (susceptible = S), Georgia Jet (S), Sulfur (S), and Beauregard (S). *Meloidogyne incognita* was most pathogenic to sweetpotato of the four *Meloidogyne* spp. evaluated in these studies. The U.S. Plant Introduction (PI) 399163 and Sumor were resistant to *M. incognita* in all tests. Only two genotypes, Beauregard and Porto Rico, were susceptible to *M. javanica*. All genotypes evaluated were resistant to *M. hapla*, *M. arenaria* race 1, and *M. arenaria* race 2. Sumor, U.S. PI 399163, and Nemagold appear to provide the highest levels of resistance against the four *Meloidogyne* spp. used in these studies. Since *M. incognita* is the most commonly occurring root-knot nematode species in sweetpotato growing areas of the southern U.S. and is pathogenic to most of the commonly grown sweetpotato cultivars, efforts to develop resistant cultivars that have desirable horticultural characteristics for the U.S. market should be directed toward this root-knot nematode species.

ADULT AND LARVAL BIOASSAYS FOR DETERMINING RESISTANCE OF SWEETPOTATO GENOTYPES TO *Diabrotica* SPP.

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Production of sweetpotatoes is severely limited by several insect pests, and new pest management approaches for this crop are needed. A host plant resistance research program typically depends on reliable bioassay procedures to streamline evaluation of germplasm. Thus, bioassay procedures were developed for both adults and larvae of two cucumber beetle species (*Diabrotica balteata* and *D. undecimpunctata*). For the adult bioassay, a piece of sweetpotato peel (periderm & cortex with stele removed) was embedded periderm-side up in plaster in a Petri dish, and a single adult was placed on it. Plugs were changed as needed and adult longevity was measured. A laboratory bioassay also was developed for *Diabrotica* larvae. Plugs (0.9 cm diameter) of sweetpotato peel or stele were placed periderm-side up into sterile microcentrifuge tubes (1.5 mL) containing 0.5 mL water-agar to prevent desiccation. One second instar *Diabrotica* was added to each micro centrifuge tube, which was held at 25 °C for 12 days. Surviving larvae were weighed. *Diabrotica* larvae grew larger when they were fed stele than when they were fed peels of any sweetpotato genotype. Larval growth was not different among genotypes for any of the stele treatments. However, larval growth on the peel of the resistant genotypes (Regal and W-375) was significantly lower than for the susceptible cultivars Beauregard or SC1149-19. These bioassays were consistent with field results, indicating that these techniques could be useful for evaluating pest resistance in sweetpotato genotypes for *Diabrotica* and other insect species.

NC 98-608: MANAGING THE POTENTIAL NEW SWEETPOTATO (*Ipomea batatas*) CLONE RELEASE

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The goal of this research was to determine the effects of in-row spacing and planting time on yield and root grade of NC 98-608 over time. Two plantings were made in two grower locations (four total). An early planting was made 19 and 25 May and a late planting 19 and 24 June. NC 98-608 was evaluated at the following in-row spacings; 23, 31, 38, and 46 cm. 'Beauregard' spaced at 23 cm in-row and was used as the standard comparison. Roots were harvested and graded into canner, number one, jumbo and cull grades 90, 105, and 120 days after planting for each of the planting dates and locations. Each grade was weighed. An early planting in late May resulted in roots reaching the highest percentage grade of U.S. number one roots as early as 100 days after planting, while the late planting in June resulted in roots never reaching their full number one yield potential in some cases. For an early harvest after planting (90 days after planting) the 38 cm in-row spacing produced the most marketable number one yields compared with the 23, 31, and 46 cm in-row spacings. For a later harvest time after planting (105 days or later), it appeared as though the 31 cm in-row spacing was the most economical spacing to use. Roots from the early plantings (late May) and finer textured soils appeared to have shorter roots than roots harvested from later plantings (after 15 June) or coarser textured soil. Root shape and yield was more uniform with NC 98-608 than with the Beauregard clone. With yields comparable to Beauregard, the NC 98-608 clone provides an excellent opportunity to produce a quality sweetpotato with consistent shape.

Extension Section

MASTER GARDENER UNIVERSITY: A PILOT LEADERSHIP/ADVANCED TRAINING EVENT

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In a time of budgetary constraints, new strategies have to be developed if we are to continue to meet the demand for home horticulture information. This on-campus event was developed as one of those strategies. The goal of this event was to provide a train-the-trainer opportunity that would equip selected Master Gardeners to assume a larger role in the delivery of home horticulture information. Training needs were determined and included advanced training in insect and disease management, leadership, presentation skills, and computer skills. Educational materials were provided and "graduates" were given the charge of going back to their county groups and sharing what they had learned. Other goals of the event were to provide an opportunity to tour campus facilities, meet key university personnel, and provide recognition and motivation. Sixty-eight Master Gardeners attended this two-day pilot event in May. On-site evaluations were very positive with attendees ranking the educational sessions most beneficial of the activities provided. Year end reporting from the counties indicated that Master Gardeners conducted 82% more public programs in 2004, 49% more home visits and handled 18% more homeowner calls. Part of this substantial increase in program delivery can be contributed to the training these volunteers received at this event. Personal communication with county directors and Master Gardeners indicate that these volunteers are assuming more of a leadership role in the management of the county Master Gardener

MANAGING A REGIONAL USDA-FUNDED FOOD SAFETY PROGRAM

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This paper summarizes the management framework of a multi-state, multi-institutional partnership delivering a targeted train-the-trainer program. The program provided Good Agricultural Practices (GAPs) and Good Manufacturing Practices (GMPs)-based training to southeastern U.S. fresh fruit and vegetable (produce) growers and packers. Twelve southern U.S. states cooperated in this project: Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. The 2000–04 work was funded by United States Department of Agriculture – Cooperative State Research, Education, and Extension Service (USDA–CSREES) National Food Safety Initiative grants. This project developed materials, pilot tested them, refined them for use by a regional group of specialized agents, assisted the agents in delivering the new programming and evaluated the results.

DISTANCE EDUCATION FOR GRADUATE AND IN-SERVICE TRAINING FOR AGENTS

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Many potential students, because of distance from the University campus and/or job requirements, cannot take traditional courses on-campus. This group of learners is place-bound—a group of learners who may be employed full-time, most-likely married with job responsibilities and/or other situations demanding most of their attention. These persons are the very definition of nontraditional, and their educational needs demand non-traditional pedagogy. Their maturity and self-directedness eliminate many concerns often voiced about extending support and evaluation inherent in maintaining quality for and among students adopting Distance Education (DE). In North Carolina, the audience is large and demands that the University reach out to them. Cooperative Extension's more than 120 Horticultural Crops Extension Agents (field faculty) and over 300 other field faculty whose interests include horticultural topics constitute students identifiable as likely enrollments for credit taking hours off-campus. Distance Education can overcome these problems in several ways. First, high demand, low-seat-available classes can offer additional enrollment for credit if open to Distance students. Second, courses can be offered asynchronously or with alternative delivery. Finally, courses

offered collaboratively among institutions generate a level of interest and enthusiasm that may not exist for home-grown courses. Such efforts as these are creating a Distance Education program in NCSU's Horticultural Science Department.

HANDS-ON TECHNIQUES TO REINFORCE READING PESTICIDE LABELS THOROUGHLY

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Many people, including growers and gardeners, fail to carefully read pesticide labels before each use because they assume they know what the label contains. The UF Miami-Dade County Extension pesticide trainer developed several hands-on exercises where participants had to find information on labels chosen for specific features. The first group was people taking the Core/General Standards training. Five pesticide labels were used. Participants were asked to find information from three different categories: 1) basic information used for record keeping and about the product;2) Personal Protective Equipment (PPE) and Precautionary Statements; and 3) additional product information such as irrigation and tank mix warnings. A second group, Private Applicators (growers and their employees), studied 6 labels (1 overlap with Core training). They were asked information that focused on Worker Protection Standard issues, resistance management, limits on number total amount applied, and pre-harvest intervals. For both types of licensed applicator training, participants were divided into groups of 5 to 6. On several occasions, growers and other licensed applicators said they thought labels should have greater uniformity regarding location of key information. Master Gardeners (MGs), the third group, were first given three general publications on labels and 1 on protecting the applicator. They then received labels of four homeowner products and were guided through finding information such as: labeled crops/sites, pests controlled, signal words, mixing instructions, preharvest intervals and replant information. MG knowledge was evaluated with a five-question quiz. All participants commented that they learned a lot about reading labels.

HORTICULTURE IN A CAN

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Science is a challenging subject to teach at the middle school level. The state of Louisiana requires public school teachers to plan their curriculum around Grade-Level Expectations or state mandated educational benchmarks. A program titled Horticulture in a Can has been designed to teach horticulture lessons to middle school students while targeting the state regulated grade-level expectations. All lessons use a hands-on approach as it has been proven more effective than traditional classroom teaching. Horticulture in a Can was developed by a cooperative effort between the Louisiana Sea Grant College Program and the LSU AgCenter's Department of Horticulture within the Coastal Roots Nursery Program. Eight lesson plans have been created to meet twenty-six Grade-Level Expectations for 463 students in 4 schools. Pre- and PostHorticulture tests were given to each class in addition to pre- and postChildren's Attitude Towards the Environment Scale (CATES). All tests were given to both treatment and control classes within each school. The evaluations tested both short and long-term memory on material contained in the lesson plans. The data was analyzed by school, treatment, sex, and grade-level.

THE SOUTHEASTERN VEGETABLE CROPS GUIDELINES AND SEVEW MEETING

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Initiated by DC Sanders, the Southeastern Vegetable Crops Guidelines (SVCG) represents a major regional collaborative effort of Extension Specialists from Alabama, Louisiana, Georgia, Mississippi, North Carolina, and South Carolina whose aim is to produce an annually updated, all-in-one, fits on the dashboard of your truck reference for commercial vegetable growers and Extension workers for the Southeastern US. The first edition was developed in 1998 and published in 1999 as a "for pay" publication, but subsequent editions have employed a partnering with a corporate sponsor and publication company resulting in faster turnaround for printing and a no-cost publication. Each August, a team of Extension Vegetable Specialists, Extension Plant Pathologist, Extension Weed Specialists and Extension Entomologist from around the southeastern US meet for the Southeastern Extension Vegetables Workers (SEVEW) meeting. At this 2-day meeting, the participants' primary focus is to review, rewrite, refine, and update the current year's recommendations for the next edition of the SVCG. Although this publication is mainly used by the states listed, researchers and specialists from other states (FL, KY, OK, VA, TN) annually participate in this meeting. The SEVEW meeting has developed into an opportune forum for dialogues and exchanges updating each other as to the present critical issues in our respective states. Several land-grants are in the process of or are counting the SVCG/SEVEW as part of their federally-mandated multistate programming. Additionally, the SEVCG and SEVEW meeting are officially recognized as a Regional Project by CSREES. The 2005 edition can be found at http://www.aces.edu/dept/com_veg/2005_SEVCG.pdf.

GREEN INDUSTRY SPRING TUNE-UP: FOCUSED TRAINING FOR THE RETAIL/LANDSCAPE SECTOR

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Starting in 1999, the University of Arkansas implemented an annual workshop to prepare employees of the landscape and retail sectors for the spring rush. Since the sales and service sectors account for 91% of the annual gross sales for the Arkansas Green Industry it was felt a specialized workshop was justified. The program format consists of three, one-hour sections devoted to the most common disease, insect, and weed problems that these professionals face. The program is presented in the evening so more employees can attend. The format has changed over the years from the typical road-trip, to a compressed video conference format, and finally back to a live performance in the two major population markets in the state. A detailed handout is provided so participants can easily follow the program. These same notes serve as a handy reference when these employees return to their jobs. To further expand the audience, an interactive CD is now available that summarizes the three topic areas. Because the CD program is hyperlinked, viewers can either proceed through the program in a linear fashion or easily search for answers on specific topics of interest. For disease and insect topics, life cycle and host information is provided. Control measures are separated into chemical and biological options. A recent addition to the CD is the inclusion of actual photographs of consumer products to illustrate examples of suitable active ingredient options for the control of specific pests or diseases.

DEVELOPING PESTICIDE CERTIFICATION TRAINING FOR HISPANICS WORKING IN THE GREEN INDUSTRIES

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Hispanic agricultural workers are difficult to reach and educate. Many can't benefit from Extension programs because of the language barrier, education level and social factors. Safety (WPS) and Pesticide Applicator certification are required for workers to find employment and advance. In Florida, the total non-fatal agricultural occupational injuries among Hispanic workers rose 33% between 1999 and 2001, and total fatal injuries rose 18% between 1999 and 2002. Florida laws require that pesticide applicator exams be in English. Many Hispanics have experience and knowledge in pesticide use, but lack of sufficient language skills prevents their becoming certified. The University of Florida is addressing this issue with an extension agent whose main responsibility is to design and deliver programs in Spanish. First, we assessed the needs and started networking within the Hispanic community. Concurrently, training programs were developed in WPS and 7 certification categories in greatest demand. These have been offered in 11 south Florida counties to 4000+ workers. After each class, presentations were modified to incorporate effective content and methods, based on surveys and test scores. Among participants who took an exam, the passing rate has risen from below 50% to above 60%. The following have given good results: use two native speakers (Spanish and English); conduct the class in Spanish, but emphasize written and spoken English words; both trainers must interact with the audience; use props or good illustrations; teach at all levels, but recommend the exam only to those who can read an English label.

Watermelon Research Group

UPDATE ON POWDERY MILDEW RESISTANCE SCREENING IN WATERMELON

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Powdery mildew has been reported on *Citrullus lanatus* in Africa and Europe for the past nine years, and in the United States for the past 6 years. During this time, it has occurred in the main watermelon production areas in the U.S. and has been documented in nine states (South Carolina, Georgia, Florida, Oklahoma, Texas, Maryland, New York, Arizona, and California). This is of great concern to the watermelon industry since powdery mildew is difficult to control and can have a severe impact on yield and fruit quality due to loss of photosynthetic area and sunscald. Finding resistant *C. lanatus* germplasm is needed for the development of commercial varieties containing this resistance. This report summarized the status of an ongoing project to screen the entire USDA–ARS *C. lanatus* germplasm collection. Currently, the collection is being screened for race 1 and race 2 *Podosphaera xanthii* (syn. *Sphaerotheca fuliginea auct*. p.p.), the causal agent of powdery mildew in *C. lanatus* in the United States. Resistance genes appear to exist for both races and the genes conferring resistance to race 1 appear to be different than race 2 resistance genes. Allelism tests are currently in process to determine the number of resistance genes present.

COMPARISON OF COMMERCIAL POLLINIZERS FOR TRIPLOID WATERMELON PRODUCTION, 2003

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Market demand for diploid fruit has been declining over the past ten years, especially the past three years. Thus, the watermelon industry is looking for ways to produce triploid fruit more efficiently. Several companies have developed pollinizers for planting in-row so as not to take up space like a commercial diploid cultivar. The objective of our experiment was to determine the effects of 'Companion' and 'SP-1' pollinizers on triploid yield compared with a traditional diploid pollinizer which until recently were routinely sold to grocery chain stores. The experimental locations were Bradenton, Florida and Kinston, NC. Treatments included two triploid cultivars; Tri-X-313 (Syngenta, Rogers Brand Seeds) and Olympia (Seminis Seed Co.), and three pollinizers; 'Companion' (Seminis Seed Co.), 'SP-1' (Syngenta, Rogers Brand Seeds), and 'Summer Flavor 800' (Abbott & Cobb Seed Co.). A seventh treatment included 'Tri × 313' in which no pollinizer was planted next to the triploid cultivar. 'Companion' was interplanted every two triploid plants. 'SP-1' was interplanted every three triploid plants, and 'Summer Flavor 800' planted every third hill. All fruit were harvested when ripe and each watermelon was weighed. Results in the Florida location were compromised due to the close proximity of pollen from adjacent watermelon cultivar trials. In North Carolina, some pollen movement did occur between treatment plots as evidenced by fruit set in the 'Tri-X-313' plots which did not contain a pollinizer. Yields; however, were 25% to 33% of those treatments which contained a pollinizer. 'Tri × 313' yielded greater fruit numbers but individual fruit weights were less than those harvested from 'Olympia'. Early fruit yield was similar regardless of pollinizer, while late yields were greater using 'SP-1' rather than 'Companion' or 'Summer Flavor 800'. Cumulative yields (three total harvests) were highest with 'SP-1' than the other pollinizers. The use of 'SP-1' provided the greatest potential for improved yields over traditional diploid pollinizers.

EFFECTS OF WATERMELON GRAFTING ON FRUIT YIELD AND QUALITY

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Grafted cucurbits are commonly grown in various Asian and European countries, but only rarely in North America. Disease control in fields where crop rotation cannot be practiced is a common justification for grafting cucurbits. In the present study, grafting is being examined as a methyl bromide alternative, which may allow cucurbits to be grown in fields where heavy disease pressure would make production of nongrafted cultivars impractical. A study with watermelons (*Citrullus lanatus*) grafted onto rootstocks of squash and gourd was conducted at Lane, Oklahoma in 2004. Treatments consisted of watermelon cultivars SF 800, SS 5244, SS 7167, SS 7177, and SS 7187 from Abbot & Cobb Seed Co., grown on their own roots, or grafted onto rootstocks of RS1330, RS1332, RS1420, or RS 1421. Controls consisted of nongrafted cultivars Sangria, Royal Sweet, Jubilee, and Jamboree. Two fields were planted, with three replications per field. Plants were grown on 1 m centers, with rows 3 m apart. Yields of grafted plants were generally equal to or greater than the nongrafted plants. Sugar content, measured as soluble solids, was affected minimally, if any, by grafting. Lycopene content of fruit from grafted plants was equal to, or marginally better than, fruit from nongrafted plants. Fruit firmness, as measured by a penetrometer, was significantly greater in the grafted fruit than in the nongrafted fruit. The firmest fruit occurred with SS 7167 scions, grafted onto RS 1420 rootstock, which had a value of about 2.0×10^5 Pascals. The nongrafted plants had values of about 1.0×10^5 Pascals, or less. Matching of scions with appropriate rootstocks was important, as interactions did occur. Certain combinations were significantly superior to other combinations. We estimate that the cost to purchase a grafted seedling plant from a seedling supplier would be $0.75 to $1.00, which would include the cost of the seed and the grafting operation. This cost would compare favorably with the cost of applying methyl bromide to the soil and then planting nongrafted seeds or transplants. Higher plant survival due to disease resistance along with planting fewer plants per hectare is anticipated with grafted plants. The high values in fruit firmness in grafted fruit should be of particular interest to the fresh-cut industry.

IMPROVING THE QUALITY OF FRESH-CUT WATERMELON THROUGH GRAFTING AND ROOTSTOCK SELECTION

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The shelf life and over-all quality of fresh-cut watermelon from two cultivars grafted onto four rootstocks were compared with fresh-cut fruit from the nongrafted cultivars. Fresh-cut cubic pieces of about 4.5 cm per side were prepared from ripe watermelons grown at the Lane Research Station and were stored at 5 °C in 35-oz PETE containers. Quality attributes of firmness, soluble solids content, lycopene content, and bacterial counts of the pieces were measured after 0, 5, and 10 days of storage. Sugar content of the cut fruit was independent of rootstock and remained constant over the ten days of storage. Lycopene content of the fruit decreased by 5% to 10% during the storage period, regardless of treatment. Bacterial count on the fruit from all treatments remained low and variable during the ten days at 5 °C. Firmness of cut pieces from fruit originating from the grafted plants was dependent upon the rootstock employed, and melons from grafted plants possessed firmer fruit than did those from the nongrafted plants. Overall, the firmness of fruit from all sources decreased 20% to 30% during the ten days of cold storage. However, the firmness of fruit from some of the rootstocks after 10 days of storage was equal to or significantly higher than that of the fruit from nongrafted plants when it was initially cut. Thus, these studies suggest that grafting to a proper rootstock will produce fresh-cut watermelon that is equal in sweetness and lycopene content to its nongrafted counterpart, but it will possess greater crispness throughout its storage on the supermarket shelf.

DEVELOPING GENETIC LINKAGE MAP AND CDNA SUBTRACTION LIBRARY FOR WATERMELON

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Genetic linkage map is being constructed for watermelon based on a testcross population and an F_2 population. The testcross map comprises 262 markers (RAPD, ISSR, AFLP, SSR and ASRP markers) and covers 1,350 cM. The map comprises 11 large linkage groups (50.7–155.2 cM), 5 medium-size linkage groups (37.5–46.2 cM), and 16 small linkage groups (4.2–31.4 cM). Most AFLP markers are clustered on two linkage regions, while all other marker types are randomly dispersed on the genome. Many of the markers in this study are skewed from the classical (Mendelian) segregation ratio of1:1 in the testcross or the 3:1 ratio in the F2 population. Although the skewed segregation, marker order appeared to be consistent in linkage groups of the testcross and F2 population. A cDNA library was constructed using RNA isolated from watermelon flesh 1 week (rapid cell division stage), 2 weeks (cell growth and storage deposition stage, 4 weeks (maturation stage), and 5 weeks (postmaturation stage) post pollination. Over 1,020 cDNA clones were sequenced, and were analyzed using the Basic Local Alignment Search Tool (BLAST). The sequenced cDNA clones were designated as expressed sequenced tag (EST) markers and will be used in mapping analysis of watermelon genome.

GENETIC LINKAGE MAP FOR WATERMELON: SEGREGATION AND DISTRIBUTION OF DNA MARKERS

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Genetic linkage map is being constructed for watermelon based on a testcross population and an F_2 population. About 51.0% and 31.8% of the markers in the testcross and F_2 populations are skewed form the expected segregation ratios. AFLP markers appeared to be clustered on linkage regions, while ISSR and RAPD markers are randomly dispersed on the genome. AFLP markers also have greater genetic distances as compared with ISSR and RAPD markers, resulting in significant increase of map distance. An initial genetic map (based on the testcross population) that contains 27 ISSR and 141 RAPD markers has a total linkage distance of 1,166.2 cM. The addition of 2 ISSR, 8 RAPD and 77 AFLP markers increased the genetic distance of the map to 2,509.9 cM. Similar results with AFLP markers were also shown in mapping experiments with an F_2S_7 recombinant inbred line (RIL) population that was recently constructed for watermelon. Although the skewed segregation, marker order appeared to be consistent in linkage groups of the testcross and the F2 population. Experiments with SSR, and EST markers are being conducted to saturate the linkage map of watermelon genome.

CHARACTERIZATION OF THE GROWTH AND DEVELOPMENT OF COMMERCIALLY AVAILABLE WATERMELON POLLENIZERS

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Pollen from triploid (seedless) watermelon (*Citrullus lanatas*) is nonviable. Diploid (seeded) watermelons are required in seedless watermelon production for pollination and fruit set. In 2004, markets continued to increase for triploid watermelon but decrease for diploid watermelons. Seed companies are commercializing diploid cultivars (pollenizers) specifically designed as a pollen source for triploid watermelon production. The objectives of this research were to characterize the vegetative, floral, and fruit growth and development of these pollenizers. Five cultivars were evaluated: 'Companion', 'Mickylee', 'Mini Pool', 'SP-1', and 'Jenny'. When measuring the longest vine, 'Companion' produced the smallest plants reaching a maximum vine length of 183 cm, 31 days after transplant (DAT). 'Mickylee', 'Mini Pool', 'SP-1', and 'Jenny' had similar vine lengths reaching maximum lengths ranging 294–335 cm, 31 DAT. The compact growth of 'Companion' is consistent with the shorter node length of 3.8 cm, while the other pollenizers had a node length of 9.9–10.9 cm. 'SP-1' produced more male flowers than the other pollenizers beginning 24 DAT and produced 30–40 male flowers per plant per day, 31–55 days after transplant. 'Mickylee', 'Mini Pool', and 'Jenny' produced 9–15 male flowers per plant per day, 24–55 days after transplant. Early production of male flowers by 'Companion' was similar to 'Mickylee', 'Mini Pool' and 'Jenny'; however, flower production became the lowest compared with all pollenizer cultivars 24 DAT. 'SP-1' produced more female flowers resulting in the most fruit production (4 fruit per plant). In contrast, 'Companion' produced the fewest female flowers and produced 2 fruit per vine. 'Mickylee' had the largest fruit weighing 5.9 kg, and 'SP-1' and 'Jenny' produced the smallest fruit weighing 3.1 kg. The use of specific pollenizers may provide the opportunity to customize production for specific cultivars for either early and or late harvests.

UPDATE ON POWDERY MILDEW RESISTANCE SCREENING IN WATERMELON

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Powdery mildew has been reported on *Citrullus lanatus* in Africa and Europe for the past 9 years, and in the United States for the past 6 years. During this time, it has occurred in the main watermelon production areas in the U.S. and has been documented in nine states (South Carolina, Georgia, Florida, Oklahoma, Texas, Maryland, New York, Arizona, and California). This is of great concern to the watermelon industry since powdery mildew is difficult to control and can have a severe impact on yield and fruit quality due to loss of photosynthetic area and sunscald. Finding resistant *C. lanatus* germplasm is needed for the development of commercial varieties containing this resistance. This report summarized the status of an ongoing project to screen the entire USDA–ARS *C. lanatus* germplasm collection. Currently, the collection is being screened for race 1 and race 2 *Podosphaera xanthii* (syn. *Sphaerotheca fuliginea* auct. p.p.), the causal agent of powdery mildew in *C. lanatus* in the United States. Resistance genes appear to exist for both races and the genes conferring resistance to race 1 appear to be different than race 2 resistance genes. Allelism tests are currently in process to determine the number of resistance genes present.

WATERMELON CULTIVAR EVALUATIONS

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Forty-one watermelon cultivars were compared for yield and fruit size. Fields were prepared with raised beds 1 m wide covered with black plastic and equipped with drip irrigation. Plots were 2.7 m wide × 15.2 m long, with 10 plants being spaced 2.7 m apart in the row, and the remaining 6.1 m of each plot being used as a buffer zone. There were 4 replications of each plot, arranged as a randomized complete block. Seeds were placed in pre-moistened Jiffy-9 pellets in a greenhouse on 16 June 2003. Germinated seedlings were transplanted to the field on June 30. There were 27 triploid cultivars grown, with an average yield of 34.3 $t \cdot ha^{-1}$, and 14 diploid cultivars grown, also with an average of 34.3 $t \cdot ha^{-1}$. The three highest yielding diploids were 'Gold Strike' with 51.7 $t \cdot ha^{-1}$, 'Jamboree' with 44.8 $t \cdot ha^{-1}$, and 'Dulce' with 43.0 $t \cdot ha^{-1}$. The three highest yielding triploids were 'Sweet Slice' with 49.1 $t \cdot ha^{-1}$, 'Sweet Delight' with 46.6 $t \cdot ha^{-1}$, and 'Samba' with 45.0 $t \cdot ha^{-1}$. Small, personal sized melons are gaining popularity in the markets, and several small sized cultivars were included in this study. The cultivars with the smallest fruit, and their average fruit sizes, were 'HA 5133', 2.6 kg; 'HA 6007', 2.7 kg; 'HA 5109', 2.8 kg; 'Minipol', 3.0 kg; 'WD-02-05', 3.4 kg; 'HA 6008', 3.4 kg; 'HSR 2920', 3.5 kg; 'HA 6009], 3.7 kg; 'HA 5116', 3.7 kg; and 'WT-03-05', 4.2 kg.

WATERMELON SEEDLING MORTALITY ASSOCIATED WITH *Pythium aphanidermatum*

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Forty-one cultivars of triploid and diploid watermelons (Citrullus lanatus) were grown at Lane, Oklahoma in 2003. Seeds were placed in Jiffy-9 pellets in a greenhouse on 21 May. Fields were prepared with raised beds 1 m wide covered with black plastic. Plots were 3 m wide by 15 m long, with 4 replications, arranged as a randomized complete block. Seedlings were transplanted to the field on 4 June. From 4–9 June, rainfall occurred 5 days. Maximum soil temperatures at 5 cm, under bare soil, from 1–9 June were 34, 34, 35, 26, 22, 26, 31, 29, and 32 °C, respectively. On 9 June, 84% of the seedlings were dead. Lesions were observed on the roots and stems and isolations were made from symptomatic tissues. The predominant pathogen isolated from the seedlings was *Pythium aphanidermatum*. Some of the cultivars appear to have some degree of resistance to *P. aphanidermatum*. Mortality among the cultivars, averaged across all replications, ranged from 33% to 100%. The cultivars with the lowest mortality were "Tri-X Carousel" (33%), 'Sunny' (40%), 'WT-02-31' (53%), 'Ole' (58%), and 'Tri-X Palomar' (68%). New seeds were seeded in the greenhouse on 16 June, and transplanted to the field on June 30. The replacement seedlings were planted in the same field, in the same location as the previous plants. Maximum soil temperatures for the two week interval following the second planting ranged from 33 to 39 °C, with only one rain of 0.8 cm occurring 10 days after planting. There was no apparent plant loss due to *P. aphidermatum* in the second planting.

J.B. Edmond Undergraduate Student paper Competition

HERBICIDE USE ON GOLF COURSE NATIVE AREAS CONTAINING WEEPING LOVEGRASS

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Weeping lovegrass (*Eragrostis curvula*) is commonly used in native areas bordering golf courses in the Southeastern United States. These areas do not receive significant levels of maintenance, thus weed encroachment is a problem that can negatively impact the functional and aesthetic values of the golf course. The objectives of this study is to determine which selective postemergent herbicides labeled for use on golf courses can remove weeds from Weeping Lovegrass and to determine the level of phytotoxicity. Herbicides included monosodium methane arsenate (MSMA 6.0) applied at 3.0 lb/acre a.i., sulfosulfuron (Certainty) at 0.047 lb/acre a.i., metribuzin (Sencor 75 DF) at 0.5 lb/acre a.i., and imazaquin (Image 70 DG) at a rate of 0.5 lb/acre a.i.. Treatments were applied on July 20, 2004 to 9.6 × 9.6 plots arranged in a randomized complete block design (RCBD) using Teejet 8005 nozzles at 40 psi calibrated to deliver 40 ga/acre. Plots were monitored daily and data was collected 0, 7, 14, 21, 28, 35, and 42 DAT. Sulfosulfuron and MSMA provided the highest level of weed control 35 DAT. Metribuzin and imazaquin provided limited weed suppression compared to the control. Initial phytotoxic damage to the Lovegrass was observed in all herbicide treatments. The highest level of phytotoxic damage was observed in the MSMA and Metribuzin treatments; however there was no apparent damage at 42 DAT. Herbicide applications of sulfosulfuron and MSMA are effective in reducing weed populations with acceptable levels of phytotoxicity to the Lovegrass.

DESIGNING A CHILDREN'S WATER GARDEN IN THE SOUTH CAROLINA BOTANICAL GARDEN AS AN OUTDOOR LEARNING LAB FOR ENVIRONMENTAL EDUCATION

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During the fall semester of 2003, a Clemson University introductory landscape design class collaborated with South Carolina Botanical Gardens staff and coordinators of Sprouting Wings, an after school gardening program for at risk children, to design an exploratory Children's Garden within the Botanical Gardens. Project methodology included site selection, research, site analysis, conceptual diagrams, preliminary designs, and full color renderings of final designs. Students periodically presented their progress on the project to the clients in order to receive feedback and advice. One of the thirteen themed gardens designed is the Wonders of Water Garden. Project goals were to create a center for environmental education addressing current issues in water quality such as pollution from industries and runoff, erosion, stream degradation, and sedimentation resulting from land clearing and development. Visitors will be able to observe and learn about various environmental factors affecting native plant and animal life. The garden will help to teach environmental stewardship and understanding of general aquatic ecology. An observation deck, serpentine bridge through a bog garden, and a bridge crossing a waterfall stream will allow close observation of native aquatic plant and animal life. The Wonders of Water Garden design includes the bog garden and carnivorous garden that border two pools connected by a stream of small waterfalls which may be used to create awareness of current water quality issues and serve as a model to teach visitors the importance of water and aquatic plants in the environment.

IDENTIFYING AMOUNTS AND TYPES OF ANTHOCYANINS IN CULTIVARS AND BREEDING LINES OF COWPEAS

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Anthocyanins are naturally occurring plant pigments that are classified as flavonoids. Anthocyanins have important antioxidant properties which may help in prevention of cancer, arthritis, and cardiovascular disease. Finding common sources and possibly increasing levels of anthocyanins in food could be important to human health. This research project determined amount and type of anthocyanins in 16 cultivars and breeding lines of cowpeas (*Vigna unguiculata*). The information obtained from this research project will be used to improve anthocyanin content of cowpeas by breeding. Of the 16 cultivars and breeding lines, only a black cowpea breeding line, 95-356, contained measurable levels of 3 types of anthocyanins: delphinidin, peonidin, and an unknown anthocyanin. Total anthocyanin content was 0.00242 $mg \cdot g^{-1}$, which is equal to 0.21 mg per ½-cup serving. In another study with 95-356 Rabi A. Musah, found a total anthocyanin content of 121.26 mg per serving and also found three other types of anthocyanins. The difference in the studies could be explained by the storage time of two weeks after the anthocyanins were extracted, but before they were eluded in this study. Additional studies are needed to determine if cowpeas can provide anthocyanin levels comparable to other fruits and vegetables.

Warren S. Barnham PhD Graduate Student paper Competition

JAPANESE BEETLE (*Popilla japonica* NEWMAN) FEEDING PREFERENCE ON BIRCH TAXA (*BETULA*)

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Japanese beetle (*Popilla japonica* Newman) has caused severe damage on a wide range of horticultural crops since its first introduction to the Eastern United States from Japan in 1916. Leaves are skeletonized by adult beetles feeding in masses, which makes this insect damage easy to identify. In Arkansas, Japanese beetle was first trapped in Washington County in 1997 and has reached epidemic proportions in the most recent three years. Leaf skelotonization and feeding preference on eighteen birch accessions by Japanese beetle were recorded in 2003 and 2004. There was a wide range from no feeding (0% leaf skelotonization) to high feeding preference (89% leaf skelotonization). *Betula utilis var. jacquemontii* and *B. papyrifera* 'Renaissance Upright' had highest preference. *Betula pendula* 'Laciniata' had no feeding damage from Japanese beetle.

IDENTIFICATION OF COMPOUNDS CONTRIBUTING TO ANTIOXIDANT ACTIVITY IN SPECIALTY POTATOES (*Solanum tuberosum* L.)

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Antioxidants have been widely reported to play an important role in disease prevention. In addition to preventing cancer, stroke, heart diseases, and inflammation, they are also involved in immune surveillance. Since the per capita consumption of potatoes in the U.S. is about 137 lb, even moderate levels of antioxidants in this most important vegetable crop probably have an

important human health benefit. About 75% to 80% of antioxidant activity in specialty potatoes is due to phenolics and carotenoids. The objectives of this investigation were to evaluate antioxidant activity and total phenolic and carotenoid content of specialty potato selections from the Texas Potato Variety Development Program, and to identify candidate compounds for cancer cell culture investigations. Potato tubers were also used to identify and quantify individual phenolics and carotenoids. Some 320 specialty selections were screened for antioxidant activity (AA), total phenolic content (TP) and carotenoid content (CC) using DPPH (2,2-Diphenyl-1-picrylhydrazyl), FCR (Folin-Ciocalteu Reagent) and colorimetric assays, respectively. After the initial screening, the top 10% were used for analysis of individual phenolics and carotenoids using HPLC. Wide variability for antioxidant activity, phenolic content, and carotenoid content was found among specialty potato selections, providing evidence for genetic control of theses traits. The specialty selection CO112F2-2P/P (purple flesh, purple skin) had the highest AA (832 µg trolox equivalents/g fw), TP (1553 µg chlorogenic acid equivalents/g fw) and CC (590 µg lutein equivalents/100 g fw). Chlorogenic acid (55% to 60%), caffeic acid (≈5%), gallic acid (18% to 20%), and catechin (18% to 20%) were found to be the most prevalent phenolic acids, and lutein and zeaxanthin were the most prominent carotenoids contributing to antioxidant activity. Gallic acid was identified as the candidate compound for use in cancer cell culture investigations.

INHERITANCE OF VARIEGATED AND PURPLE FOLIAGE PHENOTYPES IN *Hypericum androsaemum* L.

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Inheritance of two mutant foliage types (purple and mottled variegated) was investigated for diploid, triploid, and tetraploid tutsan (*Hypericum androsaemum*). Segregation ratios were determined for diploid crosses in reciprocal dihybrid F_1 and F_2, BC_{1P1}, and BC_{1P2} families. F_2 tetraploids were derived from autotetraploid F_1s. Triploid segregation ratios were determined from crosses between autotetraploid F_1s and diploid F_1s. Diploid di-hybrid crosses fit the expected 9:3:3:1 ratio for a single, simple recessive gene for both traits, with no evidence of linkage between each trait. Data from backcross and triploid crosses generally supported this model. In tetraploid crosses we observed twice as many variegated phenotypes as predicted which was not explained by random chromosome or chromatid assortment. Inheritance of purple foliage did not deviate from random chromosome assortment at the tetraploid level.

MOLECULAR MARKER-DERIVED GENETIC SIMILARITY ANALYSIS OF A SEGREGATING BLACKBERRY POPULATION

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A tetraploid blackberry population that segregates for two important morphological traits, thornlessness and primocane fruiting, was tested with molecular marker analysis. Both randomly amplified polymorphic DNA (RAPD) and simple sequence repeat (SSR) markers were used to screen a population of 98 genotypes within the population plus the two parents, 'Arapaho' and 'Prime-Jim' (APF-12). RAPD analysis averaged 3.4 markers per primer, whereas SSR analysis yielded 3.0 markers per primer pair. Similarity coefficient derived from the Dice index averaged over all individuals was 63% for RAPD markers, 73% for SSR markers, and 66% for RAPD and SSR markers together. The average similarity coefficients ranged from a high of 72% to a low of 38% for RAPD markers, 80% to 57% for SSR markers, and 73% to 55% for both. Comparison of the parents indicated a similarity of 67% for RAPD markers, 62% for SSR markers, and 67% for both. This is similar to a previous study that reported the similarity coefficient at 66%. Although inbreeding exists within the population, the level of heterozygosity is high. Also, evidence of tetrasomic inheritance was uncovered within the molecular marker analysis. This population will be used to identify potential markers linked to both morphological traits of interest. Further genetic linkage analysis and mapping is needed to identify any putative markers.

POLLEN DISPERSION IN RABBITEYE BLUEBERRY

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Poor fruit set is one of the most important horticultural problems of the rabbiteye blueberry industry. Rabbiteye blueberries require cross-pollination and several bee species are expected to transfer pollen from one cultivar to another. A novel method was developed to measure bee-mediated pollen dispersion in rabbiteye blueberry. Pollen diameters were used to predict the proportion of cross-pollen in bumble bees' pollen load. Bumble bees visiting blueberry flowers had low proportions of cross-pollen. It is proposed that inadequate levels of cross-pollination play a major role in the failure of rabbiteye blueberries to set adequate commercial crops. The composition of bees' pollen load changed with the phenology of the crop. Data indicate that the greatest likelihood for cross-pollination occurred around the time of maximum bloom overlap of the two studied cultivars.

SHORT DURATION HEAT PRECONDITIONING AND HEAT TOLERANCE IN ORNAMENTAL BEDDING PLANTS

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One of the greatest impediments to production of marketable ornamental herbaceous plants in southern U.S. is high temperature stress. Exposure of plants to sub-lethal temperature (heat preconditioning) before sustained heat stress helps some plants to tolerate subsequent heat stress a phenomenon often referred as acquired thermotolerance. The objective of this research was to examine various morphological, physiological and anatomical responses of 'Vista red' (heat tolerant) and 'Sizzler red'(heat sensitive) cultivars of *Salvia splendens* to heat preconditioning (HC) and subsequent heat stress treatments (challenging temperatures, CT). Cultivars of Salvia were subjected to short duration HC of 35 °C for 3 hours every third day until 5 weeks after germination and subsequent exposure to two CT treatments 30/23 °C and 35/28 °C (D/N) cycles in growth chambers for the next five weeks. Plant growth, marketable quality, stomatal conductance and net photosynthesis declined for Sizzler Red without HC treatment. Compared with nonpreconditioned plants, heat preconditioned Sizzler Red had 38.28% higher root dry weight, 95% greater leaf thickness, 50% higher marketable quality at 35/28 °C heat stress condition. Heat preconditioning helped both Vista Red and Sizzler to survive in both the heat stress treatments. Vista Red had greater heat tolerant traits than Sizzler Red, these traits exacerbated with heat preconditioning treatment. The results demonstrated that heat preconditioning enhanced heat tolerance in cultivars of Salvia, which could be related to maintenance of dense plant growth with shorter internodes, thicker stems, greater stomatal conductance, extensive root growth that compensated the transpirational water loss and overall cooling of plants.

Norman F. Childers MS Graduate Student Paper Competition

A SURVEY OF VIRUSES IN BLACKBERRY NURSERY STOCK

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In 2004, two surveys were conducted to assess the presence of four viruses in marketable blackberry nursery stock. The U.S. survey consisted of dormant nursery stock received from 11 nurseries in the southern, southeastern, midwestern, northeastern, and Pacific northwestern regions of the U.S. The second survey was focused only on Arkansas licensed propagating nurseries with samples collected during the growing season. Samples were tested using reverse transcription–polymerase chain reaction or enzyme-linked immunosorbent assay for the presence of Blackberry yellow vein associated virus (BYVaV), Raspberry bushy dwarf virus (RBDV), Tomato ringspot virus (ToRSV), and Tobacco ringspot virus (TRSV). Of the total samples in the U.S. survey, there were 9% that tested positive for virus infection. Ninety percent of the positives were infected with BYVaV. Forty percent of these were detected in 'Triple Crown', 40% in 'Chickasaw', and 20% in 'Apache'. The remaining 9% of the total positive virus samples were infected with TRSV and 100% of these were in 'Triple Crown'. No viruses were found on any samples of 'Chester Thornless'. In the Arkansas survey, 11% of the total samples tested positive for virus. Of these, 50% were infected with BYVaV.

The percent infected with BYVaV was distributed evenly among 'Apache', 'Chickasaw', and 'Kiowa'. The other 50% of the infected samples were positive for TRSV (67% 'Apache', 33% 'Chickasaw'). There was one mixed infection of BYVaV and TRSV detected in 'Apache'. These findings indicate that BYVaV is the most prevalent virus found in nursery stock and that the occurrence of BYVaV is not restricted to a single region or cultivar.

ANTHRACNOSE SEVERITY ON *Euonymus fortunei* GROWN ON PLASTIC OR GRAVEL WITH OR WITHOUT PERIODIC BLEACH APPLICATIONS

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Euonymus fortunei (Turcz.) Hand.-Mazz. is susceptible to anthracnose caused by *Colletotrichum gloeosporioides* (Penz.) Penz. & Sacc. Fungicides have provided little control of anthracnose on *E. fortunei* in past studies. Identification of cultural practices that reduce disease incidence would be beneficial to the nursery industry. Containerized *E. fortunei* 'Emerald 'N Gold' plants were placed either on gravel beds or black plastic-covered gravel beds. Half of the beds in each bed treatment were sprayed with a 10% bleach solution monthly to attempt to reduce the presence of *C. gloeosporioides* inoculum. Plants were rated monthly from May (initial rating) through October for disease severity. A covariate analysis was performed using initial ratings as the covariate for ratings from all other months. Bleach did not affect disease ratings at any time. Disease ratings of plants on plastic-covered beds were lower than those of plants on gravel beds. Disease ratings decreased linearly as the growing season progressed.

EFFECT OF PLANTING DENSITY ON THE ONTOGENY OF THREE *Allium* SPECIES

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This research evaluated for the NASA ALS program the effect of plant spacing on edible biomass of green salad onions. The ontogeny of Japanese bunching onion, *A. fistulosum*; bulbing onion, *A. cepa*; and chives, *A. schoenoprasum* grown at 10, 15, and 20-mm spacings harvested weekly were compared. Onions were grown hydroponically in Environmental Growth Chambers 16 hours light/8 hours dark, 24/20 °C, 75/99%, ≈650 µmol·m^{-2}. Experimental design was a completely randomized block with repeated measures. Subsamples of plants completely surrounded by neighboring plants were chosen at random from experimental units. Weekly removal of shoots began 28 days after planting (dap); destructive harvest was 70 dap. Length and diameter of longest leaf, weight (g), number of leaves/tillers were recorded weekly. Bulb caliper and weight was taken 70 dap. Bunching and bulbing onion leaves were longest at 28 dap; leaf lengths steadily decreased over time. Chives were slower to germinate and establish but at 70 dap had longest leaves of all species. Leaf diameter of all species increased as spacing increased. At 56 and through 70 dap chives at all three spacings produced more leaves. Mean weight of shoots differed significantly at the 20-mm spacing: chives weighed the least and bulbing onion the most. Bulb weight for bulbing onion and chives increased with increased spacing; bulbing onion weighed significantly more at 15 and 20-mm compared to the other species and spacings. Chives grown at 20-mm had tillering clumps of rhizomes. Total edible biomass weight (bulb, pseudostem, shoots) of bulbing onion grown at 10-mm exhibited similar ontogeny to chives grown at 10 and 15-mm spacings; bulbing onion grown at 20-mm had the most edible biomass.

EFFECTS OF PRUNING TIME ON LIGHT INTERCEPTION AND FRUIT QUALITY IN PECAN TREES.

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Pecan tree pruning is a standard cultural practice in commercial pecan farming operations. Pruning often promotes canopy light infiltration, air movement, and crop load management. Timing of pecan tree pruning is often during winter for labor and time management purposes, yet the most effective pruning time is not known for pecan. 'Pawnee' trees were pruned during March (winter), May, June, July and August in a commercial orchard in Charlie, Texas during the 2003 and 2004 growing seasons. June pruning produced the greatest two year summed annual average yield (2447.7 kernel lb/acre), largest increase of kernel lb/acre (625%) and largest increase percent kernel (113%) between 2003 and 2004. Furthermore, June produced the largest nuts (39.8 nuts/lb) with the lowest yield (337.5 kernel lbs/acre) in 2003, and smallest nuts (59.4 nuts/lb) with the highest yield (2110.2 kernel lb/acre) in 2004. March pruning produced the least variable yield of kernel lb/acre (38% decrease) between 2003 and 2004. July pruning produced the most consistent percent kernel (1.3% increase) between 2003 and 2004. August pruning produced the lowest two year summed annual average yield (879.8 kernel lbs/acre). Percent light transmission and leaf area index data showed no correlation with pruning times and kernel yields. Data collection will continue for another 2 to 3 years to asses the continuous affects of varied pruning times.

EFFECT OF SUBSTRATES ON ROOTING OF STEM CUTTINGS OF THE ENDANGERED SPECIES *Clematis socialis*

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Clematis socialis Kral, also known as the Alabama Leatherflower, is an endangered species with only six known populations in northeast Alabama and northwest Georgia. Cutting propagation of the species would be beneficial for establishing additional self-sustaining populations and providing genetic material for future hybridization. A study conducted in 2000 and 2004 determined the effects of four nonamended substrates on root initiation and growth, as well as survival of *C. socialis* stem cuttings. Of the four substrates tested, including sand, perlite, vermiculite, and 1:1:1 (by volume) peat (P): pine bark (PB): sand (S), cutting survival was highest in sand in both 2000 and 2004. In 2000, sand also produced the longest roots and highest root quality. Vermiculite produced the longest and most roots and highest root quality in the 2004 study. In 2004, cuttings rooted in fine-particled substrates, such as sand and vermiculite, had higher cutting survival, root growth, root number, and root quality than those rooted in perlite and 1:1:1 (by volume) P:PB:S. The 1:1:1 P:PB:S substrate produced the lowest averages for all data collected in both the 2000 and 2004 studies. Sand was among the two highest performing media in both years, regardless of differences in IBA concentration, misting times, and environmental conditions, making it the overall best substrate for rooting

C. socialis stem cuttings. Increasing the concentration of IBA in the rooting solution, providing a cooler environment, and decreasing the number and duration of misting cycles the cuttings received increased cutting survival, root length, root number, and root quality for all four substrates from 2000 to 2004.

QUANTITATIVE DESCRIPTIVE ANALYSIS METHODOLOGY FOR THE DETERMINATION OF THE OPTIMUM MONTH FOR CONSUMPTION OF DAYLILIES (*Hemerocallis* SPP.).

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There are over 30,000 named daylily cultivars in existence today. *Ancient Chinese used the plant for nutritive and medicinal qualities.* The Greek name *Hemerocallis* means beautiful for a day. Daylilies demonstrate potential in food service due to the range of color, fragrance, flavor, and textural varieties. The objective was to quantify by descriptive analysis the attribute descriptors for two edible daylily cultivars, i.e., 'Rosie Meyer' and 'Siloam Powder Pink' and to provide data indicating optimum month for consumption of these two cultivars of daylilies. Blooms were harvested during early morning hours over 5 months (May to September). Six panelists were trained utilizing Quantitative Descriptive Analysis for 6 months on the sensory attributes of 'Rosie Meyer' and 'Siloam Powder Pink' cultivars. Training consisted of determining attribute categories as well as intensity ratings for references. Attribute categories included appearance, odor/scent, handfelt texture, oral texture, basic taste(s), flavor, mouth feeling factors, and chew rate. Results showed attribute categories with descriptors for 'Siloam Powder Pink' as odor/scent, flavor, mouth feeling factors, and oral texture as having a significant difference ($P < 0.05$) for the evaluation months. 'Rosie Meyer' demonstrated significant differences ($P < 0.05$) for the evaluation months in attribute categories for appearance, odor/scent, flavor, oral texture, and mouth feeling factors. The optimum month for consumption of 'Rosie Meyer' was September ($P < 0.05$); 'Siloam Powder Pink' was July ($P < 0.05$). These results provide a descriptive language for daylily (*Hemerocallis* sp.) cultivars 'Rosie Meyer' and 'Siloam Powder Pink'. The optimum month for consumption to obtain the fullest range of desirable attributes will provide the food and horticultural industry with added information by which to market these cultivars.

PHENOLIC CONTENT AND ANTIOXIDANT CAPACITY IN DIFFERENT PECAN CULTIVARS.

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The objective of this study was to evaluate kernels of different pecan (*Carya illinoinensis*) cultivars for their antioxidant capacity and characterize the nature of the antioxidant compounds. Nuts collected from four pecan cultivars 'Cheyenne', 'Cape Fear', 'Desirable', and 'Pawnee' were shelled, chopped and analyzed for their antioxidant capacity (AC), and for their phenolic, tannin, and vitamin C content. AC was measured using one spectrophotometrical [DPPH (2,2-diphenyl-1-picrylhydrazyl)] and one fluorescence method [ORAC (Oxygen Radical Absorbance Capacity)]. Total phenolic and tannin content were determined using spectrophotometrical assays. Finally, ascorbic and dehydroascorbic acid were determined using a high performance liquid chromatograph. Both AC methodologies, DPPH and ORAC, gave similar results with marked differences between cultivars. 'Desirable' had the highest antioxidant capacity (47,747 µg TEq/g DW with DPPH method) followed closely by 'Cheyenne' (36,192 µg TEq/g DW) and, with smaller amounts, by 'Cape Fear' and 'Pawnee' (16,540 and 13,705 µg TEq/g DW, respectively). Total phenolic content showed a similar trend but 'Pawnee' showed a higher phenolic content than 'Cape Fear'. 'Cheyenne' had the highest amount of tannins, 9,114 µg/g DW, followed by 'Cape Fear', 'Pawnee' and 'Desirable' with 7,764, 6,043 and 5,508 µg/g DW respectively),. 'Cheyenne' had also the highest vitamin C content, up to ≈10-fold greater than 'Cape Fear' and 'Pawnee', the highest difference within the antioxidants analyzed. There is the need to determine the phenolic profile and degree of polymerization of tannins, their contribution to the AC and how they are affected by horticultural practices in order to better understand the nutraceutical potential of each cultivar.

THE EFFECTS OF STORAGE AND IONIZING IRRADIATION ON ANTIOXIDANT ACTIVITY, PHENOLICS, AND CAROTENOIDS IN POTATO (*Solanum tuberosum* L.)

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Potatoes are stored to ensure a continuous supply; however, losses due to shrinkage and sprouting can be large. It is believed that ionizing irradiation will become more prominent for sprout inhibition due to the increasingly higher operating costs of low-temperature storage and possible phase-out of chemical sprout inhibitors. The effects of storage and ionizing irradiation (gamma and electron beam) on antioxidant activity (AOA), phenolic content, and carotenoid content were analyzed using the potato cultivar Atlantic. Tubers were subjected to 0, 75, and 200 Gy γ-irradiation doses, stored at 20 °C, and analyzed after 0, 10, 20, 75, and 110 days. Tubers from another harvest were subjected to a surface dose of 0 or 200 Gy e-beam irradiation, stored at 20 °C, and analyzed after 0, 10, 20, 75, and 110 days. AOA was measured via the DPPH method; phenolic content via the Folin-Ciocalteau method and individual phenolics via HPLC; and carotenoid content via absorbance at 445 nm and individual carotenoids via HPLC. During early storage, higher doses resulted in higher AOA, while, during longer storage, lower doses produced greater AOA. Phenolic content increased in storage during the γ-irradiation study, but decreased in the e-beam study, partly due to increases in chlorogenic acid in the former and decreases in caffeic acid in the latter. The e-beam dose of 200 Gy resulted in significantly greater total phenolics than 0 Gy. Total carotenoids and lutein decreased with storage, but were not affected by irradiation. Storage exerted a much greater influence on AOA, phenolic content, and carotenoid content than either irradiation treatment.

National Cowpea Improvement Association

RESPONSE OF COWPEA CULTIVARS TO RHIZOCTONIA SOLANI IN FIELD TESTS.

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Rhizoctonia solani is an important pathogen of cowpea (*Vigna unguiculata*) in the southern U.S. and worldwide. Cowpeas are especially susceptible to seedling diseases caused by *R. solani* when planted in cold, moist, spring soils. Nine cowpea cultivars were evaluated in inoculated field tests at six planting dates in Charleston, S.C., during 2004. The cowpea cultivars evaluated were Bettergro Blackeye, Knuckle Purple Hull, Mississippi Silver, Colossus-80, Charleston Nemagreen, Texas Cream-40, White Acre, Coronet, and Charleston Greenpack. The tests were planted on 20 Apr., 29 Apr., 11 May, 19 May, 27 May, and 8 June. The experimental design for each test was a split-plot with six replicates. Whole plots were cultivars, and sub-plots were inoculation with *R. solani* and an uninoculated control. *Rhizoctonia solani* caused significant seedling losses in all cultivars evaluated during mid-April to early June and seed yields were reduced in the 11 May planting. In general, standard cowpea cultivars (Mississippi Silver, Colossus-80, and Coronet) had higher stand counts and produced heavier seed yields than other cowpea cultivars, although these standard cultivars were not resistant to *R. solani*. Resistant cowpea cultivars are needed to allow earlier planting of the crop in cold soils, which would extend the growing season and allow more efficient use of harvesting equipment and processing facilities.

PROGRESS REPORT: EFFORTS TO DEVELOP PINKEYE-TYPE SOUTHERNPEA CULTIVARS WITH AN ENHANCED PERSISTENT GREEN SEED PHENOTYPE

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The USDA has developed four pinkeye-type southernpea candidate cultivars (Experimental designations: US-1090, US-1092, US-1094, and US-1096) that have a persistent green seed phenotype conditioned by both the green cotyledon gene (*gc*) and the green testa (*gt*) gene. Each of the candidate cultivars produces dry seeds that have a richer and more uniform green color than seeds of either green cotyledon or green testa phenotype cultivars. Seeds of these candidate cultivars are much less susceptible to color loss due to blanching when harvest is delayed than are seeds of green cotyledon phenotype cultivars. Color loss is a critical problem in production systems where pre-harvest chemical desiccants are used to facilitate mechanical harvesting operations. The 7-day delay between application of the desiccant and initiation of harvesting operations can result in serious color degradation. The results of four 6-replicate field trials indicate that the yield potential of each of the four candidate cultivars is equal to that of the green cotyledon pinkeye-type cultivar Charleston Greenpack. Additionally, each of the candidate cultivars is resistant to blackeye cowpea mosaic virus and do not produce hard seeds that are troublesome to frozen food processors. The seed shape, seed size, and seed eye pattern traits of the candidate cultivars are similar to those of Charleston Greenpack.

CANNING AND TASTING EVALUATION OF THE SOUTHERNPEA COOPERATIVE TRIAL IN ARKANSAS

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There are four southernpea breeding programs left in the United States: USDA-South Carolina, Louisiana, Texas and the largest at University of Arkansas. Selected breeding lines from these programs are grown in the Southernpea Cooperative Trial along with industry standards as checks. The yield trial is conducted in Alabama, Arkansas, Louisiana, Oklahoma, South Carolina, and Texas. Each location collects yield data; at the University of Arkansas-Fayetteville samples are also canned at the Department of Food Science Pilot Plant Facility. The process we use for canning southernpeas is similar to that used in the industry. Dry weights are recorded then soaked overnight in water. Imbibed weights are recorded after the peas are drained, blanched, and cooled. A weighed amount of peas are placed in each can; prepared brine (water, salt, and preservatives) is poured to the top of the can. The cans are sealed then cooked in a retort. The cans set a month before the tasting evaluation. For the tasting evaluation we use a minimum of 10 individuals for a consumer panel. Panelists rate pea color, liquor color, wholeness, texture, flavor, and the general appearance on a scale of 1–10, 10 being best. The industry standards are included, these are used as checks. This allows breeders to see how their lines look and taste as a canned product.

GROWING SOUTHERNPEAS WITHOUT INSECTICIDES IN SOUTH-CENTRAL ALABAMA IS THIS AN ABERRATION OR A SUSTAINABLE TREND?

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A considerable amount of cowpea, or southernpea, is grown in Alabama by small, limited resource farmers for home consumption, fresh market or for direct freezing. Most cowpea is retailed in Farmers' Markets, from roadside stands, or as a "you pick" crop and usually sells for $15 to $25 per bushel. Cowpea fodder has also been shown to be a good feed supplement for goats. Many growers plant cowpea several times during the season, in part to satisfy customer demands throughout the summer and fall, but also because cowpea will often grow and produce a relatively good crop even if the rainfall were erratic or inadequate as has been the case in recent years. Many farmers use prophylactic insecticide sprays on cowpea, often in a calendar-driven program because they do not want to lose any value on their crop, especially if the cowpea is grown for canning. In experiments conducted by Tuskegee University in Macon and Bullock counties, we were able to grow fresh market cowpeas without recourse to any insecticide application and with no apparent loss in yield. The situation may be different if the peas were grown for canning. We conclude that unless a program that would use more environmentally friendly IPM interventions is developed in a timely manner, we can expect to see an increase in pest damage and a steady increase in pesticide usage.

MISSISSIPPI HAND-HARVEST, FRESH MARKET SOUTHERNPEA TRIAL–2004

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Twenty southernpea (*Vigna unguiculata*) entries were evaluated for fresh market potential in a hand-harvested trial at Crystal Springs, Miss. Ten entries in the pinkeye or black-eye categories were evaluated in an experiment with four replicates and randomized complete block design. Another ten entries in the cream or crowder category were evaluated in an adjacent observational trial with one plot per entry. In both experiments, rows were 40 inches apart and 20 ft long. Peas were seeded in May 2004. Plots were harvested on three dates in July. Pods were weighed after harvesting ten feet of row in each plot. After resting overnight in bins, the peas were shelled and weighed. Quick Pick matured earlier than other entries in the replicated trial. Lady Pea was very late in the observational trial, to the point it was not harvested. In-shell fresh weight was greatest for CT Pinkeye, Quick Pick, Mississippi Pinkeye, Knucklehull, and Top Pick. Shelled weight was greatest for CT Pinkeye, Quick Pick, and Mississippi Pinkeye in the replicated trial. Yields of the cream and crowder peas tested in a adjacent observational trial were less than those of the pink-eye and black-eyed peas.

Education Section

DEVELOPMENT OF ON-LINE HORTICULTURE DEGREE PROGRAMS

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The Department of Plant and Soil Science at Texas Tech University has developed on-line master's of science nonthesis and master's of agriculture nonthesis degree programs in response to the perceived needs of mature place bound students. Initial enrollments have been successful. The development of these types of programs requires time, funding and technically capable personnel. In addition, there are administrative, curricular and personnel issues involved with the implementation of such a project. These issues and the solutions we have employed will be discussed.

FIVE-YEAR ASSESSMENT OF A MANDATORY INTERNSHIP PROGRAM

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An assessment was conducted for our departmental internship class (HORT 2010) for 1999–2003. With rare exceptions, all students majoring in Horticulture must complete 3 credits of HORT 2010, based on 480 hours of approved work, reports, a seminar, and evaluations. The course is graded pass/fail. An internship requirement was added to the Landscape Contracting major in 2000–01. Enrollment in HORT 2010 was greatest among students in the Turf Management option (TURF) in 3 of 5 years. Over the 5-year period, females averaged 27% of the enrollment in HORT 2010, in part because there was only one female TURF student. The mode for earned hours completed just before the semester of enrollment in HORT 2010 was 97, thus classing the typical intern as a rising Senior. Only 8% of the interns failed to graduate. A total of 126 students interned at 109 different sites, with 70% interning within Oklahoma. Four Oklahoma employers accounted for 23% of all internship employment. Feedback has led to documented program improvements, e.g., 'Bilingual Horticultural Communications' was made available on campus via distance education in Spring, 2001; 'Turfgrass Integrated Pest Management' was created and added to the TURF option sheet for 2001-2002; and 'Personnel and Financial Management for Horticulture' was created and approved in 2005. In a 2000 alumni survey, 100% of responding, employed Horticulture alumni (19 of 19) rated their internship as helpful. The program has worked well and has contributed to student success.

ASSESSING THE NEED FOR ORGANIC PRODUCTION COURSES IN HORTICULTURE CURRICULA

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Higher education curricula should be alert to trends in production and science, and responsive to needs of producers and consumers in our society. A recent trend has emerged nationally and internationally for the production and consumption of certified organic produce which is increasing at a significant rate. Following the creation of the National Organic Program and formal federal regulations for certification which govern production, it has been questioned whether horticulture programs in land grant institutions have adjusted curricula appropriately to train producers, consultants, extension specialists, teachers and research scientists to be engaged in organic production systems. According to USDA statistics, several states in the southern region have significantly fewer certified organic farms and certifying agencies than the northeast, Midwest or western regions. A review horticulture and crops programs at 36 land grant universities (1862 and 1890) in 14 southern region states indicated although several institutions had research and outreach programs for sustainable and organic production, there were only three classes on organic gardening, two classes on organic crops production, and one field-based organic production course that could be identified in existing curricula. It appears that with the growth of the organic industry worldwide that students in programs in the southern region may be under-served in this educational area. Further, it may be questioned whether the lack of production and certifying agencies in the southern region is associated with the lack of science-based education provided by the land grant universities. A recent survey of faculty indicated a perceived need for stand-alone coursework on organic, sustainable, and ecologically-based production systems.

ETHNOBOTANY EDUCATION AND OUTREACH THROUGH EXPERIENTIAL LEARNING

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The term Ethnobotany describes the study of people's relationships to plants as foods, fibers, medicines, dyes, and tools throughout the ages. Using the student active technique of experiential learning, undergraduate students enrolled in landscape design and implementation classes at Clemson University planned and installed an Ethnobotany garden in partnership with the South Carolina Botanical Garden (SCBG) staff, volunteers, and Sprouting Wings children. Sprouting Wings is an after-school gardening and nature exploration program for under-served elementary school students. College students and faculty working on this service-learning project contributed over 1,000 hours to their community while learning more about both the art and the science of landscape design and implementation. Students enrolled in the landscape Implementation class were surveyed to evaluate their perceptions on a variety of possible learning outcomes for this class. Students indicated that their service learning experience with the Ethnobotany project allowed them to acquire and practice new skills, broadened their understanding of the surrounding community, increased their ability to work in real world situations, introduced new career possibilities, gave students a better understanding of their course work, increased their ability to work on a team, increased their knowledge of environmental sustainability, and allowed them to discover or develop leadership capabilities. In a survey question regarding preference for service learning rather than traditional classes, the majority of students prefer the service learning pedagogy. In addition, most students reported a high degree of initiative for this project in their reflections.

INTERNATIONAL OPPORTUNITIES FOR AUBURN HORTICULTURE STUDENTS

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International experiences enhance opportunities for future employment in that many companies, and particularly government agencies desire graduates that comprehend the global economy of our world. Traditional and emerging opportunities with ports of entry, Homeland Security, and international companies are increasing. There are seven primary avenues to an International Experience for Auburn Horticulture students. In recent months, some students have been deployed to military assignments. Through the IPPS we have been able to facilitate student exchange programs. Several graduate students have accompanied faculty on plant expeditions or in agricultural development or research efforts. However, these three types of opportunities are not long-term or sustainable. The E.T. and Vam York Endowment provides monetary support, often equal to air fare, to faculty and graduate students for short duration trips. A similar endowment created by Bill and Margaret Stallworth provides monetary awards for airfare and other incidentals to undergraduates on international internships six months or longer in duration. The Henry P. Orr Fund for Excellence commemorates out-of-the-classroom experiences championed by Orr for almost 40 years at Auburn. The purpose of the Orr Endowment is to provide short-term study tours of gardens of the world for students and faculty. In Summer 2005 we begin our first Horticulture Study Abroad Program operated on a cost recovery basis providing 13 semester hours of academic credit at a cost similar to taking the same course load on campus. Altogether, our current goal is to involve about 10% of our students annually in international opportunities.

A MULTI-INSTITUTIONAL APPROACH TO HIGH SCHOOL EDUCATION IN FLORICULTURE—CONCEPTS

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In Georgia, horticulture is now the number two commodity in the state. The labor needs of the industry is increasing, however, enrollment in horticulture classes at UGA has been dropping. Most entry-level employees joining horticulture firms are completely without training or understanding of the industry, the type of work or the basic skills necessary to be functional. If horticulture was taught, it was by persons with Vo-Ag training in small engines, or animal husbandry etc. Students reported teachers had very little enthusiasm for the subject, no school facilities and that the school principle/administration had no vision for, or understanding of, horticulture. We are addressing this situation through an innovative partnership between Georgia High Schools, The Georgia Department of Education, and the University of Georgia. We can reverse the trend by training new and existing high school teachers by providing them a standardized floriculture curriculum and comprehensive training in greenhouse management, classroom teaching methods, industry awareness and a provide a long-term link to UGA. Our objective is to increase the number of students who are trained, motivated and willing to work in the field of horticulture as entry level workers. To do this we set about to standardize the course curriculum statewide, certify the high-school, faculty and administration for commitment and program continuity, Set up a model training greenhouse system at UGA, and conduct new teacher training at UGA through ALEC, and conduct postcertification training for teachers at UGA during the summer to upgrade skills, enthusiasm. The venture, including a model greenhouse at UGA, has been funded for over $100,000. The program currently has 218 Schools, 64 w/labs and greenhouses, 215 teachers and 25,049 students participating.

A MULTI-INSTITUTIONAL APPROACH TO HIGH SCHOOL EDUCATION IN FLORICULTURE– PROGRAMS AND PROGRAM EVALUATION

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In an effort to expand and improve the agriculture curriculum, the Georgia Department of Education set standards for new greenhouses to be built at high schools. These modern greenhouses are to serve as teaching facilities for new horticulture classes. However, current teachers had little or no background or experience in teaching greenhouse or nursery management courses. In response to the GDE needs, a summer workshop "Managing Crop Production and Equipment in the School Greenhouse" was held at CAES Griffin Campus and at Pike County High School. Faculty from UGA departments presented topics such as water quality, irrigation and crop nutrition, cultural guidelines for major floricultural crops, IPM, pesticide safety, and marketing, business planning and fund raising. Included in the program were numerous hands-on activities designed to cover the essential practical skills needed for a greenhouse employee—proper handling and planting of plugs, watering, calculating fertilizer rates, fertilizer injector maintenance and calibration, soil pH and fertility monitoring, scouting and pest identification, and proper pesticide handling and spraying techniques. Twenty-two teachers from schools with horticulture curriculum attended the training. The workshop evaluations indicated high satisfaction with the material presented. Teachers pointed out that the practical skills had not only been very useful but also the manner in which they were presented would be easily applicable to students. The knowledge acquired will be incorporated into the fall and spring curriculum. Through the effort of the floriculture specialist, a high-quality educational program was delivered to Georgia High School teachers, which in turn translate into attracting student into joining the growing ornamental horticulture industry.

COMPARISON OF BACCALAUREATE STUDENTS WITH DUAL ENROLLED HIGH SCHOOL STUDENTS IN AN ON-LINE INTRODUCTORY COURSE

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In the Fall 2004 semester, an on-line Introductory Horticulture course was offered to both Baccalaureate (BS) and dual enrolled high school (HS) students through Texas Tech University. In this preliminary study, comparisons were made between the progress of BS and HS students. Mean exam scores, lab report grades, worksheet scores, number of hits, and final scores for all populations were normally distributed. A one-way analysis of variance indicated a significant difference between mean exam scores ($F = 6.950$, $p < 0.01$) with HS scoring higher than BS students. Lab report and worksheet scores were significantly higher for BS students ($p < 0.001$). BS students accessed the website more often than HS students ($p < .001$). Final grades for the course were not significantly different ($F = 6.950$, $p = 0.391$) indicating that HS students performed as well as BS students in this online Introductory Horticulture course.

POSTERS

SUCCESSFUL INTERSPECIFIC HYBRIDIZATION BETWEEN *Kalmia angustifolia* VAR. *caroliniana* (SMALL) FERNALD AND *Kalmia latifolia* L.

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The genus *Kalmia* L. is endemic to North America. *Kalmia latifolia* is the best known species in the genus. It is a rounded evergreen shrub to small tree that ranges from northern Florida to New England. Flower color varies from white to pink, but at lower elevations in the southeastern U.S., pink flowers quickly fade to white. It is a diploid species with $2n = 2x = 24$ chromosomes. *Kalmia angustifolia* var. *caroliniana* only occurs in the southeastern US. It is a thin upright evergreen shrub to 1.5 m tall. Flower color is either light pink or rosy purple, and the flower pigments appear to be heat stable. It is also diploid. *Kalmia latifolia* has not crossed readily with any other *Kalmia* species to date, but a small number of hybrids have been produced. The objective of the present study was to intercross *K. angustifolia* var. *caroliniana* with *K. latifolia* to attempt to develop color stable pink flowered *Kalmia* hybrids for warm climates. The crosses were made at Cary, N.C., from late April through mid May and included two clones of each species. Only one parental combination was successful and involved a rosy purple form of the former species. With this cross 15 mature seed capsules resulted from 38 pollinations. Numerous seedlings initially germinated, of which about 15% were albinos. Only 38 seedlings survived to transplanting. Thirty seedlings remain relatively vigorous 8 months after potting and are phenotypically intermediate between the parents. Their potential will depend on their ornamental characteristics once they reach maturity.

THE FIRST FLOWERING EVENT OF CORPSE FLOWER, *Amorphophallus titanum*, IN TEXAS

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Amorphophallus titanum, corpse flower or titan arum, was discovered

in 1878 in Sumatra, Indonesia by the Italian botanist Odoardo Beccari. The plant first bloomed in cultivation at Kew in 1889 and the first flowering event in the U.S. was a sensation in 1937 at the New York Botanical Garden. With fewer than thirty recorded flowering events in the U.S., the foul-smelling flower always excites the public and attracts great media attention. On 12 July 2004, a specimen at the SFA Mast Arboretum flowered successfully and Jack became the first-ever corpse flower to bloom in Texas. The SFA Mast Arboretum accessioned Jack as a small corm in June 2000. The plant has spent winters in a climate-controlled greenhouse and summers in a humid shade house and has annually produced a strong leaf stalk and umbrella like leaf blade before collapsing in December or January. In March 2004, the corm weighed 26 lb before placement in a larger pot. The inflorescence emerged in early June 2004, reached 61 inches 11 July, opened 12 July, and collapsed after 77 hours. Fresh pollen from a University of Connecticut plant was flown in but a pollination effort eight hours after opening failed. Jack's corm weighed 21 lb when moved into the greenhouse in November 2004, and remains dormant. Detailed information and a complete pictorial history are available at http://arboretum.sfasu.edu/events/amt/index.htm.

EVALUATION OF SCARIFICATION PERIOD AND GENOTYPE ON BLACKBERRY SEED GERMINATION

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A study was conducted in the Winter–Spring 2004 to evaluate the effects of seed (pyrene) scarification period on blackberry (*Rubus* L. subgenus *Rubus*) genotypes that had a range of seed weights. The study was done in an attempt to identify optimum scarification period for variable seed weights for the purpose of increasing germination of blackberry seeds produced from hybridizations in the Arkansas blackberry breeding program. Scarification treatments of 1, 2, or 3 hours were used on 14 genotypes. Seeds were then stratified for 3.5 months and sowed on a commercial potting medium in a heated greenhouse. Germinating seedlings were counted over a 15-week period and total germination determined. Data analysis indicated significant genotype effect on germination but no scarification treatment nor genotype × scarification treatment interaction significance. The results indicated that scarification period did not affect germination and varying this period predicated on seed weight was not beneficial based on the genotypes used in the study.

FOLIAR DAMAGE OF BLACKBERRIES AND BLUEBERRIES BY JAPANESE BEETLE (*Popillia japonica*)

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Since 1997, populations of Japanese beetle have settled into some of the major urban areas of Arkansas, especially Little Rock and Northwest Arkansas, due to transported turf and nursery material. Experimental trials at the University of Arkansas Agricultural Research and Extension Center, Fayetteville have sustained significant damage due to the increasing Japanese beetle population. Plantings of blackberries and blueberries were rated for feeding damage. Significant differences were observed among genotypes of both crops. Mean damage ratings varied from 0.6 to 4.0 for the blackberries and 1.2 to 3.5 for the blueberries. As evidenced by the mean damage ratings, some resistance or tolerance is present within these populations and may be exploited for improvement.

PHYTONUTRIENT EVALUATION OF STRAWBERRIES FROM FIELD AND GREENHOUSE PRODUCTION ENVIRONMENTS

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Fresh strawberries (*Fragaria ×ananassa* Duch) are readily available throughout the year with several new cultivars being successfully grown in diverse environmental conditions (e.g., field and greenhouse). Consumption of strawberries with higher nutritive values and antioxidant activity may contribute to improved human wellness. Phytonutrient contents and antioxidant activity was measured as oxygen radical absorbance capacity (ORAC) were assayed in berries ('Camarosa', 'Diamante', and 'Gaviota') sampled in January, February to March, and April to May from fields in Plant City, Fla., and Oxnard, Calif., and from a greenhouse in Kearneysville, WV. Strawberry cultivars varied in skin color, soluble solids, total phenolics, and anthocyanins, ascorbic acid, folic acid, and ORAC activity. Response to environment was cultivar dependent. All phytonutrient constituents were lower in 'Diamante' berries compared to 'Camarosa' and 'Gaviota'. For all cultivars, berry ORAC activity declined as TSS increased, and ORAC activity was coincident with phenolic content. ORAC activity in berries fruit harvested from plants grown in a temperature-controlled greenhouse did not change during the January to May sampling period. For 'Gaviota', ORAC activity in greenhouse-produced berries was the same as that of field-produced berries. Whereas greenhouse vs. field-gown 'Camarosa' and 'Diamante' berries ORAC was higher and lower respectively. These findings demonstrate that the environmental conditions in greenhouses in Kearneysville, W.Va., from winter to spring are adequate for 'Camarosa' and 'Gaviota' color development, but not for 'Diamante' strawberries. Of the three cultivars, only 'Camarosa' was highly productive (1.2 kg berries per plant), even in the greenhouse. Berries were high in ascorbic acid, folic acid, phenolic acid, anthocyanins, and ORAC activity.

GAS EXCHANGE AND GROWTH OF TWO FIELD-GROWN MAPLE TREE SPECIES IN RESPONSE TO THREE REFERENCE EVAPOTRANSPIRATION BASED IRRIGATION REGIMES

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Recent droughts and depleted water tables across many regions have elevated the necessity to irrigate field-grown (FG) nursery trees. At the same time, ordinances restricting nursery irrigation volume (often without regard to plant water requirements) have been implemented. This research investigated gas exchange and growth of two FG maple tree species (*Acer × freemanii* 'Autumn Blaze' and *A. truncatum*) subjected to three reference evapotranspiration (ETo) irrigation regimes (100%, 60%, and 30% of ETo) in a semi-arid climate. During Spring 2002, nine containerized (11.3 L) trees of each species were field planted in a randomized block design. Each year trees were irrigated through a drip irrigation system. During the first growing season, all trees were irrigated at 100% ETo. Irrigation treatments began Spring of 2003. Gas exchange data (pre-dawn leaf water potential and midday stomatal conductance) were collected during the 2003 and 2004 growing seasons and growth data (shoot elongation, caliper increase, and leaf area) were collected at the end of each growing season. For each species, yearly data indicates irrigation regime influenced gas exchange and growth of these FG trees. However, it is interesting to note gas exchange and growth of these FG maple trees were not necessarily associated with trees receiving the high irrigation treatment. In addition, it appears the influence of irrigation volume on the growth of these FG trees is plant structure and species specific. Our data suggests irrigation of FG trees based upon local ETo measurements and soil surface root area may be a means to conserve irrigation water and produce FG trees with adequate growth. However, continued research on the influence of reduced irrigation on FG tree species is needed.

GROWTH OF ANNUAL PLANT SPECIES IN GROUND PROCESSED RICE HULL PRODUCTS

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Pepper (*Capsicum annuum*) and impatiens (*Impatiens walleriana*) plants were grown in substrates composed of 20% perlite and 20%, 40%, 60% or 80% of a coarse, medium or fine grind of fresh rice hulls with the remainder being *Sphagnum* peat. Impatiens grown in substrates containing 40% of a coarse, medium or fine and 80% of a fine grind of rice hulls had similar shoot dry weights as those grown in a substrate containing 80% peat. Only impatiens grown in a root substrate containing 40% of the coarse grind of fresh rice hulls had lower root dry weight than those grown in substrates containing 80% peat. Peppers grown in a substrate containing 60% and 80% of a coarse, 60% of a medium or 60% and 80% of a fine grind of fresh rice hulls had similar shoot dry weights as those grown in a substrate containing 80% peat. There were no significant differences in pepper root dry weights among the substrates. Impatiens and pepper plants grown in a substrate containing 80% of the fine grind of fresh rice hulls were similar to those grown in 80% peat, and therefore, the fine grind of fresh rice hulls served as a suitable substitute for *Sphagnum* peat.

FUNGICIDAL PROPERTIES OF GARLIC EXTRACT IN *Sphagnum* PEAT- AND SAND-BASED SUBSTRATES

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Growth of *Pythium aphanidermatum*, *Pythium ultimum*, *Pythium irregulare*, *Phytophthora nicoctianae*, *Phytophthora cinnomomi*, *Fusarium oxysporum*, *Rhizoctonia solani* and *Thielaviopsis basicoli* was inhibited in vitro when grown in a clarified V-8 nutrient solution containing 10% garlic extract. After exposure to 10% garlic extract for 3 days, all fungi and fungal-like organisms failed to grow after being washed and transferred to fresh cornmeal agar nutrient medium without garlic extract. When *Sphagnum* peat was inoculated with *P. aphanidermatum* and drenched with solutions containing varying concentrations of garlic extract, a single drench of 35% garlic extract or two drenches of 15% garlic extract were required to rid the substrate of viable *P. aphanidermatum*. In sand, a single application of 25% garlic extract or two applications of 10% garlic extract were required to rid the sand of viable *P. aphanidermatum* Thus, *Sphagnum* peat appeared to partially inactivate the components in garlic and did so to a greater extent than sand. Therefore, efficacy of garlic extract as a soil drench fungicide will be affected by the type of substrate or soil to which the garlic extract is applied.

EFFICACY OF BIOLOGICAL AMENDMENTS ON POSTTRANSPLANT ROOT ROT

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Biological substrate amendments including SG-11, Subtilex, SoilGuard, ActinoIron, Companion, RootShield and BioYield were evaluated for their efficacy to control common soil-borne fungal and fungal-like pathogens when incorporated into the substrate at transplanting. The biological agents were incorporated into an 80% *Sphagnum* peat and 20% perlite substrate at the label recommended rates and four-to-six-leaf plugs of the test species were transplanted into the substrates. Substrates were either inoculated or uninoculated with a test pathogen. Pathogen-host combinations included *Pythium ultimum* on geranium (*Pelargonium ×hortorum*), *Phytophthora nicotianae* and *Pythium aphanidermatum* on vinca (*Catharanthus roseus*), and *Theilaviopsis basicoli* on pansy (*Viola ×wittrockiana*). The incidence of disease development, plant mortality and root fresh weights did not differ among the biological agents and the inoculated controls. Therefore, under the conditions of this study, the biological agents did not provide significant disease suppression. Pansy and vinca plants grown in uninoculated substrates amended with Subtilex had significantly higher shoot dry weights than those grown in unamended substrates. Pansy, vinca and tomato plants grown in uninoculated substrates amended with SG-11 had significantly higher shoot dry weights than those grown in unamended substrates.

RESIDUAL WEED CONTROL WITH FALL HERBICIDE APPLICATION IN APPLE AND PEACH

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Flumioxazin (Chateau 51WG) is an herbicide for the preemergence and early postemergence control of broadleaves and grasses. Chateau was recently labeled for use in non-bearing fruit trees and bearing grapes. Long-term weed control in apple, peach, and blueberry was investigated following fall application of herbicides. Treatments consisted of simazine 2.8 kg a.i., norflurazon 2.24 kg a.i., napropamide 2.24 kg a.i., and oryzalin 2.24 kg a.i. were applied on 11 Nov. 2003. Flumioxazin was also applied at 0.1 and 0.43 kg ai on apple and peach. All treatments included glyphosate 1 lb a.i. for burndown control of preexisting weeds. Weed control evaluation in mid-April or 4 months after application showed that flumioxazin-treated plots had no weeds present and no weed regrowth. Plots treated with napropamide, norflurazon, and oryzalin showed significant regrowth of dandelion, common ragweed, and chickweed. Simazine plots had fewer weeds germinating than the other herbicides. By early June or 6 months after application, no differences in residual weed control were observed for all treated plots when compared to the control. All plots were equally weedy and required immediate floor management measures. It appears that flumioxazin weed control benefit was exhausted by 6 months after application, compared to 4 months for all other herbicides. Fall application of flumioxazin can eliminate the need for early spring weed control. This time saved can be spent on other important activities such as pruning and disease and insect control.

ALL-AMERICA DAYLILIES: LANDSCAPE PERFORMANCE AND RUST OBSERVATIONS 2003 AND 2004

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All-American daylily cultivars named from 1994-2004 were evaluated for landscape performance and daylily rust (*Puccinia hemerocallidis*) susceptibility during 2003 and 2004. Cultivars included 'Black-Eyed Stella', 'Bitsy', 'Leebea Orange Crush', 'Plum Perfect', 'Judith', 'Starstruck', 'Frankly Scarlet', 'Lullaby Baby', 'Lady Lucille', and 'Chorus Line'. Bareroot plants were planted in raised beds composed of an Olivier silt loam soil in full sun and received irrigation as needed to prevent stress. Visual quality ratings were made weekly from 19 Apr. to 25 Oct. 2003 and 15 Mar. to 20 Sept. 2004. Included in the visual quality ratings were growth habit and flowering with favorable growth habit being compactness, foliage color, uniformity, and overall aesthetics, and favorable flowering being longevity and visual appeal. Flower observations were made in regard to time in bud and peak blooming periods over the same time frames. Daylily rust ratings were taken in September and November 2003 and in August and November 2004. Flowering observations indicated that Black Eyed Stella and Bitsy were the only cultivars showing reliable repeat bloom potential. Among the other cultivars, Judith was the earliest to bud and bloom but also had a blooming period of only 2 to 3 weeks compared to 4 to 5 weeks of bloom for other cultivars. Rust was most prevalent on Judith, Leebea Orange Crush, Starstruck and Lady Lucille. Judith and Leebea Orange Crush have rust symptoms earlier than other cultivars. 'Plum Perfect', 'Frankly Scarlet', 'Bitsy', 'Black Eyed Stella', and 'Lullaby Baby' were least susceptible to daylily rust.

SORBIC ACID AND GARLIC PRODUCTS

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In Summer 2003, sorbic acid was detected in a processed Louisiana product that had been shipped internationally. This discovery caused the food product to be rejected by the foreign market since sorbic acid was not declared on the label. The source was eventually traced by an analytical lab to a garlic powder component used in the product. Subsequent evaluations by the lab of fresh and dried garlic products obtained from stores indicated sorbic acid. The presence of sorbic acid suggested that it might either be a contaminant or a previously unreported naturally occurring component of garlic. To determine which was more likely, 12 garlic varieties were planted in Baton Rouge, La., during September 2003 and harvested the following spring. In addition to this harvested garlic, fresh garlic, garlic juice and garlic powder were purchased in May 2004 from three local stores. All these samples plus the original product were analyzed for sorbic acid using spectrophotometry and HPLC methods at the LSU Horticulture Dept. None of the samples contained measurable quantities of sorbic acid except for the original product. Since there appears to be no naturally occurring sorbic acid in garlic, it is likely that at least a portion of the fresh and processed garlic distributed in the U.S. during 2003 may have been adulterated with sorbic acid.

FERMENTATION OF JALAPENO PEPPER MASH

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The demand for hot sauce products continues to expand in the U.S. In the case of jalapeno pepper sauce, there are many cultivars available for sauce production but those best suited for processing have not been adequately determined. Six cultivars (four replications) of jalapeno peppers ('Coyame', 'Grande', 'Jalapeno-M', 'Mitla', 'Tula' and 'Veracruz') were evaluated for mash fermentation. The attributes studied during mash aging were color spectra, capsaicin content and fermentable sugars. Fructose and glucose were the predominant sugars in jalapeno peppers and these sugars were utilized gradually with time indicating slow fermentation by microorganisms in the 15% salt mash. Capsaicin and dihydrocapsaicin were the predominant capsaicinoids in the jalapeno peppers with 'Tula' containing the greatest concentration and 'Veracruz' the least. All mashes displayed an apparent and unexpected rise in measurable capsaicinoids up to 6 months with a decline at 12 months. Color changes in the pepper mash were rapid initially but slowed after the first month of fermentation. Percent reflectance in fresh ground peppers was strongest in the range of 550–560 nm but, after salting, reflectance

shifted to 580–590 nm and remained throughout the fermentation. Based on the characteristics tested, any of these cultivars would make a suitable mash for sauce. The heat content of the final product could be controlled by cultivar selection or through blending.

PERFORMANCE OF GARDEN ROSES UNDER MINIMAL INPUT CONDITIONS IN NORTH-CENTRAL TEXAS

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To enlarge the palette of environmentally-responsible landscape plants, 117 garden rose cultivars were evaluated under minimal input conditions. Other than mulching and irrigation, no other inputs were provided, including no fertilization and no pesticide applications. Plants were established in completely randomized blocks with four reps in the spring of 1998 with data collection beginning in 2000 and continued through 2002. Data on overall performance (an index comprised of flower number, percent of plant covered with flowers and plant growth) and relative chlorophyll content were collected the first and third week of each month from April through October. Disease ratings or incidence ratings were collected for *Diplocarpon rosae* Wolf (black spot), *Alternaria* sp. (petal blight) and *Sphaerotheca pannosa* (powdery mildew). Statistical analysis was performed on the mean data for all dates. 'Knockout' was the top rose for overall quality with little or no disease observed, high foliage quality, and continuous flowers from spring until late in the fall. 'Knockout' also ranked among the top rose cultivars in terms of overall nutrient concentrations (N, P, K, and Fe) in new growth tissue. Most of the hybrid tea roses such as 'Peace' and 'Double Delight' died in at least three blocks due to disease and a lack of vigor.

NEW MOLECULAR MARKERS IN *Hydrangea* AND THEIR USEFULLNESS IN EVALUATING DIVERSITY, VERIFYING HYBRIDS, AND UNCOVERING GENES

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Hydrangea popularity and use in the landscape has expanded rapidly in recent years with the addition of remontant varieties. Most cultivars in production belong to the species Hydrangea macrophylla but *H. paniculata*, *H. arborescens*, *H. serrata*, *H. aspera*, *H. heteromalla*, *H. integrifolia*, *H. anomala*, *H. seemanii,* and *H. quercifolia* are also commercially available. In addition to species diversity there is high intra-species variation, particularly in *H. macrophylla,* which includes mopheads, lacecaps, French, Japanese, dwarf, and variegated varieties. Relatively little is known about the genetic background or combinability of these plants. DNA sequence data, genome size, RAPD, AFLP, and ISSR markers have been used for taxonomic identification and to estimate diversity within the genus. All of these methods have limited usefulness in a large scale breeding program. We recently established microsatellite markers for *Hydrangea* and evaluated their utility for estimating species diversity and identifying cultivars within *H. macrophylla* and *H. paniculata*. We also verified an inter-specific cross between *H. macrophylla* and *H. paniculata* using these markers. Future research includes marker assisted breeding, particularly with respect to remontant flowering traits.

ASSESSMENT OF PHENOLIC ACID QUANTITATION METHODOLOGIES FOR SWEETPOTATOES

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Phenolic acids are one of several classes of naturally occurring antioxidant compounds found in sweetpotato. Simplified but reliable methodologies were developed to quantitate total and individual phenolic acids in sweetpotato roots. Total phenolic acid content was measured using both Folin-Denis and Folin-Ciocalteu reagents. The Folin-Ciocalteu reagent gave an overestimation of total phenolic acids due to the absorbance of interfering compounds (i.e., reducing sugars and ascorbic acid). The average total phenolic acid content in 'Beauregard' sweetpotatoes was 60.9 mg/100 g fresh weight. Individual phenolic acids were separated with two reversed-phase C18 columns of different dimensions and particle size. The columns tested were a 7 × 53 mm, 3 µm, Alltima Rocket (Alltech Assoc.) and a 3.9 × 150mm, 4 µm, Nova-Pak (Waters Corp.). Different mobile phases were also evaluated. The Alltima C18 column using a mobile phase of 1% (v/v) formic acid aqueous solution: acetonitrile: 2-propanol, pH 2.5 (70:22:8) provided the best separation of individual phenolic acids. Total analysis time was less than 5 minutes. Chlorogenic acid was the major phenolic acid found in sweetpotato root tissue (15.8 mg/100 g fresh weight). In a comparison of different tissue preparation states (fresh, frozen, freeze-dried), fresh tissue gave the highest concentration of total and individual phenolic acids. Among the 3 extraction solvents tested (80% methanol, 80% ethanol, and 80% acetone), 80% methanol and 80% ethanol gave higher, but similar, phenolic acid extraction efficiency.

VARIABILITY FOR ANTIOXIDANT ACTIVITY IN THE U.S. COWPEA [*Vigna unguiculata* (L) WALP.] CORE COLLECTION

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Antioxidants are important to human health, as they are responsible for reduced risk of diseases such as cancer, hence motivating researchers to examine crop plants for available antioxidant compounds. There is also increasing interest in the use of antioxidants from plants instead of synthetic products. In order to evaluate variability of antioxidant activity (AOA) in cowpea, 697 cowpea accessions from the U.S. Cowpea Core Collection obtained from the Regional Plant Introduction Station, Griffin, Ga., were analyzed for AOA expressed as µg trolox equivalents/gdw. Two grams of dry seed from each accession were ground, extracted in methanol and analyzed for AOA using the free radical, 2,2-Diphenyl-1-picrylhydrazyl (DPPH), method. A large variation in AOA within the core collection, ranging from 1859 $\mu g \cdot g^{-1}$ dw (PI 180355, pigmented seed coat) to 42.6 $\mu g \cdot g^{-1}$ dw (PI 583100, cream seed coat), was observed. A least significant difference of 131.5 (p =0.05) was obtained. Higher AOA was manifested by accessions with pigmented seed coats. Accessions that were speckled, striped or had a pigmented eye were moderate in AOA, while the cream types were generally low. Variability in AOA observed among cowpea accessions suggests that breeding for high AOA can be successfully conducted. Accessions with high AOA could also be used to extract antioxidants for industrial purposes. Some accessions were a mixture of various colors and patterns, making it difficult to classify them into a particular category. Therefore, there is need to ensure purity of these accessions by ascertaining whether the mixtures are physical, i.e., combination of different varieties, or are composed of segregating material.

DEFOLIATION OF WOODY CUT STEMS WITH PREHARVEST, LESS TOXIC CHEMICAL AND POSTHARVEST ENVIRONMENTAL METHODS

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Six defoliants were applied in fall and tested for their efficacy in preharvest defoliation of field grown curly willow (*Salix matsudana* 'Tortuosa'), american bittersweet (*Celastrus scandens*), and american beautyberry (*Callicarpa americana*). Defoliants included acetic acid, chelated copper, crop oil concentrate (COC), ethephon, dimethipin plus COC, pelargonic acid, and a tap water control. For chelated copper, a concentration of 800 $mg \cdot L^{-1}$ was most effective at promoting defoliation, providing 100% defoliation of american bittersweet and 76% defoliation of american beautyberry. For curly willow and american beautyberry, all concentrations of dimethipin produced good or excellent defoliation. Increasing concentrations of ethephon from 200 to 2500 $mg \cdot L^{-1}$ increased defoliation from 0% to 67%. Pelargonic acid was not effective at promoting defoliation of woody plants at the concentrations used. In an experiment conducted during spring using containerized curly willow, irrigation was stopped for 0, 3, or 6 days before defoliants were applied, but none of the irrigation treatments promoted defoliation. In a postharvest study using cut curly willow, stems were held in distilled water at 5, 20, or 35 °C for 1, 3, 5, or 7 days. Holding cut stems of curly willow at 20 °C promoted 68% defoliation, compared to 53% or 28% for 5 or 35 °C, respectively.

EFFICACY OF FLURPRIMIDOL (TOPFLOR) ON WARM-SEASON BEDDING PLANTS

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The objective of this study was to compare the effects of flurprimidol or paclobutrazol on the growth of four bedding plant species: nicotiana (*Nicotiana ×sanderae*), portulaca (*Portulaca grandiflora*), verbena (*Verbena ×hybrida*), and zinnia (*Zinnia elegans*). Plants were treated 10 days after

transplanting with foliar sprays of five concentrations (in $mg \cdot L^{-1}$): 5, 10, 20, 40, or 80 from each plant growth regulator. Phytotoxicity symptoms were not observed on plants sprayed with flurprimidol or paclobutrazol. Foliar sprays of flurprimidol at 20 $mg \cdot L^{-1}$ and paclobutrazol at 80 $mg \cdot L^{-1}$ provided sufficient growth control of nicotiana for retail sales, while concentrations of 40 to 80 $mg \cdot L^{-1}$ flurprimidol produced more compact plants for wholesale production. For portulaca only flurprimidol sprays of 40 and 80 $mg \cdot L^{-1}$ produced plants that were proportionate to the container. Foliar sprays of flurprimidol at 20 $mg \cdot L^{-1}$ and paclobutrazol at 40 $mg \cdot L^{-1}$ controlled growth of verbena and zinnia suitable for retail sales, while concentrations of 40 $mg \cdot L^{-1}$ flurprimidol and 80 $mg \cdot L^{-1}$ paclobutrazol provided more compact plants which may be useful for wholesale growers. Concentrations were based under Florida conditions and should be adjusted for other areas.

EFFECT OF STORAGE CONDITIONS AND GENOTYPE ON SHELF-LIFE OF FRESH SOUTHERNPEA

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Postharvest storage of southernpeas, *Vigna unguiculata* (L.) Walp., is a crucial point of the production process. Governed by consumer demands, farmers strive for a product that is high in quality and freshness, and has an appropriate texture and appealing color. Improper storage of southernpeas will result in their eventual deterioration, unacceptance, and possible loss of profit. Because of this, an appropriate storage facility and temperature should be devised that will benefit both farmer and consumer. In an effort to prevent potential losses of southernpeas, a study was conducted to determine the best environmental condition at which to store them to potentially extend their shelf-life. In 2004, five southernpea varieties—'Early Acre,' 'Early Scarlet,' 'Excel Select,' 'Coronet,' and 'Arkansas Blackeye #1'—were planted in a randomized block design on the University of Arkansas horticulture farm. Upon maturity, 12 green pods of each variety were subjected to a sweated and unsweated treatment and then shelled. After shelling, the seeds were subjected to four different environmental conditions evaluating each on the basis of changes in physical appearance. Further objectives of the study were to determine the best variety, environmental condition, and treatment to maintain product quality in a manner that would relate to growers on a commercial basis. Results showed that a refrigerated environment at or near 3 to 5 °C is a good environment to store this particular crop for nearly 2 weeks. It also appeared that the sweated treatment assisted with the shelling process and maintained the appearance of each variety longer. From the results, temperature and percent relative humidity are arguably two important components of postharvest storage that have the potential of negatively affecting the crop.

FRUITING PATTERNS OF TWO FIG (*Ficus carica*) CULTIVARS OVER A FIVE-YEAR PERIOD

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The common fig is a popular backyard fruit tree and grown in small orchards throughout the coastal regions of the southeastern U.S. Two commonly grown cultivars in coastal areas have distinct fruiting patterns which would be of interest to processors and marketers of summertime fruit. A study was conducted over a 5-year period to determine the fruiting characteristics of 'Celeste' and 'LSU Purple' figs. The 9-year-old orchard used for the study is located in St. Gabriel, LA. Annual results over a 5-year period indicated a longer and more productive fruit-bearing season for 'LSU Purple' than 'Celeste'. The fruit-bearing cycle for 'LSU Purple' is about 4 weeks longer than is for 'Celeste'. 'Celeste' and 'LSU Purple' exhibited different fruiting patterns over a 5-year period. 'Celeste' consistently produced ripe fruit about one week before 'LSU Purple' over the 5-year period. 'Celeste' produced 85% of its total yield in a 2-week period with one main crop per year. However, 'LSU Purple' produced two and sometimes three distinct crops each year. 'LSU Purple' produced a greater total yield compared to 'Celeste' with 6.45 kg/tree compared to 4.57 kg for 'Celeste' during the 5-year evaluation. Additionally, 'LSU Purple' retained foliage longer each year than 'Celeste'; a characteristic perhaps due to a higher level of resistance to fig leaf rust. In areas where 'LSU Purple' is adapted, this selection of fig may offer a more productive alternative to traditional cultivars planted.

HORTICULTURAL CHARACTERISTICS OF MAYHAW (*Crataegus opaca*) CLONES FROM A 36-YEAR-OLD NATIVE POPULATION

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National demand for authentic Southern cuisine has contributed to the increased utilization of mayhaw fruit. Certain fruit characteristics are essential for the processing of mayhaw. Most of the mayhaw fruit used in processing comes from wild populations. Efforts are being made to identify superior clones from native populations. This study was undertaken to determine the chances of finding a superior clone with desirable processing attributes in a completely random population of mayhaw seedlings. Trees were removed from a 36 year-old mayhaw seedling orchard and relocated to a new orchard. The original orchard contained over 1500 trees. Five years after establishment in the new orchard, fruit were harvested from 75 of the trees and evaluated for fruit weight, percent malic acid, percent soluble solids, and color. Of the 75 trees, 48 were within one standard deviation of the mean trunk diameter. Seven trees fell below 12.1 cm and only 4 trees were larger than 19 cm. The mean fruit weight was 2.1 g with a range from 1.77-2.4 g. Sixty-seven percent of the trees produced fruit having weights within one standard deviation of the mean. Percent malic acid of mayhaw juice averaged 1.35% among the 75 trees. Seventy-two percent of the trees produced fruit with percent malic acid within one standard deviation of the mean. Mean percent soluble solids of mayhaw juice were 6.1 with a range of 5.36% to 7.01%. Seventy-three percent of the trees produced fruit with soluble solids percentages within one standard deviation of the mean. The probability of finding individuals in this population that exceeded the mean of these parameters (percent malic acid,%SS, and fruit weight) is less than 10%.

'GULFKING' AND 'GULFCREST', NEW PEACHES FOR THE LOWER COASTAL PLAIN

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'Gulfking' and 'Gulfcrest' peaches are jointly released for grower trials by the U.S. Department of Agriculture, Agricultural Research Service, the Georgia Agricultural Experiment Station, and the Florida Agricultural Experiment Station. Trees of 'Gulfking' and 'Gulfcrest' produce an attractive, sweet-tasting, yellow and non-melting flesh fruit intended for the fresh fruit market. They are expected to produce fruit with tree-ripened aroma and taste while retaining firmness for longer shelf life than fruit from conventional melting-flesh cultivars. Trees of 'Gulfking' reach full bloom most seasons in mid-February in lower southern Georgia and are estimated to require 350 chill units. We expect this new peach to be adapted in areas where 'Flordaking' has been successfully grown. Fruit ripen 73 to 80 days from full bloom, typically in early May, usually with 'Flordaking' in southern Georgia. The fruit are large, ranging from 105 to 130 grams. Commercially ripe fruit exhibit 80% to 90% red (with moderately fine darker red stripes) over a deep yellow to orange ground color. Fruit shape is round with a recessed tip. Pits are medium small and have little tendency to split even when crop loads are low. Trees of 'Gulfcrest' are estimated to require 525 chill units. This is based on full bloom consistently occurring with 'Sunfre' nectarine at Attapulgus, Ga. where full bloom occurs most seasons in early-March. Fruit ripen 62 to 75 days from full bloom, typically in early to mid-May, usually a few days after 'Flordacrest' in southern Georgia. The fruit are medium-large, averaging about 105 g. Commercially ripe fruit exhibit 90% to 95% red over a deep yellow to orange ground color. Fruit shape is round with a recessed tip. Pits are medium small and have little tendency to split even when crop loads are low.

PHOTOSYNTHESIS OF BIRCH TAXA (*Betula* L.) UNDER VARIED IRRADIANCE AND CO_2 CONCENTRATION

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Abstract The genus *Betula* consists of approximately 50 deciduous species throughout northern hemisphere. Net CO_2 assimilation ([A]) of four birch taxa (*Betula alleghaniensis* Britton, *B. davurica* Pall., *B. nigra* L. 'Heritage', and *B. papyrifera* Marsh.) was measured with a portable gas exchange system, CIRAS-I. Light was increased from 0 to 2000 $\mu mol \cdot m^{-2} \cdot s^{-1}$ at increments of

25, 50, 100, 250, 500, 750, 1000, 1250, 1500, 1750, 2000 μmol·m^{-2}·s^{-1} to create an [A] light-response curve. CO_2 concentration was gradually increased to 1100 ppm in increments 50, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100 ppm to create an [A]-Ca (ambient CO_2) curve. *B. davurica* had significantly higher potential A capacity than the other taxa under high CO2 conditions. *Betula nigra* 'Heritage' had the highest carboxylation efficiency among four taxa. *B. davurica* and *B. nigra* 'Heritage', had higher [A] when ambient CO2 is 0ppm. *Betula davurica* and *B. nigra* 'Heritage', had higher light-saturated rate of gross [A] than *B. alleghaniensis* and *B. papyrifera*.

USE OF VOLUNTEERS IN CONDUCTING FIELD RESEARCH

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As funding directed toward research has diminished, it has become vital seek other avenues of support to maintain long term field projects. To meet this need, the University of Arkansas Horticulture Department began the Friends of Fruit (FOF) program during 2004 engaging volunteers in conducting tree fruit field research. Volunteers were graduates of the Master Gardener program and executed tasks including data collection and plot maintenance. Objectives of this study were to evaluate the experiences and benefits to the volunteers and horticulture department, and to assess the success of the FOF program in providing assistance and support to research. All volunteers and facilitators were interviewed. Interview questions were designed to understand the motivation and level of volunteer activity, determine if training and supervision was adequate, and determine if ample recognition occurred. Volunteers sought experience and knowledge with fruit crops. Costs to volunteers included time and travel, conversely benefits included knowledge, experience and fellowship. Volunteers planned to repeat the program and were pleased with the recognition they received. Facilitators noted that volunteers had basic horticultural knowledge and the desire to learn. The program did call for improved task management and increased planning time by facilitators. The program succeeded in benefiting volunteers and horticultural research. The FOF volunteers contributed to fruit research by harvesting ≈4,000 kg of fruit samples and providing >200 hours of time.

THESOUTHERN ORGANIC FRUIT PRODUCTION INITIATIVE: PROJECT GOALS, EXPECTED OUTCOMES AND PRELIMINARY FINDINGS

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A multidisciplinary effort has been initiated between the University of Arkansas and the National Center for Appropriate Technology to identify production barriers, research and outreach needs, and market opportunities for sustainable and organic fruit in the Southern region. The goals of the project are to identify barriers of the organic system through focus group meetings with producers, processors and marketers, and to develop regional research and outreach projects to overcome these obstacles. Market development, organic fertilizer knowledge and organic pest management have been identified as areas that need research and outreach activities. Long-term outcomes are expected to increase sustainable and organic fruit production, provide opportunities for growers and consumers, and encourage local economic development in the Southern region.

EFFECTS OF VARIOUS ACID COMPOUNDS ON CO_2 ASSIMILATION, EVAPOTRANSPIRATION, AND STOMATAL CONDUCTANCE OF APPLE

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Alternative fruit thinners and pesticides are needed for certified organic fruit growers. A transient reduction in photosynthesis has proven to be an effective technique used for fruit thinning. Conversely, pesticides, which reduce Pn may be detrimental to plant growth. This study was developed to measure plant response to foliar applications of various organic acids as potential horticultural chemicals Treatments were applied to vegetative apple trees under controlled environmental conditions to study photosynthetic effects. CO_2 assimilation significantly decreased temporarily 3 days after treatment with citric acid. Decreased trends of evapotranspiration were observed for all treatments 1 day after foliar application; however, not significant. Salicylic acid significantly decreased stomatal conductance 1 and 15 days after treatment. Average leaf area was not significantly affected but oxalic acid increased plant stem growth while acetic acid application reduced growth. This model system for screening new and alternative compounds will be a basis to study agents that may have potential to be used as certified pesticides or fruit thinning agents.

INCORPORATING CREATIVE LEARNING INTO HORTICULTURE CLASSES

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The Clemson University Communication Across The Curriculum program is coordinating a creative response for learning (CRL) project to provide students with creative learning and critical thinking opportunities relevant to course content while creating a learning community. Faculty representing numerous disciplines asked their students to respond with creative projects (e.g., drawings, poems, posters, multimedia, sculpture, music, etc.) to the subject matter of the course. Students in Horticulture courses responded by writing poems in a Landscape Appreciation class, designing creative solutions to environmental problems in a Landscape Design Class, and installing an Ethnobotany Garden in a landscape implementation class. The landscape design and implementation classes used a service learning methodology to identify and solve problems in local communities. Following a four-part process of preparation, action, reflection, and celebration, students in the design class completed plans for thirteen theme gardens constituting a Children's garden in the South Carolina Botanical Garden. The following semester, landscape implementation students built the first of the series, an Ethnobotany Garden, using teamwork and university/community partnerships. They also practiced individual creative thinking and building skills through the design and installation of creative projects including a bat house, a stained glass and a broken tile birdhouse, four container gardens, artistic stepping-stones, and a dramatic metal sculpture of a butterfly representing the sustainable wildlife habitat aspect of the Children's garden. College students and faculty working on the Ethnobotany Garden project alone contributed over 1,000 hours to their community while learning more about both the art and the science of landscape design and implementation.

SENSORY EVALUATION OF LOW SUGAR WATERMELON BY CONSUMERS

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Red-fleshed watermelons contain lycopene, a compound that has health functional properties. Watermelon intake may be restricted for individuals who have diabetes or those who limit carbohydrate intake. Recently, a low-sugar watermelon (<6% soluble solids content) was developed using traditional plant breeding techniques. Low-sugar and a commercial variety of watermelon (9% SSC) were washed, cut in half and red flesh was removed and cut into cubes. Low and high levels of artificial sweetener were added to the low-sugar watermelon. Students at a Native American school (grades 1 through 12) and adults at a Native American Feeding Center were asked to rate how much they liked or disliked the watermelon using a seven-point hedonic scale. Lycopene and other carotenoids were analyzed from samples using established methods. Artificially sweetened melons were rated as acceptable as commercial control melons for taste. Lycopene and total carotenoid levels were similar among the treatments. These results show that artificially sweetened low-sugar watermelons were acceptable to Native American consumer groups.

LYCOPENE AND TOTAL PHENOL CONTENT OF AUTUMN OLIVE (*Elaegnus umbellata*) SELECTIONS

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Autumn olive *(Elaeagnus umbellata)* is a small red berry that grows on shrubs from Maine to Alabama. This plant originated in China and was introduced to the U.S. in the late 1800s for erosion control. About 20% of the berry' fresh weight is in its single, large seed. The berries of Autumn olive are extremely rich in lycopene (30–50 mg/100 g). The berries are astringent, indicating that fruit may be high in phenolic compounds as well as carotenoids. There has been great interest in producing the plants in domesticated plantings, and in using the fruit as a natural source of lycopene.

This study was done to determine the relative contents of lycopene and phenolics among selections and varieties of autumn olive. The lycopene content of six selections and varieties was 30 to 55 mg·g^{-1}. The lycopene content of berries did not increase after 4 days storage at 25 °C followed by 2 days at 5 °C. Autumn olives are high in soluble solids content (11% to 17%), and relatively high in acidity (1.7% to 5.5% citric acid). The astringent flavor of the berries may be due to the high total phenolic content (1700 mg·kg^{-1} chlorogenic acid equivalents). The berries were found to be high in flavanols and hydroxybenzoic acids (33 rutin and 31 gallic acid mg·kg^{-1} equivalents), while the seeds were high in hydroxycinnamic acids and extremely high in hydroxybenzoic acids (35 chlorogenic acid and 184 gallic acid mg·kg^{-1} equivalents).

MARKETING FEASIBILITY STUDIES OF DIFFERENT SUBSTRATE MIXES FOR RESIDENTIAL USE

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Murray State University was asked to compare different amendment percentages of worm castings incorporated into a substrate and two different soilless substrates for bedding and vegetable production by Ferry-Morse Seed Company. Both studies were performed at Murray State University's Pullen Farm Greenhouse Complex during fall 2004. Lycopersicon esculentum 'Early Girl' was chosen to represent the vegetable plant category because of consumer popularity. Amendment percentages of 0%, 10%, 20%, and 30% of worm castings were incorporated into a soilless media substrate for Treatment 1. Treatment 2 was the same with the addition of soluble fertilized when plants were watered. Visual differences were found between Treatments 1 and 2. Zinnia elegans 'Giant Cactus' were grown from seed to test chlorophyll levels, germination rates, and root:shoot ratios in Jiffy Professional Seed Starter Mix Plus and Ferry-Morse Seed Starter Mix. Statistically significant differences were found in dry root and shoot weights, along with leaf chlorophyll levels.

CRITERION DEVELOPMENT FOR DELIVERING WEB-BASED PLANT IDENTIFICATION COURSES AT MURRAY STATE UNIVERSITY

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Murray State University is developing an on-line delivery for the four plant identification courses offered in the horticulture option program. Reasons for developing this are to provide more efficient use of limited faculty time, to utilize new technologies in the delivering of courses, and to provide an interactive teaching assistance to students outside of class. The American Society for Horticultural Sciences (ASHS) was contacted for a listing of universities in the United States that offered horticulture programs. E-mails were sent to 109 universities and 44 surveys were received for a 40.4% return rate. None of the responding universities were using new technologies in the form proposed by MSU. Of the respondents, 27.3% were interested in a course of this type and thought it was a good idea to pursue whereas 11.4% were not interested in developing a course and 15.9% said a course of this kind would not have applications in their universities. Currently 25% are using computer-aided delivery for their horticulture courses. Macromedia Dreamweaver MX is being used for its versatile and accessible format over current Blackboard PowerPoint options.

THE EFFECTS OF DIFFERENT FERTILIZER APPLICATIONS ON *Acer rubrum* 'AUTUMN BLAZE' AND *Acer rubrum* 'RED SUNSET' ON POT-IN-POT NURSERY PRODUCTION

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Kentucky West Nursery Cooperative, producers of pot-in-pot trees, needed recommendations on slow-release fertilizer applications due to regional environmental influences affecting production. Murray State University established a pot-in-pot tree nursery to research these influences in 2004. Two different fertilizer applications in three different treatments were tested on one-year old bare-root whips of *Acer rubrum* 'Red Sunset' and 'Autumn Blaze'. These trees were planted in 100% pine bark in 15-gallon pots and placed in the sockets with a complete random split-block design. Drip irrigation by spray stakes watered each pot. Nursery floor was kept clean by landscape fabric. New growth was pruned as needed to keep the trees within nursery standards. Tree calipers were measured on 1 Apr. and 1 Dec. 2004 at the beginning and end of growth. Leaves for chlorophyll readings were randomly selected to measure nitrogen uptake in late summer. Measurements were analyzed by SAS 9.1 and results found no significant differences among the treatments either in caliper increase or in chlorophyll levels (SAS, 2002). This experiment recommends a treatment using one application of slow-release fertilizer, versus split or additional applications, provides equal, quality growth of *Acer rubrum* 'Autumn Blaze' and 'Red Sunset'. The information gathered will direct fertilizer applications for KWNC and reduce their labor costs.

CUTTING PROPAGATION WITH AUXIN APPLIED VIA THE ROOTING SUBSTRATE

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Stem cuttings of golden euonymus (*Euonymus japonicus* 'Aureo-marginatus'), shore juniper (*Juniperus conferta* 'Blue Pacific'), white indian hawthorn (*Rhaphiolepis indica* 'Alba'), and 'Red Cascade' miniature rose (*Rosa* 'Red Cascade') were successfully rooted in plugs of a stabilized organic substrate that had been soaked in aqueous solutions of the potassium salt of indole-3-butyric acid (K-IBA) at 0 to 75 mg·L^{-1} before inserting the cuttings. Cuttings were rooted under intermittent mist in polyethylene-covered greenhouses with rooting periods appropriate for each species. Rooting percentages showed some increase with increasing auxin concentration with juniper cuttings, but were similar among treatments for the other three species. Number of roots per rooted cutting increased with increasing auxin concentration with cuttings of juniper, Indian hawthorn, and rose, and was greatest using around 60 mg·L^{-1} K-IBA for cuttings of juniper and Indian hawthorn and 30 to 45 mg·L^{-1} K-IBA for cuttings of rose.

CORN GLUTEN MEAL: ALTERNATIVE WEED CONTROL FOR SQUASH

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Corn gluten meal (CGM) has been identified as a potential organic preemergence and preplant-incorporated herbicide. It is an environmentally friendly material that has demonstrated ability to decrease seedling development and plant survival by inhibiting root and shoot development. Unfortunately, CGM can also decrease the development and plant survival of direct-seeded vegetable crops. As a result, the use of CGM is not recommended in conjunction with direct-seeded vegetables. The development of equipment to apply CGM in banded configurations has created an opportunity to investigate whether banded CGM applications will provide significant crop safety for direct-seeded vegetables. The objective of this research was to determine the impact of banded CGM applications on squash plant survival and yields. A factorial field study was conducted during the summer of 2004 on 81-cm-wide raised beds at Lane, Okla., with two application configurations (banded and solid), two CGM formulations (powdered and granulated), two incorporation treatments (incorporated and non-incorporated), and three application rates (250, 500, and 750 g·m^{-2}). The two CGM formulations at three application rates were uniformly applied in both banded and solid patterns on 18 Aug. The banded application created a 7.6-cm-wide CGM-free planting zone in the middle of the raised bed. The CGM applications were then either incorporated into the top 2.5 to 5.0 cm of the soil surface with a rolling cultivator or left undisturbed on the soil surface. 'Lemondrop' summer squash (*Cucurbita pepo* L.) was then direct-seeded into the center of the raised beds. When averaged across the other factors, there was not a significant difference between powdered and granulated CGM formulations or incorporating and non-incorporating the CGM for either squash plant survival or yields. CGM application rates made a significant difference for both squash survival and yields, when averaged across all other factors. As the CGM application rate increased, the plant survival and yields decreased. When averaged across all other factors, the banded application resulted in significantly greater crop safety (59% plant survival) and yields (228 cartons/ha) than the solid applications (25% plant survival and 118 cartons/ha). The research demonstrated the potential usefulness of CGM in direct-seeded squash production, if used in a banded application configuration. Additional research should further investigate the interaction of CGM application rates and the width of the CGM-free zone on crop safety for various vegetables.

CORN GLUTEN MEAL APPLICATION OPTIONS FOR WEED CONTROL

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Producers of organic vegetables often report that weeds are a troublesome production problem. It has been documented that corn gluten meal (CGM), a by-product of the wet-milling process of corn, is phytotoxic. As a preemergence or preplant-incorporated herbicide, CGM inhibits root development, decreases shoot length, and reduces plant survival of weed or crop seedlings. The development of a mechanized application method for CGM and the ability to apply the material in a banded pattern would increase its potential use in organic vegetable production, especially in direct- seeded vegetables. Therefore, the objective of this research was to develop a mechanized method to uniformly apply CGM to the soil surface in either a broadcast or banded pattern. An applicator was assembled using various machinery components (fertilizer box, rotating agitator blades, 12-volt motor, and fan shaped gravity-fed row banding applicators). The equipment was evaluated for the application of two CGM formulations (powdered and granulated), three application rates (250, 500, and 750 $g \cdot m^{-2}$), and two application configurations (solid and banded). Field evaluations were conducted during Summer 2004 on 81-cm-wide raised beds at Lane, Okla. Differences between CGM formulations affected the flow rate within and between application configurations. The granulated formulation flowed at a faster rate, without clumping, compared to the powdered formulation. While the CGM in the banded configuration flowed faster than the solid application. It was determined that the CGM powder used with the solid application configuration was inconsistent, unreliable, and thus not feasible for use with this equipment without further modifications. These evaluations demonstrated the feasibility of using equipment, rather than manual applications, to apply CGM to raised beds for organic weed control purposes. Several design alterations may increase the efficiency and potential usefulness of this equipment. If research determines equivalent weed control efficacy between the two CGM formulations, the granulated formulation would be the preferred formulation for use in this equipment. This equipment would be useful for evaluating the benefits of banded applications of CGM for weed control efficacy and crop safety for direct seeded vegetables.

TOMATO YIELD AND SPOTTED WILT VIRUS INCIDENCE AMONG CULTIVARS IN A MISSISSIPPI TRIAL

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Mississippi's two largest tomato-growing areas are in Smith and George Counties. The Truck Crops Branch Experiment Station in Crystal Springs is the closest vegetable research site to Smith County but does not share the same soil type. Tomato spotted wilt virus (TSWV) reduces fruit yield and marketability, and its incidence appears to be increasing in the state. The objectives of this trial were 1) to determine fruit yield and TSWV incidence in tomatoes (*Lycopersicon esculentum*) grown in central Mississippi, and 2) compare yield and relative yield among cultivars and between locations. Tomato seedlings were transplanted to the field in April 2004 in Smith and Copiah County plots. Production practices included raised beds, black plastic mulch, drip irrigation, and fertilizer applied pre-plant and as side-dressings based on soil test and regionally recommended practices. TSWV incidence was recorded in each plot in Smith Co. in June 2004. In both locations, 'Amelia' and 'Mountain Spring' were among the top yielding entries. In Smith, the top entries also included 'BHN 543' and two commercial experimental entries. In Copiah, 'Florida 47 R', 'Biltmore', 'Mountain Fresh', and 'BHN 543' also produced high marketable yields. 'Florida 47R', 'Bush Celebrity', and 'Mountain Fresh' were among the poorest yielding varieties in Smith County. Incidence of TSWV was not formally rated in Copiah. In Smith, percent symptomatic plants per plot were negatively correlated with yield. Symptoms were found on entries reportedly resistant or tolerant to TSWV.

PRELIMINARY FINDINGS ON PRODUCING ORGANIC VIDALIA ONIONS

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There has been interest in producing Vidalia onions organically among both conventional and organic growers. In the 2000–01 season we began to look at producing onions organically. Starting with conventionally produced transplants that were transplanted at standard commercial spacings on beds prepared with 10.2–15.2 cm of incorporated compost and 2,802 $kg \cdot ha^{-1}$ rate of fresh poultry litter. This was sidedressed with an additional 2,500 less/acre (2,802 $kg \cdot ha^{-1}$) poultry litter. Yields were about half of conventional onion production. In 2002–03, production of organic transplants with 10.2 cm of incorporated compost with 2.24 $t \cdot ha^{-1}$ rate of poultry litter, which was followed by an additional sidedressing of 2.24 $t \cdot ha^{-1}$ rate of poultry litter resulted in similar findings. The weight of harvested transplants was about half that of conventionally produced transplants. In the 2002–03 and 2003–04 seasons various natural mulches were evaluated for weed control. They included wheat straw, oat straw, Bermuda hay, pine straw, and compost. None of these performed better than hand weeding and the wheat straw, oat straw, and Bermuda hay actually reduced yields apparently due to allelopathic effects. Finally in the 2003–04 season rates of poultry litter from 0–22.4 $t \cdot ha^{-1}$ were evaluated for transplant production with rates of 13.4, 17.9, and 22.4 $t \cdot ha^{-1}$ yielding plants comparable to conventional transplants. Work continues in the area of organic Vidalia onion production. One of the greatest challenge for future work will be finding a cost-effective and practical method of controlling weeds in transplant production.

DIRECT SEEDING VIDALIA ONIONS

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The majority of Vidalia onions are produced as a transplanted crop. Seeding in high density plantings in September is followed 8 to 10 weeks later by transplanting to final spacing. This practice is labor intensive and expensive. Direct seeding would save on labor, cost, and time. Traditionally, transplanting has been done because of better winter survival, more uniform stands, and better irrigation management during seedling emergence. Beginning 5 years ago, we began evaluating direct seeding onions. Initially, seedstems (bolting) and lack of uniform stand establishment were the main problems. Sowing in September resulted in almost 100% seedstems and using a belt planter with raw seed resulted in poor singulation for uniform stand establishment. Mid-October ultimately proved to be the best time for sowing Vidalia onion seed. Earlier sowing resulted in more seedstems and later planting did not give the plants sufficient time to grow resulting in later stand loss during cold winter temperatures. Using polymer coated seed and a precision vacuum planter resulted in uniform, even stand establishment. Fertilizer requirements are almost half with direct seeded onions compared to transplanted onions with a reduction in the need for fungicides and herbicides. We have established direct seeded onions both with drip irrigation and overhead irrigation. There was concern that center-pivot irrigation would not be able to sufficiently irrigate fields during seedling establishment with the frequent hot fall days we experience. Since this work was initiated several growers have successfully produced direct seeded onions under center-pivot systems. Direct seeding Vidalia onions requires attention to detail because there is only one opportunity to get it right. Timing is also critical particularly with planting date and herbicide application.

EVALUATION OF FERTILITY PRACTICES FOR VIDALIA ONIONS

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Fertilizer rates of N, P, K were evaluated over 4 years (2000–03) as were different sources of experimental and commercial fertilizers. The highest total yields and yields of jumbos (≥7.6 cm) occurred with nitrogen rates of 140–168 $kg \cdot ha^{-1}$. Neither phosphorus nor potassium rates had an affect on total yield. Phosphorus rates of 0-147 $kg \cdot ha^{-1}$ and potassium rates of 0–177 $kg \cdot ha^{-1}$ were evaluated. Increasing nitrogen fertilizer resulted in increasing leaf tissue nitrogen, but did not affect P, K, Ca, or S. Increasing phosphorus fertilizer increased leaf tissue phosphorus only slightly ($p = 0.060$) with no affect on other leaf nutrient levels. Increasing potassium fertilizer did affect leaf tissue potassium 2 out of 4 years with none of the other leaf nutrient levels affected. Several fertilizers were also evaluated including an experimental fortified peat (10%N), calcium nitrate, ammonium nitrate, diammonium phosphate, 5–10–15 (56 $kg \cdot ha^{-1}$ N), 18-6-8 liquid, 14–0–12 8%S liquid,

19–8–19 slow-release at rates of 140 and 168 kg·ha^{-1} nitrogen. All were used to supply 168 kg·ha^{-1} nitrogen unless noted otherwise. P and K were supplied according to soil test recommendations unless they were part of the fertilizer formulation. There were no differences between the different fertilizer sources for total yield and differences in jumbo yields only occurred one year out of three years of testing and for medium (≥5.1 and <7.6 cm) yields there were differences two years out of three years of testing.

SCREENING OF NEW HERBICIDES FOR WEED CONTROL IN THREE CHENOPOD CROPS

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Because of the limited number of herbicides in spinach, beet, and swiss chard, a screening study was initiated to identify new preemergence herbicides. Field soil at the study was a fine sandy loam. The study was initiated on 8 Apr. 2004 at Bixby, Okla. Each plot had four direct seeded rows of spinach, beet and chard. 22 treatments were replicated four times in a RBD that included a nontreated check. Treatments used 12 preemergence herbicides. Herbicides were applied PRE with a research sprayer at 20 GPA in a 6-ft swath perpendicular to crop rows. The experimental area received 0.5 inch of irrigation after application. Callisto (mesotrione) and V10146 (Valent exp. compound) both resulted in 100% death of beet, chard and spinach seedlings. Herbicides that had injury at or below Dual Magnum included Pyramin (pyrazon), Nortron (ethofumesate), Lorox (linuron), and Bolero (thiobencarb) tank-mixed with Bio-Power. Yields were zero for the nontreated check and several treatments due to weed competition and the lack of crop plants in some plots. Treatments with the highest beet yields included Dual Magnum at 0.5 lbs/acre, Pyramin at 3.6 lbs/acre, and Outlook (dimethenamid-P) at 0.25 lbs/acre (11,822, 8,034, 8,010 lbs/acre respectively). Highest chard yields were from Dual Magnum at 0.5 lbs/acre, Pyramin at 3.6 lbs/acre, Outlook at 0.5 lbs/acre + Bio-Power, and Outlook at 0.5 lbs (12,753, 12,596, 11,495, and 10,563 lbs/acre, respectively). Spinach yields were highest for Dual Magnum at 0.5 lbs/acre, Define (flufenacet) at 0.3 lbs/acre, and Outlook at 0.5 lbs/acre + Bio-Power (4,465, 4,259, and 3,207 lbs/acre, respectively).

'VERNON': A NEW EARLY SEASON RABBITEYE BLUEBERRY CULTIVAR

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Released in 2004 by the University of Georgia and U.S. Dept. of Agriculture, 'Vernon' is an early season rabbiteye blueberry (*Vaccinium ashei* Reade), having large fruit size, good yields and excellent plant vigor. 'Vernon', tested as T-584, was selected in 1990 at the Coastal Plain Experiment Station in Tifton, Ga. from a cross of T-23 × T-260. 'Vernon' fruit ripens early with the cultivar Climax in south Georgia, and few days before 'Premier'; however, 'Vernon' flowers 5 to 10 days after the standard cultivars. On average over a 6 year period, 'Vernon' yielded 5.8 kg/plant per season, compared to 3.1 and 4.5 kg/plant for 'Climax' and 'Premier', respectively. Berry stem scar, color, firmness, and flavor of the new cultivar are good to excellent. Berry size of 'Vernon' is considerably large, averaging 2.05 g/berry over 4 locations in 2003, compared to only an average weight of 1.56 g/berry for 'Climax'. 'Vernon' berries are firmer than 'Premier'. Propagation of the new cultivar is easily accomplished from softwood cuttings. Chill hour requirement is estimated to be in the range of 500 to 550 hours (<7 °C). 'Vernon' should be planted with other rabbiteye blueberry cultivars with a similar time of bloom to provide optimum pollination. Propagation rights are controlled by Georgia Seed Development Commission, 2420 S. Milledge Avenue, Athens, GA 30606 (for more information go to www.gsdc.com).

DOWNY AND POWDERY MILDEW MANAGEMENT FOR WINTER SQUASH

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Control of downy (*Pseudoperonospora cubensis*) and powdery mildew [(*Podosphoera xanthii* (*Sphaerotheca fuliginea*)] on 'Sweet Dumpling' winter squash (*Cucurbita maxima*) was evaluated at the University of Florida, IFAS, Indian River Research and Education Center (IRREC) in Fort Pierce, Florida during Spring 2004. Seven foliar spray fungicide treatments were evaluated against an untreated control. Powdery and downy mildew ratings (estimated percentage of foliage damage) and marketable yields (mt/ha) were measured. Plants in the untreated plots had significantly higher powdery and downy mildew ratings. All fungicide treatments reduced powdery mildew on adaxial leaf surfaces. Downy mildew appeared unusually late in the crop season and all fungicide treatments significantly reduced it. There were no significant differences among treatments for marketable yield. Although the level of disease occurrence was not sufficient to reduce yields, each foliar spray treatment significantly reduced powdery and downy mildew.

FLOWER PETAL PIGMENTATION AFFECTED BY THE EXPERIMENTAL PLANT GROWTH REGULATOR A-1699 DF

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Anti-gibberellin plant growth regulators (PGRs) not only affect cell elongation, but other biochemical processes. The experimental PGR A-1699 DF was evaluated for efficacy of height and width control as well as effect on flower petal pigmentation. While the active ingredient in A-1699 DF has proven effective for height control on several crops, that was not observed on Impatiens 'Accent Cranberry' in this study. However, A-1699 DF did affect flower petal pigmentation. A-1699 DF likely inhibited anthocyanin production that resulted in light pink versus cranberry flower petals observed on the control, Paczol, and B-Nine/Cycocel PGR applications.

Vegetable Crops Section

PUMPKIN CULTIVAR TRIALS, 2003 AND 2004

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Pumpkin cultivar trials were held in 2003 and 2004 at the Agricultural Experiment Station Fayetteville, AR. 18 cultivars were direct seeded the 4th week of June. Plots 8 plants each, spaced 3 ft apart, 12 ft between rows were randomly replicated 6 times. Pumpkin fruit were harvested October 1 and evaluated for number, size shape, and quality. Plots were irrigated by drip irrigation and standard production practices were followed. During 2004 the same practices were followed except plots were planted during the second week of July. In 2003 large fruited pumpkins yielded 700 to 1950 fruit per acre. Howden, the industry standard yielded 700 fruit, averaging 16 lb each, with a gross return of $700/acre. Cultivar fruit size ranged from 15 to 27 lb, and yields ranged from 10200 to 52000 lbs to the acre. Based on the 1 Oct. 2003 prices from USDA AMS, gross returns ranged from $744 to $1760 per acre. Specialty types Jack be Quick, Rouge, and Long Island Cheese yielded 15700, 1800, and 1470 fruit per acre valued at $2100, 1950, and 3400 respectively. Excessive rain in June 2004, and cooler that normal weather during July and early August significantly affected quality and yields of pumpkin fruit. Fruit number and size per plot were reduced up to 75%. Yields ranged from 10% to 20% of 2003 yields. Fruit quality was significantly affected making most of the fruit harvest unmarketable due to immaturity and size.

RESULTS OF THE SOUTHERN PEA COOP TRIALS IN OKLAHOMA

L. Brandenberger, L.K. Wells, J. Sanchez, B. Bostian; Oklahoma State University*

Trials were conducted to determine southern pea performance in two different production environments in Oklahoma. Plots consisted of one row 20 feet long with 30 or 36 inches between rows. Seed were spaced 10 seed per foot and were inoculated with *Rhizobium* at planting. The trials were seeded on 15 June 2004 at Bixby, Okla. (elevation836), and on 16 June 2004 at Goodwell, Okla. (elevation 3293). Trials included at least three replications in a RBD for the 15 cultivar/breeding lines. Plots received a PRE application of Dual Magnum at 1.0 lb ai/acre tank-mixed with Pursuit at 0.063 lb a.i./acre. Supplemental water was applied with overhead irrigation. Maturity before harvest was rated as percentage of dry pods. TX158BEgc, LA 96-4, and US-1076 had the highest percentage of dry pods at both Bixby and Goodwell for blackeye, cream, and pinkeye types, respectively. Yields are given as imbibed lb/acre. Peas with consistent yields at both Bixby and Goodwell included blackeye types AR 00-178 with yields of 2,558 and 4,738 lb/acre, respectively, and ARK Blackeye #1, which had yields of 2,605 and 4,406 lb/acre, respectively. The highest yielding cream type at Bixby was LA 96-4, at Goodwell it was Early Acre, these had yields of 2,346, and 3,983 lb/acre, respectively. The highest yielding pinkeye types included

AR 96-854 at Bixby and AR 01-1293 at Goodwell which yielded 3,593 and 4,366 lb/acre, respectively. LA 96-18 had yields of 2,886 and 2,853 lb/acre at Bixby and Goodwell, respectively, and was the most consistent yielding pinkeye for both sites.

SAFETY AND EFFICACY OF COMPOSTED BROILER LITTER IN MISSISSIPPI VEGETABLE PRODUCTION

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Mississippi is one of the nation's largest broiler litter producing states. Interest in using litter and other organic waste products, such as compost, in horticultural systems is increasing in the state and region. The objective of this research was to determine the influences of composted broiler litter (CBL) on three aspects of vegetable crop productivity: growth and yield, microbiological safety, and mineral nutrition. This report focuses on the first two objectives. Compost was made in a covered, turned windrow for a blend of broiler litter and hardwood sawdust. Responses to CBL were tested in two vegetables: collard (*Brassica oleracea* var. *Acephala*) and tomato (*Lycopersicon esculentum*). Rates of CBL ranged from 0 to 5 tons/acre, preplant incorporated in a randomized complete block design with four replicates for each species in two separate experiments in 2004. Testing of the CBL, the soil after application, leaves, and harvested organs found no significant influence of CBL on pathogenic microbe concentrations. At each of five sampling dates through commercial crop maturity, collard (*Brassica oleracea* var. *Acephala*) fresh and dry weight per plant increased linearly with CBL applications up to 5 tons/acre. Tomato (*Lycopersicon esculentum*) shoot fresh weight increased with increasing CBL applications at each sampling date. Marketable fruit yield increased linearly with increasing CBL applications. Total fruit yield response to CBL was best described by a quadratic equation.

EFFECTS OF COLORED MULCHES ON "B" SIZE POTATOES

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The small, "B" size potatoes (<2 inches but ≥1.25 inches in diameter) represent a keen interest in new, specialty food items. Exotic shapes and color shades of the specialty varieties are also known for intense flavors and variations in textures in firmness and fiber that consumers are looking for today in an ever increasing health consciousness among consumers. In 2004, the varieties 'French Fingerling' (West Edmonton, Alberta, Canada), W2275-3R (Univ. of Wisconsin) and B1145-2 (USDA, Beltsville, Maryland) were planted in a double row 8 inches between tubers and 18 inches between rows in a replicated trial using colored mulches. The mulch color included red, white, black, blue, green, and silver foil. These plastic mulches were laid on 6-ft centers. The mulches were shown to affect the microclimate of soil temperature, as expected, and therefore affecting yield. These temperature differences were measured with a Campbell CR 10X weather station (Logan, Utah) probes at 2 inches above the soil surface and 4 and 6 inches below the soil surface. Plant stands were excellent with all mulches, however, blue mulch caused early emergence while white and silver delayed emergence. Just the opposite effect happened when it came to yields. The highest individual tubers per plant came from the silver mulch with the blue having the lowest tuber yields. Cultivar differences were also seen in there ability to produce marketable tubers. 'French Fingerling' had the highest plant vigor and also the most marketable tubers per plant. B1145-2 produced most of its tubers greater than 2 inches in diameter with the tubers nonuniform in shape. W2275-3R produced a very uniform round tuber with few defects. Yields were higher this past year, however, there was a greater incidence of hollow heart due to excess water and higher fertility.

THE EFFECT OF IN-ROW TRANSPLANT SPACING ON SPRITE MELON YIELD AND SIZES

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Sprite is an oriental crisp melon owned by Sakata Seeds. Markets and cultural practices were developed through the efforts of the N.C. Specialty Crops Program. In 2003 and 2004 studies were conducted to determine the in-row spacing, which would maximize the 20 (10.16 to 11.43 cm diameter) to 24 (9.53 to 10.16 cm diameter) count melons. The experimental design was a randomized complete block with four replications. Plot size was 1.5 m × 6.1 m with a 1.5-m alley. Spacing treatments were as follows: 30.48 cm = 20 plants/plot; 45.72 cm = 13 plants/plot; 60.96 cm = 10 plants/plot; 76.2 cm = 8 plant/plot; 91.44 cm = 7 plant/plot and 106.68 cm = 6 plant/plot. In both years a conventional muskmelon plasticulture regime was used and a conventional fungicide and insecticide program was followed beginning at fruit set. Differences in total marketable yield at any in-row spacing were not evident in either year. In 2003, the 45.72-cm spacing produced significantly more 24 and 28 count melons and no differences were evident at other in-row spacing. In 2004, the 45.72-cm spacing yielded significantly more 20-count melons and significantly fewer 15–18 count melons than the other in-row spacing treatments. No difference between spacing treatments in the 24 and 28 count grades were evident in 2004. When the data was combined for both years, the in-row spacing treatments were not significantly different with respect to the 20, 24, and 28 count grades. The 45.72-cm spacing produced significantly less 15–18 count melons.

EVALUATION OF SLOW-RELEASE FERTILIZER MATERIALS ON SELECTED VEGETABLE CROPS

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Despite some advantages, adoption of slow-release fertilizers in vegetables has been slow primarily due to cost. In crops fertilized with ground equipment, growers can make fewer trips through the field and assure fertilizer is present when conditions prevent application. With drip irrigation, some materials are difficult to inject, however, Nitamin is a new injectable liquid produced by Georgia Pacific. Thus, with plasticulture, growers can inject less frequently and potentially use lower rates. Granular and liquid formulations of slow-release fertilizer were tested on onions (Winter 2003–04), cabbage (Winter 2003–04) and pepper (Spring 2004) in Georgia. Combinations of traditional fertilizer with slow-release formulations and various rates of slow-release fertilizer alone were compared to a standard fertilizer program on these crops in separate experiments. The slow-release contains only N. So, other nutrients were held constant. Otherwise normal cultural practices were employed. Crops were harvested at maturity and data collected on yield and quality. In cabbage, with at least 50% of the standard N rate using the slow-release fertilizer, yields were comparable to the standard. Results on onions were similar with N rates of at least 75% of the standard for the liquid material; the granular formulation did not perform well. Split applications of slow-release fertilizer and combinations with standard fertilizer worked well for cabbage, but not for onions. Results on pepper, although inconclusive, indicated it was possible to get comparable yields at lower N rates with the slow-release material. Based on these results, lower N rates are possible on cabbage and onions with slow-release fertilizers which may make them economically feasible while providing application advantages to growers.

WEED CONTROL IN TOMATO WITH HALOSULFURON (SANDEA)

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Halosulfuron (Sandea 75WG) is labeled for pre- or posttransplant use in tomato, cucumber, cantaloupe, among other vegetable crops. For pretransplant usage, the label specifies a 7-day waiting period after halosulfuron application under the plastic mulch before transplanting tomatoes. This period may be too long for growers who are busy in the spring with planting and pesticide sprays while on a race with the constantly changing climate of early spring. Experiments were conducted in the last 2 years to determine whether transplanting tomato within 7 days of halosulfuron application had any deleterious effects on tomato. In 2003, tomatoes were transplanted daily from day 0 through 7. Plant survival and height were collected. Tomato plants survived all dates of transplanting treatments. Plant height indicated that plants transplanted early were taller than those transplanted late, only because they had more time to establish and grow in the field. There was no adverse effect to tomato growth. In 2004, tomatoes were set on a 2-day interval from day 0 through 10 after halosulfuron application under the plastic mulch. Plant height, visual rating, % early blight infection, and yields were collected. A severe early blight infection confounded the results of herbicide applications. Still, it was clear that halosulfuron 0.026 or 0.051 kg a.i./ha had no effect on plant height or visual rating. Yields were not statistically different from those of the control, when the effect of early blight was factored out.

FIELD EVIDENCE FOR A NEW RACE OF POWDERY MILDEW ON MELON

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Races 1 and 2 of *Podosphaera xanthii* (syn. *Sphaerotheca fuliginea*) were defined in Imperial Valley, Calif. 1938 when *P. xanthii* overcame genetic resistance in 'PMR 45'. Race 3 was first observed in the U.S. in 1976 in Texas; 15 additional races of *P. xanthii* have been reported in the literature since 1996. Races 1 and 2 have been common in Arizona and California based upon the effectiveness of the powdery mildew resistance genes in commercially available melon cultivars grown in these states. Field data from 11 commonly used melon *P. xanthii* race differentials in 2001 and 2002 indicated the presence of race 1 in the Imperial Valley and San Joaquin Valley of California, and Yuma, Arizona. In spring 2003, the powdery mildew race situation changed. The first evidence was the occurrence of a severe and widespread infection of powdery mildew in a commercial cantaloupe field. The 11 powdery mildew race differentials were susceptible to powdery mildew in a nearby replicated field test. PI 313970, a melon from India, was resistant to this apparent new race of powdery mildew.

IR4 SUPPORTED PEST CONTROL PRODUCT RESEARCH PLANS IN THE SOUTHERN REGION FOR YEAR 2005

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The three IR4 Programs(Food-Use, Ornamentals, Biopesticides) research pest control needs that originate from stakeholders in each state. Pest control needs are documented as Project Clearance Requests. Researchable projects are identified at the National Food UseWorkshop anda research plan is developed at National Headquarters.This year IR4will research magnitude of residue projects to secure labels on 25 pest product and vegetable crop combinations. The list of projects will be distributed. The IR4 Project, Southern Region has augmented this process by establishing the Southern Region Performance Program(SRPP). Research scientists are asked to submit funding proposals to evaluate pest control products. Each proposal is scrutinized to prioritize needs and identify the most appropriate pest control product technologies. Product registrants, IR4 coordinators and stakeholders are consulted before a final decision is made. More than 70 research scientists from all states in the Southern Region will participate in the SRPP in 2005. Research data will be documented by in the IR4 National Data Mining process and many new project requests will be produced and others expanded to provide workshop participants information as they set priorities for IR4 researchin year2006.

USING COVER CROPS TO IMPROVE VEGETABLE PRODUCTION IN SOUTH FLORIDA

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Summer cover crops can improve soil fertility by adding organic matter, supplying nutrients through mineralization, reducing nutrient leaching, and improving soil water and nutrient holding capacity. Other benefits include weed suppression and reduction of soil parasitic nematodes. A series of field experiments have been conducted at the UF IFAS Tropical Research and Education Center in Homestead, Florida to evaluate several summer cover crops for use in vegetable production in South Florida followed by field demonstrations conducted in the growers' fields. Best performing cover crops were legumes: velvet bean (*Macuna deeringiana*) and sunn hemp (*Crotalaria juncea* L. 'Tropic Sun') providing 13 and 11 Mt of dry matter/ha, respectively. Sunn hemp supplied 330 kg N/ha followed by velvet been with 310 kg N/ha. Traditional summer cover crop sorghum-Sudan produced 4 Mt of dry matter/ha and retained only 36 kg N/ha. In addition Sunn hemp significantly reduced soil parasitic nematodes for successive crops. Limitations in use of Sunn hemp by more vegetable growers in South Florida include cost and availability of seeds.

ORGANIC TOMATO PRODUCTION IN OKLAHOMA

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Plots were established at the Lane Agricultural Center in Lane, Okla., in 2003 for the purpose of conducting research in certified organic vegetable production. A field was selected that had been in pine timber since 1985. The field was cleared, plowed, disked, and land-planed. To establish a baseline for future reference, soil samples were collected on a 30 × 30 ft grid. Lime was added to adjust the pH. Poultry litter was added to the field as a fertilizer, and was incorporated by disking. Turnips were grown as a cover crop during the winter of 2003–04. In Spring 2004, the field was divided into four equal sections, which were planted with either tomatoes, sweet corn, watermelons, or southern peas. Tomatoes were planted using both determinate and indeterminate types. Plants were selected based on reported properties of interest to organic growers, such as disease resistance, pest resistance, or heat-set capabilities. The cultivars with greatest yield were Sunny, Solar Set, Classica, Sun Leaper, and Mountain Fresh. Visual disease ratings were taken throughout the season. Copper sulfate was used as a fungicide. The cultivars with the lowest disease ratings were Amelia, Peron, Celebrity, Florida 91, and Mountain Fresh. The major insect pest throughout the season was aphids. Aphid counts reached 6.9 aphids per leaf on 11 June. Two applications of AzaDirect, a neem extract, reduced aphid populations to 1.0 aphid per leaf on 17 June, 0.1 aphid per leaf on 25 June, and 0 aphids on 9 July.

REDUCING METHYL BROMIDE RATES WITH VIRTUALLY IMPERMEABLE FILMS FOR SOILBORNE PEST CONTROL IN BELL PEPPER

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Two field trials were conducted in Bradenton, Fla., to determine the effect of reduced methyl bromide plus chloropicrin (MBr + Pic 67:33 v/v) rates applied under two types of virtually impermeable films (VIF) on nutsedges (*Cyperus* spp.) and stunt nematode (*Tylenchorhynchus* spp.) control, and 'Capistrano' bell pepper (*Capsicum annuum*) crop yield. MBr + Pic rates were 0, 88, 175, and 350 lb/acre. Mulch types were low-density polyethylene (LDPE) mulch, Hytibar VIF, and Bromostop VIF. Results showed that there were no differences on weed and nematode control, and bell pepper fruit yield between the two types of VIF. Two exponential models characterized the nutsedge responses to MBr + Pic rates with LDPE mulch and VIF, with weed densities declining as MBr + Pic rates increased. Reducing MBr + Pic rates by one-half (175 lb/acre) under VIF provided similar nutsedge control as the full-rate (350 lb/acre) with LDPE mulch. Similar results were observed with stunt nematode, where the most effective control occurred with VIF. Bell pepper yield with LDPE mulch responded linearly to increased MBr + Pic rates. However, a logarithmic model described the response of pepper yields to the fumigant rates under VIF. The application rate of this fumigant could be effectively reduced to 25% of the commercial rate (350 lb/acre) under either VIF, without causing significant bell pepper yield losses.

FUNGICIDE APPLICATION FREQUENCIES FOR POTATO LATE BLIGHT (*Phytophthora infestans*) MANAGEMENT IN THE DOMINICAN REPUBLIC

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Field trials were conducted in Constanza, Dominican Republic to determine the most effective fungicide application programs against potato late blight, and the cost component associated to those programs. Fungicide programs were: a) chlorothalonil (1.0 kg a.i./ha) every 5, 8, 11, 14 or 17 days; b) chlorothalonil rotated with metalaxyl (1.5 kg a.i./ha) every 5, 8, 11, 14 or 17 days; c) mancozeb (1.5 kg a.i./ha) every 8 days (grower standard); and d) a nontreated control. Examined data indicated that the highest 'Granola' marketable tuber weights were obtained with the rotation of metalaxyl and chlorothalonil applied every 5, 8 or 11 days (14, 9 or 6 applications/season). This same rotation every 5 or 8 days (14 or 9 applications/season) was the most effective controlling late blight. There was no correlation between disease severity and marketable yield. For the cost components, the fungicide rotation

applied every 11 days reduced application costs by 29%, in comparison with applications every 8 days.

TOMATO NUTRIENT ABSORPTION AND NUTSEDGE (*Cyperus* SPP.) MANAGEMENT WITH PROPYLENE OXIDE

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Among the current methyl bromide alternatives under study, propylene oxide (Propozone) has shown potential to control soilborne diseases, nematodes, and weeds in polyethylene-mulched tomato. However, further research is needed to determine the appropriate application rates to control nutsedge in the crop. Also, the effect of this fumigant on tomato nutrient absorption has not been determined yet. Therefore, field trials were conducted for this purpose in Bradenton, Fla. Tested rates of Propozone were 0, 190, 380, 570, 760, and 950 $L \cdot ha^{-1}$ and were shank-applied in raised planting beds three weeks before 'Florida 47' tomato transplanting. Examined data indicated that there was a rapid decrease in nutsedge density with 570 $L \cdot ha^{-1}$. For phosphorus (P) and potassium (K) foliar content, there was a linear increase of P concentrations as rate increase, whereas K content increased rapidly after 190 $L \cdot ha^{-1}$. The highest tomato yields were obtained with 760 and 950 $L \cdot ha^{-1}$ of Propozone.

EFFECTS OF TIME OF EMERGENCE ON PURPLE AND YELLOW NUTSEDGE AREA OF INFLUENCE IN BELL PEPPER

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Field trials were conducted in Bradenton, Fla., to determine the effect of purple and yellow nutsedge (*Cyperus rotundus* and *C. esculentum*) time of emergence on the area of influence of each weed on bell pepper (*Capsicum annuum*). Each weed-bell pepper complex was studied separately. A single weed was transplanted 1, 2, 3, 4, and 5 weeks after bell pepper transplanting (WAT) and bell pepper yield was collected at 0, 30, 60, and 90 cm from each weed. Bell pepper yield data indicated that yellow nutsedge was more aggressive than purple nutsedge interfering with bell pepper. When yellow nutsedge emerged 1 WAT, bell pepper yield losses were between 32 and 57% for plants at 0 and 30 cm away from the weed, respectively, which represents at least a density of approximately 3.5 plants/m^2. For purple nutsedge, one weed growing since 1 WAT between two bell pepper plants (0 cm; 10 plants/m^2) produced a yield reduction of 31%. These results indicated that low nutsedge densities, which are commonly believed to be unimportant, can cause significant bell pepper yield reductions.

DIFFERENTIAL PURPLE NUTSEDGE (*Cyperus rotundus*) PENETRATION THROUGH MULCH FILMS

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Purple nutsedge can easily penetrate polyethylene mulch films. However, there are no reports on possible differences among mulch films. Because of this situation, field trials were conducted in Ruskin and Bradenton, Fla., during 2002 and 2003. In Spring 2002, the treatments were a) no mulch, b) black Pliant High Barrier mulch, and c) green Klerk's Virtually Impermeable Film (VIF). In Spring 2002, the films were a) black Pliant High Barrier, b) black IPM Bromostop, c) metallized Pliant, and d) green Klerk's VIF. The number of nutsedge emerged through the films was determined. No fumigants or herbicides were applied. Results indicated that the Klerk's VIF had the lowest nutsedge densities. No nutsedge control differences were found between the IPM Bromostop and the metallized Pliant films. These differences might be due to the physical properties of the films, including stretching and thickness.

EFFICACY OF DRIP-DELIVERED HERBICIDES FOR WEED CONTROL IN TOMATO IN PUERTO RICO

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A field study was conducted in Gurabo, P.R., to examine the potential of drip-applied herbicides for weed control in polyethylene-mulched tomato. The herbicide treatments were a) metolachlor at a rate of 1.1 kg a.i./ha; b) napropamide at 2.2 kg a.i./ha; c) pebulate at 4.5 kg a.i./ha; and d) trifluralin at 0.8 kg a.i./ha. A nontreated control was added. Each herbicide plot was split in two application methods: preemergence application and through the drip lines with 100 m^3 water. In both cases, herbicides were delivered three weeks before tomato transplanting. There was no significant difference between the two delivery methods. Metolachlor showed the best control of broadleaf weeds (>80%) and highest tomato fruit yield. Applying herbicides through the drip lines is a viable alternative in mulched tomato.

MELON PEST MANAGER—CHALLENGES OF A NEW INFORMATION RESOURCE

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Geographical dispersion of production hampers watermelon integrated pest management (IPM) information delivery in Oklahoma. Melon Pest Manager (MPM) was created to educate and provide advisory information on IPM. Available at www.lane-ag.org, the site emphasizes information relevant to the area. MPM was conceived as Internet availability grew and was recognized to have potential for enhancing IPM implementation. Survey of producers suggested the value of Web-based information may depend on how easily it can be accessed. MPM was designed to provide easy access to watermelon IPM information. Compared to printed literature, web-based format is easier to revise and suited to presentation of information that applies yearly as well as that which may change frequently. MPM provides general discussion of melon IPM tactics and pest-identification and time sensitive information such as pest advisories and pesticide registration changes. MPM offers opportunity for novel presentation of educational information such as the real-time posting of field demonstrations. An initial challenge was to balance site development, promotion and education. Promotion and education followed placement of watermelon IPM tactic information on MPM but preceded advisory and pest identification. Pest identification links to existing sources are enhanced by material prepared for MPM. Progress is slowed by the need for expert intervention and the availability of images and descriptive information. Education on use of advisory resources (e.g., disease forecasters) is a high priority. However, availability and applicability of such products is dependent on the home site. The original concept envisaged mapping of pest activity using grower, extension agent and expert input. Time demands of other components of the site delay development of this aspect. Pest alerts are posted and distributed to county extension offices.

THE INCORPORATION OF THE FRACTAL GROWTH HABIT INTO WESTERN SHIPPING MELON

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Plant improvement incorporating quantitatively inherited yield component traits is technically difficult, time consuming, and resource demanding. In melon (*Cucumis melo* L.), the inheritance of yield components is poorly understood. A unique highly branched fractal melon plant type has been developed by the U.S. Department of Agriculture (USDA) from exotic germplasm to improve yield of U.S. Western Shipping type melons (Group Cantalupensis). In order to more effectively develop useful germplasm for commercial use the genetic of components of yield must be clearly understood. Thus, the genetics of branching, an important yield component, was investigated. Melon progeny derived (F1, F2, F3, BC1P1, and BC1P2) derived from a cross between USDA line 846-1 (P1) and Top-Mark (P2) were used to evaluated in two locations (Wisconsin and California) to estimate of components of variance, and narrow-sense (h2N) and broad-sense (h2B) sense heritabilities. Lateral branch numbers among 71 to 119 F3 families were significantly different (P ¾ 0.01) regardless of test environment. Covariance analyses indicates that branching is moderately heritable (h2B = 0.62 to 0.76, h2N = 0.43 to 0.48), and conditioned by several additive factors (perhaps 2 to 4) that are highly additive. Although environment plays an important role in lateral branch development, family rankings over environments were relatively consistent, indicating that effective selection for this trait should be useful for incorporating the fractal plant habit into Western Shipping melon. The significant additive component underlying lateral branch number indicates

that quantitative trait loci (QTL) conditioning this yield component might be identified for use in marker-assisted selection.

TOMATO CULTIVAR EVALUATION IN ARKANSAS

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A fresh-market tomato trial was conducted in 2003 at two locations in Arkansas (Fayetteville and Kibler) to evaluate new and old tomato varieties of interest to home gardeners and farmers' markets. The observational trial consisted of 43 varieties, indeterminates and determinates. Heirloom tomatoes comprised a large portion of the trial due to increasing popularity. Heirlooms are unique and can be very eye-catching. There is immense variety in shape, size, and color. They can be large or small, many times the shape is irregular, and the fruits flawed (cracking, cat-facing, green shoulders). The fruit may not store or ship well; most are grown and sold locally. Some heirlooms are better than others. A few of the varieties that stood out in the trial were Costoluto Genovese, Abraham Lincoln, Dona, and Persimmon. Costoluto Genovese, a uniquely ruffled red tomato, was the highest yielding variety at the Kibler location. Fruit quality remained high even in the highest temperatures. One of the most promising was a orange variety called Persimmon, it produced large fruit and the plants provided excellent cover. Dona and Abraham Lincoln, both reds, yielded well and had good flavor. San Marzano and Arkansas 7985 were the best paste types. Arkansas varieties such as Bradley, Ozark Pink, and Arkansas Traveler 76 also did well. Brandywine varieties had low yields and lesser quality fruit. Green zebra, a green striped fruit with good flavor, yielded less due to Blossom End Rot. Cherokee Purple and Carbon were two from the purple/black category that did not do well; yields were low and the fruit cracked.

Fruit Crops Section

REGIONALIZATION AND FRUIT CROPS IN THE SOUTHERN REGION: INTRODUCTION

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Regionalization is a contemporary issue facing those of us involved in research, teaching and extension in the area of agricultural and environmental sciences. Primarily, regionalization involves sharing of intellectual resources (i.e., scientists, specialists) across institutional boundaries to accomplish common objectives. While at times it seems that regionalization is simply a euphemism for down-sizing, the issue can actually be broader reaching than that. Given our increased ability for virtual technology transfer, the global market our clientele face, and the ever decreasing budgets for agriculture, regionalization may well be a key to meeting the needs of those we serve in the most cost efficient way. Hopefully, as we regionalize, the efforts will be synergistic. There also has to be awareness that personal contact with our constituents is still highly desirable for many. The purpose of this forum is to gain perspectives, both pros and cons, from those involved in regional efforts. These perspectives will include an administrator, a regional faculty, and an extension specialist/agent. Also, there will be two examples of regional efforts that are underway: the USDA–ARS Southern Horticultural Laboratory and the Southern Region Small Fruit Consortium.

REGIONALIZATION AND FRUIT CROPS IN THE SOUTHERN REGION: BENEFITS AND CHALLENGES FROM AN ADMINISTRATIVE PERSPECTIVE

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Regional cooperative efforts such as the Southern Association of Agricultural Experiment Station Director's Advisory Committees, Development Committees, Multi-State Research Fund supported projects, and Southern Extension/Research Activities Information Exchange Groups have been in existence and have been successful for many years. However, there are opportunities and compelling circumstances for more intensive regionalized efforts, including multi-state faculty positions and multi-state cooperatives. The University of Georgia is involved in three multistate horticulture faculty positions—an orchard floor management specialist (shared with Clemson University and North Carolina State University), an apple research position (shared with Clemson University, North Carolina State University, and The University of Tennessee), and an apple extension specialist (shared with The University of Tennessee)—and one multi-state cooperative, the Southern Region Small Fruit Consortium (supported by Clemson University, North Carolina State University, The University of Georgia, and The University of Tennessee). Justification for these regional efforts includes the following: 1) federal legislation now mandates multi-institutional and integrated (research and extension) activities; 2) state boundaries form artificial barriers that are transparent to clientele groups, problems, and solutions; 3) decreasing state budgets have resulted in faculty and staff reductions at many institutions, with a subsequent decline in services to clientele groups; and 4) in times of limited funding, universities must focus on areas of excellence and collaborate with other institutions to fill in the remaining gaps. Benefits we have realized from these efforts include the following: 1) better service for minor commodities; 2) better educational programs due to larger venues and pooled overhead funds; 3) enhanced communication among institutions leading to increased cooperative efforts in other areas; and 4) reduced duplicity among institutions resulting in freed up resources to address other high priority areas. There are challenges unique to regional cooperatives: 1) travel distances for extension faculty may be increased and require a high degree of planning and coordination; 2) depending on the housing location of the shared specialist, response time can be greater than if program were housed in-state; and 3) shared programs require open, effective, and increased communications among cooperators. In our experience, the benefits of regionalization far outweigh the additional challenges encountered. However, to be successful: 1) the whole must be greater than the sum of the parts; 2) each partner must have identify preservation; 3) stakeholders must realize value from the programs and must be kept abreast of program successes to assure their continued support.

REGIONALIZATION AND FRUIT CROPS IN THE SOUTHERN REGION: SPECIALIST'S POINT OF VIEW

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Regional efforts among research and extension workers in Southeastern fruit crops have evolved from early meetings to write pest control recommendations to more formal interactions such as regional research projects, meetings and publications. For apples, there are currently three individuals in the Southeast working in more than one state. Why regionalize? Similar growing conditions, the need to react quickly to critical issues, intensification within production, broadening of responsibilities and a dramatic reduction in the number of research and extension personnel to address these issues necessitate cooperative efforts. Regional efforts pose special challenges such as increased workloads and greater travel demands, often without increased funding. Conversely, regionalization may enable specialists and researchers to focus their attention on fewer commodities and areas, thus becoming better resources for growers and the industry. In this vein, regional responsibilities entirely within research or extension might be a better option than split appointments encompassing research, extension and, perhaps teaching, within a state. In the future, state lines will become less distinct with research and extension appointments reflecting regional responsibilities. Growers do not care where their information comes from as long as it is available and pertinent to their operations. Regionalization is a positive step for increasingly challenging times.

REGIONALIZATION AND FRUIT CROPS IN THE SOUTHERN REGION: USDA–ARS SOUTHERN HORTICULTURAL LABORATORY

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The Southern Horticultural Laboratory evolved from the USDA Small Fruit Research Station located at Poplarville, MS. A short history of the research facility and present horticultural research directions will be discussed. Emphases will be on past and present cooperative regional research efforts in horticultural crops.

REGIONALIZATION AND FRUIT CROPS IN THE SOUTHERN REGION: UPDATE ON THE SOUTHERN REGION SMALL FRUIT CONSORTIUM

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The Southern Region Small Fruit Consortium (SRSFC) was established in 1999 through a Memorandum of Understanding signed by representatives from NC State University, Clemson University and the University of Georgia.

The mission of the SRSFC is to promote the small fruit industry in the south through education, research and outreach by regional collaboration utilizing the expertise of the member institutions. The University of Tennessee joined the SRSFC in 2002. Annual dues for membership in the consortium are $35,000. The SRSFC is governed by a steering committee comprised of university and industry personnel from the four member states. The SRSFC has sponsored 10 agent trainings since 1999 on various small fruit topics involving a total of 233 agents from the member states and adjacent states. From 2001 to 2004, the SRSFC awarded $221,300 to research and outreach projects in the member states. A web site has been established (http://www.smallfruits.org) to provide information on small fruits. The site averaged 2,059 hits per day for 2004.Challenges facing the SRSFC are renewal of the MOU in 2007; equal distribution of research and outreach funds in the member states; continuity of leadership; and recruitment of new members.

ORGANIC BLUEBERRY PRODUCTION AND OBSERVATIONS IN GEORGIA

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Georgia has an excellent window for organic blueberry production since much of the crop ripens ahead of production in the northern U.S. Major challenges facing Georgia organic blueberry growers are weed control, organic fertilization, insect control and disease control. A team of Georgia growers, extension agents and scientists are working together to solve these production problems. Since 2002 a series of experiments have been conducted on blueberry establishment and maintenance. Various mulch materials were tested. On young plants, pine straw produced the highest yields, but pine bark and landscape fabric were also successful. With the pine straw treatment, a respectable yield of 0.97 kg/plant occurred 24 months after planting. In addition, a bed shaper–plastic mulch layer was modified by developing a removable center. Using this system, beds are formed, plants are mechanically transplanted, plants are pruned to 75 mm, and plastic is then pulled over the stem. This produces a fairly tight fit around the stem and a nearly weed free system except for weeds growing from the edges. On mature plants, pine bark and wheat straw were tested. Wheat straw produced excellent weed control and improved blueberry growth in year one and two. However, pine bark mulch provided the best weed control in year three. Various organic burn down compounds such as vinegar, Xpress, Alldown, and Matran 2 were tested for winter weed control efficacy. In these trials Matran 2 was the most effective, and the product also performed well on woody weeds that were winter pruned, allowed to resprout and then treated. A propane torch was also tested, but discarded because of the fire hazard. Entrust insecticide was tested for thrips control and gibberellic acid for fruit set. Thrips populations were low, so no effect on fruit set was noted from Entrust. Gibberellic acid significantly improved fruit set.

STIGMATIC RECEPTIVITY AND POLLEN TUBE GROWTH IN RABBITEYE BLUEBERRY

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Effective pollination period (EPP) is the number of days during which pollination is effective to produce a fruit. The EPP is determined by ovule longevity, pollen tube growth rate and length of stigmatic receptivity. The objectives of this research were to establish the EPP of rabbiteye blueberry and to further the understanding of its limiting parameters. The experiments were conducted in growth chambers using blueberry plants of the cultivars Brightwell and Tifblue. Emasculated flowers were hand-pollinated at 0, 2, 4, 6, and 8 days after anthesis (DAA). Ripe fruit were harvested to record percentage fruit set. Stigmatic receptivity was evaluated as the number of germinated tetrads on the stigma 24 hours after pollination. Under day/night temperatures of 23/10 °C, the EPP was 7 days. Stigmatic receptivity was lowest on the day of anthesis and increased as flowers aged. Stigmatic receptivity was not positively correlated to fruit set, therefore, this parameter was not the most limiting factor of the EPP. Observations of pistils pollinated 3 DAA indicated that the fastest growing pollen tubes reached the bottom of the style 2 to 3 days after pollination. Self-pollination resulted in normal pollen tube growth in the style and inside the ovary. Self-pollen tubes were seen penetrating the micropile.

STATUS OF BLUEBERRY PRODUCTION IN CHINA

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China is poised to make a substantial leap in blueberry production within the next ten years. This paper reviews the history of blueberry introduction and evaluation in China, current distribution, potential growing areas, the species and cultivars involved, propagation studies, production and projected market potential. Rabbiteye varieties introduced in 1987 to the Nanjing Botanical Garden have many years of production data. Nursery propagation and multiplication is a success. Rabbiteye blueberries with over 10 years of evaluation include Baldwin, Brightwell, Centurion, Choice, Climax, Delite, Gardenblue, Powderblue, Premier, Tifblue, and Woodard. There are many regions in the Southern belt of China adapted to blueberries, provided specific soil and climatic preferences are present. The potential for a large domestic fresh and processed blueberry industry appears enormous. Economic gains in China and the entire Pacific rim has resulted in a large population of health-conscious citizens with disposable income. China appears uniquely poised in the region to greatly expand production. This paper will review a number of business efforts underway—both private and joint ventures—that will soon reach full commercial production.

PERFORMANCE OF DAY-NEUTRAL STRAWBERRIES IN WESTERN NORTH CAROLINA

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Day-neutral strawberries have the potential to fruit throughout the growing season as long as maximum air temperatures do not exceed 32.2 °C for extended periods. Appropriate temperatures for season-long production of day-neutrals occur in the southern Appalachians at 900 m elevations and above. Replicated studies were conducted at Laurel Springs (900 m elevation) in northwestern N.C. in 2002–04 to determine the most promising combinations of mulch types, planting dates and cultivars. Plasticulture establishment recommendations were followed and white/black plastic mulch compared to black. Dormant plants were established 15 Apr., 1 May, or 15 May at 12 × 12 inch spacing in 2002; plug plants on 30 Oct. 2002 at 12 × 12 inches and overwintered under rowcovers for 2003; and plug plants on 25 Sept. 2003 or 23 Oct. 2003 at 18 × 12 inches and overwintered under rowcovers for 2004. Plants came from commercial sources. Aromas, Diamante, Everest, and Seascape were included in 2002; Diamante, Everest and Seascape in 2003; and Everest and Seascape in 2004. Harvest season lasted 11 weeks in 2002, 12 weeks in 2003, and 10 weeks in 2004. Only main effects were statistically significant. White and black plastic mulch yields were significantly higher than black two years out of three. Fall planting resulted in earlier onset of production and higher yields in most cases. Planting date was important; for fall planting, mid- to late September was superior to October planting, and for spring planting, middle to late April was superior to mid-May. A plant spacing of 18 inches between plants in rows and 12 inches between rows was important to avoid crowding when planting in fall. Everest and Seascape had the best overall performance.

'WHITE ROCK' AND 'WHITE COUNTY' FRESH-MARKET PEACHES

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'White Rock' and 'White County' fresh market peaches (*Prunus persica* (L.) Batsch) were released in 2004 by the University of Arkansas Agricultural Experiment Station. These cultivars join 'White River' as recent products of the peach breeding program which is based at the University of Arkansas Fruit Substation, Clarksville. Both cultivars are sub- or low-acid types and have white flesh. 'White Rock' ripens at on average 25 June, and is very firm at maturity. Average fruit weight was 142 g with 12% soluble solids and light white peach flavor. 'White County' ripens on average 14 July. It is large fruited with average weight of 258 g and maintains firmness until full maturity. The fruits are freestone with an excellent white peach flavor. Both cultivars show good bacterial spot resistance although occasional lesions are seen on leaves. These new cultivars offer additional white peach cultivar choices for the mid-South and other areas of similar climate.

TESTING POTENTIAL ALTERNATE METHODS OF BLOOM THINNING FOR APPLE IN VITRO

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Alternate bloom thinners are needed for apple are needed to replace compounds which can no longer be used or have production system limitations. The effects of 24 chemicals selected as osmotic agents, organic acids, oils, essential oils, or potential metabolic agents and their properties of pH, electrical potential (EP) and water potential were tested in vitro on 'Gala' apple pollen germination, tube growth and pistil damage. Solution concentrations of 0%, 0.25%, 0.5%, 1%, 2%, 5%, and 10% were prepared and solution pH, EP, and water potential measured. To test affects on germination, pollen was placed on agar germination media in petri dishes and then treated with 10: l of chemical solution. Percentage pollen germination and tube growth was calculated 4, 12, and 24 h after treatment. Excised pistils from forced flowers were placed on glass filter papers saturated with chemical solution. Pistil damage was visually, subjectively rated for damage indicated by discoloration 24 h after treatment. Effects of solution pH, EP and water potential on pollen germination, tube growth and pistil damage was significant with pH less than ≈4.0 or greater than ≈10.0, EP > 200mv, or water potential less than ~4.0MPa inhibited pollen germination, growth, and killed pistils. Several chemical had apparent metabolic effects beyond the chemical effects mentioned above. In vitro tests were correlated to in vivo field tests in other studies indicating the use of pollen and pistil in vitro as a useful model for screening potential alternative thinning agents.

APPLE CULTIVAR DEVELOPMENT IN ARKANSAS

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Apple cultivar development is an important program necessary to sustain the existing fruit industry and stimulate new production systems for Arkansas and the region. The cultivar development program has two parts. First, currently available cultivars are tested with multiple trees for multiple years. Second, about 150 advanced selections from the Arkansas apple breeding program are evaluated in trials with multiple trees (2nd test) and in replicated trials (3rd test). The goal of both programs is to identify cultivars that have potential in the local production systems and for Arkansas' markets, and to identify those cultivars which are not adapted to the region. All cultivars and advanced selections are evaluated for ≈35 qualitative and quantitative characteristics, including time of bloom, time of harvest, length of harvest season, fruit aesthetic and internal quality, environmental adaptability especially to heat and high light, and insect and disease susceptibility. Primary diseases for which cultivars and selections are screened include fireblight, cedar apple rust, powdery mildew, black rot, white rot and bitter rot. Primary insect pests include mites, codling moth, plum curculio and Japanese beetle. Cultivars are evaluated in the field, under standard management conditions for five to seven years of production before summary evaluation. The program has identified cultivars including traditional cultivars, new cultivars, and heritage cultivars adaptable to the local and regional climates and suitable for those markets.

THE SOUTHERN ORGANIC FRUIT INITIATIVE: A NEW MULTI-STATE, MULTI-DISCIPLINARY COOPERATIVE PROJECT TO STIMULATE RESEARCH, OUTREACH AND PRODUCTION IN THE SOUTHERN REGION

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Fruit production in the Southern region has declined in the last several decades. Further, although certified organic fruit production has increased significantly in other regions of the US in the past decade, there has been very little growth of that industry in this region. It is presumed that the lack of production is based upon the lack of research, out-reach, and science-based information available to growers which make organic production possible. Based on planning grant funding from the Southern IPM Center program and the Sustainable Agriculture Research and Education program a Southern Organic Fruit Working Group is being formed. The projects are collaborative efforts of horticulturists, entomologists, plant pathologists, soil scientists, and agricultural economists in Arkansas, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee. In each state, a coordinator is hosting stake-holder focus groups of producers, marketers, processors, extension workers, consultants, organic certifiers, etc. The purpose of focus group meetings is to identify challenges and opportunities in production and marketing organic fruit, especially apples, blackberries, blueberries, and peaches, in the Southern Region. Coordinators are combining findings from state focus group meetings to establish priorities for research and outreach to support organic production, and will work collaborative to addresses those priorities. Because of the similarity in climate, geography and demographics of growers and markets among the states of the region, this is a project best addressed as a regionally collaborative effort.

DRIP-IRRIGATION RATES FOR MUSCADINES

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During 1997 through 1999 mature 'Southland' muscadine grapes were grown in Griffin, Ga., with different rates of daily irrigation. Irrigation rates were 0, 15, 22.5, and 30 $L \cdot d^{-1}$ (LPD), supplied to individual plants through 2 emitters. In 1997, substantial water deficit occurred during August, in 1998 during May and June, and in 1999 during July and August. The greatest yield response to irrigation was observed during 1998. No significant response to irrigation was observed during 1999, even though soil water was greatly depleted in the upper 30 cm late in the season for control plants. The 3-year average response of total yield indicated a significant response to irrigation, with the greatest yield occurring at the 22.5 LPD rate. Together these data suggest that muscadine grapes respond to irrigation, especially when water deficits during the early to mid season are prevalent. With single trellis vines, 22.5 LPD should provide adequate water in warm, humid regions similar to the southeastern U.S.

Floriculture, Ornamentals, and Turf Section

EFFECTS OF FLURPRIMIDOL AND ANCYMIDOL ON GROWTH AND POSTHARVEST PERFORMANCE OF *Geogenanthus undatus* 'INCA'

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Geogenanthus Ínca' is a new cultivar introduced the foliage plant industry which shows promise in interior plantscaping. The objectives of this study were twofold; to examine the effects of ancymidol and flurprimidol on G. 'Inca' growth and determine if plant growth retardant (PGR) application could improve postharvest performance. Four weeks before attaining marketable sizes, the plants were drenched with ancymidol or flurprimidol at 0.0, 0.5, 1.0, or 1.5 mg (a.i.). Plants were then placed in interior-evaluation rooms under 12 $\mu mol \cdot m^{-2} \cdot s^{-1}$. Ancymidol or flurprimidol reduced plant height, width, growth index and total leaf area, total dry weight and shoot to root ratio of *Geogenathus* 'Inca'. Flurprimidol increased the deposition of insoluble carbohydrates (starch) and altered the pattern of starch deposition; higher starch content was found in stem tissue compared to foliage tissue. The effects of ancymidol or flurprimidol persisted in the postharvest environment. After 4 months under low irradiance, PGR-treated plants exhibited higher quality, i.e., compact stature and reduced leaf and shoot necrosis. This research has potential significance for the foliage plant industry and it showed that a single drench application at label recommended rates of ancymidol or flurprimidol late in the production cycle can produce desired growth control of *Geogenanthus* 'Inca' in the postharvest environment. Plants retain aesthetic characteristics for extended period thus necessitating lower replacement rate.

THE INFLUENCE OF TEMPERATURE, IRRADIANCE AND PHOTOPERIOD ON GROWTH AND FLOWERING OF *Ruellia* 'RAJIN CAJIN'

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Plants were subjected to daily temperatures of 15, 20 or 25 °C after transplanting to 10cm containers. As temperatures decreased, plants were significantly slower to reach anthesis, however, however no significant differences in visible bud time occurred between 20–25 °C. Night break incandescent lighting or HID lamps for 2 or 4 weeks were used to illuminate plants during the daylight production cycle (0800–1700 HR). No differences in growth or flowering time between HID durations occurred, but both HID treatments resulted in larger plants and one week faster flowering compared with control and incandescent-lit plants. The effect of incandescent light,

however, had no effect on flowering time but resulted in significantly taller plants. Additional photoperiod studies were conducted using continuous LD (night-break lighting), continuous SD (black cloth from 1700-0800) and a combination of LD-SD and SD-LD treatments. In all treatments, photoperiod had no significant effect on flowering time or growth, suggesting *Ruellia* 'Rajin Cajin' is a day neutral taxon. Experiments with 'Rajin Cajin' suggested in was a 6 week crop from plug to market.

LANDSCAPE PLANT OBSERVATIONS FROM THE LSU AGCENTER, 2004

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Performance evaluations of numerous annual and perennial herbaceous ornamentals were conducted in landscape settings in 2004 at the LSU AgCenter in Baton Rouge. A mid-summer through fall evaluation of Kong coleus found no difference in flowering performance and visual quality ratings of the five available cultivars. In a sun/shade study, Kong coleus cultivars in 60% shade were about 50% shorter than those in sun. Other impressive coleus have been Aurora Black Cherry and Mississippi Summer Sun. The Stained Glassworks series of coleus have been average performers. The Son series of lantanas (Sonrise, Sonset, Samson, Sonshine) have been top performers in terms of visual quality and continual bloom. All-America daylilies most prevalent to rust symptoms have included Judith, Leebea Orange Crush, Starstruck, Lady Lucille, and Chorus Line. Some rust has also been noted on Plum Perfect and Frankly Scarlet. Profusion Apricot and Profusion White have been less susceptible to *Xanthomonas* bacterial petal blight than Profusion Fire, Profusion Cherry, and Profusion Orange. Earth Kind roses, being promoted by Texas A&M, are being evaluated for landscape performance along with black spot and powdery mildew susceptibility. Most problematic cultivars thus far have included Georgetown Tea, Clotilde Soupert, Nacogdoches, Reve d'Or, New Dawn, Souvenir de St. Anne's, Spice, Lamarque, Puerto Rico, Sarah Jones, Ducher, and Louis Philippe. Lady Bird cosmos have been good late summer/early fall landscape performers.

EVALUATION OF A SLOW-RELEASE FERTILIZER POWDER FOR LIQUID APPLICATION TO TURF AND TREES

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A new slow-release powdered fertilizer product has been developed for use in the landscape industry. A series of tests was conducted to evaluate this product in several landscape applicator modes: turf broadcast, turf gun, and soil injection (for trees). Variables included concentration, nozzle size and type, pressure, agitation, and holding time in the tank before spraying. The product worked well in a wide variety of spray equipment and operating conditions. It could be sprayed at a rate of 0.030 kg N/L in nozzles as small as DG 8002 (0.011 $L \cdot s^{-1}$ flow rate) without nozzle plugging and at rates of up to 0.060 kg N/L in larger nozzles. The product settled out of suspension rapidly, so good agitation was critical. No differences were noted due to nozzle type or spraying pressure. Suspensions could be held overnight if properly reagitated before spraying. Foaming was a problem with this product. An antifoam agent should be considered. Large-diameter filters minimized problems.

SILICON INVESTIGATION ON FLORICULTURE CROPS

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Silicon (Si) is a nonessential element that has proven to be a beneficial supplement to agricultural crops. In floriculture greenhouse production, soilless substrates have limited Si content and supplements may improve plant quality. The objective of this study was to determine Si sources, rates, and application methods to improve plant quality. *Zinnia elegans* 'Oklahoma Formula Mix', *Helianthus annuus* 'Ring of Fire', and *Gerbera* 'Acapella' were provided potassium silicate ($KSiO_3$) as a media incorporated flakes or weekly drench, sodium silicate ($NaSiO_3$) as weekly foliar spray or ashed rice hulls. *Zinnia* and *Helianthus* Si levels were highest in leaf (0.5% to 1.7%), followed by flower (0.3-0.5%) and stem (0.2-0.4%) tissues. *Gerbera* accumulated lower amounts of Si compared to *Zinnia* and *Helianthus* with similar leaf and flower content values ranging from 0.4% to 0.6% with stem values 0.4% Si. Depending on source and rate, several horticultural traits were improved. *Zinnia* benefits included stem thickness, increase in flower diameter and stem erectness. *Helianthus* Si supplementation resulted in increased stem thickeness and flower diameter. However, phytotoxicity problems occurred with Si rates above 200 $mg \cdot L^{-1}$ (SiO_2 applied as weekly potassium silicate drench). *Gerbera* stems thickened with $KSiO_3$ and $NaSiO_3$ applications, but $NaSiO_3$ foliar sprays increased stem length, flower diameter and resulted in earlier flowering.

A HISTORY OF SOUTH FLORIDA GARDENING—A REVIEW OF MABEL WHITE DORN AND MARJORY STONEMAN DOUGLAS' *THE BOOK OF TWELVE FOR SOUTH FLORIDA GARDENS*

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Published by the South FL Garden Club in 1928, when Mabel Dorn was president and Marjory Stoneman Douglas—famous for championing the protection of the Everglades—was garden editor of the *Miami Herald*, *The Book of Twelve* lists twelve tried and true flowering and shade trees, large to small shrubs, etc. for southern Florida, but also includes some plants which are now tried and true invasive species. The book was reviewed in July 2004 by the Univ. of Florida (FL)/Miami-Dade Florida Yards and Neighborhoods (FYN) Extension Agent in response to a request from a local garden club, which as a club project, had decided to re-print and distribute the book to its 100 members. Because it might encourage the use of invasive species, the review was discussed at a seminar on ecologically sustainable alternatives to invasive species. One recommended plant, *Schinus terebinthefolius* (Brazilian pepper) is now prohibited by the FL Dept of Environmental Protection and considered a noxious weed by the FL Dept of Agric and Consumer Services. The FL Exotic Plant Pest Council (FEPPC) considers five plants Category I invasives, i.e., exotics altering native plant communities, displacing natives, changing community structures or ecology, or hybridizing with natives. These include *Lantana camara*, *Lonicera japonica, Abrus precatorius* and *Asparagus africanus.* Ten plants are FEPPC Category II invasives, exotics increasing in abundance or frequency, but not yet altering plant communities as extensively as Category I species: *Cestrum diurnum, Murraya paniculata, Sesbania punicea, Cryptostegia grandiflora, Jasminum sambac, Antigonon leptopus, Macfadyena unguis-cati, Asystasia gangetica, Wedelia trilobata,* and *Tradescantia fluminensis*.

EXTENSION PROGRAM HELPS CITY OF NORTH MIAMI SAVE A MILLION IN HURRICANE DAMAGE

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In 1992, Hurricane Andrew destroyed over 1000 mature trees in the City of North Miami, located 50 mi north of the storm center. The cleanup cost over $1,000.000. Most of the tree failures were caused by structural faults: co-dominant leaders, narrow limb attachment, included bark, over-lifting, hat-racking, poor vertical limb placement, crown imbalance, overly-dense crowns, crossing and in-growing branches. All could have been corrected with proper pruning. Action was taken to reduce future damage. The city arborist made a complete, computerized inventory of all trees on public property, creating a data-base with all structural problems identified. These were prioritized so the worst could be addressed first. After any pruning work was done on a city tree, a follow-up evaluation was made, and any additional pruning needed was scheduled. Pruning followed the recommendations of state specialists and three county extension agents with the University of Florida Cooperative Extension Service. City workers were taught using lectures, demonstrations, site visits, CES publications, and individualized instruction. In addition, all new trees purchased were grades FL Fancy or FL no. 1, based on *Grades and Standards for Nursery Plants*; such trees require little or no corrective pruning at planting and mature as structurally-sound trees which resist wind damage. Two later storms (1993, 1999) produced winds in North Miami similar to those of Hurricane Andrew. Together they destroyed only 35 trees which cost $35,000 to remove. These data demonstrate that following CES pruning recommendations reduces storm damage to trees, saving money and preserving the urban forest canopy.

HEIGHT CONTROL OF HERBACEOUS PERENNIALS FORCED USING NIGHT-INTERRUPTED LIGHTING UNDER NURSERY CONDITIONS

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In previous studies, night-interrupted lighting (NIL) promoted earlier flowering of summer-blooming herbaceous perennials grown under outdoor nursery

conditions in the southeastern U.S. However, NIL promoted excessive plant height, thus reducing product quality. Our objective was to control plant height of *Coreopsis grandiflora* 'Early Sunrise' (ES) and *Rudbeckia fulgida* 'Goldsturm' (RG) grown under NIL with plant growth retardants (PGR) without offsetting earlier flowering promoted by NIL. Treatments under NIL were three rates of daminozide, daminozide plus chloromequat, flurprimidol, uniconazole, and NIL and natural controls. Plant height was reduced 3% to 38% in ES and 8% to 31% in RG and time to visible bud was unchanged by all PGR treatments compared to the NIL control. Time to visible bud was unchanged in RG by all PGR treatments and flurprimidol in ES, but the remaining PGR treatments increased time to visible bud compared to the NIL control in ES. Only ES plants treated with daminozide and daminozide plus chloromequat at the two highest rates and all rates of uniconazole were similar in height to the natural control. RG plant heights with the two highest rates of flurprimidol and uniconazole and the highest rate of daminozide plus chloromequat were less than the natural control; heights of plants in the remaining PGR treatments were similar to the natural control. Quality rating was unchanged in RG but was increased in ES by all PGR treatments compared to the NIL control.

SUCCESSFUL APPROACHES PROVIDING SAFETY TRAINING FOR FARM AND LANDSCAPE EMPLOYEES IN SOUTHERN FLORIDA

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Safety training for farm, nursery and landscape workers has been provided in Miami-Dade County in English and Spanish for many years. Vegetable workers are available August–September; nursery, landscape and tropical fruit workers all year. Certificates of Completion and proof of training cards are provided. Traditionally, a half-day rodeo was offered—instructors delivered presentations several times as participants move from room to room. 4 to 6 agents and 2 to 4 volunteers are needed to teach such training, plus 8 to 10 classrooms. 100+ vegetable and nursery workers participate. A local school was used for many years, with training scheduled when school was out. A tractor driving competition was held after lunch, with trophies and cash prizes. As scheduling the school became difficult, training was offered at the CES office using one room and 2 agents (Spanish in AM, English in PM). This is easier to arrange and can be offered any time of year. In total, 40–50 nursery workers attend. A third type of training developed as topics were requested by the industries; for example, chainsaw and climbing safety for tree crews. One agent and one volunteer are required; 50 or more participate, and class is in English. Safety is also taught as part of other seminars, required by law (pesticide applicator training, Worker Protection Standard), trade organizations (landscape, nursery, arborist) or county policy (hurricane pruning for public employees). Participation varies widely (15 to 100+), as does language. We have concluded that successful safety training depends on being willing and able to offer the type of training required by a given situation, which will change over time.

Postharvest–Biotechnology–Plant Biology Section

IMPACT OF GAP AND GMP ON FEVERFEW PLANT MARKETABILITY

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Feverfew has aspirin-like properties and has been utilized for the treatment of pain, particularly migraine headache. Parthenolide is the sesquiterpene lactone believed to be responsible for the medicinal properties. The potential for utilizing existing tobacco production and handling systems for the production and postharvest handling of feverfew was investigated. In year one, 8 commercial tobacco growers each planted about one-half acre of feverfew (*Tanacetum parthenium* L. Schulz-Bip.). The yield of dry herb varied among farmers from about 122 to 772 (55 to 350 kg) pounds per half-acre. The parthenolide content of the dried herb from most producers was within the range desired by industry, but four factors precluded its salability: a) presence of foreign matter, primarily weeds; b) excessive ash content due to contamination from sandy soils; c) mold resulting from processing with excessive moisture content, and; d) insect infestation (tobacco beetles *Lasioderma serricorne*) during storage. All of these limitations resulted from the failure to implement good agricultural aractices (GAPs) and good manufacturing practices (GMPs) during production and handling of the product. A second planting of the feverfew was carried out with strict attention to GAPs and GMPs. In this trial, all of the dried feverfew met the requirements for sale. Here we report on the management of production and handling systems for feverfew that can enable growers to produce high quality herbs that meet the high standards for medicinal use.

EVALUATING A SIMPLE SYSTEM FOR BLACKBERRY SHELF LIFE

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The postharvest life of blackberries is shortened by decay, leakage, and softness. Shelf life is shortened after periods of rainfall, and often fruit that appear firm in the field soften rapidly in storage. Blackberry selections of interest for advanced selections from plants without fungicide application are routinely screened for shelf life at Lane by storing fruit at 5 °C for seven days. Blackberry varieties are increasingly being used for farmer's markets, national, and international markets. A rapid test to gauge shelf life of blackberry varieties new to growers would be useful in determining the best type of marketing. Ripe blackberries were harvested from Clarksville, Ark., and transported in 260 g plastic clamshells on ice (about 5 °C) to Lane, Okla. Berries were weighed upon arrival and placed at 5 or at 20 °C for 7 and 2 days, respectively. Overall ratings were considerably worse at 20 °C compared to 5 °C, often with decay on all fruit in clamshells held at 20 °C. Separate subsamples of berries, placed individually in egg cartons and held over water at 20 °C (a 99% relative humidity) yielded Rhizopus, Collectotricum, and Botrytis cinerea growth after 24 hours. Because 2 days at 20 °C proved to cause decay in blackberries too quickly, fruit will be held for 1 day at 20 °C in the next season.

FOOD SAFETY TRAIN-THE-TRAINER PROGRAM

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This paper summarizes the results of a multi-state, multi-institutional partnership delivering a targeted train-the-trainer program. The program provided good agricultural practices (GAPs) and good manufacturing practices (GMPs) based training to southeastern U.S. fresh fruit and vegetable (produce) growers and packers. Twelve southern U.S. states cooperated in this project between 2001 and 2004. In the work 150 trainers introduced nearly 20,000 persons to GAPs principles, including over 2,000 Spanish-speaking workers and a similar number of limited resource/specialty crop/grower/packer/buyer audience members. Actual numbers of persons reached was nearly 20,000, a number arrived at by counting signed-in registrations for events. Cost per person for outreach was about $6.00 per person, including travel expenses. In cooperation with the federal Risk Management Agency, a training component about risk in fresh produce operations was developed. This unit was delivered to historically underserved audiences, small farms and roadside markets, and other non-traditional audiences. This training continues today.

USING DISTANCE EDUCATION IN A POSTHARVEST COURSE

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Land-grant institutions throughout the US face declining resources in general. Particularly reduced is institutional ability to offer core graduate and upper level undergraduate courses in production agriculture and agricultural science. For example, while North Carolina (NC) State University is still able to offer a wide range of upper-division production courses in Horticulture, many sister institutions are facing restrictions on offerings in Fruit and Vegetable Production and Floriculture courses. New areas such as Sustainable Agriculture and Organic Farming also justify course offerings but few resources exist to create and teach such courses. At NC State, distance education (DE) is able to begin overcoming these problems in several ways. First, high demand, low-seat-available classes such as Postharvest Physiology can offer additional enrollment for credit if open to DE students. Second, courses offered asynchronously or with alternative delivery strategies (such as the videotapes distributed in this course) students having course/time conflicts in a semester can enroll simultaneously in two campus time-conflicted courses, completing both successfully. The framework for the Postharvest course now being taught via DE and how it came to gain institutional support will be discussed in this paper.