universities to encourage risk taking or exploring new areas by minimizing the potential negative impact on faculty. Therefore university personnel should be leaders in risk taking. Perhaps we should avoid "comfort projects" done primarily because we know there is a high probably of obtaining publishable results. It is not unusual to make mistakes and if we share the experiences with others, we can help make our profession more dynamic and more productive.

Reinvent Yourself Every Five Years. I am not sure there is a magic frequency associated with this principle and it will vary with different areas of your program. However, it is important to continually review the important issues of society and our commercial clientele and change priorities accordingly. Identify yearly goals for new areas of focus and reinvent a percentage of your program each year. If we do not change and update the focus of our programs, we risk losing public and private support.

In summary, I am very optimistic about the future opportunities for our profession. If we are willing to listen to the needs of our commercial clientele and society and adjust our programs on a regular basis, we should be able to contribute to enhancement of our society. Continually updating and broadening our skills allows us to address complex societal issues. As such, we will become increasingly important to society and our profession and profession will grow.

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Abstracts of the ASHS Southern Region 62nd Annual Meeting

Orlando, Fla. 2–5 Feb. 2002

J.B. Edmond Undergraduate Competition

Sunflower to Municipal Solid Waste Compost Amended Media

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Sunflower (*Helianthus annus* L. 'Sunbright') grown in two commercial potting mixes amended with 0%, 25%, 50%, 75%, or 100% (by volume) municipal solid waste (MSW)/biosolids co-compost grew as well as and in some cases better than the commercial controls. The purpose of this study was to determine the usefulness of MSW/biosolids co-compost as a potting medium amendment. Sunflower seedlings were planted in the amended potting media in June 2001. They were harvested in August after growing in the greenhouse to full open flower and growth measurements made. Half the plants received a weekly application of 150 ppm of 20–10–20 and the other half received only water during growth in the greenhouse. At harvest the following data were collected to assess plant growth and flower quality and subjected to statistical analysis: days to flower, height, flower disc diameter, total flower diameter, flower fresh weight, total plant fresh weight, flower dry weight, and total plant dry weight. The growth and quality parameters show the addition of compost to the potting mix either resulted in plants that were not different in plant growth or had enhanced plant growth and flower quality as compared to the controls. Further, the addition of compost to the potting mix did not have any negative effects in any of the parameters measured. The addition of fertilizer increased plant height and fresh and dry weights but did not affect days to flower and flower size measurements, which is consistent with previous reports on compost utilization that there are insufficient nutrients to sustain optimal plant growth. These result provide further evidence that plants can be grown successfully in MSW/biosolids co-compost supplemented potting mix.

Variability for Antioxidant Activity in Potato (*Solanum tuberosum*) as Influenced by Genotype and Storage

Tyann Blessington, Anna L. Hale, and J. Creighton Miller, Jr., Dept. of Horticultural Sciences, Texas A&M Univ., College Station, TX 77843-2133

Antioxidants have a major impact on human health by reducing incidences of cancer, stroke, coronary heart disease, macular degeneration and high levels of LDL cholesterol. Potatoes are an important source of antioxidants since per capita consumption of potatoes in the United States is ≈145 pounds. Several antioxidant compounds have already been identified in potatoes, and this can be used as a marketing tool to increase consumption. The objectives of this study were to evaluate the antioxidant activity of a broad range of potato genotypes; determine the effects of storage and harvest date on antioxidant activity; and identify potential parents for the TAMU breeding program. Tubers from named varieties and advanced selections from both early and late harvest near Springlake, Texas, were evaluated in 2001. A sample of tubers was stored for two months at 4.4 °C (40 °F) and allowed to recondition for two weeks. Potato extracts from replicated tuber samples were used for the antioxidant assay. The assay involved use of 1,1-diphenyl-2-picrylhydrazyl (DPPH), which is a stable radical that absorbs at 515 nm. This assay is an easy and rapid procedure to evaluate antiradical properties of the extract. Upon reduction, a decrease in absorbance is observed, i.e., greater absorbance of DPPH in the extract indicates a smaller amount of antioxidant activity. For comparison, standard curves were prepared with known concentrations of Trolox (6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid), a widely used synthetic antioxidant. Significant differences were found for total antioxidant activity among genotypes in the early harvest, with Stampede Russet the highest and NDTX4304-1R the lowest. Few significant differences among genotypes were found in

the late harvest. No significant differences were found between fresh and stored tubers from the late harvest. Significant differences were found between the early harvest and the late harvest. In conclusion, substantial variability in antioxidant content was found. This is evidence for genetic control of the trait and offers the possibility of breeding for enhanced antioxidant content in potato.

In-vitro Propagation of a Liriope

Patricia Borskey, Charles Johnson, and Ed Bush*, Louisiana State Univ., Dept. of Horticulture

A method of "in-vitro" propagation of *Liriope muscari* has been developed. The use of rhizomes with trimmed leaves has been shown to be successful in this research. 'Silver Dragon' plants were rinsed with copious amounts of distilled water and treated with a diluted bleach solution or Benlate solution to reduce the chances of surface contamination. The results of the experiment determined surface bleach sterilization and media amended with plant preservative material (PPM) produced a 68% success rate. The use of TDZ (thiodiaurion)/IBA (indole-3-butyric acid) and PPM amended media was shown to be the most affective for subsequent growth and development of the plants. TDZ/IBA was found to enhance the multiplication of the plants with less roots than multiplication media. After successful multiplication, plants were transplanted into nursery containers with no mortality.

Enhancing Caladium Growth under Photoselective Greenhouse Films

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The response of four caladium (*Caladium bicolor* Ait.) cultivars to photoselective greenhouse films was investigated as a part of a study investigating the bulb and tuber crop response to changes in light quality. Three types of photoselective films were used; control, a far-red (FR) light intercepting film (AFR) and a red (R) light intercepting film (AR). The R/FR ratios for the light transmitted through control, AFR and AR films were 1.0, 1.7, and 0.7, respectively. The photosynthetic photon flux was adjusted to uniformity among chambers using neutral density filters. Caladium cultivars responded differently to photoselective films. Far-red light absorbing film accelerated the shoot and leaf emergence of 'Red Flash' and 'Rosebud' but not in 'Candidum' and 'Fannie Munson'. Plant height, leaf area, number of leaves, and dry weights (at the end of eight weeks of growth) were not different among photoselective film treatments. In a preliminary experiment conducted in early spring (March/April) with 'Red Flash' and 'White Queen' caladium, both cultivars emerged three weeks earlier than the control plants. However, in the present experiment, which was conducted in late spring (May/June), 'Red Flash' emerged 1 week earlier than the control suggesting that there may be a seasonal difference in response to photoselective films. Experiments will be conducted again in early spring to confirm our observations.

DNA Fingerprinting of Cultivated Liriopogons

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Genetic analyses were conducted on 19 commercially available *Liriopogon* selections. A total of 184 genetic markers were amplified by the amplified fragment length polymorphisms (AFLPs) method and the data were analyzed using the Dice coefficient of similarity and unweighted pair-group mean analysis (UPGMA) to determine relatedness. Overall, the molecular analysis showed a homogeneous genetic constitution. Standard varieties of liriope and monkeygrass were selected to show genetic representatives of the entire population. Genetic distances estimated from the molecular marker data showed a low level of diversity between Mondograss and 'Variegated' mondograss and 'Big Blue' liriope and 'Variegated' liriope mean. Genetic distances estimated from the molecular marker data showed a low level of similarity diversity between mondograss and 'Variegated' mondograss. 'Aztec Grass' genetic distances estimated from the molecular marker data showed a closer relationship to *Ophiopogon* than to *Liriope*.

Variability for Antioxidant Activity in Cowpea (*Vigna unguiculata* L. Walp.) as Influenced by Genotype and Postharvest Rehydration

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Cowpea is an important legume worldwide and is used for its grain, as a vegetable, and as a fodder. It is known to be highly nutritious and is valued especially for its protein content. Antioxidants are receiving more attention regarding their human health benefits; however, no reports have been found concerning the levels of these compounds in cowpeas. The objective of this study was to assess the antioxidant activity of entries in the 2001 Regional Southernpea Cooperative Trial and to compare antioxidant activity of fresh and rehydrated trial entries. Fourteen breeding lines and 4 check varieties were evaluated. Check varieties included Coronet, Mississippi Silver, Arkansas Blackeye, and Early Acre. Fresh and rehydrated samples were obtained from each of 4 field replicates grown in College Station, Tex. Five grams of peas were analyzed by spectrophotometry using the reduction of 1,1,-diphenly-2-picrylhydrazyl as a colorimetric assay. Results were converted into micrograms of Trolox equivalents per gfw of tissue. Significant differences were found among varieties in within both the fresh and rehydrated treatments, as well as between the fresh and rehydrated peas. The fresh peas ranged from 917 (US-1036) to 382 (US-904) µg Trolox equivalents/gfw. The rehydrated peas ranged from 532 (ARK 92-574) to 211 (TX128BE) µg Trolox equivalents/gfw. Antioxidant activity was significantly higher in the fresh peas as compared to the rehydrated peas. Interestingly, the three top entries were crowder types, the middle group was composed of blackeyes and pinkeyes, while the lowest activity was found in the cream types. Further analysis confirmed that the lower activity of the rehydrated peas could have resulted from a dilution effect or leaching of the antioxidants into the rehydrating water.

Norman F. Childers Graduate Competition

Comparison of Digital Images and Compressed Video as Supplements in the Teaching of Floral Design

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A controlled study was performed to determine whether three methods of instruction resulted in similar student learning of floral design techniques. The traditionally taught introductory floral design lab was compared to two different Web-based methods. A Web site was created containing QuickTime video segments and a second site featured digital images of floral design demonstrations. Each of the eleven lab designs included information regarding history, usage, and floral materials needed. During the fall semester 2001, 35 Texas A&M Univ. students were instructed by all three teaching methods in rotating groups. Learning was measured by the collection of a weekly design grade. Student learning style and preference surveys were conducted to gauge students, reaction to the different methods. Students in the traditional lab groups scored significantly higher than both video and digital image groups in design scores, and there was no significant difference between the video and digital image groups. The results indicate that Web-based instruction may not be as effective a teaching method for a floral design lab but there may be other compelling reasons to use the technology.

Scheduling of Celosia, Gladiolus, Helianthus, and Zinnia

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Scheduled plantings of *Celosia argentea* var. *cristata* L., *Helianthus annuus* L., *Zinnia elegans* Jacq., and *Gladiolus ×hortulanus* L.H. Bailey were conducted to determine the effect of time on flower quality and yield. Plants were grown in an open field from Apr. to Sept. 2001. Days to flower bud initiation decreased for the later planting dates of *Gladiolus* and *Helianthus* however, the number of days from bud to harvest increased for the later planting dates. Days to flower bud formation for *Celosia* and *Zinnia* indicates the second planting took fewer days than other plantings, however the overall trend increased from the first to the last planting. The number of days from bud formation to harvest decreased for later plantings. Scheduled plantings of cut flowers are necessary for season-long production of a particular crop however; earlier plantings resulted in better quality and higher yields.

Plant Growth Regulators to Enhance Branching of *Clematis* sp.

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The purpose of this experiment was to test the effects of four plant growth regulators (PGRs) on growth of two large flowering *Clematis* hybrids, namely Ernest Markham and Hagley Hybrid. Plant growth regulators used included Atrimmec (dikegulac sodium, 0, 800, 1600, 2400, 3200 ppm), Fascination (BA + GA 4/7, 0, 400, 800, 1200, 1600 ppm), and Florel (ethephon, 0, 500, 1,000 ppm). Plants were treated with one foliar spray of each treatment. The experiment was arranged in a randomized complete-block design with six single plant replications. Plants were measured at 2-week intervals up to 10 weeks after treatment. Data collected included length of three main leaders per pot (in cm), the number of new shoots and the number of branches (>2.5 cm) per pot. Mean branch number and mean heights were compared within a chemical by rates and between species, using one-way ANOVA (SAS Institute, Cary, N.C.). Significant rate effects were evaluated with a contrast analysis to test if effects were linear or quadratic. Atrimmec treatments resulted in a significant increase in branch number and a linear suppression of branch height with increasing rate. Fascination treatments resulted in a linear increase in branch number. Fascination caused phytotoxic symptoms, including tip dieback, that may have contributed to an unexpected linear suppression of leader length. Florel did not have significant effects on branch number of 'Ernest Markham', but did significantly suppress axillary bud break of 'Hagley Hybrid'. Florel suppressed plant height more with each increase in rate. Results indicate clematis growers could use Atrimmec or Fascination at about 800 ppm to increase branch number, and Florel or Atrimmec to effectively suppress plant height.

Extension

Southeastern Training Program: Fresh Produce Food Safety

Dennis J. Osborne[1], Douglas C. Sanders[1], Donn R. Ward[1], and James R. Rushing[2]*; [1]NC State Univ.; [2]Clemson Univ.

In 2000–2001, a consortium of 11 SE states focused on development, implementation and evaluation of innovative food safety-based educational endeavors created a regional Fresh Produce Food Safety ("FPFS") Training Program for southern produce growers, packers and consumers. Consortium members reached more than 150 Agents in 4 regional "Train the Trainer" sessions, published a 250-page training manual also available on compact disc and drafted a series of 7 "crop specific brochures." Eight of the 12 national food safety "priority issues" were addressed in a program specifically directed to the conditions and the commodities of the Southeastern United States. A Southeastern focus was required because most Southern producers, unlike those of other regions, are typically seasonal grower-packers having their own packinghouse operations for their own farm produce—often using migrant and seasonal labor. The consortium plans future work in (1) hands-on individual state assistance with FPFS program implementation, (2) developing a web-based undergraduate credit course about Fresh Produce Food Safety, and (3) applied research examining the influence of packing line procedures on the survival of food borne pathogens.

Agroterrorism: Issues in Protecting Our Food Supply from Terrorists

Dennis J. Osborne and Douglas C. Sanders*, NC State Univ.

Is there an Extension role in the ongoing agroterrorism conversation? Should there be? Southern Region has the most diverse and extensive agricultural area and has the greatest continuous length of external border (VA to TX) of any region in the US. These two factors create more potential terrorist "niches" than exist in any other agricultural region. Terrorist activities as threats to agriculture and the national food supply are now clearly recognized. Traditionally Extension has "managed" threats to agriculture such as hoof-to-mouth disease. We seem comfortable managing historic threats to agriculture yet have not adopted nor as yet discussed a unified approach to the new terrorist problem. Even if Extension feels the conversation about terrorism and American agriculture is best left to "someone" other than Extension, ceding agriculture and terrorism to others less knowledgeable should be a considered decision on Extension's part. Nonparticipation will mean loss of new initiatives, programming, funding opportunities—but most of all, the American public will be deprived of its perhaps most knowledgeable discussion leaders if we choose to not participate. The purpose of this presentation is to begin to build consensus as to method of discussion and fora of presentation for any effort in which we in this region may choose to engage as we consider this new threat.

Education

Horticulture Internships: Complementing Education with Experience

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To complement content-driven, science-based curricula, and increasing use of electronic media, it is becoming more important for students to have a horticultural experience as part of the educational program prior to employment. Students in the horticulture program had been offered internship enrollment credit as an elective during the period from 1992 to 1997, but only an average of ≈3% of the students enrolled. Following surveys of alumni and employers, meetings with current and prospective students, and surveys of other programs, a mandatory, graded internship experience became a requirement of the Horticulture, and Turf and Landscape Horticulture degree programs as part of a thorough curriculum revision. Since the requirement was instituted, ≈25% of all student have completed an internship experience. Students may enroll in one of 4 internship sections: Horticulture Management, Turf Management, Landscape Horticulture, and Horticulture Merchandising. Each student is required to complete 3 semester credit hours (SCH) of internship defined as 12–15 weeks of full time employment (34 or more hours per week as defined by the Internship Provider–Employer). Students may repeat up to 8 SCH and may enroll in 1SCH increments. To be eligible for an internship, students must complete 60 SCH, have a 2.00 CGPA, be in "good standing" at the Univ., complete a "Career Development" preparatory course, and submit and have approved an internship proposal. Students must complete the internship prior to the last semester of enrollment or at least 10 SCH prior to graduation. Evaluation and

grading of the experience is based upon the intern completing and submitting a daily journal, midterm, final written review report, final evaluation summary of the internship provider-employer, final public oral presentation, and final oral examination by the internship advisor. Program quality is supported by a annually revised Internship Handbook available both in hardcopy and on-line, and by review of the Internship Director and Undergraduate Program Committee.

Incorporating Survey Designs in Educational Research

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Surveys are useful in educational research due to their flexibility and versatility in collecting data. However, there are some limitations inherent in survey designs including cost, expertise needed and difficulty in measuring causality. These limitations can be minimized by implementing a suitable design, using an appropriate instrument, avoiding bias and increasing validity and reliability. There are several useful designs commonly used. Simple random sampling, stratified sampling, and cluster sampling are frequently employed to gather data on individuals or groups of individuals using the least amount of resources. To create a suitable survey instrument, caution must be used so that every question is focused on a specific piece of desired information. The questions ought to be short and should use terminology common to the participants. Every person needs to interpret each question in the same manner. The instrument should be professional in appearance and easily read. Ideally, the instrument will be an adapted version of a previously used survey that has been piloted on a similar population. Bias can be avoided by cautiously following the established research protocol. This includes preventing self-selection. Reliability is assured by randomly inspecting the data collected for accuracy in entry. By addressing these areas of concern in the planning stages of a survey study, the results garnered can be very rewarding.

Taking Theory to the Field in Landscape Construction

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Teaching an applied landscape construction course at a traditional academic institution presents a unique challenge. Landscape Construction, HORT 3280, was designed to give students at Auburn Univ. hands on experience in the principles and practices used in the interpretation and implementation of landscape construction and planting plans. Upon successful completion of this course, our goal is for students to have gained knowledge and skills in the principles and practices involved in determining landscape construction costs, utilization of common construction materials and equipment; landscape plan interpretation; and installation principles and practices. The course consists of two 50-minute lectures and one 4-hour lab per week for 14 weeks. Topics include safety, equipment operation, turf installation, plant installation, wood construction, concrete construction, pavers and patios, water gardens, retaining walls, and irrigation installation. In the labs students are divided into 2- to 5-person crews for each project, and a crew leader is assigned. The crew leader must manage the crew, organize the job site, and deal with the client while assuring successful completion of the assigned projects, many of which require time commitments outside of lab. It is obvious that the students who have completed this course have an increased awareness of critical aspects of the landscape contracting profession, such as teamwork needed for successful completion of projects, interaction with clients, the idiosyncrasies of a job site, and dealing with Mother Nature. The students soon become aware that these issues can directly affect whether or not timelines are met, which can affect profitability as well as customer satisfaction. Interviews with former students have revealed that the primary benefit they feel they received from the course was an increased confidence in their abilities. Former students have stated they feel this confidence gave them an edge during job interviews as well as more than once on the job.

An Overview of Youth Gardening Research at Texas A&M University

*Cynthia D. Klemmer** and Jayne M. Zajicek*, Texas A&M Univ.

People–Plant Connections is an area of horticulture focusing on the audience rather than on plants. Research in this area encompasses the economic, environmental, educational, physical, psychological, and social aspects of plants, effects on people. The Growing Minds research program has been developed within this area of study for the purpose of evaluating the benefits of horticulture and gardening activities on people's attitudes, behaviors, and learning. Currently this program has a strong concentration in the area of youth gardening including the effects of school gardening on nutritional attitudes and behaviors, environmental attitudes, leadership skill development, science achievement, and parental involvement. Significant results that have been found in each of these areas include: Nutritional attitudes and behaviors: Children's attitudes were more positive toward fruits and vegetables as a snack after participating in a program entitled "Health and Nutrition in the Garden." Environmental attitudes: Children who gardened, whether in a school program or outside of school, had more positive environmental attitudes. Leadership skill development: Children who participated in a school gardening program improved life skills of "working with groups" and "understanding self." The program helped to equalize differences in life skill development due to gender and age level. Science achievement: Children who participated in a school gardening program scored significantly higher on a cognitive test of science achievement, with fifth grade students exhibiting the strongest effect. Parental involvement: Parents of students participating in a school gardening program reported more positive attitudes toward the school and better participation in school activities after the implementation of the gardening program.

Understanding the Dynamics of Growth and Implications in the Department of Horticulture at Auburn University

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The Auburn Univ. Dept. of Horticulture has experienced increased enrollment each fall for 16 of the last 17 years. This growth accounts for a 330% increase in student numbers since 1985, with faculty positions decreasing from 18 to 16 during the same period. The current 240+ undergraduates represent the largest enrollment in the 126-year history of the department, and account for 32% of the students in the College of Agriculture. Enrollment projections for Fall 2002 are above 260. Undergraduate 4-year BS degrees are available in three areas: Fruit and Vegetable Production; Landscape Horticulture; and Ornamental Production. Graduate enrollment at the MS and PhD level has also increased during this period to ≈35 students total. Traditional and unique teaching methods were highlighted in this presentation. Multiple lab sections for all courses within a term, and teaching a full slate of courses in the summer term are now common place for our department. While all courses are taught by faculty, a greater dependence on graduate teaching assistants for assistance in some labs has occurred. For 17 consecutive years, every graduate has been placed in a career-track position upon or before graduation. Students are receiving multiple job offers, with industry demand for graduates at an all-time high. Over the past century as the southern United States has become more urbanized and the number of traditional farms and farmers has substantially declined, involvement in horticulture has shown a marked and consistent increase. We anticipate growth in the Dept. of Horticulture at Auburn to continue.

Can We Predict Student Success in Online Instruction?

*Igino Teolis** and Ellen B. Peffley*, Texas Tech Univ.; *Cynthia B. McKenney*, Texas Tech Univ./Texas A&M Univ.; *Roman M. Taraban*, Texas Tech Univ.

The dropout rate of students in online courses is relatively high. It may be beneficial if factors related to student success or failure could be identified. The objectives of this study were: 1) to determine if

student-related variables and learning styles correlate with student performance in an online introductory horticulture course, 2) to evaluate whether variables and learning style can be used to assess the likelihood of success in the course, and 3) to determine whether previous horticultural knowledge and/or previous computer knowledge are important to succeed in online horticultural instruction. Data was collected over six semesters from a pre-course survey, a learning styles inventory, and the total points accumulated by the student in the course upon which the course grade was based. The pre-course survey consisted of questions to obtain demographic information from the student, their level of interest in horticulture, their level of familiarity with computers, and a short quiz to measure their knowledge of horticulture. Gardening experience, interest in horticulture, distance from campus, and the score on the quiz were all significantly and positively correlated with total points (0.10 level of significance). Factual learners tended to have higher scores than theoretical learners. Horticultural background tended to benefit the student in achieving a high grade in the course. There was no evidence to suggest that a computer background would help the student obtain a high grade.

Lessons Learned in an On-line Horticulture Course

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An on-line horticulture course, Principles of Horticulture, was developed for internet delivery using Web-CT format. The course is popular on campus among majors and non-majors as it is one of the few internet-based courses at Texas Tech Univ. that satisfy 4 hours of General Education requirements for a Natural Laboratory Science Course. Students removed from campus can also enroll. The course is offered each full semester and each summer session. It has been modified each of the 13 semesters it has been offered. Advantages of on-line, asynchronous delivery include giving place-bound students and those employed full-time the opportunity to earn college credit for a horticulture course. We have learned, however, that while taking a course removed from the classroom has great appeal, for a student to succeed in an asynchronous course, they must be self-disciplined and manage their time well. Steps we have made to encourage timely completion (within the semester in which they enroll) include the implementation of (1) a mandatory orientation session and (2) set exam dates and (3) set lab assignment due dates. The student is required to appear on campus only four times—for orientation and exams. (4) Exams are proctored live to ensure student identity. (5) Extra points are given if students set a calendar of course activities and (6) additional points if they adhere to their schedule. (7) Very few incompletes are allowed—students are expected to finish within the semester or they must drop the course. With these modifications, we have seen the percent completion rate (passing grades) increase from a dismal 51% in the initial offering to 78%, with concomitant decreases in percent failures and incompletes.

Posters

Eggplant Tolerance to Sandea (Halosulfuron) Applied Topically and Precision-Directed

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A field experiment was conducted in Grady County, Georgia, during the spring of 2001 to determine the tolerance of eggplant to Sandea (halosulfuron). The experiment was a randomized complete-block design with four replications. Treatments included Sandea applied at 0.5 and 1.0 oz/A over-the-top and precision-directed to eggplant. Precision-directed treatments were applied with spray contacting no higher than 25% up the plant. All treatments included a nonionic surfactant at 0.25% by volume. Percent visual stunting was estimated seven and twelve days after treatment. All herbicide treatments significantly ($P = 0.05$) reduced plant growth compared to the non-treated control. Sandea applied over-the-top of eggplant stunted eggplant 51% to 66% at 12 days after treatment. Less stunting was noted with the precision-directed treatment but reduction in plant growth was still 21% to 29% and unacceptable. Further research is needed to determine eggplant tolerance to Sandea when applied to the soil surface between the bed forming and plastic laying operations.

Differentiation of Arkansas Blackberry Cultivars Using RAPD Markers

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There is an increasing reliance upon molecular DNA studies to determine genetic similarities or differences among plant types. In this study, random amplified polymorphic DNA (RAPD) analysis was used to determine genetic similarity among seven Arkansas blackberry cultivars. Differences were found among the cultivars, however the cultivars were similar in nature suggesting a lack of genetic diversity in this group. Bootstrap analysis showed that all cultivars were highly related (as expected). The weakest join being between the 'Choctaw'/'Chickasaw'/'Shawnee' cluster and the 'Apache'/'Navaho' cluster suggests that the clusters are different. More testing may increase the robustness of the phylogram. A continuation of these studies have the possibility of yielding such important results as identification of unknown cultivars, gene segregation, and important gene characterization.

Effect of Supplemental N and Shade on Spring and Fall-grown Snap Bean Cultivars

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Two snap bean cultivars, 'Strike' and 'Carlos' (*Phaseolus vulgaris* L.), were planted into a Hebbronville sandy loam soil on 22 Sept. 2000 and on 23 Feb. 2001, fertilized with 20, 40, and 80 kg N (as ammonium nitrate)/ha, and grown under 0%, 30%, and 70% of ambient daily light (shade) throughout the 77-day growing seasons. Yield and leaf area, greenness (SPAD), chlorophyll and carotenoid pigments, and mineral nutrients were measured. In Spring 2001, rhizobium nodules per plant, incidence of powdery mildew, and root dry wts. were also determined. Fall cumulative light was ≈68% that of the spring planting and fall mean seasonal temperatures were 1.6 °C lower. Yield ($P < 0.09$) and leaf area were higher in the fall planting. In both spring and fall the reduced yield response of cultivars was generally quadratic with respect to increased shading. Leaf greenness was reduced by shading, but leaf area and chlorophyll content (dry wt basis), as well as the incidence of powdery mildew late in the season, was increased by shading. Rhizobium nodules per plant and root dry wt. were reduced linearly (L) by shading. Increasing the N fertilizer rate from 20 to 80 kg/ha decreased (L) nodules per plant, but increased leaf area (L). Leaf blade Ca, K, S, Fe, Na, and B varied between seasons. Shading increased leaf blade N, K, P, Na, and Zn. Adding more N increased leaf blade Ca, Mg, NO_3, and Mn but decreased K and Ca. When there were significant differences in nutrient levels, these differences were usually linear. There were cultivar differences in leaf blade N, K, P, Mg, S, NO_3, and B.

The Effects of Photoperiod on Biochemistry, and Photosynthesis in Onion, *Allium fistulosum*

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Plant growth and carbon gain may be regulated by source–sink interactions. Previous studies have demonstrated that increased source activity (i.e., photosynthesis) relative to sink activity (i.e., growth) may increase carbohydrate accumulation, thereby initiating a carbohydrate feedback effect that results in the downregulation of photosynthesis. In this study, we used a 24-h photoperiod to increase source activity in Japanese bunching onions (*Allium fistulosum*) and

assess the effect of increased carbohydrates on plant growth, biochemistry, and photosynthesis. Onions were grown hydroponically in environmental growth chambers in a 12-h (control) or 24-h (increased source) photoperiod for 56 days. Carbohydrate and elemental analysis of the onions indicated a 20% lower nitrogen concentration and a 3-fold increase in total nonstructural carbohydrate concentration in the leaves of 24-h plants at the 28-day period, when compared to 12-h plants. Furthermore, there was a significant reduction (20% to 25%) in the photosynthetic capacity to assimilate carbon for 24-h onions, between 28 and 56 days, in comparison to 12-h onions. The combined biochemical and physiological effects of downregulation led to a significant decrease in diurnal carbon gain of 24-h plants (1.73 mmol C/day) compared to 12-h plants (4.92 mmol C/day). The reduction in carbon gain for 24-h plants reduced their final biomass by 55% compared with 12-h plants. These results indicate that carbohydrate feedback processes did signal and initiate a downregulation of photosynthesis in *Allium* grown under a 24-h photoperiod, which subsequently reduced plant growth. Future experiments will investigate the process of carbohydrate feedback inhibition of photosynthesis by increasing source activity, using photoperiod and elevated CO_2, in onions that are sink limited (nonbulbing) and not sink limited (bulbing).

Effects of Poultry Litter on Yield and Quality of Staked Tomatoes

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A study was conducted at the E.V. Smith Res. Ctr. in Shorter, Ala., in 1999 and 2000 to determine effects of PL on premium yield, cull fruit distribution and physiochemical attributes such as citric acid content, soluble solids, and total acidity in staked tomato production using 'Mt. Spring' transplants. Composted PL was applied at rates of 27, 54, 108, 216 and 432 kg·ha^{-1} potential available N and incorporated into the soil prior to mulch bed formation with no methyl bromide applied. The control treatment received 108 kg·ha^{-1} N from calcium nitrate and potassium nitrate (7–0–7) and was fumigated with 60% methyl bromide : 40% chloropicrin at a rate of 561 L·ha^{-1}. In 1999, tomato fruit yields decreased with increasing amounts of PL. PL applied at rates of 27 and 54 kg·ha^{-1} were sufficient for tomato production. In 2000, tomato yields were higher in the 432 kg·ha^{-1} rate than other treatments. Tomatoes grown in the heavily amended soils fared better in the 2000 drought because of the increased water holding capacity created by amendments, indicating benefits afforded by PL maybe physical as well as chemical. PL applied at a rate of 27 kg·ha^{-1} N produced yields above the control without increasing the occurrence of culled fruit. Otherwise, culled fruit was similar in all treatments. Total fruit acidity was significantly lower in the 432 kg·ha^{-1} treatment compared to the control. PL treatments provided sufficient nutrients for plant growth and tomato production with the exception of potassium. Potassium levels were low in all treatments including the control. Physiochemical attributes of tomatoes grown in soils amended with PL at these rates were comparable to those grown using inorganic fertilizers.

Sweet Potato Response to Nitrogen and Irrigation In Missouri

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The application of four levels of nitrogen fertilizer to two sweet potato (*Ipomoea batatas* Lam.) cultivars at Central Missouri (Jefferson City) and five at Southeast Missouri (Libourne) did not increase the yield of marketable roots. Leaf nitrogen concentration tended to decrease with increasing levels of nitrogen fertilizer in Southeast Missouri. Irrigation regimes did not affect the concentration of nitrogen in the leaf. Irrigating as needed throughout the growing season resulted in a larger increase in marketable yield in Central Missouri than in Southeast Missouri. Irrigation significantly increased the yield in Central Missouri but not in the southeast region. Irrigating between 31 and 61 days increased the yield of canner size roots but decreased number one size roots in Southeast Missouri. Varieties responded differently to irrigation in the Southeast Missouri. Irrigation tended to stimulate the production of jumbo size roots more in the southeast location than in Central Missouri. The returns above all cost was higher for irrigated than nonirrigated sweet potato production in Central Missouri.

Evaluation of Horticultural Characteristics of Table Stock Potatoes for Florida Production

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The objective of this study was to identify red- and purple-skinned Irish potato (*Solanum tuberosum* L.) varieties that are adapted to short-day production, resist diseases, and have desirable horticultural characteristics. Trials were conducted at the Hastings REC on an Ellzey fine sand soil. Experimental design was a randomized complete block with four replications. Plots were one row by 6 m and irrigated with seepage irrigation. Between-row spacing was 100 cm. Beds were fumigated with 1,3-dichloropropene (Telone II, 58 L·ha^{-1}). Aldicarb (Temik, 23 kg·ha^{-1}) was applied at planting. Metribuzin (Sencor, 1.4 kg·ha^{-1}) was broadcast at hilling. Seed pieces were planted on 13 Feb. 2001 at a 30-cm in-row spacing. Fertilizer was applied in a split application (total, 306–41–263 kg·ha^{-1}). Plots were harvested and graded on May 24, 2001. Red La Soda, the standard red-skinned fresh-market variety for North Florida, produced 32 MT·ha^{-1} of marketable tubers. Marketable yield of Chieftain, Pontiac, Rideau, B1523-4, and B1758-3 were similar to Red La Soda. B1523-4 and B1758-3 had similar size distribution and internal flesh color as Red La Soda. Of the 13 red-skin, white-flesh varieties in the trial, Rideau, B1523-4, and B1758-3 will be evaluated further in trials at grower sites. Marketable yields of Michigan Purple, All Blue, S45-5, S48-6, B1816-5, all specialty potatoes, were relatively less than that of Red La Soda. B1816-5 produced small purple-skinned tubers with yellow flesh. All Blue and S45-5 produced purple-skinned tubers with blue flesh. Michigan Purple was an attractive purple-skinned tuber with white flesh. S48-6 produced red-skinned tubers with red flesh. The quality and unique horticultural characteristics make these varieties suitable for the Florida specialty market.

Explant Production and Callus Initiation of Sweet Pepper

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The objective of this study was to test the basic culture medium strengths, growth regulator concentrations on explant production, and subsequent callus initiation of sweet pepper cultivars, 'California Wonder', 'Camelot', and 'King Arthur'. Full and half Murashige and Skoog (MS) medium strengths and 2 photoperiods plus different concentrations of BA were studied for their effects on cotyledon explant growth and the in vitro performance of tested sweet pepper cultivars. For each medium-strength treatment, seeds of tested cultivars were incubated to produce cotyledon explants under 2 different photoperiod conditions: (1) under darkness for 10 days and then transferred to a 16-hour photoperiod for 4 days; or (2) under a 16-hour photoperiod for 14 days. The cotyledon explants were then cultured on MS basal medium plus different concentrations of BA for callus initiation. Seeds cultured on full-strength MS media incubated in darkness for 10 days and then transferred to a 16-hour photoperiod for 4 days produced adequate cotyledons. Results on callus initiation will be also presented.

Throw Away the Hexane: A Novel Spectrophotometric Method for Analyzing Lycopene Content in Watermelon, Tomato, and Grapefruit

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Lycopene is a carotenoid that has antioxidant properties and imparts the red pigment in some fruits and vegetables. Watermelon, tomato, and pink grapefruit make up the predominant lycopene sources in a typical North American diet. Because of its health benefits and

food colorant potential, lycopene content in fruits is of interest to the food industry. Current methods to assay lycopene content in fruit are time-consuming, expensive, and use hazardous organic solvents. Here, we report a method by which light absorbance measured with a xenon flash colorimeter/spectrophotometer is used to quantify lycopene content in puréed translucent fruit samples. We evaluated 152 red fleshed watermelons, 13 tomatoes, 38 tomato products, and 5 grapefruit juice samples. Our purée absorbance method had linear correlation coefficients with lycopene content by hexane extraction/spectrophotometry of R-square = 0.98 for watermelon, 0.97 for tomato, 0.88 for tomato products, and 0.70 for grapefruit juice. These linear correlations show that this method will likely work for quantitating lycopene content in purées of fresh watermelon, tomatoes, grapefruit juice, and some prepared foods. Since puréeing the sample is the only processing required and no chemicals are needed, the method is rapid, inexpensive, and requires no hazardous chemicals. This simple method for measuring lycopene content in a wide variety of foods and food products promises widespread use for lycopene quantitation.

Optimum Plot Size and Number of Replications for Evaluating Short-day Onions

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Five different methods were used to estimate optimum plot size and three different methods were used to estimate optimum number of replications with short-day onions for yield with a basic plot size unit of 1.5 × 1.8 m. Bartlett's test for homogeneity of variance was used to compare per plot variances with nine different plot sizes of 1, 2, 4, 5, 8, 10, 16, 20, and 40 basic units in the 1999–2000 season. Differences occurred between plot sizes of 1 and 2, 2 and 4, 5 and 8; and 16 and 20 basic units. In the 2000–2001 season plot sizes with basic units of 1, 2, 5, 7, 10, 14, and 35 were compared. There was considerable overlap between compared variances with no clear breakpoints. Computed LSDs with 30 df for treatments and $P \leq 0.05$ had a detectable difference of <5% of plot yield with 4 replications and 5 basic unit plot size in both the 1999–2000 and 2000–2001 seasons. Visual evaluation for maximum curvature of the power trendline of coefficient of variability against plot size found an optimum plot size of approximately 7 basic units for both seasons. By Hathaways' method, a difference below 20% of the mean can be detected with a plot of 5 basic units with 5 replications in both the 1999–2000 and 2000–2001 seasons. Detectable differences by Cochran and Cox's method of <10% of the mean were detected with plot sizes of 4 basic units and 3–7 replications in the 1999–2000 season and with 2 basic units and 4–7 replications in the 2000–2001 season.

Temperature Influences Flavor Development in 'Granex 33' Onion

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To test the effects of temperature and developmental age on flavor intensity and quality, 'Granex 33' onions were subjected to four different temperatures during growth. At 12 weeks, onions were placed in growth chambers and grown at 16.5, 22.1, 26.7, and 32.2 (±0.4) °C for 50 days and to maturity. Plants were harvested and evaluated for flavor precursor and sulfur content. Total bulb sulfur (S) increased linearly with temperature regardless of plant maturity. However, bulb sulfate changed little over temperatures. This indicated that the amount of organically bound S increased with temperature. Pyruvic acid content, an indicator of gross onion flavor, and total S-alkenyl cysteine sulfoxide (ACSO) content demonstrated a linear response to temperature when measured at the two developmental stages. Similarly, individual ACSOs increased linearly with temperature. Methyl cysteine sulfoxide (MCSO) had the largest regression coefficient of all individual ACSOs. At 32.2 °C, MCSO dominated the precursor profile in plants grown to maturity. At all other temperatures 1-propenyl cysteine sulfoxide (1-PRENCSO) was most abundant. Additionally, propyl cysteine sulfoxide was present in the least amount at all treatment levels. Gamma glutamyl propenyl cysteine sulfoxide, the penultimate peptide to 1-PRENCSO in the ACSO biosynthetic pathway also showed a positive linear response to temperature suggesting that it may be a point of accumulation in this biosynthetic pathway. The different patterns of flavor precursor accumulation obtained here may help explain yearly differences in the flavor intensity and quality of field grown onions.

Yardlong Bean: An Innovative Crop for Mississippi Growers and Consumers

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Ethnicity plays a strong role in niche market development, and this market is currently under served. As Asian populations continue to grow in Mississippi, especially along the Gulf Coast, it is important to recognize new market opportunities. The fruits and vegetables desired by the diverse Asian population is often unavailable or of poor quality due to extensive shipping distances. Mississippi growers can meet this need for fresh oriental produce at a higher price than traditional vegetables. Yardlong or asparagus bean (*Vigna sesquipedalis*) is related to the cowpea. The cultural practices for yardlong bean is similar to that of traditional pole beans. However, there is still much to be learned about this crop in terms of pest, management, disease susceptibility, and variety superiority. The objectives of this research were to compare yardlong bean varieties and collect observational data regarding production practices. Four replications of 8 yardlong bean varieties were grown at the Beaumont Horticultural Unit during the summer of 2001. Beans were grown on 4-ft trellises set 1 ft above the soil line. Beans were harvested twice a week. Date of first harvest, number of harvests, and yields were affected by variety. Highest marketable yields were attained with 'Red Seed' and 'Red Stripe Seed' varieties, which are best suited for growing conditions in southern Mississippi. However, mosaic viruses may pose a potential production problem, and further research is warranted to determine best cultural practices and pest management.

Okra Variety Trials for the Arkansas Delta

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Okra is an extremely important crop for several counties in the Arkansas Delta, namely Lee County. The Arkansas Delta is an area that lies along the west bank of the Mississippi River and is characterized by high poverty, high unemployment and a high dropout rate from secondary schools. Numerous programs have been implemented to assist the Delta throughout the past decades including the Lee County Vegetable Growers Cooperative Association (1960s), which processes and handles vegetables grown by its members. Today, okra is still the leading vegetable produced by the small farmers within this county, but at a reduced volume than the 1960–70s. Currently, the leading variety produced by the growers is 'Clemson Spineless'. Problems have been observed with this variety, namely the reduction of fruit production ≈1 month after first fruit set. 'Clemson Spineless' has been one of the industry standards, but several newer varieties are currently on the market with reported high yields. Two varieties, 'Annie Oakley II Hybrid' and 'Cajun Delight' were grown to compare their productivity to 'Clemson Spineless' for this region in Arkansas. Two locations within the Delta were chosen to compare yields of the three varieties of okra. The results at each location were similar except for 'Clemson Spineless' at Lee county, which produced significantly less than the other varieties or 'Clemson Spineless' in Craighead county. There was a reduction in harvested pods in each variety during either early or mid-August. They also had a two week period of no pod production in mid- to late July. 'Clemson Spineless' produced a lower quantity of pods than either 'Annie Oakley II Hybrid' or 'Cajun Delight' in both locations.

Pepper Variety Trials in Eastern Arkansas

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Traditional varieties of three types of peppers were compared against several heirloom varieties or common peppers for the homeowner and small farmer markets. Seeds of each variety were planted at the Univ. of Arkansas Cotton Branch Experiment Station in Marianna on 15 May 2001. Two seeds were planted per hole and thinned to one plant after the seedlings were established. The design was a completely randomized design with a 3-foot spacing between plants. Each variety was replicated four times and three plants represented one experimental unit. Fruits of each variety were harvested when mature and the weights were determined. This area in East-central Arkansas was well below average rainfall throughout the summer and required frequent furrow irrigation. There was little incidence of insect or disease problems noted on any pepper variety. From the Sweet bell pepper varieties, the Bell Boy Hybrid (avg. 19,104 grams/plant) produced two times the quantity of fruit produced by California Wonder 10,224 g/plant), the second largest producer. Bell Boy Hybrid was also the only variety that consistently produced fruit that was similar in size to published data. Of the Sweet (non-bell) varieties, the two most reproductive varieties were Aruba Hybrid (6,480 g/plant) and Gypsy Hybrid (4,296 g/plant). One hot pepper variety, Giant Thai Hot, produced abundant quantities of fruit (8,832 g/plant). Two additional varieties, Super Cayenne II (4,596 g/plant) and Hungarian Yellow Hot Wax (2,448 g/plant) had a very heavy fruit set compared to plant size.

Production of Gourds as an Alternative Crop for the Arkansas Delta

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The Delta Region of Arkansas is predominately a rural area that parallels the west bank of the Mississippi River. This region has been traditionally economically depressed and dependent on small farms. The primary crops grown in this region are rice, cotton and soybeans. Due to the inability of the small farmers to make a profit with these crops, many are now turning to alternative crops. Small scale production of okra, squash and strawberries have been grown in this area of Arkansas. Another alternative crop that is gaining in popularity is gourds. Currently, two small growers and numerous large scale backyard gardeners are supplying the gourds in this region. Research on production problems such as disease, insect control and fertility has been limited. Currently, growers are using the same cultural information as used by cucurbit growers. Production research and standardized growing information needs to be published for gourd production. Interest has been stimulated in gourd production by the increase in decorating gourds for the craft market and for luffa sponges. Currently, luffa is an imported crop and the increased demand has stimulated local growers to begin experimenting with producing them. Preliminary research conducted at ASU has been to determine the productivity of several gourds. The following gourds were planted on ASU Horticultural Hill in Craighead County and at the Univ. of Arkansas Cotton Branch Experiment Station in Lee County: Orange gourd, Apple gourd, Tennessee dancing or Spinning gourd, Extra long handled dipper, and the Maranka gourd.

Extension of Postharvest Vaselife of 'John Fanick', Perennial Phlox Cut Inflorescences

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Recently, superior selections of perennial phlox (*Phlox paniculata* L.) have been identified for Texas landscapes. The flower, borne on a long stalk, offers great potential as a cut flower crop. Among other factors, display life of phlox inflorescences is influenced by quality of leaves on the axis, rate of flowers opening during vaselife and flower abscission. This investigation was aimed at optimizing variables related to postharvest performance of inflorescences of phlox 'John Fanick'. Freshly harvested inflorescences with leaves were put in glass vases containing deionized water supplemented with thidiazuron (TDZ), 0–45 µM, at 22 ± 1 ºC under light. Compared to control, TDZ (22 µM) strongly retarded the senescence of the leaves below the flowerhead, and enhanced the overall functional display life of the inflorescences. These results indicate that the TDZ, a phenylurea derivative with strong cytokinin-like activity, considerably improves the postharvest performance of cut inflorescences of phlox 'John Fanick'. Experiments are in progress to evaluate whether TDZ directly affects the vaselife or its effects are mediated via retardation of leaf senescence.

Evaluation of Eight to Twelve Month Controlled Release Fertilizers in #5 Containers

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Five long-term (8 to 12 month) controlled-release fertilizers with micronutrients were evaluated under south Georgia nursery conditions for nutrient release over an 8-month growing period. The controlled release fertilizers evaluated in this study were: Gracote 18–5–14 (8 mo.), Multicote 17–5–11 (12 mo.), Nutricote Total 17–6–8 (12 mo.), Osmocote Plus 15–9–12 Southern Formula (12 mo.), and Polyon NPK+ 17–5–11 (12 mo.). The study was conducted at Gainous Shade Trees Incorporated in Cairo, Ga. On 25 Feb. 2000 uniform # 5 *Acer ×freemanii* 'Jeffersred' (Autumn Blaze) red maples growing in a substrate consisting of milled pine bark, peat moss, and river sand (7:2:1 by volume) amended with dolomitic limestone at 4.0 lbs, Micromax at 1.5 lbs and Osmocote 17–6–12 (6 mo.) at 3.0 lbs per yd^3 were topdressed with the five fertilizers at a rate of 20.4 g of nitrogen per container. Plants were arranged as a completely randomized block with five replications per treatment. Electrical conductivity (EC) readings were take at 30, 60, 90, 120, 150, 180, 210, and 240 days after application. The Virginia Tech pour-through method was used to collect leachate from the container substrate. Electrical conductivity of the leachate samples were determined using a Myron L AG6 conductivity and pH Agri-Meter (Myron-L Co., Carlsbad, CA). Gracote provided sufficient nutrients based on EC measurements (EC > 0.2 $dS \cdot m^{-1}$) for <150 days while all other fertilizers provided sufficient nutrients for ≈180 days. Differences in release characteristics will be discussed. Fertilizer had no influence on final height, stem diameter, or shoot dry mass.

Analysis of Isolated *Echinacea* Pollen Grains via AFLP Markers

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An innovative approach for the collection of an individual pollen grain using micromanipulation and AFLP (amplified fragment length polymorphism) markers' amplification is reported. The small amount of DNA in a single pollen grain needs to be increased before a genetic analysis can be conducted. A primer extension pre-amplification (PEP) protocol was used in this study by amplifying *Echinacea* pollen genome with an array of continuous random 15-mer primers. Our findings suggest that this procedure can amplify most of the pollen's genome. The PEP-based amplified products were an array of varied size fragments, which were discernible as a smear on ethidium-bromide stained DNA gels. The amplified DNA was used in subsequent analyses for restriction based AFLP markers. Since amplification of the coneflower pollen DNA by primer extension pre-amplification resulted in genome distributed in fragments of varied lengths, only short-sized (around 500 base pairs) AFLP markers were generated. This is the first report on the production of AFLP markers from PEP products. These procedures can be used for construction of the AFLP based genetic maps without the need of performing controlled pollinations.

Vegetable Crops

Timing of Insecticide Application on Directly Seeded Cabbage Stands

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Presented at the 2001 SR–ASHS Meeting, Fort Worth, Texas.

Difficulty in obtaining and maintaining an adequate plant stand in directly seeded cabbage led to the investigation of possible causes of plant loss. A series of experiments were conducted to evaluate the effect of two insecticides, diazinon and chlorpyrifos, applied at four different times for control of insect damage to seedlings. The insecticides were applied at label recommended rates. The application timing treatments included 1) insecticides applied at planting, 2) insecticide applied at seedling emergence, 3) insecticide sprayed at seedling emergence and again 7 days later, and 4) insecticide sprayed at seedling emergence and 7 and 14 days later. All insecticide treatments were broadcast over the top of the bed except the at-planting treatment, which was sprayed directly into seed furrow prior to covering seed. Plant counts were taken twice weekly beginning approximately 5 days after seeding. Number of cabbage plants in all treatments decreased after the second counting date, but neither insecticide nor timing of application affected cabbage stand during either season.

Methyl Bromide Alternatives for Several Vegetable Production Systems

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Pre-plant soil fumigation with methyl bromide will be phased out by 2005 in the United States. Vegetable growers in the southeastern United States have relied on a plasticulture system which includes methyl bromide to control weeds, soilborne pathogens and nematodes. In response to the impending loss of methyl bromide, a multidisciplinary team formed to address soilborne pest control in vegetable plasticulture. Promising alternative fumigants (metam sodium, Telone-C35) have been identified along with soil amendments (composts, worm castings), double-cropping systems and herbicide programs which complement alternative fumigants. Trials conducted at Clinton, N.C., have addressed multiple facets of vegetable production without methyl bromide. Yield, quality and plant health parameters were evaluated for tomato, bell pepper, and cucumber in soil amended with controlled microbial compost (CMC) or reactor treated compost (RTC) made from swine waste in conjunction with different fertilizer regimes. At the same location, alternative soil fumigants Telone-C35 and metam sodium accompanied by pre- and post-emergence herbicides were evaluated for tomato and cucumber production. Impacts on yield and quality as well as weed and disease control were evaluated. Telone treated plants produced more total and marketable tomatoes and cucumbers than the non treated control, but the metam sodium was intermediate. The high rates RTC and CMC resulted in cucumber yields equal to methyl bromide (MB) and better than the control, but only MB increased tomato yield. With pepper both rates of CMC and the high rate of RTC produced or tend to produce total and marketable yields equal to MB and better than the control.

Summer Cover Crops for a Vegetable Production System

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A study was undertaken to evaluate methods of seeding summer cover crops, methods of killing summer cover crops prior to planting vegetables, and equipment for tilling/planting into killed summer cover crops. The cover crop was a mix of 'Iron & Clay' southernpea and pearl millet. Planting methods were grain drill, broadcast then rotary till, broadcast then harrow, and broadcast then roll. The grain drill and broadcast then till treatments yielded the most biomass one month after planting. Methods of killing the cover crop were nonselective herbicide (glyphosate), roll with spool shaper, mow with sickle bar, roll with flail mower (pto disengaged) mow with rotary mower, and mow with flail mower. All of the killing methods left at least 88% residue cover. Killing the cover crops approximately one month after planting appeared to be optimum. Both herbicide and mechanical control were necessary to kill and knock down the crop. Tilling/planting implements tested were dibble plant setter, powered tiller/cultivator on sides of bed top, powered tiller/cultivator on center of bed top, conventional rolling cultivator, straight-tine rolling cultivator, plastic mulch lifter, subsoiler (run only 10–15 cm deep), grain drill, and wavy coulter. The most effective implements for tillage/planting were powered rotary tillers and rolling cultivators. No implement produced a seedbed that would allow direct seeding with a vegetable seeder. We can grow a summer cover crop and then prepare the bed for transplanting vegetables; we cannot direct seed into the mulch left by a summer crop with our available equipment.

Broiler Litter Pellets for Tomato Production in Mississippi

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Mississippi is one of the largest producers of broiler chickens in the United States. Researchers throughout the state are seeking environmentally and economically feasible methods of disposal of the litter produced by broiler farms. This study was undertaken to investigate the influence of litter applications on fruit yield and mineral nutrition in tomato (*Lycopersicon esculentum* Mill.). Tomatoes were grown on bare raised beds, with subsurface drip irrigation, using the stake and weave system. Three treatments were compared: unfertilized control, fertilizing with conventional granular 13–13–13 ($N–P_2O_5–K_2O$), and fertilizing with 3–3–3 pasteurized broiler litter pellets. The fertilized plots were sidedressed, based on sap nitrate concentration, with either a 3:1:2 granular blend or 6–2–4 litter pellets. Materials were broadcast in strips and incorporated. N–P–K application rates were equal for both the litter and conventionally fertilized plots. Plants fertilized with litter pellets produced higher total and marketable yield than those receiving either of the other two treatments. Tests of tissue and soil nutrient concentrations failed to provide clear evidence of why yields were highest in the plots fertilized with litter. Petiole sap nitrate concentrations and leaf blade nutrient levels were not significantly different at any of four midseason sampling dates. After sidedressing, sap nitrate concentration increased in plants receiving either sidedress treatment, with the highest concentrations found in the conventionally fertilized plants. Soil testing forty-four days after transplanting (including organic matter, pH, cation exchange capacity, P, K, Ca, Mg, S, and Zn) did not reveal any significant differences in nutrient availability that help explain the higher yields in the plots fertilized with litter pellets. Nutrient concentrations in leaf blades were not significantly different among treatments, except that conventionally fertilized plants had significantly higher Mn levels than those from the other two treatments.

Utilization of Legumes in Rotation with Potato to Reduce Nitrate Leaching in Florida Watersheds

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Best Management Practices have been developed by state regulatory agencies to reduce nitrate non-point source pollution from potato production in the St. Johns River watershed in the tri-county agricultural area near Hastings, Fla. The suggested BMP and the current grower average nitrogen rate are 224 and 287 $kg \cdot ha^{-1}$, respectively. This project was developed to determine if legumes planted as summer cover crops and/or fall cash crops could supply nitrogen to a spring potato crop reducing the need for inorganic nitrogen fertilizer. Experimental design was a split plot, complete block with four replications. All crops were irrigated with subsurface seepage irrigation. Summer

cover crop main plot treatments were sorghum-sudan grass (*Sorhum vulgare* x *Sorghum vulgare* var. *sudanese*, SX17) and cowpea (*Vigna unguiculata*, Iron Clay). Fall split plot treatments were green beans (*Phaseolus vulgarus*, Stallion) and fallow. Potatoes (*Solanum tuberosum*, Atlantic) were planted on 28 Feb. 2001 and fertilized at five nitrogen rates (0, 112, 168, 224, 280 kg·ha^{-1}). Potatoes were harvested and graded into five size classes on 1 June 2001. The only significant interaction the first year for potato production was between the fall treatment and potato crop nitrogen treatment. Total and marketable tuber production, percent large tubers, and tuber specific gravity were higher in the 0-kg·ha^{-1}-nitrogen potato treatment following green bean compared to fall fallow. Marketable yield was for both treatments was 26 and 16 MT·ha^{-1}, respectively. This was the first year of a 3-year study and a transitional period between a traditional system and an alternative system. Results suggest that legumes planted in sequence with potatoes may help growers successfully implement the new BMPs by supplying nitrogen to the potato production system.

Differential Response of Bell Pepper Cultivars to Foliar-applied Biostimulant

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Bell peppers, *Capsicum annuum*, cvs. Brigadier and X3R Camelot, were grown during fall (Sept.–Dec. 2000) to evaluate the effect of 'Atonik' foliar-applied biostimulant (Asahi Chemical Co., Mfg. Ltd., Japan) on fruit yield and nutrient uptake. Production system was the full-bed polyethylene mulch with micro-(trickle-) irrigation. Treatments, Atonik spray (0.6% sodium nitrophenolates) and a water control, were arranged in a randomized complete block and replicated three times. The Atonik biostimulant at 0.5 L·ha^{-1} was applied in 254 to 508 L water with a portable backpack sprayer four times, at early flower bud stage [30 days after planting (DAP)], at first bloom (42 DAP), flowering and first fruits (49 DAP), and after the first harvest (64 DAP). Fruits were harvested six times and graded according to USDA standards. Plant heights were similar with Atonik or water sprays. In the first four harvests, cumulative yields of U.S. Fancy grade fruits of 'Brigadier' were 20% higher ($P < 0.05$) with Atonik than with water treatment. Marketable total fruit yield in the first harvest was 32% higher with Atonik than with water sprays. Yields of 'X3R Camelo', were similar with Atonik or water treatments. There were very little or no significant differences in elemental concentrations in shoots and in fruits with Atonik or water treatments.

Influence of Temperature on Germination of *su, se,* and *sh$_2$* Sweet Corn Phenotypes

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The optimal relationship between temperature and final percent germination of sweet corn seedlings (*Zea mays* var. *rugosa* Bonaf.) and vigor of the seed is important to growers. The objectives of this research were to determine for new sweet corn *su, se,* and *sh$_2$* phenotypes, 1) the ideal temperature range to judge maximum germination rate in the minimum time; and 2) the minimum time period within which to judge seed vigor. Twenty-seven cultivars of sugar enhanced (homozygous *se*), super sweet (*sh$_2$*), and sugary (*su*) sweet corn seeds were evaluated for differences in germination requirements according to phenotype and ear kernel color makeup (white, bicolor, and yellow). Seeds of each cultivar were placed along a temperature gradient on a thermogradient table, Type 5001 (Seed Processing Holland, Enkhuizen, The Netherlands), and allowed to germinate over a 10-day period. The gradient treatments were: [± 2 F (± 1.1 °C)] 52, 56, 60, 64, 68, 72, 76, 80 F, 84 F, and 86 F (11.1, 13.3, 15.6, 17.8, 20.0, 22.2, 24.4, 26.7, 28.9, and 30.0 °C, respectively). All cultivars (*se, sh$_2$, su*) germinated at their maximum percentage within a temperature range of 76 to 80 F (24.4 to 26.7 °C). *SU* cultivars germinated to their maximum three days after initiating testing and 1 day earlier than the *se* and *sh$_2$* cultivars. The rate of germination, measured by calculating a germination index, indicated that *sh$_2$* and *se* cultivars germinated at their greatest rate 3 days after the initiation of testing; however, the *su* phenotype germinated at its greatest rate in 2 days. We concluded that kernel color does not play a strong role in the germination performance of the phenotypes. Vigor data should be collected 2 days after initiation for *su* cultivars, but 3 days for *se* and *sh$_2$* cultivars at the temperature range of 76 to 80 °F. We suggest that first germination counts should be taken to reflect the vigor of the seed (2 and 3 days), rather than 4 days as suggested by AOSA in the rules for testing seeds.

State Wide Testing of Spinach Cultivars for Production Attributes

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Three spinach variety trials were completed during the spring of 2001. Two were completed in Western Oklahoma in Blaine and Caddo Counties and one was completed on the OSU research station in the Arkansas River Valley near Bixby, Okla. Trials were seeded at a rate of approximately 558,000 seeds per acre. Each of the nine varieties was replicated four times in plots having two rows on 12- or 15-inch centers 20 or 30 feet long. Trials were rated for seedling emergence, vigor, color intensity and bolting. Color and vigor ratings were recorded utilizing a scale of 1 to 5 where 1 = the lowest and 5 = the highest level. Yield data and bolting were recorded at harvest with bolting as the estimated percentage of bolting plants within a plot. Trial results include emergence, vigor, color, yield and bolting and can be obtained from the authors. Although spinach cultivars in the trials varied significantly for differences in emergence and in vigor, these differences did not correlate with yield differences at harvest time. High levels of color intensity are thought to be related to higher nutritional value in spinach and did vary considerably in these studies, with Catalina, Olympia and XP 278 having the highest levels of color intensity. Bolting was the most clear-cut characteristic that was measured, five cultivars, including 'Baker', 'Bolero', 'Catalina', 'Olympia', and 'XP 278', recorded 0% to <4% bolting at harvest time.

Powdery Mildew of Watermelon. Can We Find Resistance?

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Powdery mildew, incited by *Sphaerotheca fuliginea*, has been a devastating disease for many cucurbit crops in the past. However, watermelons produced in the U.S. have typically been resistant to this pathogen. Unfortunately, outbreaks of powdery mildew in watermelon have been confirmed in the past few years in Oklahoma, Texas, Florida, Georgia, California, and South Carolina, suggesting increased frequency of an existing race, or appearance of a more virulent race of the pathogen. To combat this new disease problem, resistance needs to be identified in *Citrullus lanatus* germplasm for introduction into commercial watermelon cultivars. To this end, 111 *Citrullus lanatus* (PIs) were evaluated in a 2000 field trial at Lane, Okla. The results indicate that resistance to the Oklahoma isolate of powdery mildew present during these tests may exist in the U.S. Plant Introduction germplasm collection. Plants that exhibited a high level of resistance in the field study were crossed with plants of the susceptible cultivar Black Diamond to determine the inheritance of the resistance. Growth chamber experiments were undertaken to evaluate F1, F2, and BC1 generations from these crosses. In these studies, the observed resistance appears to be controlled by multiple genes. Information gained from these and future studies will be useful in transferring powdery mildew resistance genes into commercial watermelon cultivars.

Effects of Cultural Practices on Watermelon Stand and Disease

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Inadequate germination, or plant death after germination and prior to harvest, causes significant loss to watermelon producers. A variety of causal agents have been implicated and correlated with such plant losses. A study was conducted to determine the effectiveness of

various cultural practices in reducing plant loss, or in maintaining plant stands until harvest. Watermelon (*Citrullus lanatus* cv. Sangria) was planted at one of three planting dates, 4 May, 25 May, or 15 June, at the Lane Agricultural Center in Lane, Okla. Within each planting date, watermelons were either transplanted or direct seeded. Within each planting method, one of four chemical treatments was applied, including Vapam, Quadris, Ridomil Gold, or an untreated control. Vapam was applied pre-plant, ≈3 weeks before planting. Quadris and Ridomil were applied post-plant, just after planting. Stand counts were taken weekly. In the third planting, stand counts were substantially lower in direct-seeded plots than in transplanted plots. There were more plants with phloem discoloration and stem xylem discoloration in the second planting than in the first or third planting. In the second planting, the greatest stand counts occurred with plots that had received Vapam. However, in the first and third plantings, the plots that received Vapam had lower stand counts than did the other chemical treatments or the control. Yield was greater in the second planting than in the first or third planting.

Effect of Preemergence Herbicides on Early Seeded Watermelon

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Herbicides approved for watermelon may result in crop injury under cool or wet conditions. To obtain market prices associated with early harvest, planting may occur when conditions are sub optimal for seed germination and plant growth. Consequently, early planting may contribute to crop injury from herbicides. Field trials were conducted to compare existing and possible new herbicides for crop injury potential with early planting. A RCB design was used with split-plot treatment arrangement (main plots = planting dates and subplots = herbicides). Yearly, four watermelon (cv. Allsweet) plantings were made every 2 weeks beginning mid-April on fine sandy loam soil in 1999 and very fine sandy loam in 2000 and 2001. Herbicides and base rates (in lbs. active ingredient per acre) were ethalflualin @ 1.125, a mixture of bensulide @ 4 and naptalam at 4, a mixture of ethalfluralin @ 0.8 and clomazone @ 0.25, and halosulfuron-methyl @ 0.025. Herbicide treatments included an untreated check, base rates of herbicides, base rates × 2 of herbicides and the base rate × 3 of halosulfuron-methyl. Stand counts and plant weights were determined when 50% of plants had a first female flower in 2000 and 2001. Stand counts were made at 63 days after planting in 1999. In 1999 no interactions were detected between planting date and herbicides. In 2000 and 2001, significant $P < 0.05$ interactions occurred between plant date and treatment for stand only and no significant decreases in stand or plant weight resulted from 1× rate treatments as compared to the untreated control. For the 3× rate of halosulfuron-methyl and the 2× rate of ethalfluralin + clomazone, instances occurred when stand and plant weight were significantly lower than for the respective 1× rates.

Real-time Irrigation Scheduling for Drip-irrigated Watermelon

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Producing economical yields of vegetables while conserving water and fertilizer requires an integrated approach to fertilization and irrigation management for vegetable crop production. This approach is central to the development of Best Management Practices (BMPs). However, irrigation recommendations for real-time management are currently not available for most drip-irrigated vegetables in Florida. As part of BMP development, watermelon was grown with plasticulture with factorial combinations of three N regimes (75%, 100% and 125% of the recommended 150 kg N/ha rate) and four irrigation regimes (33%, 66%, 100%, and 133% of a reference rate; I3). Different numbers of drip tapes, two sub-main lines, and three fertilizer injectors were used to create the factorial combinations of N and irrigation rates. For I3, daily drip irrigation was based on class A pan evaporation (Ep) and a crop factor ranging between 0.20 and 0.90 depending on crop age. Seasonal irrigation was 5,400 gal/100 ft (70 m^3/100 m) of bed for I3. Soil water tension tended to decrease with increasing water amounts and exceeded 15cb for I1 and I2 on most dates. Watermelon early yield was significantly affected by N and irrigation rates (all $P < 0.01$), but the interactions N rate × irrigation rate were not. Early yield was significantly higher with 125% (26,400 kg/ha) than with 75% (22,400) and 100% (18,600) N rate. Early and total yields responses to water rates were both quadratic ($P < 0.01$) and maxima occurred at 96% and 120% of I3, respectively. Therefore, a combination of 190 kg N/ha and 96% I3 irrigation regime should be used together for highest early watermelon yields grown with plasticulture.

Squash Bug: Vector of Cucurbit Yellow Vine Disease Pathogen

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Cucurbits, especially watermelon and cantaloupe, are important crops in the South Central region of the U.S. and are affected by a variety of insect and disease complexes. Prominent among these are the squash bug, *Anasa tristis* (DeGeer), and a destructive vine decline, cucurbit yellow vine disease (CYVD). The causal agent of CYVD has been identified as a strain of *Serratia marcescens*. The disease is especially severe in Oklahoma and Texas, but has also been confirmed in Arkansas, Tennessee, and Massachusetts. Losses can range from <5% to 100% in affected fields of watermelon, squash, pumpkin, and cantaloupe. Earlier experiments suggested that the pathogen was insect transmitted. In 2000, healthy squash plants caged with feral squash bugs collected from diseased field plants developed symptoms consistent with CYVD. In addition, squash bugs collected in Nov. 2000 and Apr. 2001 from overwintering habitat near DeLeon, Texas, were caged individually on successive squash seedlings at 7-d intervals. Of the insects tested (n = 76), 10.5% of the overwintered squash bugs transmitted the bacterium to seedling squash as determined by phloem discoloration and PCR. Control plants not subjected to squash bugs remained healthy. Our data confirm the capability of squash bug to transmit the CYVD bacterium and serve as an overwintering host of the bacterium.

Time of Removal and Population Density Effects of Livid Amaranth (*Amaranthus lividus*) on Bell Pepper (*Capsicum annuum*)

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A field study was performed in the year 2001 in Gainesville, Fla., to determine the influence of times of removal and population densities of livid amaranth on the yield and grade of plastic mulched-bell pepper. 'Camelot' pepper was established from transplants, at a fixed density of 6 plants/m^2. Livid amaranth was established from seed sown 2 cm from the pepper stems. The treatments were factorial combinations of weed densities (0, 1, 2, 3, 4, and 6 plants/m^2) and times of removal (0, 2, 3, 4, 5, and 14 weeks after weed emergence, WAE) in a randomized complete-block design with four replications. The variables measured in pepper were concentration of nitrogen/nitrate in the petiole, plant dry weight at final harvest, and marketable fruit yield. In livid amaranth, the variables measured were plant height and dry weight at the time of removal. Analysis of variance and regression were performed on the resulting data. Delaying the time of removal resulted in decreasing pepper plant biomass accumulation, decreasing yield and decreasing fruit size, while weed plant height and biomass accumulation increased. Concentration of nitrogen/nitrate in pepper petioles was not different between treatments, indicating lower nitrogen accumulation in pepper in treatments with lower biomass values. Thus, competition for nitrogen may be an important factor in the weed-crop relationship. Based on the resulting regression models, a 10% yield loss in pepper would occur if removal were performed at

4, 3, and 2 WAE with livid amaranth densities of 1, 2, and 3 plants/m^2, respectively. With densities of 4–6 livid amaranths/m^2, that yield loss would occur between 1 and 2 WAE. Maximum yield loss was 65%, when 6 livid amaranths per m^2 interfered with the crop season-long.

Effect of Boron and Molybdenum on Flowering and Yield of 'Kapoho' Papaya (*Carica papaya*)

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A field study was conducted in the Dominican Republic to determine the effects of boron (B) and molybdenum (Mo) rates on flowering and yield of 'Kapoho' papaya. B and Mo content in the soil were 0.5 and 0.2 ppm, respectively. The crop was managed following commercial practices, except for B and Mo fertilization. The treatments were foliar applications of B (0, 5, 10, 15, 20, 25, 30 mg/plant) and Mo (0, 25, 50, 75, 100, 125, and 150 µg/plant), sprayed 6 weeks after transplanting. A randomized complete-block design with four replications was utilized. The variables measured were time to flowering, and marketable fruit yield. Analysis of variance and regression were performed on the data. Mo rates did not significantly influence time to flowering. As Mo rates increased, papaya yield declined. At 75 µg Mo/plant, yield loss was 50%, as compared to no Mo application. Yield loss was 90% when 150 µg Mo/plant were applied. B significantly influenced time of flowering and yield. The earliest flowering and harvest were obtained with 15–20 mg B/plant. When no B was applied, flowering and harvest were delayed 10 weeks. When 30 mg B/plant were applied, toxicity symptoms were evident, and flowering was delayed 6 weeks. Maximum yield was obtained with 15–20 mg B/plant. Without B application, yield was reduced by 50%, due to deficiency. When 30 mg B/plant were applied, yield loss was ≈40%, due to toxicity. The concentration of Mo in the soil (0.2 ppm) seemed sufficient to provide adequate yield, while a soil concentration of 0.5 ppm B resulted in delayed flowering and reduced yield. Under these conditions, applying B at rates 10–20 mg/plant could hasten flowering and increase yield in 'Kapoho' papaya.

Comparison of Weed Management Programs in Papaya (*Carica papaya*)

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A field study was conducted in the Dominican Republic to compare 10 weed management programs and their effect on the yield of 'Sunrise' papaya. The reference or control treatment was standard cultivation (SC = cultivation at 3, 6, and 9 WAT) followed by application of paraquat at 15, 27, 39 and 51 weeks after transplanting (WAT) and paraquat+diuron at 21, 33, and 45 WAT. The alternative treatments were (1) SC/diuron every 6 weeks, (2) SC/paraquat every 6 weeks, (3) SC/oxyfluorfen every 6 weeks, (4) SC/oryzaline every 6 weeks, (5) SC/glyphosate every 6 weeks, (6) SC/paraquat at 15, 27, 39, and 51 WAT, alternated with oryzaline at 21, 33, 45 WAT, (7) SC/paraquat at 15, 27, 39, 51 WAT, oxyfluorfen at 21, 33, 45 WAT, (8) hoeing every 3 WAT, and (9) cultivation every 3 WAT. Herbicide rates were 1 Kg/ha for glyphosate, paraquat, and oxyfluorfen, 1. 5 Kg/ha for oryzaline and 2 Kg/ha for diuron. Treatments were arranged in randomized complete blocks with three replications. The variables measured were marketable fruit yield in nine harvests, injury attributable to treatments, weed abundance, and incidence of insects and disease. The weeds more commonly present were *Cyperus rotundus*, *Echinochloa colona*, *Eleusine indica*, *Panicum maximum*, *Momordica charantia*, *Parthenium hysterophorus*, and *Amaranthus dubius*. Herbicides differentially controlled these weeds, *Cyperus rotundus* being the most resilient weed. Herbicide damage was apparent only when oryzaline was used. The treatments did not influence disease or insect pressure on the crop. The best yield was obtained with the control treatment, SC/glyphosate every 6 weeks, and SC/paraquat every 6 weeks. Managing weeds with hoeing, SC/paraquat alternated with oxyfluorfen, and SC/diuron resulted in yields significantly lower than when the control treatment was used. The lowest yields were obtained with cultivation and SC/oryzaline.

Influence of Mulches and Drip Irrigation on the Growth, Yield and Quality of Vidalia Onion

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Sweet onions are typically grown on bare soil and irrigated with high-pressure systems such as sprinklers or center-pivots. Drip irrigation alone or in combination with plastic mulches is widely used for vegetable production, particularly for tomatoes and peppers. To our knowledge, there is no information on sweet onion production in Georgia under drip irrigation and plastic film mulch. The objective of this study was to determine the effects of drip irrigation and mulch on onion plant growth and yield. The experimental design was a split plot, where the main plot was the irrigation system (sprinkler or drip) and the sub-plot was the type of mulch (bare soil, black plastic film or wheat straw). Fertilization of sprinkler-irrigated plants was according to UGA extension recommendations. Drip-irrigated plants were fertilized (N and K) weekly through the drip tape. The results indicated that bulb and shoot dry masses were higher under drip than under sprinkler irrigation. Total bulb yield and bulb pungency were not affected by the irrigation system. Soil moisture content was lower and fluctuated more under sprinkler than under drip irrigation. Weekly plant measurements during the course of the season indicated that bulb and shoot dry masses were largest under plastic and lowest under straw. Total yields were highest on bare soil and lowest under straw, while pungency was unaffected by mulches. Average soil moisture over the season was lowest under bare soil, while soil moisture under plastic mulch was similar to that under straw. In conclusion, plants on bare soil yielded the most, and plants under drip irrigation had similar bulb yield and quality compared to plants under sprinkler irrigation.

Fruit Crops

Blueberry Breeding for Low-chill Environments

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Practical plant breeders everywhere attempt to develop cultivars that give high yields of high-quality product with minimum input costs in the environments where those cultivars are to be grown. Breeding methods are surprisingly similar, whatever the crops and whatever the environments. Breeding goals almost always include tolerance to numerous insects and diseases, improvement of numerous and diverse quality parameters, and the adjustment of numerous different elements of adaptation. Evergreen blueberries that cross readily with cultivated highbush blueberry and have no chilling requirement are native throughout the Florida peninsula to an area south of Miami. Through recurrent selection, the Florida program has attempted to obtain clones that do not flower before 1 Feb., no matter how warm the fall and winter, that flower suddenly in early to mid-February, even if little or no cold weather has occurred, that produce new leaves vigorously at the time of flowering, that have a short flowering-to-ripening heat unit requirement, that yield well, and that have high-quality berries. If temperatures during the winter in Florida were not so variable and if the winters of different years were more consistent, breeding well-adapted blueberry varieties would be a lot easier. Some of the varieties that have been developed can produce high yields from 10 Apr. to 15 May when grown in central Florida, but blueberry germplasm is still rich in unexploited variability that could increase yields, simplify culture, and improve adaptation.

'Alapaha': A New Early Season Rabbiteye Blueberry

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'Alapaha' is a rabbiteye blueberry (*Vaccinium ashei* Reade) jointly released by The Univ. of Georgia College of Agricultural and Environmental Sciences, The Univ. of Georgia Agricultural Experiment Station, and the U.S. Dept. of Agriculture's Agricultural Research Service. Named after the Alapaha River in south Georgia, 'Alapaha' was selected from a cross of T-65 x 'Brightwell' and was tested as T-256. Its primary attribute is that it ripens early in the rabbiteye season along with 'Climax' yet blooms at least a week later than the standard cultivar in south Georgia. The later blooming characteristic is of paramount significance since 'Climax' has been subject to moderate to severe freeze damage during bloom for at least 4 of the last 10 years. 'Alapaha' plants are vigorous and upright, with quite narrow crowns, and its chilling requirement is estimated to be 450 to 500 h. 'Alapaha' has better leafing than 'Climax', even following mild winters. The new cultivar easily produces sufficient stems to renew the plant; but, is somewhat susceptible to twig dieback. Fruit are medium size, having excellent firmness, color, flavor and small dry scars which contribute to good shelf life. The cultivar should be suitable for mechanical harvesting. 'Alapaha' should be planted with other rabbiteye blueberry cultivars with similar time of bloom. Propagation is easily accomplished from softwood cuttings. USPPAF. Propagation rights controlled by Georgia Seed Development Commission, 2420 S. Milledge Ave., Athens, GA 30606.

Integrating Dwarfing Rootstocks, Interstems and Peach Latent Mosaic Viroid into Peach Orchard Systems

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Size controlling rootstocks for intensive orchard systems and bloom delay via interstems and viroids to reduce frost risk were evaluated for peach production in the southeastern United States. Two orchards of 'Carogem' peach were planted in either 1995 or 1998 near Clemson, S.C. The 1995 orchard planted at a 5.2 × 6.0-m tree spacing had six replications of single-tree plots of the treatments 'Carogem' peach on Lovell rootstock inoculated with a single bud containing Peach Latent Mosaic Viroid (PLMVd) and non-inoculated 'Carogem' on Lovell. The 1998 orchard consisted of 4-tree plots each of 'Carogem' budded to a 30–40 cm *Prunus* sp. interstem on Lovell (*P. persica*) rootstock, and to the rootstock cultivars Jaspi [(*P. domestica* x *P. salicina*) x *P. spinosa*], PumiSelect (*P. pumila*), and a *P. pumila* seedling selection. Treatments were replicated 4 times with trees spaced at 2.2 × 6.0 m. Trees were trained to an open-center or Kearney-V system in the 1995 and 1998 orchards, respectively. Tree growth, phenology, maturity date, fruit yield and bacterial canker resistance were evaluated through year 2001. The interstem and PLMVd-infected trees delayed bloom by an average of 4 and 5 days, respectively. The *P. pumila* rootstocks advanced bloom by 4 days. The interstem and viroid treatments delayed fruit maturity 2 and 4 days, respectively. Cumulative fruit yields were significantly higher for both the control trees versus the viroid trees and the interstem trees versus the other rootstock treatments. However, yield efficiency did not differ significantly between the viroid and control treatments. Trunk cross-sectional area was significantly reduced by 17% in both the viroid trees and those on PumiSelect rootstock. All trees on Jaspi rootstock died from bacterial canker by Spring 2001, and some trees on the two *P. pumila* rootstocks died from waterlogging, while others were severely leaning.

Alternative Ground Cover Management Systems for Mature Transition Orchards: Preliminary Observations

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To provide technology for transition and organic apple producers, a study of mulch effects on mature trees was established. Trees of 'Gala', 'Jonagold', and 'Braeburn', on M.9 planted at 1.75 × 3.3 m and 8-years-old were studied. Trees were given one of the following ground cover treatments: 1) annual contact herbicide application, 2) PVC landscape fabric, 3) hardwood compost mulch, 4) shredded office refuse paper mulch. All treatments covered an area of 1.5 × 1.75 m; the compost and paper mulches were applied annually to a depth of 10–15 cm. Cultivars were the main plot and mulch treatments were a split-plot with 6 cv × mulch experimental unit replications. This reports covers the first two seasons after treatments began. During this time, there were very few significant cv × mulch interactions and only the main effects of mulch are presented herein. The fabric mulch tended to result in increased soil pH and reduced bulk density compared to the herbicide treatment; the wood and paper mulches were intermediate. Soil moisture content was generally higher in all mulch treatments compared to the herbicide treatment measured during both growing seasons. Both the wood and paper mulch had average higher soil moisture content than the landscape fabric mulch. Water infiltration rate was highest in the herbicide treatment and was negatively related to soil moisture content of the soil at time of measurement. Apple root density at depth of 0–25 cm was highest in the wood and paper mulch and significantly lower in the fabric mulch with the herbicide treatment being intermediate. Annual and cumulative yield was not effected. Fruit size tended to be largest in the paper and wood mulches and smallest (significant in both years) in the fabric mulch. Fruit from trees with the fabric mulch tended to mature earlier than other mulch treatments, have higher soluble solids and lower firmness. Fruit from trees with the white paper mulch tended to have better red color. The mulches had significantly lower weed infestation compared to the herbicide treatments with the wood mulch having the least weeds.

Effect of Number of Branch Crowns on Yield of 'Chandler' and 'Camarosa' Strawberries in South Georgia

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Branch crown number and yield were evaluated in 'Chandler' and 'Camarosa' strawberries to determine the relationship between these traits in plants grown in south Georgia. 'Chandler' plants were transplanted in Savannah on the last week of Oct. 2000, 'Camarosa' plants in Enigma on the third week of Oct. 2000. Branch crowns were counted twice in 100 plants in each cultivar, the first counting done about five months after planting (MAP) and the second at ≈7 MAP. Harvested fruit was separated into marketable and non-marketable fruit. Regression analysis was conducted to determine if a relationship existed between branch crown number and yield. Branch crowns ranged from 1–12 in 'Chandler' and 2–14 in 'Camarosa' 5 MAP, and 3–24 in 'Chandler' and 7–25 in 'Camarosa' 7 MAP. Based upon regression analysis, there is a significant positive linear relationship between branch crown numbers 5 MAP and 7 MAP in both 'Camarosa' (R^2 = 0.40) and 'Chandler' (R^2 = 0.58). Marketable and total fruit weight tended to increase with an increase in the branch crown number 5 MAP. Based upon regression analysis, there is a significant positive linear relationship between branch crown number 5 MAP and marketable and total yield in 'Camarosa' (R^2 = 0.52, 0.63) and 'Chandler' (R^2 = 0.41, 0.44). Average fruit weight tended to decrease slightly with an increase in the branch crown number 5 MAP. A higher branch crown number in 5-month-old strawberry plants will generally result in more fruit production in 'Camarosa' and 'Chandler' in south Georgia. The regression equations generated in the analysis may be useful in predicting potential marketable and total yield in the two cultivars.

Imidacloprid Insecticide Slows Development of Phony Peach and Plum Leaf Scald

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Observations in controlled field experiments over five seasons indicated that imidacloprid, a systemic, xylem-transported insecticide, when applied as a soil drench around the trunks of peach, nectarine and plum trees in the early spring and mid-summer at planting and for two subsequent seasons at a concentration of 0.7 g actual insecticide/tree-application slowed the development of xylem fastidious bacterial diseases in the trees. After four seasons the percentage of peach trees showing phony peach symptoms was 34.5% in the untreated trees and 8.5% in the treated trees. After 5 years, the percentage of peach trees showing phony peach symptoms was 71.4% in the untreated trees and 13.1% in the treated trees. After four seasons, nectarine trees in untreated and treated plots showed phony peach disease symptoms in 8.3% and 0.9% of the trees, respectively. After 5 years, phony peach disease symptoms were found in 32.3% of the untreated trees and 8.5% of the treated trees. Development of plum leaf scald disease in plums was slowed by the trunk drench with imidacloprid. After 4 years, twig dieback was seen in 55% of the untreated and 23% of the treated trees in the Au Rosa cultivar. After 4 years, twig dieback was seen in 33% of the untreated and 12% of the treated trees in the Santa Rosa cultivar.

2001 Peach Variety Evaluations and Web Site Development

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During the 2001 growing season, over 200 peach and nectarine varieties and advanced selections (both yellow and white-fleshed) were evaluated at the Musser Fruit Research Farm, Clemson Univ., Clemson, S.C. The earliest variety was harvested May 11 and the latest was 13 Sept. This is part of a long-term project to determine suitability of new cultivars and advanced selections for South Carolina, in particular. Many selections were from the breeding program of Dr. Dick Okie (USDA–ARS, Byron, Ga.). Some varieties may perform better or poorer in neighboring states depending on location, disease and insect pressure, chill hours received, etc. For nearly every variety evaluated this year, fruit size was larger than in 2000. This was likely due to early flower thinning due to freezes in early March. Most trees had a good crop load and were thinned appropriately. All trees were irrigated throughout the growing season as necessary. It was also noted that nearly every variety was harvested commercial ripe 1 to 5 days earlier than in 2000. Variety images, evaluation tables and other relevant peach information can be found at my peach web site at: http://www.clemson.edu/hort/peach/peachhome.htm

Peach Systems Trial: The Influence of Training System, Tree Density, Rootstock, Irrigation and Fertility on Growth and Yield of Young Trees in South Carolina

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The purpose of this trial is to compare conventional SC peach tree culture with higher levels of management for short and long-term impacts on tree growth, yield, cost of production and profitability. In 1999, the research orchard was established consisting of three tree training systems and planting densities: i. Open Center (5.5 × 5.5 m spacing ≈ 332 trees/ha); ii. Quad V (5.5 × 2.7 m spacing ≈664 trees/ha); and iii. Perpendicular V (5.5 × 1.8 m spacing ≈997 trees/ha); two rootstocks: i. 'Lovell'; and ii. 'Guardian™'; and three irrigation/fertilization treatments: i. Rainfall only plus granular fertilization at standard commercial recommended rate; ii. Supplemental irrigation plus granular fertilization at standard commercial rate; and iii. Supplemental irrigation plus liquid fertilization (fertigation) at half of the commercial rate. The scion cultivar is 'Redglobe'. Each treatment combination comprised 5 adjacent trees down the tree row and was replicated in four distinct blocks. Environmental data was collected by computer from a weather station and also included pan evaporation and soil moisture content. During the first three years of the trial, supplemental irrigation substantially increased TCA relative to the nonirrigated treatment. This is primarily due to the lack of sufficient summer and spring rainfall during 1999–2001. No disadvantage was observed when trees were fertilized at half the commercial rate. By 2001, high and medium density trees became more crowded in the tree row and as tree density increased, TCA was reduced. Three radiational frost events in 2001 dramatically reduced tree yield for the shorter open-center trees in comparison with the taller quad V and perpendicular V trees. As a result, yield of quad V and perpendicular V trees was 4–5 fold greater than open center trees. Tree yield for supplementally irrigated trees was double that of nonirrigated trees.

Floriculture/Ornamentals

The Effect of Yard Trimming Mulch on the Growth of Bedding Plants in the Landscape

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During 2001, Chatham County Dept. of Public Works collected over 15,000 tons of yard trimmings set curbside by citizens. This material is ground in a tub grinder and made available to citizens. A series of research projects were initiated to evaluate the effect of these materials on bedding plants, so that recommendations to consumers and landscapers regarding their use could be formulated. The effect of depth of application of the mulch on the growth of bedding plants was evaluated. Other studies examined the effect of soil incorporation of freshly ground or composted mulch on the growth of bedding plants. Another study compared the effect of Chatham county mulch, pine straw mulch, cypress mulch and pine bark mulch on the growth of bedding plants as well as the temperature at the mulch/soil interface. Results showed that bedding plants grew as well when mulched with Chatham county mulch as they did when mulched with pine straw, cypress mulch or pine bark mulch. Mulch type had little effect on temperature at the soil/mulch interface. Incorporation of freshly ground mulch into the soil was detrimental to plant growth, but well-composted mulch provided a positive growth response. Incorporation of the composted mulch increased soil pH slightly and increased calcium, potassium, manganese and phosphorous in the soil. Overall, Chatham county mulch had a positive effect on plant growth and proved to be an economically beneficial alternative to other mulches on the market.

Influence of Shipping Time on Heliotrope and Lantana Cutting Quality and Rooting

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The objective of this study was to look for warm season plants that would react adversely to shipping by losing leaf chlorophyll. *Heliotropium arborescens* L. 'Marine' and *Lantana camara* L. 'New Gold' were selected as model plants to study and to determine if they meet this criteria. Heliotrope cuttings, ≈5–6 cm long were harvested from greenhouse-maintained stock plants and placed in a simulated shipping environment for 0 to 7 days using six cuttings per treatment in a randomized complete-block design with three replications. Cuttings were placed in sealed plastic bags to prevent desiccation in the shipping environment in darkness and maintained at 22 °C. Cuttings were removed, rated for chlorophyll content using a Minolta SPAD 502 chlorophyll meter and placed under mist for rooting. After 16 days under mist, cuttings were removed and again rated for cutting quality and rooting. Lantana cuttings were treated the same as previously described for heliotrope but held under shipping conditions from 1 to 11 days. Heliotrope cuttings shipped form 0 to 7 days did not exhibit

a decrease in leaf chlorophyll content as estimated by the SPAD meter and similarly rooting was not affected by any shipping treatment. There was no significant differences in the data of either SPAD readings or root ratings up to 7 days of shipping. Similarly with lantana, as long as there were leaves to measure, there was no decrease in chlorophyll content from 0 to 11 days. However, by day seven, leaves began to abscise and rooting decreased significantly. At day 11 there were no leaves, the cuttings did not root, and most died. Both heliotrope and lantana withstood the shipping environment for 7 and 6 days, respectively, without any decrease in cutting quality or rooting. Lantana cuttings shipped more than 7 days had increasing leaf abscission with time. Neither lantana nor heliotrope met the initial criteria for model plants system to study in the Florida summer heat and humidity that would react adversely to shipping by losing leaf chlorophyll. However, we learned that as long as leaves were maintained without chlorophyll loss during shipping, cuttings would root well for up to 7 days from harvest after shipping.

Effect of Photosynthetic Irradiance and Nutrition On Growth of English Ivy (*Hedera helix* L.) in Subirrigation Systems

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The growth of three English Ivy cultivars in ebb-and-flow subirrigation systems was examined under light levels (520, 364, 260 $\mu mol \cdot m^{-2} \cdot s^{-1}$) and fertilizer concentrations (0, 100, 200, 300 $mg \cdot L^{-1}$ N) geared toward production of acclimatized foliage plants. Nutrition did not significantly affect chlorophyll content, specific leaf area [SLA, leaf area/leaf dry weight (LDW)], or shoot dry weight (SDW) of any cultivar. High light levels significantly increased chlorophyll content only in 'Gold Child'. Highest irradiance resulted in highest SLA, the lowest LDW (per leaf), and the highest SDW in all cultivars. English Ivy can be grown successfully in subirrigation systems. Quality plants can be produced with 100 $mg \cdot L^{-1}$ N. Although 520 $\mu mol \cdot m^{-2} \cdot s^{-1}$ produced the maximum SDW, good quality plants also were produced under 260 $\mu mol \cdot m^{-2} \cdot s^{-1}$. 'Gold Child', 'Gold Dust', and 'Gold Heart' English Ivy produced with low fertility and low light may be better acclimatized and show superior performance in interior environments. Under light levels lower than 500 $\mu mol \cdot m^{-2} \cdot s^{-1}$, yellow-variegated cultivars tend to decrease the amount of leaf variegation. 'Gold Dust' retains attractive foliage with overall perception of increased lighter-green coloration. 'Gold Child' tends to decrease the marginal white variegation and is less attractive. 'Gold Heart' tends to decrease or loose the central yellow variegation and is less attractive.

Effect of Co-compost on Sandy Soil Properties for Specialty Cut-Flower Production

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Compost has many beneficial effects on crop production and soil properties. These effects may vary with compost blends produced from various combinations of waste stream feedstocks. The objective of this study was to determine the effects of co-compost rates on sandy soil chemical properties during sunflower (*Helianthus annuus* L.) growing season in Florida. A co-compost prepared from municipal solid waste (MSW) and biosolids (67:33) was applied at the rates of 0, 33, 67, and 133 $Mg \cdot ha^{-1}$ to sandy soil in June 2001 in a randomized complete-block design with three replications. Soil samples were collected at beginning and end of season from top 10 cm soil layer, air-dried, sieved in 2-mm sieve, and analyzed at Agricultural Service Laboratory, Clemson, S.C., for pH, EC, CEC, total macro- and micro-nutrients. Soil pH in all amended soil treatments was 7.1 due to compost inherent pH (7.2) in comparison to non-amended soil (6.5). The electrical conductivity (EC) increased just after compost application and decreased at the end of the season. As compost rate increased, soil cation exchange capacity (CEC) increased significantly in all compost amended treatments and was double in the highest compost rate treatment in comparison to that in non-amended treatment. This compost blend did not provide significant increases in N, P and K for the sunflower production. However, Ca, Mg, Zn, Cu, and Mn levels increased with increases in compost rate applied and were highest in soils treated with co-compost at highest rate (133 $Mg \cdot ha^{-1}$). This study provided very significant information on sustainability and enhancement of sandy soil properties during the growing season of the specialty cut-flower sunflower using this blend of co-compost.

Postharvest/Biotechnology

Optimizing Yield and Post-harvest Fruit Quality: The Effects of Mycostop™, Nutrient Volume, and Irrigation Regulated by a Solar Irradiation Based Irrigation Controller (Solar-Gro12™) on Hydroponic Greenhouse Tomatoes

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'Trust' tomatoes were grown in perlite media bag culture. A randomized block design with split-split plot treatment arrangement was utilized. Mycostop™ was applied as the whole plot treatment at a rate of 1 g per 72 plants once a month. Nutrient application was regulated by either sunlight availability or by time. The amount of nutrient applied was controlled by spray stakes that supplied 0.86, 1.13, 1.14, 2.01, 3.48, and 3.95 L of water per day at 20 psi when controlled by timer. Fruit was collected and percent soluble solids (SS) and titratable acidity (TA) were measured. The experiment was repeated in Fall 2000 and Spring 2001. No significant differences in yield or fruit quality among treatments were observed for the fall crop. Neither irrigation control method nor Mycostop™ treatment resulted in significant differences in yield in the spring experiment. However, nutrient quantity did have an effect on yield ($P < 0.01$). Plants irrigated at 2.01, 3.48, and 3.95 L/day produced equally high yields, while plants supplied with 0.86 L/day produced the lowest yields. There were significant differences in TA and SS attributable to amount of nutrient applied ($P < 0.01$). Fruit from plants receiving 0.86 L/day had the highest TA and SS content. Solar irrigation control was found to have a slight, but statistically insignificant, increase in TA and SS. No other treatment differences were seen. Quality and yield were maintained in the spring with a minimum application rate of 2.01 L/day. Solar irrigation, which decreased the amount of nutrient applied by half, was effective in maintaining yield and showed promise for increasing fruit quality as compared with timed irrigation.

Capillary Electrophoretic Isolation and Quantitation of Individual Glucosinolates from Seeds of Sixteen Plant Species and the Relative Toxicity of their Isothiocyanate Derivatives to *Sclerotium rolfsii*

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Glucosinolates (GS) are secondary plant metabolites involved in plant defense. These compounds are organic anions containing ß-D-thioglucose and sulfonated oxime moieties. A highly variable side chain results in over 120 identified GS in a diverse group of plants including members of the Brassicaceae, Capparaceae, Phytolaccaceae, and Resedaceae. When hydrolyzed by the enzyme myrosinase, GS produce D?glucose, sulfate, isothiocyanates, thiocyanates, and nitriles. Isothiocyanates, the predominant breakdown product, have been shown to have biocidal activity. The objectives of this study were: 1) identification and quantitation of intact GS using capillary electrophoresis (CE); 2) comparison between the CE and the standard HPLC method and 3) comparison of the relative toxicity of the GS breakdown products. Seeds were extracted using 95 °C water and then processed using solid phase extraction. Aliquots of each extracts were analyzed on an HP 3D capillary electrophoresis system using MECC separation techniques and on an HPLC using the ISO desulfo-GS

method. Crude seed extracts (100 µL) and myrosinase (50 µL) were applied to potato dextrose agar along with a *Sclerotium rolfsii* mycelial plug. Plates were incubated and growth at 24 h was determined. Intact GS electropherograms appeared very similar to HPLC chromatographs. The separation of early eluting GS was considerably better than that of the LC, while the later eluting compounds were less resolved. Plates treated with crude seed extracts from *Brassica oleracea* L. (Germmifera Group), *B. napus* L. (Neobrassica Group) and *Hesperis matronalis* L. did not exhibit growth significantly different from the control. All other extracts demonstrated significant inhibition of mycelial growth with >20% suppression ($P < 0.05$). *Lepidium sativum* L. exhibited the most activity with 93.7% inhibition of mycelial growth.

Microbiological Quality of Fresh-cut Sweetpotatoes

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The microbiological quality of fresh-cut sweetpotato slices was monitored after different chlorine sanitizing treatments and storage durations while packed in semi permeable polyolefin film bags (Cryovac PD 941) held at 2 and 8 °C for 14 days. The micro flora of fresh-cut sweetpotato slices was initially dominated by mesophilic bacteria, followed by psychrotrophs and yeast-molds, at populations of 4.95, 3.83, and 2.83 $\log_{10}$ CFU/g, respectively. Dipping the slices in a 200 ppm chlorine solution at 1 °C was the most effective sanitizing treatment for reducing the population of all microorganisms. Microbial load on the slices increased nearly a four-log cycle for mesophiles and psychrotrophs and about a three-log cycle for yeast-molds during 14 days of storage at 8 °C. At day 14, total plate count was about one log cycle higher at 8 °C than 2 °C. The 2 °C storage temperature reduced the mesophilic growth significantly. However, psychrotroph count from both 2 and 8 °C storage temperatures was similar. No spoilage was observed on the slices held at either 2 or 8 °C for 14 days.

UV-C Light Treatment and Storage Temperature on Quality of Stored Blueberries

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Interest in the health properties of blueberries has resulted in several studies on the antioxidant content of blueberry cultivars. Additionally, the use of short-wave light treatments (<300 nm) has been found to effectively reduce decay in strawberries and grapes. The objective of this study was to determine the effect of ultraviolet light treatment on the shelf life and antioxidant content of blueberries. 'Collins' and 'BlueCrop' blueberries were subjected to 1000 and 2000 Joules of UV-C light (254 nm). All berries were held at 2 °C for 23 days, 5 °C for 14 days, or at 2 or 5 °C for 21 or 14 days followed by 2 days at 20 °C. The firmness of 'Collins' blueberries held at 5 °C decreased while 'Bluecrop' fruit firmness decreased only after exposure to 20 °C. Decay was not reduced by UV light treatment but was increased in berries held at 20 °C. Total phenolic and anthocyanin contents and oxygen radical absorbing capacity (ORAC) will be determined. Titratable acidity and pH of fruit purees were not affected by light treatment while acidity was decreased and pH increased in stored fruit. Results from this study indicate that blueberries were able to tolerate 254 nm light treatments up to an intensity of 2000 Joules.

Storage Regimes and ORAC in Muscadine Grapes

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Muscadine grapes are usually slip-skin types with large seeds and are light green-bronze or purple-black in color. These grapes are grown in the southern part of the U.S. and are most often used for processed products. Fresh-market studies with muscadines have been done to determine the ideal stages of ripeness and use of sulfur dioxide for shelf life extension. The objectives of our work have been to determine alternative storage regimes for muscadines and to determine their antioxidant content. 'Fry' and 'Summit' (bronze) grapes harvested at 16% soluble solids content and held at 2 °C for 28 days had 20% to 40% less decay under a controlled atmosphere of 15% CO_2/10% O_2. Little to no change was seen in soluble solids content, pH, or titratable acidity. However, UV-C (254 nm) treatment (2000J) of 'Carlos' and 'Cowart' muscadines did not decrease the percentage decayed or soft berries, or change the pH or titratable acidity of the fruit. The oxygen radical absorbing capacity (ORAC) of muscadines was found to be very high. Values of 28–49 and 32–68 µmol Trolox equiv./g fresh weight were found in seven bronze and 11 purple muscadine varieties, respectively. These results indicate that controlled atmosphere storage of muscadines may offer a means of extending shelf life, and that muscadines may be a rich source of antioxidants.

Effect of Harvest Date on Controlled-Atmosphere Storage of Short-Day Onions

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Harvest date was evaluated for a number of different short-day onion varieties to determine its impact on controlled-atmosphere (CA) storage. During the 1998–99 season 15 varieties and three harvest dates were evaluated. Harvests occurred 11 Apr., 4 May, and 11 May 1999. After 5 months CA storage onions harvested on 11 Apr. 1999 had the highest marketable yield. In the 1999–2000 season the experiment was repeated with two varieties, 'Sweet Vidalia' and 'Centaur'. Six harvests were made with the two varieties. The last two harvests had no marketable onions that could be placed in CA storage due to sour skin (*Burkholderia cepacia*). After 5 months of storage the highest marketable yield of 'Sweet Vidalia' was with onions harvested on the fourth harvest date, 25 Apr. 2000. There were no differences for the four harvest dates for 'Centaur'. In the 2000–2001 season the experiment was repeated with six harvest dates and three varieties. With 'WI-609', after 5 months of CA storage, the highest marketable yields were with the fifth and sixth harvests on 26 Apr. and 2 May 2001. The highest yield with variety PS 7092 after 5 months CA storage was with onions harvested on the fifth harvest date, 15 May 2001. Only four harvests of 'Pegasus' survived through CA storage, the last two harvests succumbing to sour skin. The highest yield of 'Pegasus' was with the third harvest on 15 May 2001.

Watermelon Research Group

Uniformity in Watermelon Cultivar Trials

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A survey was conducted to determine the importance of various measurements and descriptors for watermelon cultivars. An online web-site questionnaire was developed to list and describe various descriptors and characteristics that are often used when designing watermelon cultivar evaluation studies. Survey respondents were asked to rank the importance of various descriptors as being of very low, low, medium, high, or very high importance. About 75 respondents, primarily from the United States, completed the survey. Survey respondents classified themselves as research (74%) extension (51%), consumer (37%), seed company (14%), agri-business (2%), grower (2%), or personal grower (9 %). Descriptors that were considered to be

of very high importance by 50% or more of the respondents included: plant type (diploid vs. triploid), earliness of harvest, marketable fruit weight, resistance to diseases (vine declines, gummy stem blight, powdery mildew, anthracnose, bacterial fruit blotch, fusarium wilt, WMV-1, WMV-2), flesh color of fruit, and sugar content of fruit. Descriptors that were considered to be of high or very high importance by 40% to 49% of the respondents included: total fruit weight, % seed germination, resistance to downy mildew, resistance to ZYMV, resistance to CMV, fruit shape, fruit length, fruit width, individual fruit weight, rind color, rind thickness, and shipping capability. The most desirable method of information dissemination concerning cultivar evaluations was via web pages. The descriptors receiving the most votes as highly important were, in descending order, marketable fruit weight, resistance to fusarium wilt, and fruit flesh color.

Watermelon Cultivar Evaluations in Oklahoma

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An evaluation of 20 diploid and 22 triploid cultivars of watermelon (*Citrullus lanatus)* was conducted at Lane, Okla., at the Lane Agricultural Center. Single-row plots 30 feet long, on 9-ft centers, were planted 23 May 2001. Plots were separated in length by 10-ft alleys. Ten plants, 3 feet apart, were planted in each row. All plants were on raised beds, with black plastic mulch and drip irrigation. Fertilizer applications were according to OSU recommendations. A once-over harvest was conducted on 2 Aug. Data collected included fruit length, fruit circumference, fruit yield (weight), flesh color, rind color, and stripe pattern. Lycopene content was analyzed on 20 cultivars. The 10 (out of 20) highest yielding diploid cultivars and their respective yields in tons per acre were: Piñata (19.8), Summer Flavor 800 (18.9), Big Stripe (15.8), RWM 8036 (15.4), RWM 8110 (15.4), Sweetheart (Raspa) (15.3), Festival (14.9), Summer Flavor 710 (14.7), Falcon (14.0), and WX 190 (13.7). The 11 (out of 22) highest yielding triploid cultivars and their respective yields in tons per acre were: Crispy Sweet 8006 (14.7), Trillion ACX 257 (14.3), Summer Sweet 5244 (13.6), Millionaire (12.7), 7187 HQ (12.4), 7167 (12.0), Carousel (11.0), Millennium (10.8), Sugar Shack (10.7), ACX 7177 (10.5), and Tri-X 313 (10.5). Lycopene concentrations in red-fleshed cultivars ranged from ≈27 to 45, with a mean concentration of 36 $\mu g \cdot g^{-1}$ of fresh tissue. One yellow-fleshed cultivar was tested, with a lycopene concentration of ≈1 $\mu g \cdot g^{-1}$ of fresh tissue.

Xenon Flash Spectrophotometric Method for Lycopene Quantitation in Watermelon

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Lycopene is a carotenoid with antioxidant properties that imparts the red pigment in some fruits and vegetables. Watermelon, tomato, and pink grapefruit are the most common foods in a North American diet that contain this compound. Because of its health benefits and food colorant potential, lycopene content in fruits and vegetables is of interest to the food industry. Current methods to assay lycopene content in fruit tissue are time consuming, expensive and use hazardous organic solvents. Past attempts to correlate lycopene content to reflectance tristimulus colorimeter readings of cut watermelon fruit were unable to accurately predict lycopene content. Here we report a method by which light absorbance is used to quantify lycopene content in watermelon heart tissue puree. Using a xenon flash colorimeter/spectrophotometer, we evaluated 152 red-fleshed watermelons (including 10 varieties of seeded open-pollinated, seeded hybrid and seedless triploid types) to predict lycopene content. The samples ranged in lycopene contents from 24-88 $\mu g \cdot g^{-1}$ fresh weight. We found that our purée absorbance method gives a linear relationship (R-square = 0.98) when compared to lycopene content determined by a hexane extraction method. The linear relationship is independent of watermelon variety. Since pureeing watermelon flesh is the only processing required and no chemicals are needed for this method, the method is rapid, inexpensive and needs no hazardous chemicals. This simple method for measuring lycopene content in watermelon and watermelon products promises widespread use for lycopene quantitation.

Georgia Watermelon Variety Trials

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We have conducted watermelon variety trials in Georgia from 1998 to 2001 with at least a third of the entered varieties, triploids. Trial layout has been a randomized complete-block design of four replications. Each plot consisted of 10 hills. Data collected included yield, and measurements of two melons from each plot including length, width, rind thickness, and soluble solids. Melon type and rind pattern are also noted. Fisher's protected LSD with Bonferroni's adjustment for five comparisons was computed for yield and soluble solids. In 2001, 29 varieties were evaluated with yields ranging from 27,240 lbs/acre to 2,222 lbs/acre. The top five yielding varieties in the 2001 trial were Royal Star, Big Stripe, WX8, WX22, and Montreal. Three varieties appeared in the top five yielding varieties for 1998–2001 trials more than once. These included 'Stars n Stripes', 'Starbrite', and 'Piñata'.

Progress in Constructing Linkage Map of Watermelon

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An integrated linkage map is being assembled by merging two maps constructed for watermelon. A map derived from a testcross population [Plant Accession Griffin 14113 (*C. lanatus* var. *citroides*) x New Hampshire Midget (NHM; *Citrullus lanatus* var. *lanatus*)] x U.S. Plant Introduction (PI) 386015 (*C. colocynthis*) has been constructed. The map contains 141 randomly amplified polymorphic DNA (RAPD) markers and 27 inter simple sequence repeat (ISSR) markers. Also, a SCAR marker linked (1.6 cM) to race 1 Fusarium wilt resistance in watermelon. The map consists of 25 linkage groups covering a total distance of 1166.2 cM, and with an average distance of 8.1 cM between two markers. Among the linkage groups is a group of 22 markers covering a mapping distance of 225.6 cM. Additionally, six large groups each with 10–20 markers that cover a mapping distance of 68.8–110.8 cM, five linkage groups each with 3–7 markers that cover a mapping distance of 36.5–57.2 cM, and thirteen small linkage groups each with 2–11 markers that cover a mapping distance of 3.5–29.9 cM. SCAR markers are being developed and used to integrate the linkage maps constructed for watermelon.

Watermelon Cultivar Evaluation in Florida

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Diploid (27 entries) and triploid (37 entries) watermelons were evaluated in replicated trials at the Gulf Coast Research and Education Center in Bradenton, Fla., in the Spring 2001 season. The crop was grown on EauGallie fine sand in raised, polyethylene-mulched beds. The beds were fumigated with methylbromide chloropicrin (67:33) and fertilized with 157–20–192 $kg \cdot ha^{-1}$ N–P–K. The crop was seepage irrigated. The diploid entries served as pollenizers for the triploid entries. The diploids were harvested 94–114 DAP and triploids were harvested 87–97 DAT. Diploid yields varied from 54.8 $t \cdot ha^{-1}$ for SWD 8307 to 109.0 $t \cdot ha^{-1}$ for 'Summer Flavor 790'. Other high-yielding diploids were 'Starbrite', 'Jamboree', SWD 7201, 'Royal Star', XWD 98212, RWM 8114, 'Big Stripe', 'Sweetheart', and 'Royal Sweet'. Triploid yields varied from 63.5 $t \cdot ha^{-1}$ for 'Revolution' to 128.7 $t \cdot ha^{-1}$ for 'Millionaire'. Other high-yielding triploids were Hazera 1032, 'Talladega', 'Sweetheart', 'Tri-X-313', 'Supper Seedless 7177', YS00-503, ZG 8820, 'Tri-X-Palomar', and 'Sugar Shack'.

2001 Watermelon Cultivar Trial Results, North Carolina

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Sixty red-fleshed advanced lines or watermelon cultivars (collectively termed cultigens) were evaluated for adaptation under NC growing conditions by measuring yield and quality attributes. Twenty-four of the cultigens were diploid, 35 triploid and one was a tetraploid. Twelve seed companies participated by submitting at least one watermelon entry for evaluation. The top five yielding triploid cultigens (based on total marketable fruit number) were Sunday Special, Slice n' Serve, Afternoon Delight, Wrigley, and Trillion, while the five cultigens that yielded the most mass were Hazera 1032, Millionaire, Summer Sweet HQ variety 7167, W 55, and Afternoon Delight. Triploid cultigens that produced the largest average fruit size included Freedom, Hazera 1032, Revolution, RWT 8120, W 5051, and W 5052. Several of the triploid lines not released for commercial production had increased fruit size compared with named cultivars. Nearly one-half of all triploid fruit examined had hollow heart and in most cases the hollow heart was severe. Cultigen exceptions were Millionaire, RWT 8120, Trillion, Tri-x-Palomar, and W 55. The cultigens whose flesh had the most intense red color were Freedom, Sunday Special, and Wrigley. The top five yielding diploid cultigens (based on total fruit number) were Fiesta, Athens, Crimson Sweet, Starbite, and Regency, while the five cultigens that yielded the most mass were Starbrite, Mardi Gras, Athens, Summer Flavor 800, and Mara. Diploid fruit which produced the largest average fruit size included 'Jubilee' and 'Summer Flavor 800'. Sugar Baby was the cultivar that was ready for harvest the earliest; the cultivars that were harvested the latest were Jubilee, Charleston Gray, Starbrite, Summer Flavor 800 and WX-8. The majority of watermelons grown in the United States are red flesh triploids. However, southeastern states like North Carolina (excluding Florida) currently grow ≈20% red flesh triploids and 80% red flesh diploid types. The market will increasingly demand more triploid watermelon production in the future.

Evaluation of Watermelon Germplasm for Reaction to the Peanut Root-Knot Nematode (*Meloidogyne arenaria* race 1).

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Watermelon (*Citrullus lanatus*) is an important vegetable crop in the U.S. and world-wide. Root-knot nematodes (*M. arenaria*, *M. incognita*, and *M. javanica*) are serious pests of watermelon throughout the southern U.S. Root-knot nematodes are currently controlled in watermelon by pre-plant fumigation with methyl bromide or with other nematicides. However, the proposed removal of methyl bromide from use in the U.S. in 2005 and loss of many other nematicides from the market has caused considerable interest in developing alternatives for managing plant-parasitic nematodes and other soil-borne crop pests in vegetable crops. Host plant resistance would provide an inexpensive and environmentally compatible alternative for managing root-knot nematodes in watermelon. Therefore, all available accessions of *C. colocynthis* (21) and *C. lanatus* var. *citroides* (88), and approximately 10 percent of *C. lanatus* var. *lanatus* (157) accessions from the USDA *Citrullus* germplasm collection were evaluated for resistance to *M. arenaria* race 1 in greenhouse tests. 'Charleston Gray', 'Crimson Sweet', and 'Dixie Lee' were included as check cultivars in all tests. The check cultivars and nearly all *C. lanatus* var. *lanatus* accessions were very susceptible; root gall severity indices (GI) ranged from 8.1 to 9.0 (using a 1.0 to 9.0 scale) and from 4.0 to 9.0, respectively. Likewise, all *C. colocynthis* accessions evaluated were highly susceptible (GI range: 8.0 to 9.0). However, some *C. lanatus* var. *citroides* accessions appeared to be moderately resistant (GI range: 3.0 to 9.0). These results demonstrate that there is significant genetic variability within the U.S. PI *Citrullus* germplasm collection for reaction to *M. arenaria* race 1 and also identify the *C. lanatus* var. *citroides* accessions as potential sources of resistance to *M. arenaria* race 1.

National Sweetpotato Collaborators

Irrigation Scheduling in Sweetpotato Production

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Approximately 40% of the sweetpotato acreage in Louisiana is irrigated via overhead or furrow delivery methods. Crop-specific information about irrigation scheduling is virtually absent for sweetpotatoes, hence growers are faced with a limited variety of irrigation management tools. The objectives of this research were to evaluate various irrigation scheduling tools as well as management allowable deficits (MAD) for suitability to sweetpotato production. The monitoring tools included an evaporation pan (EP), a spreadsheet-based evapotranspiration (SET) prediction program, and granular matrix sensors (GMS) in combination with a soil moisture meter. The 2001 test was conducted in Chase, La., using 'Beauregard' sweetpotato. The experimental design was split-plot, where the main-plot was the irrigation delivery method (microsprinklers or furrow) and the sub-plot was the irrigation scheduling method (EP—1 or 2 inch MAD; GMS—40% or 60% available water; SET—1 or 2 inch MAD). The checks included plots that were either irrigated (one inch per week) or unirrigated. During the first 2 months of the 2001 test, up to 5 inches of irrigation water was supplied via the various scheduling methods. However, the remainder of the growing season was characterized by heavy precipitation patterns that made supplemental irrigation unnecessary. No differences were detected in the yield among the irrigated and nonirrigated plots. This is in contrast to the previous year's data (<5 inches of rain during growing season) where irrigation increased yields by as much as 50%. This illustrates the potential utility of irrigation-scheduling methods in conserving resources, e.g., unscheduled irrigation would have already provided over 7 inches of irrigation vs. scheduled irrigation (5 inches).

Evaluation of Multimericlone Seedstock in Sweetpotato Production

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The implementation of a virus-tested (VT) foundation seed program insures the availability and sustained productivity of superior sweetpotato seedstock. Nodal cultures from a virus-tested, high-yielding mericlone comprise the starting material for VT foundation seed. Currently, mericlone 'B63' comprise the Louisiana VT foundation seed program. Under certain conditions, other mericlones outperform 'B63.' For instance, the 2000 'Beauregard' mericlone evaluation early-season (mid to late May) test showed that '97-7-4' had 26% more total marketable yield (TMY) compared to 'B63.' Using a balanced data set, a significant mericlone x planting date interaction was detected for US#1. Using STABLE, we are able to identify four mericlones that showed consistent yield potential and ranks across three planting dates. These mericlones were combined in all possible combinations in 2001 and evaluated at Chase and in two outfield locations. The results suggest that there were no yield differences among the treatments across three planting dates, suggesting that the various multi-mericlone combinations demonstrated consistent yield potential across planting dates. Due to the highly variable nature of sweetpotatoes, additional tests across years, planting dates, and locations are necessary to verify the yield consistency of the mericlones as well as the results.

Digital Image Analysis of Sweetpotato Storage Roots

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Length, thickness, and diameter are easily estimated from digitized images of sweetpotato storage roots. However, such measurements are often insufficient for detecting possible subtle variations due to genotypes and/or environmental conditions. Shape description methods,

such as Fourier descriptors, employ information about the location of all points on a contour, thereby making possible the description of the entire shape. This study explored the feasibility of using Fourier shape analysis to quantitatively characterize US#1 storage roots from eight 'Beauregard' sweetpotato mericlones. Digital images of US#1 storage roots against a black background were taken using a light stand-mounted digital camera at a resolution of 640 × 480 pixels. Image files were converted to grayscale to facilitate the generation of x-y coordinates. The coordinate data were used to generate the Fourier coefficients followed by principal components analysis (variance-covariance). The plot of the first and second principal components was used to visualize shape variation among the mericlones. Although no distinct groups based on the PCA scatter plot were evident, the data demonstrate the possible use of Fourier analysis as a tool in describing not only root shape in sweetpotato trials, but other morphological characters as well.

Evaluation of Messenger™ in Sweetpotato Production

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We currently lack information about the possible role of Messenger™ application rates and timing on sweetpotatoes. This information will provide growers with the necessary data about the effectiveness of Messenger™ in sweetpotato production management. Greenhouse-grown, virus-tested Beauregard foundation G0 plants and field-increased G0 plants were used as sources of planting materials. Standard cultural practices were followed. To test the efficacy of greenhouse pretreatments on subsequent crop performance, G0 plants were applied with Messenger™ at a rate of 4.5 oz/acre 5 days prior to cutting. Post-transplant treatments included applications at 7 and 28 days after transplanting (DAT). G0 plants that were established in field beds were used in tests to investigate the influence of Messenger™ application on subsequent crop performance. The first test compared a low rate (2.5 oz/acre) and the recommended rate of 4.5 oz/acre. The second test assessed the influence of various application times using the recommended rate. Based on visual observations, Messenger™ application seemed to help the initial establishment of the greenhouse-derived planting materials relative to the untreated checks. The results were supported by the detection of significant differences in the US#1 yield grade between some of the treatments (5-day pretreatment in combination with either 7- or 28-DAT application) and untreated plots. However, no differences were detected in other yield grades or in the field-derived planting materials subjected to rate and timing treatments. Additional tests over several locations, planting dates, and years are required to verify the role of Messenger™ in sweetpotato production. In addition, evaluations for pest reaction, and possible effects on postharvest and canning qualities must also be conducted.

Field Bed Fertilization for Sweetpotato Transplant Production

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Most sweetpotato transplants in the USA are produced in field beds. Since there is no published report on the amounts of different fertilizer elements needed for optimum sweetpotato transplant production, response to each of the elements N, P, and K for plant numbers, transplant survival and weights and subsequent storage root yield from 'Beauregard' transplants was investigated. The study was conducted in each of 3 years on different soils testing medium and low in P and K. Rates of N applied at time of bedding were 45 and 90 kg per hectare. After the first plant cutting, a second plot of each treatment received a second application of N at 37 kg. Rates of P were 90 and 180 kg, and K were 84, 168, and 336 kg. Two plant cuttings were made. No response to N or P was found for transplant numbers, weights, survival or storage root yield. Plant green weight from first cutting plants was greater with 336 kg of K than with no K; however, dry weight did not differ among treatments. Transplant survival and storage root yields also did not respond to potassium. Results from this study show no benefit from application of N, P, or K for sweetpotato transplant production since the increased green weight from potassium application did not result in increased storage root yield over no fertilizer.

Minimizing Sweetpotato Weight Loss During Storage by Using an Atomizing Humidification System

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Desiccation represents a major avenue for fresh weight loss during sweetpotato storage. Current recommendations are for 85% relative humidity (RH) in the storage environment. The driving force for moisture loss is the differential in the chemical potential of water between the roots and their surrounding environment. We altered the water vapor pressure deficit using two RH environments (85% and 95% RH, 15 °C) that gave water vapor pressure deficits of 2.60 and 0.85 mbs, respectively and monitored the fresh weight loss of cured 'Beauregard' storage roots biweekly over 16 weeks. To minimize the deposition of free water on the surface of the roots, a hydraulic (water-air) atomizing humidification system (Optiguide Atomizer, Tabor, Yokneam Illit, Israel) was utilized that produces water droplets generally <10 micrometers in diameter for the 95% RH environment and a conventional evaporative humidifier for the 85% RH environment. Weight loss was substantially reduced at the higher RH (i.e., 2.4% fwt @ 95% vs. 11% fwt @ 85% after 16 weeks) without increased pathological decay. Losses of moisture and product value of 'Beauregard' sweetpotatoes can be substantially reduced using a higher relative humidity storage environment.

Weed Control and Sweetpotato Tolerance with Flufenacet

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A herbicide trial was established in Louisiana, Mississippi, and North Carolina to evaluate Define (flufenacet) on weed control, sweetpotato injury, and sweetpotato grade yield. Several treatments included Define, a flufenacet plus metribuzin pre-packaged mix (Axiom), metolachlor (Dual), clomazone (Command), and fluazifop (Fusilade). All herbicides were applied at labeled or potential 1× and 2× rates. Treatments were applied at transplant in Louisiana and North Carolina. At 2 WAT in North Carolina, 0.825 lb ai/ac Define and 0.51 lb ai/ac Axiom controlled carpetweed, wild radish, and common lamb's-quarter 100%. At 6 WAT in Louisiana, 0.825 lb/ac Define and 0.51 lb/ac Axiom controlled broadleaf signalgrass at least 92% and large crabgrass 100%. In Mississippi, treatments to sweetpotato were applied postemergence (POST) immediately following transplant and POST at 3 weeks after transplant (WAT). At 6 weeks after transplant, sweetpotato injury ranged from 20 to 66% with Define at 0.64 to 1.28 lb/ac and Axiom at 0.81 to 1.62 lb/ac applied POST at 3 WAT. Pitted morningglory control was 86% with 2.5 lb ai/ac Command applied POST at transplant, while morningglory control was <68% with all other treatments. Broadleaf signalgrass control was 99% with Fusilade and at least 93% with Command applied POST at transplant. Control of broadleaf signalgrass ranged from 86 to 89% with Dual II Mag, 84 to 87% with Axiom, and 65 to 75% with Define applied POST at transplant. Control of broadleaf signalgrass was greater when applications were applied POST at transplant compared to POST at 3 WAT. Weed control was not different between rates, but control was higher for 2× compared to 1× treatment rates for all herbicides at the POST at transplant timing.

Field Scale Variability in Sweetpotato Production

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Mississippi currently ranks third in the United States for sweetpotato production. In 2001, production increased from 14,500 to 16,500 acres. US No. 1 grade sweetpotatoes are at least five times more profitable than other potato grades. Therefore, research is currently focused on identifying factors that affect the spatial variability of sweetpotato yield grades. Directed sampling points were selected based on US No. 1

sweetpotato yield or bare soil images from fields located in North Mississippi. Ground-truthed data collected throughout the growing season included soil properties (chemical properties, texture, compaction, and moisture), tissue samples, estimated leaf chlorophyll level, and sweetpotato grade yield. Mean U.S. No. 1 grade was used to determine yield classes. Yield classes were arbitrarily assigned a high yield of ≈237 bu/ac and a low yield of ≈236 bu/ac. Ground-truthed data was analyzed according to collection date using stepwise discriminate analysis statistics to build a model to predict yield classes and for model cross-validation. Statistical results indicated 3 variables were necessary for model 1, 10 variables for model 2, and 16 variables for model 3. The majority of variables used to predict yield class were parameters derived from leaf tissue samples and 7–12 inch depth soil samples. Data from model 2 (23 Aug. 2001) produced the best model for predicting yield classes over sample dates with 0 percent error for cross validation of discriminate models in both high and low classes. However, false positive predictions for low yield ranged from 50% to 86% when using ground-truthed data collected from September and July, respectively. Soil nutrients selected for use in prediction model 2 were magnesium, potassium, phosphorus, copper, and sodium. Planted tissue nutrients selected for model 2 were chlorophyll, potassium to manganese ratio, nitrogen to potassium ratio, and aluminum.

Use of Hairy Vetch and Rye in Organic Sweetpotato Production

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Demand for organic food has been steadily increasing by over 20% a year for each of the last 10 years. In NC, annual retail sales from organic produce approached $5,000,000 in 1998. Consumer demand coupled with increased premiums for organic sweetpotatoes provide opportunity for growers to increase profit, however, no organic production recommendations exist for sweetpotato growers in North Carolina. Four treatments and six replications were evaluated to determine the effect of management system on sweetpotato yield, weeds, and wireworms using a systems approach to production. Three organic systems, including 1) no cover crop, 2) cover crop incorporated prior to transplanting, and 3) cover crop reduced tillage, were compared to a conventionally managed check. Additional fertility in organic plots was supplied by compost, and all plots received mechanical cultivation as needed. Beauregard sweetpotatoes were transplanted July, and harvested Oct. 2001. Among organic plots, monocot weed biomass was highest in the reduced tillage plots (345 $g \cdot m^{-2}$), but no differences were noted in dicot weed biomass. Sweetpotato vine biomass was lower only in reduced tillage plots <150 $g \cdot m^{-2}$, where monocot weed biomass was high and suppressed vine growth. Overall, weed biomass was negligible in conventional plots, yet no difference in total yield among treatments was observed. Plots were baited on four occasions during the last 8 weeks of production for wireworm larvae using untreated corn and wheat seed. Larvae were lowest (one per trap or less) in organic reduced tillage and conventional plots, and highest (greater than four per trap) in organic cover crop incorporated.

Virus Incidence and Its Effect on Yield and Root Quality in 'Beauregard' and 'Hernandez' Sweetpotatoes

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Accumulation of viruses and mutations in sweetpotato contribute to a decline in yield and root quality. To determine effects of the *Sweetpotato Feathery Mottle Virus* (*SPFMV*) on decline, three micropropagated clones (mericlones) of 'Beauregard' and 'Hernandez' sweetpotatoes were evaluated in field tests in Kinston, N.C. Mericlones of each cultivar were subjected to two treatments: 1) graft-inoculation with SPFMV and 2) virus-indexing using the indicator plant *Ipomoea setosa* to ensure the absence of known viruses. Weekly monitoring of virus symptoms and aphids indicated that most plants displayed symptoms 2 weeks after the largest influx of aphids. Virus identification of randomly selected samples using indexing and a nitrocellulose-membrane enzyme-linked immunosorbent assay (NCM-ELISA) confirmed the presence of SPFMV in each treatment. Measurements taken at harvest indicate that *SPFMV* contribute to a decline in yield and an increase in length : diameter ratios for both cultivars.

Simulation of Hail Damage on 'Beauregard' Sweetpotato and its Effect on Yield

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Presented at the 2001 SR–ASHS Meeting, Fort Worth, Texas.

'Beauregard' is the most widely grown sweetpotato cultivar grown in the United States. Occasionally, a sweetpotato crop can be damaged by hail. It is unknown what the economic impact is when hail damage occurs to sweetpotato. In order to make reasonable insurance adjustments, two distinct studies were conducted each year in 1997, 1998, and 2000 (six total). One study evaluated the effect that defoliation had on yields at varying degrees of severity (50% and 100% defoliation) and various stages of plant development [21, 42, 63, and 84 days after planting (DAP)]. In the other study, to simulate hail damage, the top growth was severed at the soil surface at various times (≈20, 30, and 40 DAP) and at various percentages plant stand (100%, 75%, 50%, and 25%). In the defoliation study, total defoliation (100%), reduced total marketable yields nearly 20% each year, while in some instances, 50% defoliation reduced yields, but to a lesser extent than 100% defoliation. Defoliation late in crop development was more detrimental to yield than early in crop development. In the second study, the time at which top growth of plants in the plot were severed affected yields less than the percentage of plants affected. Early season vine removal; however, was less detrimental to yield loss than late season vine removal. Yield loss was usually greater when 50% and 75% of plant stands were affected than when 0% and 25% of plant stands were affected. Our data provide some guidance for determining yield loss when defoliation or top growth removal occurs. A model can be provided to provide some basis for insurance claims due to hail damage.

The Method of Transplant Production and its Influence on Stand Establishment and Yield

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The effect of Beauregard sweetpotato transplant source on stand establishment and yield was investigated at two locations in Eastern North Carolina. Plant source treatments included G0 source plants from greenhouse hanging baskets, greenhouse containerized trays, greenhouse float system trays and G1 source plants from greenhouse soil beds and field beds. The Beauregard clone used was micropropagated virus-indexed B94-14 and originated from the Micropropagation Unit in the Dept. of Plant Pathology at N.C. State Univ. Treatments were randomized into five complete blocks. Stands of the float system source plants were significantly reduced versus other plant production methods. Yields of the float system source plants were significantly reduced versus other plant production methods. Yields were similar for field vs. greenhouse-grown bedded plants.

National Cowpea Improvement Association

Diseases of Cowpea Incited by Soil-borne Fungal Pathogens

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Seedling diseases, root rots, and wilts are important limiting factors to cowpea (*Vigna unguiculata*) production in the U.S. and world-wide. Cowpeas planted in cold, moist, spring soils sometimes exhibit a near total stand loss. Pre- and post-emergent damping-off can be incited by a number of fungal pathogens including *Rhizoctonia solani, Fusarium solani*, and *Pythium* sp. However, the predominant causal organism of seedling mortality in the United States is *R. solani*. *Phytophthora vignae* causes seedling disease, but also incites stem and root rots affecting all growth stages. Southern blight caused by *Sclerotium rolfsii* incites stem decay at the crown and general wilting, yellowing, and drying of foliage. Fusarium wilt caused by *F. oxysporum* f. sp. *tracheiphilum* incites stunting, yellowing of foliage, wilting, and discoloration of vascular tissues. Disease control measures include crop rotation, reduction of crop residue, use of moderate-sized plant populations, fungicide treatments, soil moisture management, and resistant cultivars. Crop rotation is of limited value because many of these pathogens have a wide host range and produce resistant spores or sclerotia that survive in soil and crop debris. Fungicides are useful in managing some seedling diseases and root rots, but costly re-registration for minor crop use, environmental safety, and pathogen resistance may limit their use. Fusarium wilt–resistant cultivars are available, but cultivars resistant to diseases caused by other soil-borne fungi have not been developed. Resistant cultivars would provide cowpea growers with an effective and environmentally benign way to reduce yield losses and replanting costs. Additionally, resistant cultivars could be planted earlier, resulting in more efficient use of harvesting equipment and food processing facilities because the harvest season could be extended.