

# Abstracts of the ASHS Southern Region 51st Annual Meeting

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## Floriculture & Ornamentals

### THE GEOPHYTE, TM - A COMPUTER PROGRAM FOR BULBOUS, TUBEROUS, AND HERBACEOUS PERENNIAL PLANTS

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Much information has been accumulated on various aspects of ornamental geophytes. This knowledge has been published in research articles and bulletins, books, extension publications, etc. Thus, it is scattered and not easily accessible. The Geophyte TM software program was developed to aid in information access and transfer. It has been designed for IBM compatible systems. There are 7 major parts in each database. They are: 1- General Aspects (species origin, botanical classification, common names, etc), 2- Flowering Requirements, 3- Production Information (production countries and acreage, major commercial cultivars, production methods, etc.), 4- Gardening Information (soil types, light, planting info, cultivar performance data, etc.), 5- Forcing Information (commercial cut flowers, potted plants, homeowner forcing), 6- References, and 7- In-House Information, a slot allowing the user to insert specific information on the genera provided.

### IDENTIFICATION OF ROSE CULTIVARS BY RESTRICTION FRAGMENT LENGTH POLYMORPHISMS

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Restriction Fragment Length Polymorphisms (RFLPs) were investigated in rose cultivars as a means of reliable cultivar identification. A random genomic DNA library was generated by shotgun cloning HindIII digested fragments of DNA extracted from rose cultivar Confection into pUC8 plasmid of *Escherichia coli* strain JM 83. Compared to genomic clones carrying low or highly repeated sequences, clones with moderately repeated sequences were most effective in cultivar identification. These clones were identified by hybridizing rose DNA fragments from the library with genomic DNA from 'Confection'. Clones with moderately repeated copy sequences were used as probes to detect the presence of RFLPs by Southern hybridization of EcoRI digested genomic DNA of various rose cultivars. Several of these probes have revealed RFLPs useful in cultivar identification. By using a combination of two or more of these probes most of the rose cultivars compared at this time can be identified. A dichotomous key useful in identification of rose cultivars was prepared from RFLPs displayed by 3A9 probe.

### INFLUENCE OF R:FR RATIO ON CHRYSANTHEMUM GROWTH

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The response of chrysanthemum plants to varying R:FR ratios and phytochrome photoequilibrium values ( $\Phi = P_{fr}/P_{tot}$ ) was evaluated by

growing plants under 6%, or 40% CuSO<sub>4</sub> and water spectral filters. Using a narrow band-width (R = 655-665 and FR = 725-735 nm) and a broad band-width (R = 600-700 and FR = 700-800 nm) for R:FR calculation, 6% CuSO<sub>4</sub> filter transmitted light with greater R:FR (3.9) and greater  $\Phi$  (0.81) than 40% CuSO<sub>4</sub> or water filters. Light transmitted through 40% CuSO<sub>4</sub> and water filters had a similar narrow band R:FR ratio (1.2), but the broad band R:FR ratio (2.1) of 40% CuSO<sub>4</sub> filter was higher than water filter. Estimated  $\Phi$  value was similar for both water and 40% CuSO<sub>4</sub> filters. Final height of plants grown in CuSO<sub>4</sub> chambers was about 30% less than the plants in control chambers. The results suggest that broad band R:FR ratio correlated more closely to plant response than the narrow band R:FR ratio.

### CHARACTERIZATION OF LOW TEMPERATURE DAMAGE AND SUBSEQUENT REGROWTH RESPONSE OF FIELD GROWN ROSES

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Plants of field grown rose cultivars Blaze, Gold Glow, Queen Elizabeth, Mr. Lincoln, Montezuma, Don Juan, Chicago Peace, and Pink Peace endured two major freezes. Temperatures fell to -13°C on 16 December 1989 and as low as -20°C during an extended period from 17 to 28 December 1989 when the highest temperature reached was 5°. Grade 1 plants of each cultivar were harvested on 5 January 1990. At harvest, discoloration of the pith, xylem ray parenchyma and bud union tissue was assessed. Additional plants were then potted and forced in a glasshouse at 15° night temperature with venting at 21° during the day. At the end of the initial flush of growth, which was defined as either the opening of the first flower or the determination that all new shoots were blind, new growth was rated and measured. Blaze exhibited minimal damage with only slight pith discoloration. The total number of flowering shoots (TNFS) for Blaze was 5.5 per plant which is an expected number from a grade 1 plant. Of the other cultivars, Gold Glow and Pink Peace exhibited pith, xylem, and bud union damage with up to 50% cane dieback, but produced flowering shoots from the graft union. However, only half the expected TNFS per plant were produced. The remaining cultivars also exhibited higher damage levels than Blaze which resulted in reduced shoot numbers and flowering. Only Blaze plants received an acceptable plant marketability rating.

### AMMONIA AND NITRATE FLUCTUATIONS IN STORED WATER SAMPLES

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Water samples containing 0, 2.5, 10.0, or 20.0 ppm nitrate and ammonia were evaluated under 3 temperatures (0, 6, 20°C) plus or minus sulfuric acid (36N) for changes in concentration. Ammonia and nitrate levels were measured 0, 1, 2, 4, 8, 16, 24, and 32 weeks after storing. Response to storage conditions was the same regardless of acid or concentration of ammonia or nitrate. Nitrate concentrations in the storage locations were similar for the first 2 weeks. Afterwards, treatments stored at room temperature fluctuated from initial standards. With ammonia, frozen samples had the greatest deviation from initial standards during the first 4 weeks. By week 24, ammonia samples stored at room temperature had exceeded acceptable deviations from the standards. Nitrate and ammonia samples held in refrigeration had the least fluctuation during the 32 week storage period.

#### A COMPARISON OF 12- TO 14- MONTH SLOW RELEASE FERTILIZERS IN AZALEA PRODUCTION

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Five 12- to 14- month slow release fertilizers (Osmocote 17-7-12, Sierra 16-6-10, High-N 24-4-7, Sierrablend 17-7-10, and Nutricote 16-10-10 Type 360) were incorporated into a 3:1 pine bark:peat moss potting medium at one of 4 rates (0.9, 1.2, 1.5, and 1.8 kg N/m<sup>3</sup>). Plant growth of 3 azalea species, 'Coral Bells' (Kurume), 'Formosa' (Southern Indica), and 'Pink Gumpo' (Satsuki), and monthly medium solution electrical conductivity (EC) were determined. Growth indices 180 days after applying fertilizer were greatest for plants receiving the Sierrablend and Osmocote fertilizers regardless of azalea species. Plant growth indices increased as N rate increased for the 3 azaleas, regardless of the fertilizer product. The highest media solution EC readings occurred during the first 90 days after fertilizer application for all fertilizer treatments and declined thereafter.

#### TRANSPLANTING TO LARGE CONTAINERS TWO TREE SPECIES PRODUCED IN GROW BAGS AND BY TRADITIONAL FIELD PRODUCTION METHODS

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*Lagerstroemia* x 'Natchez' and *Quercus virginiana* were planted into a sandy loam soil in grow bags and by traditional field planting methods. After 2 years in the field, 1 sample from each of 6 replications was dug from the field in March. Root and top growth were measured. Half the remaining plants were dug and transplanted into 76 liter containers for 3 months. Growth indices were measured at this time. The remaining trees in the field were dug in July and handled similarly. Data from live oak trees showed increased height in trees produced by traditional field planting methods. No differences between planting methods were found in any other growth indices for the two species. Both crapemyrtle and live oak trees transplanted from traditional field plantings in March had greater height than trees transplanted from grow bags. However, no differences were detected for top weight, caliper or root ratings. July transplanted crapemyrtles showed no differences in any of the growth indices. Live oaks transplanted in July from traditional field plantings to containers all died with no additional growth. Grow bag transplanted oaks survived and continued to grow.

#### CHEMICAL ROOT PRUNING OF SAWTOOTH OAK WITH COPPER SULFATE

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Interior surfaces of tube trays were painted with white exterior acrylic latex paint and white interior latex paint containing 0, 50, or 300 gm/l copper sulfate. Germinated *Quercus acutissima* seedlings were used to study chemical root pruning effects and subsequent root regeneration. After 16 weeks, only 0.73 roots per seedling continued growth after being deflected by the tubewall painted with 100gm/l compared with 3.67 for the control. Fibrous roots were reduced when in contact with Cu treated surfaces. Height and caliper were not affected at any treatment level. Three weeks after transplanting to larger untreated containers, height and caliper were still unaffected by any Cu treatment. Time required for regeneration of new roots was not affected by Cu treatments.

#### HERBICIDE USE IN PROPAGATION

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Two experiments were conducted to evaluate commonly used granular preemergence herbicides applied prior to the sticking of cuttings in propagation. Rooting percentage of the three cultivars, 'Troupier' azalea, 'Hino-Crimson' azalea, and 'August Beauty' gardenia, was not affected in experiment 1. However, all three species exhibited some reduction in root quality or root length with all herbicides. In general, the herbicides with the least suppression were: Ronstar, Southern WeedGrass Control, OH-2, Snapshot 2.5 TG, and Rout. The second experiment with 'August Beauty' gardenia evaluated the effect of cuttings depth in overcoming the negative herbicide effects on root development. The results were similar to those obtained in experiment 1.

#### COMMUNICATING IN PHOTOMORPHOGENESIS

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Description of the light environment used in photomorphogenic research varies greatly among research teams. The environment is often described as the ratio of red (R) to far-red (FR) light, particularly when involvement of the phytochrome system is suspected. There is disagreement in the appropriate center and range of values for each ratio component. Often the center for R is reported as 660 nm. However, in chlorophyll-containing tissue 645 nm may be more appropriate because of the absorption of chlorophyll at 660. Band widths around a selected peak also vary. The widths generally are 10 or 100 nm. Comparison of experiments that describe different peaks or ranges is difficult. Much of the variation in description results from the behavior of phytochrome. Phytochrome has absorption and action spectral peaks, however wavelengths that cause absorption and/or action to a lesser extent may extend more than 50 nm from the peak. Integration formulas such as  $P_{fr}/P$  consider the effects of all wavelengths. However, even the integration formulas do not explain all photomorphogenic responses. A description of the entire photomorphogenic spectrum may be the most appropriate means of communication.

#### INTEGRATING CADD INTO HORTICULTURE CURRICULUMS - OPPORTUNITY OR HEADACHE?

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Nationwide, horticulture enrollments have fallen from the peak in the late 1970's. For instance, Stephen F. Austin State University enjoyed a maximum horticulture enrollment of 99 undergraduates in 1977. By fall 1990, that enrollment had fallen to 30. The absence of CADD (computer-assisted drafting or design) on SFASU's campus suggested an opportunity for horticulture to fill a void. This paper will discuss the decision-making process and costs involved in setting up a ten-station AutoCad lab with good plotting capability. A successful marketing effort has resulted in easy-to-fill sections with wide appeal across campus. CADD courses make sense in horticulture if the resource is not available in other departments, technical support is available, and the tool has value to related projects in the horticulture program.

## Fruit

#### PERFORMANCE OF 'OCONEE' PECAN AT THE GEORGIA COASTAL PLAIN EXPERIMENT STATION, 1979-90

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'Oconee' is a 'Schley' x 'Barton' cross from the USDA pecan breeding program and was tested as selection 56-7-72. It first bore in its 5th leaf and yields increased each succeeding year except year 11. Yields exceeded 23 kg/tree in year 10 and 12 and nut quality has been excellent each year. Percentage kernel averaged 56 with 26% (of inshell nut) grading fancy and 2% grading amber. 'Oconee' is large with nuts averaging 9.7 g in wt. and 13 cc in volume with 71% 2.54 cm or larger in diameter. After mechanical cracking, nuts are easily shelled into large unbroken kernel halves. 'Oconee' will pollinate 'Cape Fear', 'Stuart', 'Desirable', 'Kiowa' and 'Summer'. It is pollinated by 'Summer', 'Stuart', 'Maramek', 'Kiowa', 'Gloria Grande' and 'Forkert'. 'Oconee' should make an excellent temporary tree. More years data are needed to assess its merits as a permanent tree.

#### FATTY ACID COMPOSITION OF PECANS AS INFLUENCED BY DRYING

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Previous work in this lab has shown that drying temperatures above 35°C will cause excessive loss of the kernel's natural light color and less oleic (18:1) oxidation to linoleic (18:2)

fatty acid. The former is undesirable because of poor consumer appeal and the latter is desirable because of superiority of oleic acid in reducing low density lipoprotein in the blood plasma of consumers and a longer shelf life. The drying temperature of 35°C and an air volume of 45 CFM was superior in 1989 to 75 CFM at the same temperature and an air dried control. Lower air volumes in 1990 proved to be no better than 45 CFM at 35°C. The best compromise drying regime was determined to be 45 CFM at 35°C.

#### ADVANCED APPLE SELECTIONS IN THE ARKANSAS APPLE BREEDING PROGRAM: FRUITS FOR THE MID-SOUTH

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The Arkansas apple breeding program began in 1966 with objectives to develop high quality, dual purpose, adapted cultivars with a range of harvest dates and resistance to spring diseases. The program has two goals: 1) to develop red colored apples which are large, tart, firm and ripen between June and August; and, 2) develop yellow apples as a replacement for 'Golden Delicious' which are large, typey, without russet and with a range of maturities from July through September. Apples with commercial potential are AA-18 (red, ripens 1-July), AA-44 (red, ripens 15-July), AA-58 (yellow, ripens 29-Aug.), AA-65 (yellow, ripens 11-Sept.) and AA-62 (yellow, ripens 15-Sept.). Data on time of bloom, harvest, fruit size, and fruit storage tests will be presented.

#### EARLY PERFORMANCE OF 'REDHAVEN' PEACH ON 10 PRUNUS ROOTSTOCKS

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'Redhaven' trees on 10 rootstocks planted in 1984 were annually evaluated for growth and cropping as part of the NC-140 national cooperative rootstock trial. All trees on Citation have died, 60 % of trees on GF-43 have died and only a single tree of Lovell, Halford, and GF-677 have died. Trees on Damas GF-1869 and GF-655.2 had significantly more root suckers than other trees. Redhaven own-root, Halford and GF-677 were largest in height, spread, canopy volume or TCSA while the smallest trees were GF-43, Damas, and GF-655.2. Damas, GF-43 and GF-655.2 bloomed 3-4 days before trees on Lovell. Fruit on Redhaven own-root matured 4 days before fruit on Lovell while fruit on Halford, GF-677 and GF-43 ripened 2 days later than Lovell. Trees on Halford had the highest annual yield and accumulated yield while GF-655.2, Damas and GF-43 had the lowest yields. Redhaven own-root and Halford had the highest yield efficiencies (kg/cm<sup>2</sup>TCSA). Trees on Lovell consistently produced the largest individual fruit size.

#### USE OF CRYOPROTECTANTS FOR FROST PROTECTION IN PEACHES

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Late spring freezes often result in significant flower bud kill in deciduous fruit trees. Some products have been marketed as frost protectant compounds which purportedly protect flower stigmas and ovaries from freezing injury and death. Two of these compounds, Frost Free and Frostgard, were tested at two locations in South Carolina over three years. Varieties 'Junegold', 'Loring', 'Redhaven', and 'Jefferson' were treated with Frost Free (FF) in years 1988-1990 and with Frostgard (FG) in 1990. Significant differences in fruit yield and vegetative growth occurred during this period, but no consistent trends were evident. In 1989, FF-treated 'Redhaven' and 'Jefferson' trees averaged 10.5 and 21.8 kg more fruit/tree than the controls. However, no lethal cold temperatures occurred during the bloom period. In 1990, FG-treated 'Redhaven' trees averaged 8.0 kg more fruit/tree than the control trees. The fruit from FF-treated trees were lower in Brix, had less red color, and vegetative shoot growth was slightly greater than that of the FG and check trees. These data suggest that Frost Free may have plant growth regulator properties.

#### EFFECT OF GIBBERELIC ACID ON SEED TRACES OF ARKANSAS TABLE GRAPES

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Gibberellic Acid (GA<sub>3</sub>) was applied to 'Venus' table grape flower clusters seven days after full bloom at 0, 150 and 300 ppm

in 1987 and 1988. For both years, berry, cluster and average individual seed trace weights were not significantly affected by GA<sub>3</sub> treatment. Total seed traces/berry were reduced an average of 50%, resulting in one seed trace/berry for GA<sub>3</sub> treated clusters compared to two seed traces/berry for the control. Yield was increased in 1988 with the 300 ppm rate.

#### THE EFFECT OF SOIL SOLARIZATION ON GROWTH AND UNEVEN RIPENING OF 'CARLOS' MUSCADINE GRAPES

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In 1988 and 1989 a muscadine vineyard at Tuskegee, Alabama was treated by post soil solarization (PSS) (covering of moist soil around muscadine plants with clear polyethylene plastic mulch to achieve high soil temperature) for 30 and 75 days, respectively. The average soil temperature in 1989 of 50 and 35 C at 5cm depth for solarized and bare soil, respectively during PSS. The results showed no visible detrimental effect on 'Carlos' muscadine (*Vitis rotundifolia*) from the increased heating of the soil. And the grape plants grown in solarized soils showed increases in growth response e.g. increased yield, revitalization of new softwood vines, vine weight/plant, etc. Uneven ripening of muscadine grapes was reduced on plants grown in PSS over bare soil as indicated by the increases in the percent soluble solids content of grape berries.

#### EFFECTS OF EVAPORATIVE COOLING ON COLD HARDINESS OF CHARDONNAY AND CABERNET SAUVIGNON BUDS DURING DEACCLIMATIZATION

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Freeze losses to grapes in March, after mild deacclimatizing winters, is the major production risk on the Texas High Plains. Earlier studies indicated the effectiveness of evaporative cooling in reducing grape bud heat summation with a correlated delay in budbreak. Parameters relating to water-use-efficiency were identified. In the current study, these parameters were incorporated to minimize water use. Water was applied through microjets for 25 seconds every 4 minutes any time air temperature exceeded 10°C, 15°C, and Control. Bud temperatures were monitored continuously by thermocouples and data logger, and correlated with budbreak and plant development. Random bud samples were taken weekly prior to budbreak and subjected to differential thermal analysis. A freeze on March 23 (-3.5°C) resulted in differential primary bud losses to Chardonnay during budbreak, and to Cabernet Sauvignon 15 days prior to budbreak. Evaporative cooling significantly increased yields in both cultivars. Differential thermal analysis verified differences in cold stress tolerance in Chardonnay prior to budbreak.

#### THE INFLUENCE OF SELF- AND CROSS-POLLINATION ON FRUITING IN SOUTHERN Highbush BLUEBERRIES

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Southern highbush ("low chill tetraploid") blueberries are an earlier-ripening, self pollen-compatible alternative to rabbiteye blueberries. 'Sharpblue', the first southern highbush cultivar planted on a commercial scale, has been shown to require cross-pollination for optimal fruit size and earliness of ripening. 'Gulfcoast', a recently released cultivar for Gulf states growers of about latitude 30 to 32 N, differs in heritage from 'Sharpblue', incorporating about 50% more self-compatible northern highbush germplasm. 'Gulfcoast' fruit development after honey bee-mediated self- or cross-pollination with 'Sharpblue' was similar in terms of set (85.5 vs. 82.2%), weight (1.26 vs. 1.18g), and seed number (32.8 vs. 33.6), respectively. Cross-pollination did not result in significantly earlier ripening. Thus, 'Gulfcoast' appears to be more self-fertile than 'Sharpblue'. Other closely-related cultivars are being examined to determine the genetic influence on potential for self-fruitfulness.

#### INHERITANCE OF TOLERANCE TO MINERAL ELEMENT INDUCED CHLOROSIS IN RABBITEYE BLUEBERRY

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A study was conducted to estimate heritability of the content of Mn, Fe, and certain other mineral elements which have been associated with leaf chlorosis and to determine the genetic relationships among shoot dry weight, visual rating, and the mineral elements in rabbiteye blueberry (*Vaccinium ashei* Reade). Plants from a 10-parent dialled set of crosses were grown in sand culture to which 200 ml of 250 ppm Mn solution were applied five days per week. Visual ratings (1 = dead plant - 13 = no toxicity symptom) were made after six weeks and shoot weight and mineral element contents were determined after 10 weeks of treatment. Heritability estimates were high for all variables except Fe, suggesting that change in Mn, Zn, Ca, Mg, or K content could be expected from phenotypic recurrent selection. However, manipulation of mineral content probably would not ameliorate the Fe chlorosis. The high heritability of shoot dry weight and visual rating and the high genetic correlation between the two variables suggest that plants resistant to mineral effects on Fe metabolism can be selected on the basis of visual rating.

#### MONITORING AS AN ESSENTIAL TOOL FOR FERTIGATION MANAGEMENT

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Blueberry growers are encouraged to monitor soil, leaf tissue, and irrigation water on a regular basis. Recommendations are based on soil, leaf, and water guidelines established from previous studies. A 1986-1988 blueberry field study in east Texas and Louisiana revealed the following significant associations with low vigor fields: 1) high soil pH, Ca, Mg and low Zn, 2) high leaf Na and B, and 3) high irrigation water conductivity and bicarbonates. The findings will be compared to other benchmark studies. pH, conductivity, and nutrient monitoring procedures of a large east Texas rabbiteye blueberry field are described. Careful record-keeping allows blueberry growers to fine-tune fertigation performance by altering nitrogen source and rate, depending on changes in soil pH and conductivity.

#### SELECTION OF MAYHAW, *CRATAEGUS OPACA* L., FOR SUSTAINABLE AGRICULTURAL ECOSYSTEMS.

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In North America, cultivation of Mayhaws (*Crataegus opaca* L.) is rare; most commercial harvest is taken from the wild. *Crataegus opaca* is distributed in northeast Texas, east Texas and southeast Texas along the flood plains of the Angelina and Neches rivers and their watersheds. Mayhaws are difficult to define due to unusual factors relating to reproduction, including apomixis, or the development of an embryo from cells other than sex cells. Mayhaws are valued for economic use as food, medicine and ornamentals. Since the hawthorn has shown extremely low toxicity in every animal tested, the discovery of isolated constituents thru research has caused pharmacological interest. A small orchard plot of selections with ripened fruit measuring larger than 2.5 cm up to 3.1 cm with bright red or pink color is being established for selecting possible cultivars for medicinal or food uses.

Five *Crataegus opaca* selections were collected due to showing spurtye, large fruits and thornlessness. Yearly production of fruit was noted for five years (even after late freezes) while selections grew in Taggart's Flat, Neches river bottom, Angelina County. Seedlings are being grafted for further evaluations and uses in sustainable agricultural ecosystems.

## Vegetable Crops

#### HARVEST TIMING AND HEIGHT OF CUT EFFECT ON SAGE (*SALVIA OFFICINALIS*)

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Dalmation sage was transplanted in rows 92 cm apart with in-row spacing of 30 cm on 12 April 1989 at the Vegetable Research Station, Bixby, Oklahoma. Plots one row by 55 m long were established to determine the best timing for

harvest and to observe the effect of cutting height and date on yield and regrowth in the fall and regrowth the following season.

Four harvest dates in 1989 were 15 August, 25 August, 18 September and 8 November. In addition, one half of the plots harvested 15 August were recut on 5 November. Cutting height was 10 cm on 15 August, 12 cm on 25 August and 15 cm at all other harvest dates in 1989 and 1990. Four harvests were made on all plots during the 1990 season except those cut or recut in November 1989. Spring 1990 regrowth was very poor and no harvest was possible in April 1990 on November 1989 harvested plots. Highest total dry weight yields for the 1989 and 1990 seasons were produced by the 15 August initial cut with a 5 November recut (11,522 kg-ha<sup>-1</sup>) and the 8 November 1989 cut plots (10,881 kg-ha<sup>-1</sup>). Other plots that were harvested once in August or September 1989 plus four separate harvests in 1990 produced a total yield near 9,500 kg-ha<sup>-1</sup>. The 15 cm height of cut appeared to be superior to cutting closer to the soil.

#### PROPAGATING ROSEMARY (*ROSEMARINUS OFFICINALIS*) BY CUTTINGS

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'Arp' rosemary cuttings were treated with indole butyric acid (IBA) using three different application procedures to determine speed and quality of rooted cuttings produced at three weeks under mist. Five concentrations of IBA, 0%, 0.8%, 1.6%, 3.0%, and 4.5%, and three methods of application were compared. Methods of application were 1) cuttings treated with solutions containing IBA, captan, benomyl, and streptomycin applied as a one minute soak or 2) as a post plant drench or 3) cuttings soaked for one minute in a solution of captan, benomyl and streptomycin and then dipped into IBA + talc mixture. After the treatments were applied, the cuttings were placed on a mist bench for three weeks. Visual shoot ratings were made weekly and visual root ratings were made at three and four weeks after treatments were applied. Root dry weights were determined. Results indicated the one minute soak in a captan, benomyl, and streptomycin solution then dipped in 0.8% IBA + talc consistently resulted in a higher quality rooted cutting.

#### EFFECT OF THREE PLANTING DATES, PLASTIC MULCH AND ROW COVER ON YIELD OF COLLARD GREENS.

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Clear (CM), and black plastic (BM) mulches and bare (BS) soil plus VisPore (V) row cover (VCM, VBM, VBS), CM, BM, and BS in combination with drip irrigation and three planting dates January 3rd, February 16th, and March 16th, 1990, were used to evaluate the yield of 'Georgia' collard greens. At the 1st planting date, both mulches and row cover treatments had significantly higher yield. At the 2nd and 3rd planting dates there were significant interactions between mulch and row cover. The interaction at the 2nd planting date showed that yield was highest with VCM and VBS treatments and at the 3rd planting date CM, BM and VBS increased yield, respectively. The number of days to harvest decreased with each planting date and bolting was not observed for any planting date or treatment combination.

#### EFFECT OF AGE OF TRANSPLANTS, PLASTIC MULCH AND ROW COVER ON OKRA YIELD.

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Clear (CM) and black (BM) plastic mulch and bare soil (BS) plus VisPore (V) row cover (VCM, VBM, VBS), BM, CM and BS in combination with drip irrigation were used to evaluate the growth response of these treatment combinations on 5 and 9 wks old 'Clemson Spineless' okra transplants grown in sandy loam soil. Mulched treatments significantly increased the survival rate of 5 wks old transplants while VCM and VBM treatments increased significantly the number of vegetative branches of 5 wks over 9 wks old transplants. Total and marketable yield, as well as total and marketable number of pods were significantly influenced by mulched treatments rather than by the age of transplants.

#### INFLUENCE OF SEVERAL ROW COVERS ON YIELD OF BROCCOLI AND CABBAGE IN SOUTHEAST MISSOURI

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Four row covers were evaluated on fall production of 'Packman' broccoli and 'Gourmet' cabbage at Cape

Girardeau, Missouri. Row covers used were spunbonded polyester, insolar and clear slitted polyethylene and VisPore. The mean afternoon soil temperature for row covers were higher than the bare soil control. There were no significant differences among treatments with respect to head size, total numbers and yield of marketable broccoli. The number of broccoli heads per thousand between the bare soil control vs. row cover treatments were significantly different. Data for number of broccoli heads per thousand and marketable yield (Kg/Ha) were significant among row covers. Marketable yield (Kg/Ha) was significant among row covers for 'Gourmet' cabbage.

**A RAINFALL CAPTURE SYSTEM FOR DRYLAND CANTALOUPE PRODUCTION**  
David A. Bender\* and Frank J. Dainello, Texas Agricultural Experiment Station, Lubbock, TX 79401

A system for collecting winter rainfall and storing it for crop use during the growing season was developed and tested for three seasons for non-irrigated cantaloupe production. In early fall raised beds on 2-m centers were shaped with two trenches ca. 30 cm wide and 10 cm deep spaced 50 cm apart. Black plastic mulch was applied over the beds, with small mounds of soil placed on the plastic over the trenches to conform the mulch to the shape of the beds. Slits 15 cm long were made in the bottom of the trenches at 1 m intervals. Fifty kg/ha of a polyacrylamide gel was incorporated into the top 10 cm of some beds prior to shaping. Precipitation falling prior to spring planting was channelled into the beds through the trenches and prevented from evaporating by the mulch. Cantaloupes were seeded through the plastic in the spring and grown without irrigation. The rainfall capture system increased soil moisture in the surface 15 cm by 50% and in the top 60 cm by over 20%. Plant stands were increased from <10% in uncovered plots to nearly 70% under the system. Under drought conditions in two of the three seasons, yields were significantly higher in the rainfall capture plots than in uncovered plots, although not commercially acceptable. In a wet season, similar differences were noted and good commercial yields were obtained with the system. The rainfall capture system in conjunction with supplemental irrigation has the potential to allow excellent cucurbit production with limited water.

**EFFECTS OF GROUND COVER, PLANTING METHOD AND IRRIGATION LEVELS ON CANTALOUPE PRODUCTION**

Robert Stubblefield\* and Robert Wiedenfeld, Texas A&M University Agricultural Research & Extension Center, 2415 East Highway 83, Weslaco, Texas 78596

A field study was conducted in south Texas in the spring 1990 to determine the effects of ground cover, planting method and drip irrigation rates on cantaloupe growth, yield and quality. Transplanting vs. direct seeding enhanced early vine growth with earlier yields, although direct seeding later caught up resulting in comparable final cumulative yields. Black polyethylene mulch also improved earliness but at the lower irrigation rate total yields were reduced due to deflection of rainfall by the mulch. Irrigation at .1, .3, .5, .7 and .9 times pan evaporation had little effect on final cumulative yields with exception to the .1 and .3 rates. Melon sugar content was highest for transplants with direct seeded melons becoming comparable only at mid to final harvest. The combined practices of transplanting and black polyethylene mulch resulted in a 14 day earliness advantage over the treatments that were direct seeded on bare soil although final yields were unaffected. No appreciable increase in soil salinity were found as a result of drip irrigation usage.

**THE ROLE OF A THERMOPHILIC FUNGUS IN THE ROOT ROT / VINE DECLINE DISEASE OF MUSKMELON IN TEXAS.**

Ray D. Martyn\*, J. C. Mertely, M. E. Miller, and B. D. Bruton, Texas Agricultural Experiment Station, College Station 77843 and Weslaco 78596, and USDA,ARS, Lane, OK 74555.

A disease of muskmelon (*Cucumis melo* L.) characterized by a vine decline and a cortical root rot was first observed in the Lower Rio Grande Valley of Texas in 1986. In 1990, isolations from diseased plants collected from four commercial production fields yielded the fungus *Monosporascus cannonballus*. Pathogenicity tests with eight isolates confirmed Koch's postulates; however, there were differences in aggressiveness observed among isolates. *M. cannonballus* is an ascomycete fungus that typically produces only one (rarely two), round, jet-black ascospore per ascus. There is no known asexual stage. Temperature optimum of one isolate was 35 C. The optimum pH for growth was 6-7, but it grew well up to pH 9. *M. cannonballus* was first reported on muskmelon in 1970 from Arizona and recently was found in Japan under glass house culture. The presence of this fungus in Texas marks only the third report of this species worldwide, although a similar species (*M. eutypoides*) is the cause of a collapse of melon plants in Israel.

**THE RELATIONSHIP BETWEEN THE FUSARIUM YELLOWS DISEASES OF SUGAR BEET AND SPINACH.**

Ray D. Martyn\*, C. M. Rush, E. A. Dillard, and D. H. Kim, Department of Plant Pathology & Microbiology, Texas A&M University, College Station, TX 77845.

Twenty isolates of *Fusarium oxysporum* recovered from diseased sugar beet and spinach (Chenopodiaceae) or red-root pigweed (Amaranthaceae) were examined using pathogenicity, isozyme, and mtDNA RFLP markers to determine genetic similarity among isolates from different hosts. Pathogenicity tests defined several levels of host specificity. Most isolates were specific to their original host; however, a few primarily were pathogenic to their original host but also caused some wilt on other hosts. Two isolates were pathogenic on all three hosts and six were not pathogenic to any of the hosts. Differences in isozymes and mtDNA RFLPs corresponded with differences in pathogenicity. Three main polymorphic groups based on host specificity were identified along with three sub-groups corresponding to aggressiveness of the isolates. These data suggest that while most isolates display a high degree of host specificity isolates exist within the population that lack such specificity and cross over to other species.

**OPTIMUM SPACING AND HARVEST TIME FOR 'INTERMEDIATE LEAF' HYBRID PICKLING CUCUMBERS FOR ONCE-OVER MECHANICAL HARVEST.**

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An 'intermediate leaf' hybrid pickling cucumber (TAMU 884304 X ARK H-19 'little leaf') was direct-seeded at four plant densities (94,570; 48,440; 32,290; 25,375 plants/ha) using four within-row spacings (15, 30, 45, 60cm) at two locations and two seasons. Optimum yield based on marketable fruit number, grade distribution and fruit quality occurred with 94,570 plants/ha. Optimum harvest time depended on location and season. Delayed harvest times were also evaluated. Harvests with fruit >5.1cm in diameter had severely reduced brining quality. Fruit did not enlarge or enlarged slowly to oversize. This resulted in a mixture of fruit ages within the largest marketable fruit grades. It is recommended that 'little leaf' lines and their hybrids such as 'intermediate leaf' be harvested when fruit 3.8 to 5.1cm in diameter appear and before oversize fruit are produced. Spacing did not significantly effect length/diameter ratio(LDR) but LDR was significantly greater for delayed harvests.

**RESPONSE OF CUCUMBER GERMPLASM TO LOW-MOISTURE STRESS**

E. V. Wann\*, USDA, Agricultural Research Service, Lane, OK 74555, and J. E. Staub, USDA, Agricultural Research Service, Department of Horticulture, University of Wisconsin, Madison, WI 53706

Research was conducted to determine the reliability of several techniques for measuring the response of cucumber to low-moisture stress. Low and high moisture stress levels were imposed in field plots by differential irrigation. Plots under low stress (high soil moisture) had a mean tensiometer reading of 9±1.0 cb during the evaluation period, and plots under high stress had a mean tensiometer reading of 37±2.3 cb. Six genotypes of diverse backgrounds were evaluated for their stress response. The drought-tolerant cultivars 'Alagi', W142121, and W1983LL (Little Leaf) showed least response to the imposed stress. Visual ratings and stress index were correlated with moisture stress levels and they detected differences in stress response among cultivars. Plant water content, stomatal conductance, and transpiration rate were least reliable for measuring moisture stress. Visual ratings appeared to be as reliable as the other more quantitative types of measurements for detecting stress tolerance.

**BEE-SCENT® FOR IMPROVED POLLINATION OF WATERMELON**

G. W. Elmstrom\* and D. N. Maynard, Central Florida Research and Education Center, Leesburg, FL 34748 and Gulf Coast Research and Education Center, Bradenton, FL 34203.

Watermelon, *Citrullus lanatus* (Thunb.) Matsum. & Nakai, requires insects, most commonly honey bees, for pollination and fruit set. The transfer of an adequate amount of pollen is essential to ensure optimum fruit set, size, and shape. To encourage bee visits and the transfer of pollen, two applications of Bee-Scent®, a bee attractant, at 2.47 liter·ha<sup>-1</sup> were made to watermelon on five farms in central and southwest Florida. Honey bee, *Apis mellifera* L., activity was monitored for two days following each application and yield and fruit quality were determined. On

only a few occasions was increased honey bee activity noted. Application of bee attractant increased total yield in one field in central Florida and resulted in an increase in early yield at all three locations in southwest Florida. Soluble solids content of mature fruit was not directly affected by treatment. Treatment increased the seed content of fruit from three of five farms.

#### YIELD OF TRIPLOID WATERMELONS IS INFLUENCED BY POLLENIZERS AND INCIDENCE OF MATURE SEEDS BY PARENTS

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Mature seeds occur occasionally in triploid watermelon fruit. In one trial, the average number varied from 0.3 to 28.7 seeds per fruit in 30 entries and from 0.5 to 8.6 seeds per fruit in the cultivars within this group. The frequency of mature seed in triploid fruit with the same tetraploid parent ranged from 0.3 to 3.0 and from 1.25 to 5.0 seeds per fruit in triploid fruit having the same diploid parent. Tetra A, with 151 seeds per fruit, produced triploids with 6 seeds per fruit; whereas Tetra B, with 74 seeds per fruit produced triploids with only 1.3 seeds per fruit. Date-of-flowering of diploid watermelon cultivars used as pollenizers for triploids affected maturity date of the triploids. Icebox-types that flower early produced higher early yields of triploid fruit; whereas standard cultivars that flower later produced higher yields late in the season.

#### SWEET CORN YIELD AND INSECT DAMAGE AS AFFECTED BY COVER CROPS AND NITROGEN

Warren Roberts\* and Bob Cartwright, Department of Horticulture & Landscape Architecture and Department of Entomology, Wes Watkins Agricultural Research & Extension Center, Oklahoma State University, Box 128, Lane, Oklahoma 74555.

The effects of cover crops and nitrogen on yield and insect damage of sweet corn were examined. In 1989, sweet corn was grown in bare soil plots, plots covered with rye (*Secale cereale*), and plots covered with hairy vetch (*Vicia villosa*). In 1990 a black plastic mulch treatment was substituted for the hairy vetch treatment. Each soil cover was fertilized with 45, 90, 134, or 179 kg/ha nitrogen (N) in 1989, and 34, 101, 168, 235, or 302 kg/ha N in 1990. Covers were planted in the fall, followed by sweet corn the following spring. There was no mowing or tilling of the cover crops.

Corn yields were lower each year in the rye covered plots. There were more corn earworms on the rye covered plots. Corn pollination was poorer on the rye covered plots, but responded positively to increasing rates of N.

#### INFLUENCE OF CULTIVARS, FLOODING, AND TIME OF FLOODING ON SWEET POTATO YIELD

Warren Roberts\* and Vincent Russo, Department of Horticulture & L. A., Wes Watkins Agricultural Research & Extension Center, Oklahoma State University, and South Central Agricultural Research Laboratory, USDA-ARS, Lane, Oklahoma 74555.

Sweet potatoes are an important crop in the southern U.S. The southern U.S. is subject to heavy rainfall at any time during the production season, and soils could be flooded for days. Previous work has shown that sweet potatoes flooded just prior to harvest exhibited increased decay during curing and storage. This study was designed to determine the effects of flooding at both mid-season and late-season on sweet potato yield. Four cultivars were grown in both 1989 and 1990. Each cultivar received a control treatment (no flooding), flooding halfway through the production season, and flooding just prior to harvest. Flooding was continuous for approximately 6 days. Yield was not significantly affected by late season flooding, but mid-season flooding reduced yields of all varieties. Yield reduction due to flooding at mid-season was in excess of 35% in 1989 and in excess of 50% in 1990.

#### INTERCROPPING OF SOUTHERNPEAS AND CORN

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Intercropping increases land use efficiency and provide prolonged yields between compatible crops. A study was conducted to evaluate the yield advantage of intercropping southernpeas (*Vigna unguiculata*) with corn (*Zea mays*) in addition to determining the yield advantage of corn, 'Yellow Trucker', and two southernpeas cultivars; 'Mississippi Silver' and 'Pinkey Purplehull', in an intercrop. Cropping method significantly affected the yield of corn but not southernpeas. Cropping method also influenced leaf area, dry matter and plant height of both southernpeas cultivars. Corn had higher yields in alternate-single row (45x30 cm) with southernpeas

intercrop than within (90x15 cm) or alternate row (90x15). Competition for light and nutrients may have accounted for the reduction in dry matter and leaf area of southernpeas in intercrop. The average yield advantage, as measured by the land equivalent ratio, ranged between 1.39 and 1.70. When area time equivalent ratio was used to measure the yield advantage, the range was 1.2 to 1.45. 'Pinkey Purplehull' is more compatible with corn in intercropping than 'Mississippi Silver'.

#### NUTRIENT UPTAKE OF SWEETPOTATO CULTIVARS

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The uptake of nutrients by sweetpotato (*Ipomoea batatas*) is critical in determining crop yield. Research was conducted to assess the effects of gypsum application on the nutrient uptake in three sweetpotato cultivars; 'Carver II', 'Georgia Jet' and 'Jewel'. Gypsum application did not influence leaf P content of sweetpotato. However application of 3 tons per acre of gypsum increased leaf N and K content in 'Carver II' and 'Jewel' at 60 and 90 days after planting. There was a similar increase observed in Ca and Mg content of the leaf. While rate of gypsum did not influence nutrient uptake, date of sampling significantly influenced leaf nutrient concentration. It was noted that leaf K for 'Jewel' and Ca for 'Carver II' were greatest at 60 days after planting. Overall, Mg content was decreased following the application of gypsum in both 'Carver II' and 'Georgia Jet' cultivars.

#### SWEET POTATO TRANSPLANT PRODUCTION AS INFLUENCED BY BED COVERS

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Black polyethylene, perforated clear polyethylene, double-slitted clear polyethylene, spunbonded polyester, and a bare soil control were evaluated for their effect on the number, size, and distribution of production of sweet potato transplants. The perforated and double-slitted bed covers increased the weight and number of sweet potato transplants compared with the control or with black polyethylene at the first harvest in 1986 and 1987. Seed roots covered with the spunbonded polyester bed cover produced more plants of greater weight than seed roots covered with bare soil at the first harvest in 1986 only. Black polyethylene treatments produced the greatest weight and number of transplants at the second harvest (8 to 12 days later) in both years. There were no significant differences in total weight and number of transplants among black polyethylene, perforated or double-slitted clear polyethylene treatments in 1986. Total transplant number and weight from plots covered with spunbonded polyester were lower than those from plots with any other bed covers.

#### WATER RELATIONS IN SWEETPOTATO

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An experiment was conducted to determine the rate and frequency of irrigation needed for optimum yield in sweetpotato (*Ipomoea batatas* (L.) Lam). A line source irrigation system was used to provide continuously increasing amounts of water at each irrigation. The physiological responses of sweetpotato to water application were measured. There was an increase in leaf water potential with increasing rates of irrigation. Leaf diffusive resistance decreased as total water rate increased to 76% of pan evaporation ( $E_{pan}$ ) and then increased with higher rates of irrigation. Marketable yields increased as total water rate increased to 76% of  $E_{pan}$  and then decreased rapidly with higher irrigation rates. Water relations measurements indicated that reduction in yield with higher amounts of water application was due to low soil oxygen content.

#### SWEET POTATO GROWTH IN RESPONSE TO RELATIVE HUMIDITY

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An experiment was conducted in environmental growth chambers to study the response of sweet potato to relative humidity (RH). Twenty-four vine cuttings of 'TI-155' sweet potato were planted in growth channels in a modified half Hoagland's solution using the nutrient film technique. Plants were exposed to constant RH levels of 50% or 85%. Temperature regimes of 22/22 C were maintained during the light/dark periods with an

irradiance level of 600  $\mu\text{mol m}^{-2}\text{s}^{-1}$ , and a 14 hr/10 hr photoperiod. Plants were harvested 120 days after planting and yield data was taken. High RH (85%) resulted in significant increases in number of storage roots/plant, storage root fresh and dry weight, single leaf photosynthesis and stomatal conductance than at 50% RH. Foliage dry weight and leaf temperature was higher at 50% than 85% RH.

**GENETIC VARIABILITY OF LEAF AND POLLEN PHOSPHOGLUCOSE ISOMERASE IN *IPOMOEA BATATAS* AND *I. TRIFIDA***  
Zhiqiang Zhu\* and Paul G. Thompson, Department of Horticulture, Mississippi State University, Mississippi State, MS 39762

The polymorphisms of phosphoglucose isomerase (PGI) in sweetpotato and *I. trifida* were examined. Horizontal starch gel electrophoresis was used to analyze leaf and pollen tissue of parents and progenies of 10 crosses. Analyses revealed that PGI was a dimeric enzyme system controlled by 5 loci. The segregation ratios did not suggest that PGI was a duplicate system and therefore did not indicate hexaploidy. Only 2 loci appeared to be present in *I. trifida*. No observed band was related to different ploidy levels in *I. batatas* and *I. trifida*. No linkage was identified among the loci.

**USE OF *IN VITRO* TECHNIQUES TO OVERCOME INCOMPATIBILITY IN SWEETPOTATO**  
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To develop *in vitro* techniques to overcome incompatibility in sweetpotato the cross and self incompatible cultivars Regal and MD-708 were cross pollinated and also crossed with the compatible 'Vardaman'. Observation of pollen behavior in different crosses after 3, 7, and 24 hours, showed good germination and tube development in compatible crosses, but no germination in incompatibles. In a preliminary experiment using embryo rescue techniques plants were produced only from compatible crosses at 25 and 30 days after pollination. In subsequent experiments, immature embryos were rescued when cultured 15 days after pollination. The highest percentage of rescued embryos resulted from Murashige-Skoog medium. Intraovarian, stigmatic and placental *in vitro* fertilization were investigated to overcome incompatibility. Embryos were not formed from any of those methods, but callus was produced with placental pollination.

**EVALUATING SWEETPOTATOES FOR RESISTANCE TO THREE PATHOGENS SIMULTANEOUSLY**  
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A factorial test was conducted to evaluate the potential of screening sweetpotato plants to three pathogens simultaneously. The pathogens were *Meloidogyne incognita*, *Fusarium oxysporum*, and *Streptomyces ipomoea*. The test also involved six sweetpotato cultivars and three evaluation times. Evaluation times were 3, 6, and 9 weeks post inoculation. The symptoms evaluated were vascular necrosis, fibrous root necrosis, and gall and egg mass production. For each of the three pathogens, the ability to separate cultivars with intermediate levels of resistance from those with low levels of resistance decreased as post inoculation time increased. Simultaneous screening was practical if the goal was to select plants with resistance to all three pathogens. Resistances to individual pathogens could not be identified in plants inoculated with all three pathogens.

**PHYSIOLOGICAL CHANGES ASSOCIATED WITH HARDCORE DEVELOPMENT IN SWEETPOTATOES**  
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Storage roots of 'Jewel', 'Centennial' and 'Beauregard' were chilled at 5C for 0, 10, 20, 30 or 40 days. After chilling, the roots were placed at 21C for two days to allow hardcore development. Hardcore was measured as weight of root that remain hard after

boiling for 45 minutes. Hardcore and fatty acid composition of total lipids were compared for the three cultivars. Hardcore was present at 10 days in both 'Jewel' and 'Centennial' and at 20 days for 'Beauregard'. Severity of hardcore increased with time of chilling. Linoleic acid content of 'Beauregard' was higher for the 0, 10, and 20 day sampling periods, and decreased to a level equal to that found in 'Jewel' and 'Centennial'.

**RESPONSE OF TWO SWEETPOTATO GENOTYPES (*IPOMOEA BATATAS* L. LAM.) TO CHILLING TEMPERATURE**  
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Ten day old potted rooted cutting of sweetpotato genotypes 'Travis' and MS 21-1 were exposed for seven days to cold (12°C) or 21°C (control) temperatures. Chemical changes that may accompany tolerance or susceptibility to chilling were monitored. No consistent differences in total fatty acid composition were found between the two genotypes. There was an increase in peroxidase (POD) activity of the crude enzyme extract for MS 21-1, the chilling tolerant genotype, when exposed to 12°C for seven days. No differences were found in POD activity for 'Travis', the chilling sensitive genotype. Superoxide dismutase (SOD) and catalase (CA) activity for crude enzyme extracts did not differ between genotypes and was not influenced by storage temperature.

**THE EFFECTS OF WATER STRESS ON PLANT WATER STATUS AND GROWTH OF SELECTED SWEETPOTATO GENOTYPES**  
Thammasak Thongket\* and James O. Garner, Jr., Department of Horticulture, Mississippi State University, Mississippi State, MS 39762

Responses of four sweetpotato genotypes ('Centennial', 'Travis', 'Vardaman' and 'MS 21-2') to water stress were studied. Two irrigation regimes (irrigation vs non-irrigation) were imposed on five-week old cuttings grown in a greenhouse environment. Transpiration and leaf diffusive resistance (LDR) were measured with a steady state porometer and mid-day total leaf water potentials were determined with a thermocouple psychrometer. Leaf growth was inhibited earlier than root growth. Water stress caused a reduction of leaf size in Centennial and in leaf number in the other three. Storage root number of Vardaman was not inhibited by limited soil moisture but development of storage roots was retarded by water stress. Total growth under non-irrigation of MS 21-2 was inhibited more than Vardaman. Mid-day leaf water potential did not show promise as a good indicator of water status. Genotypic differences in the water stress sensitivity as measured by LDR, were observed.

**YIELD COMPARISONS OF SWEETPOTATO VINE CUTTINGS AND TRANSPLANTS PULLED OR CUT FROM THE PLANT BED**  
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Plots grown from 'Georgia Jet', 'Red Jewel', and 'Jewel' sweetpotato [*Ipomoea batatas* (L.) Lam.] plants cut from the propagating bed (cut-plants) yielded more than plots grown from plants pulled from the bed (plants). Presence or absence of the shoot apex had little influence on yields of 'Georgia Jet' and 'Red Jewel' when evaluated in combination with plants or cut-plants or when evaluated in combination with vine cuttings transplanted in an upright or an inverted position. Chlorine dips did not influence yield of 'Jewel' plants or cut-plants. Plots grown from 'Red Jewel' vine cuttings transplanted in an inverted position generally yielded slightly less than plots grown from vine cuttings transplanted in an upright position, but these differences were not significant.

**EFFECTS OF NITROGEN SOURCE, RATE, AND APPLICATION FREQUENCY ON YIELD AND QUALITY OF ONION**  
K.M. Batai, Dept. of Horticulture, University of Georgia Coastal Plain Experiment Station, P. O. Box 748, Tifton, GA 31793

Commercial N fertilizer formulations, ammonium nitrate, calcium nitrate, sodium nitrate, potassium nitrates (15-0-14 and 13-0-44) applied at 84 and 168 kg N/ha in 3 or 5 split

applications did not affect total marketable yield of dry onion. Application frequencies causing an increase in total amount of N applied during the spring months (Feb.-Apr.) increased marketable yield by 5 MT/ha. Bulb decay was the highest when ammonium nitrate was applied, whereas the least number of decayed bulbs resulted from sodium nitrate applications. Plants grown with potassium nitrate (13-0-44) were most susceptible to cold injury. Ammonium nitrate and sodium nitrate applications produced the highest percentage of onions that bolted. The lowest percentage of plants showing bolting incidence resulted from calcium nitrate applications. Bolting of onions was closely associated with rapid growth and increased onion size. However, cold injury and bulb decay were not influenced by these growth factors.

#### GUAR BEAN PRODUCTION IN GEORGIA

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Guar or cluster bean (*Cyamopsis tetragonoloba* (L.) Taubert), a leguminous plant, is grown in many parts of the world for consumption as green beans. However, information on green bean yield and their nutritional quality is lacking. Our objectives were to determine yield potential, optimum harvesting time, and nutritional quality of green guar beans. We planted 10 guar varieties in a RCBD with 4 replications on 1 June 1990 at Fort Valley, Georgia. The guar bean production was recorded at 55, 70, 85, and 100 days after planting (DAP). Significant variation for bean yield existed among genotypes. The bean yield ( $\text{kg ha}^{-1}$ ) varied from 9549 (Kinman) to 1629 (HG-75), at 85 DAP. The highest yield at 100 DAP was recorded for Lewis. The ideal harvesting time, based on degree of yellowness and bean texture, for Durga Jay, Esser, Hall, SPS-119, and Lewis seemed to be 100-115 DAP whereas the beans of Brooks, HG-75, HSB-130, Kinman, and Santa Cruz became tougher and yellow by 100 DAP. A comparison with published results of snap beans and edible-pod peas indicated that green guar beans contained greater amounts of protein, total carbohydrates, vitamin C, calcium, iron, manganese, phosphorus, potassium, and sodium. These results indicate that green guar beans can be a potential alternate source of income for farmers in Georgia and other states.

#### THE EFFECTS OF UNDERGROUND DRIP FERTIGATION ON SWEET CORN PRODUCTION

James E. Brown\*, Daniel W. Porch, Ronald L. Shumack, Charles H. Gilliam, Department of Horticulture, AAES, and Larry Curtis, Department of Agricultural Engineering, AAES, Auburn University, AL 36849

In sweet corn field plots in Alabama, urea-ammonia nitrogen was applied to the soil through underground and aboveground drip fertigation systems. Dry nitrogen in the form of ammonium nitrate was surface band-applied as a control. Nitrogen rates of 67 kg/ha and 135 kg/ha were applied in either 2 or 4 applications by each of the 3 methods. P and K fertilizers were applied to all treatments in a dry form according to soil test recommendations. The underground drip pipe was placed 23 cm beneath the soil surface in each row. Nitrogen (wet or dry) rate of 135 kg/ha produced greater sweet corn yield than the 67 kg/ha rate with no effect of application number on yield in 1988, when rainfall was less than adequate. In 1987 and 1989, when rainfall was adequate, no differences occurred in yields regardless of number, rate, or method of application of nitrogen.

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## Extension

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#### EXTENSION/INDUSTRY PARTNERSHIP RESULTS IN EMPLOYEE TRAINING VIDEOS FOR LANDSCAPERS

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In June, 1988, an Extension advisory committee of landscape professionals met in Atlanta to discuss educational needs of the industry. Representatives from commercial, municipal, institutional, recreational and private landscape operations present unanimously identified the need for employee training materials as a top priority. A sub-committee composed

of Extension agents, Extension Specialists and landscapers then spent months examining training aids from other states and concluded most were not pertinent to the southeastern U.S. As a result, a series of locally produced employee training videos were proposed. With funding from various landscape firms and the landscape division of the Georgia Green Industry Association, an Atlanta based videographer was hired. Scripts are written and edited by a team of Extension Agents, Extension Specialists and landscape professionals. Extension agents then direct the filming and help edit and produce the final product. To date, two videos have been released and four more are in production. Each video is packaged with an instructor's manual, multiple choice exam and evaluation form. A great deal of support and enthusiasm from both the landscape industry and Extension administration has resulted from this team approach to Extension programming.

#### XERISCAPE: A NATIONAL PERSPECTIVE

Douglas F. Welsh, Texas Agricultural Extension Service, 225 Hort./Forestry Bldg., College Station, TX 77843

Xeriscape, water conservation through creative landscaping, offers a viable alternative to traditional landscapes which require high inputs of water and labor. Xeriscape is not cactus and rock gardening; but, quality landscaping combining beautiful, function, and water efficiency.

Xeriscape is based on horticulturally sound principles, including: good design, thorough soil preparation, practical turf areas, appropriate plant selection, efficient watering techniques, mulching and proper maintenance.

Green plant and water industries across the nation have recognized Xeriscape as a proactive, education tool to curb excess water-use by the public and private sectors. In an era where water may become the limiting factor in economic growth for many regions of the nation, Xeriscape may truly be the state-of-the-art.

#### EXTENSION'S ROLE: A NEW AGRICULTURAL WEATHER PROGRAM

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An agricultural weather program has been developed in Alabama and is available on the ACENET computer network of the Alabama Cooperative Extension Service (ACES). This program involves the coordinated efforts of the National Weather Service (NWS), ACES and grower organizations. The program began in March 1987 and has been upgraded several times. Hardware now being used includes a Sun Microsystems SPARC station by NWS and a Sun Microsystems Server Model 4/280 by ACES. Existing and experimental NWS forecast products are disseminated to each of Alabama's 67 county agents offices (CEAs) and to local producers using ACES' computer network. A comprehensive selection of climate and weather related information is available to ACES staff including a widely used freeze alert program. Very detailed freeze forecasts and related information is available to users hourly, 7 days a week. A specialist prepared commentary further enhances use of information during each freeze event. Considerable cost savings have been realized by producers. A pilot program is being initiated in 1991 to incorporate data from several real time weather stations into the system.

#### ALTERNATIVE MARKETING AND CULTURE SYSTEMS FOR TEXAS HIGH PLAINS ONIONS

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Extension-research teamwork supports Texas High Plains onion grower-shippers in transition from unprofitable labor intensive marketing and culture to profitable mechanical systems that are less stressful to workers. System comparisons include machine harvest vs. lifting and hand clipping; stationary seed grading and bagging vs. mobile field grading and bagging; transplant vs. fall seeding, spring seeding and dry set production. Old marketing systems cost growers \$4.30/50-lb. sack, and the innovative system costs \$2.59 to \$3.00/sack. Old transplant systems average \$450 to \$500/acre and direct seeding costs \$200/acre. Net increase in return to grower management from adoption of new systems range from \$1,300 to \$1,700. Extension and research conduct economic analysis, cultivar performance trials, seeding technique studies and on-farm demonstrations.



## Postharvest

POSTHARVEST PERFORMANCE OF WHITE AND GREEN ASPARAGUS SPEARS  
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Black and white plastic row covers were established over 4 yr old field-grown 'Jersey Giant' asparagus in March 1990 to produce white asparagus spears. Control or green spears were grown without row covers. Spears harvested between Apr 27 and May 18 were used in subsequent experiments. Spears grown under white, black or no row cover were trimmed to 15 cm, weighed, then stored in perforated polybags at 0 or 7°C and removed from storage weekly to determine water loss and color change. Weight loss was greater in spears held at 7 than 0°C but row cover treatment had no effect on water loss. Hue (color) and CDM 'a' values (greenness) decreased in green spears stored at the higher temperature. After 21 days in storage, decay was 0 and 21% in spears held at 0 and 7°C, respectively. Decay in white and green spears were 6% and 20%, respectively. White spears, harvested May 2 and May 9 and held at 21°C for 5 days, had significantly lower rates of CO<sub>2</sub> respiration than did green spears. White spears grown under either row cover treatment had similar postharvest attributes.

### A METHOD TO MEASURE SULFUR-CONTAINING VOLATILES IN ONIONS USING A GAS CHROMATOGRAPH.

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A 50 g sample taken as a horizontal section from the mid-height of an onion bulb was blended with 100 g water for 1 min in a closed plastic mason jar. A 0.5 ml of a headspace sample was drawn and injected into a Perkin Elmer 8500 GC equipped with FPD for detection of sulfur compounds. The major volatiles tentatively identified in onion were thiopropanal S-oxide, methyl propyl disulfide, dipropyl disulfide, and propyl allyl disulfide.

We observed significant variation of peak pattern and height depending on position in a bulb, among bulbs within variety, and between varieties. These results seemed to comply well with taste test. There were no significant correlations between total peak height and bulb weight, soluble solids, or pyruvate concentration in juice extract. Our investigation suggested that this procedure provided better understanding and measurement of onion pungency than pyruvate analysis.

### STORAGE TEMPERATURE AND DURATION INFLUENCE DETERIORATION OF FILM-BAGGED AND NONBAGGED MUSTARD

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Brassica juncea var crispifolia was stored in perforated polyethylene bags, polyolefin heat-shrinkable films, and nonbagged at 1, 4, or 15C during three experiments in the spring of 1989 and 1990. Bagging mustard in perforated polyethylene bags or polyolefin films of Cryovac D-955 60-gauge or Cryovac D-955 100-gauge significantly reduced weight loss over nonbagged mustard. Bag type had a highly significant effect on CO<sub>2</sub> concentrations in the atmosphere within bags of mustard, with highest CO<sub>2</sub> concentrations occurring in the bags made of Cryovac film. Mustard stored in all bags retained marketable quality significantly better than nonbagged mustard. Bagged mustard was stored for 12 days at 1 or 4C with excellent quality, whereas nonbagged mustard was unacceptable after only 5 days in storage. Color, turgor, and appearance of all mustard were poor after 5 days in storage at 15C. Sensory evaluations indicated bagging and storing mustard for 12 days at 1 or 4C did not affect the flavor and quality of cooked mustard.

### INTERMITTENT WARMING OF RETAIL-PACKAGED FRUIT DOES NOT AFFECT STRAWBERRY FRUIT QUALITY DURING STORAGE.

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The effects of retail-display packaging on strawberry fruit quality were studied using freshly harvested 'Cardinal' strawberries. Fruit free from blemishes and disease were placed into plastic vented

boxes, covered with vented plastic lids or plastic wrap, and placed at 1 and 5C overnight. One-half of the treatments were removed from coolers, held at 25C for eight hours, returned to the coolers and evaluated over a 15-day storage period. The plastic overwrap greatly decreased weight loss during 15 days of storage; carbon dioxide reached 0.8 and 2% per mg fresh weight at 1 and 5C, respectively. Type of cover did not affect overall appearance or disease ratings. Exposure of fruit to 25C for eight hours led to no loss of overall quality. Storage of fruit at 50C led to greater disease incidence and loss of quality. The respiration rate of fruit warmed at 25C reached equilibrium after six hours, regardless of initial storage temperature. Fruit in vented dome-lid boxes had more weight loss than plastic-wrapped boxes at both temperatures.

## Sweetpotato Collaborators & Cowpea Meeting

EVOLUTIONARY BIOLOGY OF THE SWEET POTATO AND ITS RELATIVES: OPPORTUNITIES FOR MOLECULAR GENETIC STUDIES  
G. S. Varadarajan\* and C. S. Prakash, School of Agriculture, Tuskegee University, Tuskegee, AL 36088.

The sweet potato (*Ipomoea batatas*) and its relatives (the batatas complex) appear to have evolved in the New World and radiated over several geographic centers in the tropics and subtropics. Traditional studies on taxonomy, cytogenetics, and reproductive biology of the batatas complex have enabled us to investigate certain evolutionary aspects. We conclude that this complex is a monophyletic, "polyploid pillar", evolved by chromosome doubling (euploidy) and interspecific hybridization. We apply molecular genetic techniques to detect variation [restriction fragment length polymorphism (RFLP) and DNA fingerprinting analyses] to reexamine some of the evolutionary issues that could not be satisfactorily addressed by the conventional approaches, e.g., phylogenetic history of the batatas group, the diploid ancestors of the polyploid members, homology/diversity of genome(s) within the entire group. We find DNA variation in the hypervariable or multiple copy regions of the genome in *Ipomoea* species. In addition, we are investigating polymorphism in unique/low copy regions using a battery of DNA sequences from homologous as well as heterologous sources. The success of this study will hopefully shed a new light on the subject of evolutionary biology and may also have potential applications in the sweet potato breeding.

FOREIGN GENE TRANSFER TO SWEET POTATO (*IPOMOEA BATATAS*)  
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Development of a gene transfer system will enable rapid introduction of agronomically useful genes into elite cultivars of sweet potato. We compared microprojectile bombardment and *Agrobacterium* cocultivation approaches to introduce foreign genes into the genome of two sweet potato cultivars. Chimeric marker genes (*gusA* and *kan*) were successfully introduced into cvs. Jewel and TIS-70357 using both approaches. However, transgenic plants were generated *in vitro* using only the *Agrobacterium* approach. Callus and root isolates with stable expression of *gusA* gene were obtained using the microprojectile method. Expression of the screenable marker *gusA* gene was detected by histochemical assays. Integration of the introduced gene into the genome of sweet potato was confirmed by polymerase chain reaction (PCR) amplification of the *kan* gene and Southern blot analyses. Transgenic sweet potato plants from two cultivars are being raised and studied for quantitative expression and localization of the introduced genes. These results show that foreign genes can be successfully introduced and expressed in sweet potato. Current efforts are directed at optimizing several variables to increase the transformation efficiencies and to generate transgenic cultivars with foreign genes of agricultural importance.

### INCORPORATION OF GLANDULAR TRICHOMES INTO AN ADVANCED SOLANUM PHUREJA-STENOTOMUM HYBRID POPULATION

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A hybrid diploid potato population (*Solanum phureja* x *Solanum stenotomum*) with superior horticultural traits has been developed for breeding purposes. Because this highly advanced population has no resistance to potato virus Y (PVY), and because PVY pressure is very high in North Carolina, glandular trichomes from another diploid species, *Solanum berthaultii*, were introduced as a defense against aphids, the PVY vector. Two types of glandular trichomes, A and B, were transferred. Preliminary results show that genetic diversity and broad-sense heritability are adequate to transfer these traits; however, non-additive gene action was indicated in narrow-sense heritability estimates. Spearman's coefficients of rank correlation showed a low level of association between A and B trichomes; density of both types is postulated to be under the control of a small number of genes.

MANAGEMENT OF SOIL INSECTS AND THEIR DAMAGE TO SWEETPOTATO THROUGH THE USE OF INSECT RESISTANT CULTIVARS, INSECTICIDE AND BIOLOGICAL CONTROL.

J. M. Schalk,\* A. Jones, P. D. Dukes, and D. R. Seal, U.S. Vegetable Laboratory, 2875 Savannah Highway, Charleston, SC 29414-5334

The test involved the use of a control (untreated), an entomopathogenic nematode (*Steinernema carpocapsae*), a granular insecticide (Dyfonate 2.24 Kg ai/ha) in combination with 7 sweetpotato cultivars having varying levels of resistance and susceptibility to soil insect damage. The parasite was applied three times at monthly intervals (67/cm<sup>2</sup>). The parasite or insecticide did not reduce root injury by soil insects as compared to the control (untreated). Wireworms, *Diabrotica* sp. and *Systema* sp. damage in the resistant cultivars Regal, Southern Delite, Excel and Resisto was less than for the susceptible cultivars (SC-1149-19, Jewel and Centennial). Sweetpotato flea beetle resistance was observed for all cultivars except SC-1149-19 which was susceptible. In this test resistant cultivars were more effective in reducing soil insect damage than the biological or chemical control methods.

WEED CONTROL IN SWEET POTATOES WITH OXYFLUORFEN

Wayne C. Porter\*, Hammond Research Station, Louisiana Agricultural Experiment Station, LSU Agricultural Center, 5925 Old Covington Highway, Hammond, LA 70403

Oxyfluorfen was evaluated for weed control in sweet potatoes. In 1989, applications were made overtop transplants immediately after transplanting. The 1990 applications were made just prior to transplanting. Oxyfluorfen applied post-transplant at 0.38 lb ai/A and greater rates caused a significant reduction in crop vigor. A 1.0 lb ai/A rate of oxyfluorfen reduced crop vigor when applied pretransplant. All rates of oxyfluorfen controlled *Brachilaria platyphylla*, *Digitaria sanguinalis*, *Cyperus iria*, and *Sesbania exaltata*. Oxyfluorfen rates of 0.5 lb ai/A and greater were needed to consistently control *Sida spinosa* and *Echinochloa crus-galli*. *Mollugo verticillata* was controlled at all rates in 1989 but not controlled at all in 1990. Yields of all grades of sweet potato roots from plots treated with oxyfluorfen were not different from yields from plots treated with currently labeled herbicides. However, in 1989 yields from all oxyfluorfen-treated plots were lower than yields from the hoed check. In 1990, plots treated with oxyfluorfen at 0.25 or 0.38 lb ai/A had lower yields of No. 1 grade roots than the hoed check.

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GENETIC VARIANCE FOR RESISTANCE TO SWEETPOTATO WEEVIL

Paul G. Thompson\*, John Schneider, and Boyett Graves, Mississippi State University, Mississippi State, MS 39762

A breeding population including parents with known moderate levels of weevil resistance was evaluated for resistance in a field experiment with few naturally occurring weevils. Weevils were collected from several Mississippi locations and intermated for increase. One male and one female were applied to the crown of each plant 73 days after transplanting. Seventeen parents and their progenies plus 6 additional clones or families were grown in 5 plant plots replicated 8 times. Genetic variability for resistance to weevil injury was observed. Mean percentage injured roots ranged from 25 to 85 and there were differences in resistance to injury among genotypes. Additive genetic

variance was moderate so increased resistance levels should result from selection and intermating for high resistance.

INDUCED RESISTANCE RESPONSE OF SWEETPOTATO TO FUSARIUM ROOT ROT BY UV-HORMESIS

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Jewel sweetpotato storage roots previously treated with ultraviolet (UV-C) light and then stored for 30 days before artificial inoculation with *Fusarium solani* showed increased resistance to *Fusarium* root rot; as indicated by reduced lesion size, the rate of decay development of rotted tissues. There was a hormetic relationship between the incidence of *Fusarium* root rot and UV-C doses. The optimum dose of UV which reduced *Fusarium* root rot was 3.6x 10<sup>4</sup> ergs/mm<sup>2</sup>. Exposure of sweetpotato to UV-C doses promoted phenylalanine ammonia-lyase (PAL) production with the maximum PAL activity occurring at 3.6x10<sup>4</sup> ergs/mm<sup>2</sup>. Crude extracts from UV-C treated sweetpotatoes reduced germination, germ tube elongation and growth of *F. solani* when compared to untreated extracts.

MAYPOP (*PASSIFLORA INCARNATA* L.) AND PASSION FRUIT (*PASSIFLORA EDULIS*) COMPARED

Harvey E. Arjona, Frank B. Matta and James O. Garner, Jr., Department of Horticulture, P. O. Drawer T, Mississippi State University, Mississippi State, MS 39762

Fruit growth and composition of commercial passion fruit types and maypop were compared. Fruit growth (diameter) of purple passion fruit (*Passiflora edulis* Sims.) and maypop (*P. incarnata* L.) followed a sigmoidal growth curve. Passion fruit were larger than both greenhouse-grown and wild maypop fruit. Wild maypop produced larger fruit compared to greenhouse grown maypop. Yellow passion fruit had the lowest percentage pulp and the highest soluble solids. Greenhouse-grown maypop had the lowest soluble solids. Purple and yellow passion fruit had lower juice pH than maypop. Wild maypop fruit had the highest sucrose and purple passion fruit had the lowest. Yellow and purple passion fruit juice had higher fructose and glucose than did maypop juice.

COWPEA VIRUSES, INDIGENOUS AND EXOTIC, AND UNIQUE MECHANISMS BY WHICH THEY ARE DISSEMINATED AND INADVERTENTLY INTRODUCED

Richard Hampton, USDA ARS, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331  
Vectors with specific vector-virus relationships (e.g., aphid, beetle, thrip, nematode) commonly cause short-range dissemination of cowpea viruses. However, viruses that are seed-borne in cowpea can be disseminated around the world in a single year through seed shipments. Likewise, increased world emphasis on germplasm collection and exchange, for development of improved crop cultivars, increases the risk of disseminating seed-borne viruses in germplasm. Seed-borne cowpea viruses that are not reported in the U.S.A., but are apt to occur in *Vigna unguiculata* from world centers of cowpea origin include COWPEA APHTD-BORNE MOSAIC, COWPEA MILD MOTTLE, COWPEA MOSAIC, and COWPEA MOTTLE VIRUSES. All of these viruses were detected by ELISA serology in *V. unguiculata* seedlots processed as potential germplasm introductions, in collaboration with the government of Denmark. Germplasm-borne viruses, once introduced into breeding programs, may be seed-transmitted directly into breeding progenies, along with genes derived from the germplasm source. Such viruses also may be spread by insect vectors to other breeding lines, and could cause disease outbreaks to nearby commercial cowpea crops.

VIRUSES SEED-BORNE IN COWPEA: SIGNIFICANCE FOR COWPEA BREEDING PROGRAMS AND PRODUCTION

Muhammad Bashir and Richard Hampton\*, Department of Botany and Plant Pathology, Oregon State University, Corvallis, OR 97331

By ELISA serology, we have detected and identified the following seed-borne viruses in *Vigna unguiculata* seedlots, processed cooperatively with the government of Denmark as potential germplasm introductions: BLACKKEY COWPEA MOSAIC, COWPEA APHTD-BORNE MOSAIC, COWPEA MILD MOTTLE, COWPEA MOSAIC, COWPEA MOTTLE, COWPEA SEVERE MOSAIC, CUCUMBER MOSAIC, and SOUTHERN BEAN MOSAIC VIRUSES. Twenty-three of 155 seedlots

from 10 old-world countries were found to contain one or more of these viruses. TOBACCO RINGSPOT and URD BEAN LEAF CRINKLE VIRUSES are known to be seed-borne in cowpea, but were not included in assays. At least six other cowpea-crop-damaging viruses, as yet inadequately characterized, are also reportedly seed-borne in cowpea in India and countries of west Africa. We are currently characterizing viruses in *Vigna* pre-introductions and selected germplasm accessions, with emphasis on seed-borne potyviruses. Comparisons among BICMV and CAMV isolates, for which cowpea sources of genetic resistance have been identified, revealed a wide range of isolate pathogenicity for both viruses.

## Posters

### RELATIONSHIP BETWEEN SWEETPOTATO FIBROUS ROOT GROWTH AND NUTRIENT UPTAKE IN FRITTED CLAY MEDIA.

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A greenhouse study was conducted to investigate the ability of sweetpotato (*Ipomoea batatas*), cv. 'Centennial', 'Rojo Blanco', 'Georgia Jet' and 'TI-82-155', fibrous roots to accumulate N, P, K, Ca and Mg. Sweetpotato plants were grown in a fritted clay medium and harvested 42 and 82 days after planting. Fibrous roots comprised 22 to 28.1% and 3.9 to 11.1% of the plant dry weight at 42 and 82 days after planting, respectively. There was no difference in the average root length/cm depth of soil among the four sweetpotato cultivars at day 42. While there was no difference in average root length among 'Centennial', 'Rojo Blanco' and 'TI-82-155', these cultivars were significantly different from 'Georgia Jet' at day 82. For the four cultivars, there were no significant differences in N, P, K, Mg and Ca uptake at day 42, but each cultivar absorbed significantly more of each element 82 days after planting. 'Georgia Jet' absorbed significantly more of the nutrients measured than the other cultivars, resulting in the highest dry matter yield. The data show that the efficient uptake and utilization of nutrients by sweetpotato are related to the amount of fibrous roots present.

### EFFECT OF FOUR ROW COVER SYSTEMS ON PRODUCTION OF SOLANUM TUBEROSUM IN SOUTHEAST MISSOURI

Mack A. Wilson\* and Michael T. Aide, Department of Agriculture, Southeast Missouri State University, Cape Girardeau, MO 63701 and Victor A. Khan, George Washington Carver Agriculture Experiment Station, Tuskegee University, Tuskegee, AL 36083

'Norchip' and 'Atlantic' potatoes grown at Blodgett and Dielstadt, Missouri on 2 sandy, well drained entisols were evaluated using four row covers. The row covers were spunbonded polyester, insolar slitted, clear slitted polyethylene and VisPore. Row covers increased the mean afternoon soil temperature from 62° to 108°. The mean plant heights were significantly different among treatments for the cultivar 'Norchip' but were not different for 'Atlantic'. Data for average and total plant heights were significantly different between the bare soil control and all row covers. The grade a marketable weights and numbers in Kg and nos/ha of 'Norchip' and 'Atlantic' potatoes had a significant contrast at the 0.01 level of probability with cultivars.

### EFFECTS OF SURFACE MOISTURE AND COLONIZATION BY INA BACTERIA ON FROST DAMAGE TO TOMATO SEEDLINGS

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Natural colonization of tomato transplants (*Lycopersicon esculentum* Mill. 'Supersonic') by ice nucleation active (INA) bacteria was monitored during a warm, dry period in the spring and during a rainy period in the fall. Populations of INA bacteria and freezing temperatures were determined for seedlings on days 1 to 5, 7, 9, 12, and 15 after transplanting. During the spring experiment, plant freezing temperatures ranged from -6.4C to -3.6C. INA bacteria were detected from day 1 after transplant with populations ranging from 6 to 630 cells/g fresh wt. Most plants had detectable levels of INA bacteria after 3 days in the field, but some plants did not have detectable levels after 15 days. In the fall, populations of INA bacteria were

similar to spring levels for the first week after transplant. Numbers of INA bacteria were higher and plant freezing temperatures warmer on days 9 through 15 in the fall compared with the same period in the spring.

Laboratory experiments were conducted using plants without INA bacteria. Seedlings with dry surfaces supercooled to lower temperatures than tomato plants with wet surfaces.

### USE OF REFRACTIVE INDEX TO MONITOR CHANGES IN SUGAR CONTENT OF STORED SWEETPOTATOES.

William M. Walter, Jr., U. S. Department of Agriculture, ARS, and Department of Food Science, North Carolina State University, Raleigh, NC 27695-7624

The sugar content of the sweetpotato cultivars Centennial, Coroner, Georgia Red, Jewel, and Sweet Red was measured by high performance liquid chromatography (HPLC) and compared to the sugar content found by measuring the refractive index of cellular sap and converting the refractive index value to sugar concentration. The sugar content and refractive index values were measured for just-harvested, cured and stored roots. Changes in the sugar content as determined by refractive index were found to be linearly related to changes in sugar content measured by HPLC, indicating that this method can be used to monitor changes in postharvest sugar content.

### CAROLINA CROWDER: A NEW, PEST AND DISEASE RESISTANT, ALL-PURPOSE SOUTHERNPEA

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The Agricultural Research Service of the United States Department of Agriculture announced the release of Carolina Crowder southernpea on 12 October 1990. The new cultivar is well adapted for production throughout the southern U.S., where it can be expected to produce excellent yields of high quality, crowder-type peas. Carolina Crowder is resistant to the cowpea curculio, the major insect pest of the southernpea in southeastern production areas; blackeye cowpea mosaic virus, an important virus pathogen of southernpea in the United States; and root-knot, a severe root disease incited by several species of the root-knot nematode. Canned samples of fresh Carolina Crowder peas scored well in three years of quality evaluation tests. Pod color is a brilliant red at early green-shell maturity and a brilliant red heavily shaded with cranberry colored pigment at optimum green-shell maturity. The attractive pod color should make Carolina Crowder an excellent candidate for fresh market use. Carolina Crowder plants have a greater tendency to produce a second crop than plants of most southernpea cultivars.

### WESTERN FLOWER THRIPS: IDENTIFICATION OF RESISTANCE IN PEPPER

R. L. Fery\* and J. M. Schalk, U. S. Vegetable Laboratory, ARS, USDA, 2875 Savannah Highway, Charleston, SC 29414

A greenhouse study was conducted to confirm the availability of resistance in pepper (*Capsicum annuum* L.) to western flower thrips [*Frankliniella occidentalis* Pergande]. Host plant resistance ratings confirmed earlier observations that there is a considerable amount of variability within pepper germplasm for reaction to *F. occidentalis*. Plants of 'California Wonder', 'Keystone Resistant Giant', 'Mississippi Nemaheart', 'Sweet Banana', and 'Yolo Wonder L' were resistant to the insect and exhibited only mild injury. Plants of 'Bohemian Chili', 'Carolina Cayenne', and 'Santaka', however, exhibited the symptoms of severe thrips injury, i.e., poorly expanded, deformed and distorted leaves, greatly shortened internodes, and severe chlorosis. The resistance in pepper to *F. occidentalis* appears to be due to tolerance mechanisms, not nonpreference or antibiosis mechanisms. The levels of resistance identified in this study are sufficiently high to justify the initiation of breeding efforts to transfer *F. occidentalis* resistance into susceptible pepper cultivars.

### PLANTING DATE EFFECT ON PIGEONPEA DEVELOPMENT IN MID-MISSOURI

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Determinate, photoperiod-insensitive genotypes of pigeonpea, (*Cajanus cajan*) have the potential for production in the short growing season of the temperature region. A field study was conducted to determine the effect of three planting dates on the growth and

development of this crop in Missouri. Seeds of four genotypes, ICPL 87 Isolation (85k), ICPL 85010, ICPL 85024 and ICPL 8304 were planted at three planting dates in 1990, May 1, May 15 and May 31. Germination of the earliest planted seeds was low but increased in the later planted ones. The earlier the planting date the longer was the time to flowering, but the earlier was pod maturity. The earliest planted group flowered within 78-110 days after planting. The genotypes in this group produced the highest fresh pod weights of 330-730 g/plant and the latest planted ones produced the least. Pod length, the number of seeds per pod and weight of 100 seeds had ranges of 5.1-5.9 cm, 3-4 seeds and 17-23 g, respectively and were unaffected by planting dates.

#### INFLUENCE OF SEAWEED BASED FOLIAR FEED FERTILIZER ON YIELD OF TOMATOES AND CUCUMBER

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Seaweed extract has been reported to have various beneficial effects on many crops. A study was conducted in 1989 and 1990 to evaluate the effects of Response 9-9-7, a seaweed extract fortified with NPK, on yield of staked tomatoes and cucumbers. Plants were sprayed to the runoff weekly, biweekly, every 3 weeks and every 4 weeks with 1:500, 1:250, 1:150 and 1:125 v/v Response/water respectively. Results indicate that spring tomatoes sprayed with Response 9-9-7 at all rates outyielded the check which was sprayed with plain water. However, the only significant difference was obtained when tomatoes were sprayed with 1:150 Response/water in 1989 and 1:500 in 1990. Response/water at 1:500 rate significantly increased the quality and marketable yield of cucumber in both years. Response 9-9-7 had no effect on yield of tomatoes grown in the summer under heat stress.

#### THE INFLUENCE OF EXPLANT SOURCE AND CHILLING ON IN VITRO PROPAGATION OF HERBERTIA LAHUE

Jacqueline Carlisi-Dunlop\* and Dennis L. Wollard, Department of Agriculture, University of Southwestern Louisiana, Lafayette, LA 70504

*Herbertia lahue* is a rare native iris species of South Louisiana and is difficult to propagate. Seed and bulbs were evaluated as potential explants for micropropagating *Herbertia lahue*. Green and dry seeds of *Herbertia* were chilled at 8°C for 0, 3, 6 and 9 weeks on MS media containing 0.0, 4.9 and 9.8 µM BAP and 0.0, 5.4 and 10.7 µM NAA. Seeds cultured on 4.9 µM BAP plus 5.4 NAA, and 9.8 µM BAP plus 10.7 µM NAA produced healthy shoots with no roots. Cultures with no hormones produced shoots with roots. Germination appears to be a matter of time and not the effect of chilling, age of seed, nor hormones. Bulbs were scaled to 5 and 10 mm and placed on the above media with no chilling. Bulbs scaled to 10 mm resulted in a high rate of contamination. Scaling to a 5 mm explant produced fewer contaminated cultures. Decontaminated bulbs produced healthy shoots across all treatments.

#### CONTROL STIMULATION OF PHYTOCHROME ACTIVITY AND BIOLOGICAL PEST CONTROL FOR ENHANCED PLANT GROWTH IN A CONTROLLED ENVIRONMENT

Dennis L. Wollard and Jacqueline Carlisi-Dunlop\*, Department of Agriculture, University of Southwestern Louisiana, Lafayette, LA 70504

The objectives of the greenhouse tomato industry are to optimize production while simultaneously abating the use of pesticides. A variety of mulch colors were evaluated to enhance production: black, white, yellow, red and no mulch. Black mulch yielded an average of 17.05 kg of marketable fruit per plant. Yellow, red and white produced slightly less and the no mulch resulted in the least yield. Two greenhouses were used to evaluate two pest management programs. House One was established as the biological control where whitefly parasites - *Encarsia formosa*, aphid predators - *Chrysopa carnea*, thrips predators - *Amblyseius mckenziei* and worm predators - *Trichogramma pretiosum* were released at regular intervals within the greenhouse. House Two was established as the traditional control where pesticides such as Thiodan 50% WP, Malathion 57% EC and DDVP were utilized to control insect pests. There was a comparable economic return for both pest management programs where each yielded 23 kg for every \$1.00 invested.

#### YIELD RESPONSES AND NUTRIENT UPTAKE OF TRIPLOID WATERMELON AS AFFECTED BY FERTILIZER SOURCE, MULCH, AND ROW COVER

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Response of triploid watermelon [*Citrullus lanatus* (Thunb.) cv. Tiffany] to fertilizer source (FS) [poultry litter (PL) vs. commercial fertilizer (CF)], black plastic mulch (BPM), and spunbonded floating row cover (SFC) was evaluated in 1990 on an East Texas Fuquay-Darco sandy loam soil. Plant growth and percent soluble solids were equated by FS. Vine fresh weight, number and total melon weight per plot, average melon weight, and percent soluble solids were increased 27%, 29%, 45%, 24%, and 17%, respectively, by BPM when compared to no mulch treatment. BPM + SFC treatment decreased vine fresh weight but increased total melon number which in turn increased plot weight. PL increased plant P, K, and Mg 16%, 12%, and 24%, respectively, when compared to CF. Plant Ca was increased 21% by CF. Plant N, P, Ca, and Mg were increased 18%, 16%, 22%, and 15% by the use of BPM. A reduction in plant N was found when SFC was used alone and with treatments lacking BPM or BPM + SFC. Mean soil temperature was increased on the average 2°C at 10 cm depth by BPM when compared to all other treatments. Mean 24 hr air temperature 2 cm above BP and bare ground under SFC was increased 5°C above ambient.

#### THE EFFECT OF ULTRAVIOLET LIGHT ON CONTROLLING POSTHARVEST ROTS ON FRUITS

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Low doses of ultraviolet light (254nm UV-C) irradiation reduced postharvest rots of pome, stone and citrus fruits. Brown rot (*Monilinia fructicola*) of 'Elberta' and 'Loring' peaches was significantly reduced by UV-C. *Alternaria* rot (*Alternaria* spp.) and bitter rot (*Colletotrichum* spp.) the principal storage rots of 'Golden Delicious' apples showed significant reduction following UV-C treatment. Further application of UV-C was effective in controlling green mold rot (*Penicillium digitatum*) of 'Dancy' Tangerines and 'Marsh Seedless' grapefruits, stem end rot (*Alternaria citri*), as well as sour rot (*Geotrichum candidum*) of 'Dancy' tangerines after irradiation.

#### CITRUS: SURVIVAL AT -11.1°C TEMPERATURE DURING THE 1989 FREEZE

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During the 1989 freeze, a scaffold branch irrigation freeze protection system was in operation on five-year old 'Washington' navel and 'Owari' satsuma trees and several younger trees of various navel orange varieties, a cold tolerant satsuma selection and other navel orange trees. Temperature dipped to a low of -11.1°C, with 20 consecutive hours of -6.7°C or below and 80 consecutive hours of 0°C or lower. Post freeze evaluations and ratings show that an average tree survival rate of 94.6% was obtained. An average of 84.6% survival of scaffold branches and an average of 11% canopy survival was also achieved through the use of scaffold branch irrigation for freeze protection. Trunk injury ratings averaged 8.8 (scale 0-10; 0 = dead, 10 = no injury) and shoot regrowth after pruning dead wood averaged 8.0 (scale 0-10; 0 = no shoot regrowth, 10 = excellent shoot regrowth). The average percentage of the regrowth was slightly above 80% of the original tree volume prior to the freeze. Nonprotected trees sustained 100% kill and necessitated removal and reestablishment.

#### EVALUATION OF SELECTED FRUIT QUALITY ATTRIBUTES FOR SEVEN STRAWBERRY CULTIVARS

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Fresh strawberries are highly perishable commodities, and berry quality at harvest delimits their potential shelf life. We are conducting harvest quality evaluations for seven commercially available cultivars. Seven different fruit characteristics were chosen to assess cultivar performance during the early, middle and late phases of the picking season: marketable berry yield, berry weight, berry firmness, berry color ("a" value), percent soluble solids, titratable acidity (percent citric acid) and the ratio between soluble solids and titratable acidity. Marketable

berry yield, berry weight and berry firmness varied substantially between cultivars. A few differences were observed between cultivars for berry color. Berry flavor, as evidenced by the ratio between soluble solids and acidity, was also apparently different between cultivars with three of the seven cultivars consistently exhibiting higher ratios. The relationship of each measured parameter to quality will be discussed.

**PERFORMANCE OF 'REDGLOBE' PEACH ON FIVE ROOTSTOCKS**  
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Trunk diameter, yield, root sprout production, and tree mortality of 'Redglobe' peach were evaluated over a 14 year period on 5 rootstocks: 'Lovell', 'Halford', 'Nemaguard', 'Bailey', and 'Siberian C'. Trunk diameter in year 14 was not different for trees on 'Lovell' and 'Halford', with diameters on 23.7 and 23.5 cm respectively, as compared to 93 and 45 kg on 'Halford'. These were not significantly different from each other. Both 'Lovell' and 'Halford' produced 1.8 root sprouts per tree or less both years. Trunk diameter on 'Nemaguard', 'Bailey', and 'Siberian C' was different from 'Lovell' and 'Halford'. Yields on 'Nemaguard', 'Bailey', and 'Siberian C' were 92, 88, and 41 kg respectively, in year 12, with trees on 'Siberian C' being different from the other 4 rootstocks. Yields in year 14 were 60 kg on 'Nemaguard', 50 kg on 'Bailey', and 28 kg on 'Siberian C'. Root sprout averages per tree on 'Nemaguard' were 1.6 and 6.7 in years 8 and 14 while 'Bailey' averaged 1.1 and 7.7. Root sprouts on 'Siberian C' were low in year 8, but increased in year 14 to 15.1 per tree. Tree mortality on 'Siberian C' was 44% by year 14.

**PREPLANT SOIL PREPARATION METHODS INFLUENCE PRODUCTIVITY OF 'HARVESTER' PEACH TREES**

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Influence on productivity of 'Harvester' peach trees to three methods of preplant soil preparation were studied for five years. The three methods were as follows: 1) a backhoe was used to prepare the soil, 2) a turn-plow, and 3) no preparation. Trunk yield data were taken after the first three growing seasons. There were no significant treatment differences for yield at the .05 level of probability. Trends show an increase in yield using the turn-plow and the backhoe method showed better early tree growth, but by the fifth year, there were no apparent differences.

**WATER QUALITY AFFECTS CALCIUM AND MAGNESIUM REQUIREMENTS FOR AZALEA GROWING MEDIUM**

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Calcium and magnesium medium requirements were investigated for the production of container-grown 'Formosa' azalea irrigated with filtered and unfiltered deep well water. Four inch 'Formosa' azalea plants were planted into 3.8 liter containers filled with an amended 4:1(v,v) pinebark:sand growing medium. Calcium and magnesium treatments were supplied by either dolomitic lime or gypsum + epsom salt at three rates. Plants irrigated with good quality water produced excellent quality plants regardless of Ca/Mg treatment. Alkaline well water containing moderate sodium levels inhibited azalea root growth. Medium amended with gypsum + epsom salt produced significantly better quality plants than did medium with dolomitic lime during 157 days of deep well irrigation. Medium pH and Na levels were significantly higher in the control treatment than in the filtered well water treatment. Growth effects of calcium and magnesium treatments were dependent upon water quality and time length of treatment.

**A GENETIC STUDY OF RIND COLOR PATTERNS IN WATERMELON**  
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Inheritance of dark green stripe and light green rind color in watermelon was investigated. Controlled crosses were made between watermelon cultivars: 'Louisiana Sweet'-light green rind with dark green stripe; 'Calhoun Sweet'-dark green

rind without stripes; and 'Charleston Gray' and 'Calhoun Gray' both having light green rind without stripes. Plants of parental, F<sub>1</sub>, F<sub>2</sub>, and BC lines were classified as to rind color and presence or absence of stripe. All F<sub>1</sub> progenies produced only striped fruit. Chi Square analysis of F<sub>2</sub> and BC generations corresponded to 3:1 and 1:1 ratios respectively, for stripe:no stripe, indicating dark green stripe was controlled by one dominant gene. The cross 'Louisiana Sweet' x 'Calhoun Sweet', (light green x dark green rind color), resulted in F<sub>1</sub> and F<sub>2</sub> progeny having only dark green rind fruit, indicating obvious dominance for dark green rind color. Segregation in BC populations indicated a single dominant gene for dark green rind color; however, lack of segregation in the F<sub>2</sub> suggests additional factors may be involved.

**INCREASING SEED GERMINATION PERCENTAGE OF CRATAEGUS OPACA (MAYHAW) BY FERMENTATION**

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Fermentation and other seed pregermination treatments of Mayhaw [*Crataegus opaca* (L.) Hook and Arn-Series Aestivales] (Vines.; Phipps, 1988) were evaluated as potential requirements to increase germination percentages. Low seed germinability and erratic seedling emergence are major problems in *Crataegus* breeding. Freshly harvested fermented open-pollinated seed from 5 different Mayhaw selections averaged 93.4% at 8 days fermentation and 92.8% at 4 days fermentation. Frozen fruit stored from these 5 selections and later fermented 12 days showed the following higher percentages of germination: frozen storage for 10 days - 87.2% (<4 days fermentation (df); frozen storage for 20 days - 83.8% (<4 days df; frozen storage for 30 days - 74.4% (<8 df; frozen storage for 40 days - 72.6% (<4 df; frozen storage for 60 days - 70.2% (<4 df and frozen storage for 90 days - 60.8% (< 8 df. Positive responses to short fermentation durations (<8 days) were observed, but longer fermentation durations were deleterious. Embryo dormancy requiring acid treatment or stratification and problems with germination inhibiting substances were minimized by fermenting fresh ripened fruit containing large embryos. The fruits and seed were not allowed to dry and they were either prepared immediately or frozen for later use.

**CULTURAL METHODS AFFECTING YIELD OF EDIBLE DRY BEANS**

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The effects of planting date and plant density on total and marketable yield were examined for the edible dry beans 'Aurora' and 'Fleetwood', erect type I genotype cultivars, over three years. For 'Fleetwood' alone, fertilizer levels and application of a spray-on-soil polymer mulching material were examined for effects on yield. The mulching material was degraded by rain prior to canopy closure but patches were present at harvest. Using continuous recording thermometers, temperatures over two week periods following sowing of 'Fleetwood', from 23 cm below the surface of mulched and bare soil were converted to soil degree days (SDD). 'Fleetwood' generally had higher yields than 'Aurora'. Earlier planting improved yields. In one of three years increasing plant density increased yields. Increased fertilization did not affect yield. Application of mulch did not affect yield. However, spray-on-mulch did increase SDD after the earliest planting date. Cultural systems for existing production, or potential production areas, must be developed for the conditions of each location.

**INFLUENCE OF NITROGEN APPLICATION TIME AND PHOSPHORUS RATE ON PECAN**

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Thirty-five-year-old 'Hayes' and 'Patrick' trees (22 trees/ha) were fertilized with 112 kg N/ha (NH<sub>4</sub>NO<sub>3</sub>) either the second week of March or the first week of Oct each year. Phosphorus was applied (broadcast) during March 1986 and again during May 1989 at 0 or 244 kg P/ha. Treatments were arranged in a split-split-plot design with four single-tree replications. Leaf N concentration and the number of shoots/1-year-old shoot were not affected by N application time, and the effect on shoot length was inconsistent. Total yield and annual yield three of five years were greatest from 'Hayes' when N was applied during Oct rather than March. Yield of 'Patrick' was unaffected by time of N application. Phosphorus application increased soil P up to 20 cm deep, and leaf P concentration was increased three of five years in 'Hayes' and two of five years in 'Patrick'. Shoot growth, number of new shoots, nut size, kernel percentage, and yield were generally not affected by P application.

PLANT GROWTH AND RESIDUE DECOMPOSITION COMPONENT OF WEPP - WATER EROSION PREDICTION PROJECT FOR FRUIT AND VEGETABLES. Iris Cole-Crosby\*, Liang Huam, Jesse Harness, Patrick Igbokwe, Suresh Tiwari and Om P. Vadhwa.

Plant growth and residue decomposition values are needed by the Soil Conservation Service for developing data bases for selected fruit and vegetable crops. These data bases will be used for predicting soil loss using improved erosion prediction technology. The plant growth parameters under investigation are canopy cover leaf area index, plant height, plant weight, root weight, stem diameter and vegetative dry matter. The climatic parameter are daily base temperature rainfall and growing degree days. The following is a list of the residue decomposition parameter: 1. Residue weight and harvest 2. Initial carbon-nitrogen ratio, and 3. Percent residue cover at harvest. The results are being used in the WEPP model to predict soil erosion. Data collection for these parameters start 15 days after planting for vegetables and continue at 7 day intervals through maturity.

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## Anderson Graduate

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EFFECTIVENESS OF DIFFERENT ZN FERTILIZERS AND TWO METHODS OF APPLICATION IN THE CONTROL OF 'LITTLE-LEAF' IN PEACH TREES IN SOUTH TEXAS  
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Fall soil treatments of ZnEDTA and ZnSO<sub>4</sub> at three increasing rates (32.2, 64.4 and 128.8 g. Zn/tree) and 1, 2 and 3 spring foliar sprays of NZN (0.35 g. Zn/tree/application) were tested to correct Zn deficiency in three year old 'Earligrande' peach trees. All Zn carriers increased the Zn leaf content. Peach trees treated with three applications of NZN were equal to the medium or high rates of soil applied ZnEDTA or ZnSO<sub>4</sub> respectively, in appearance, chlorophyll content and foliar Zn content. Three applications of NZN at 0.35 g. of Zn/tree (473 ml/378 gal H<sub>2</sub>O) gave excellent tree response and was cost effective.

A STUDY OF DROUGHT TOLERANCE IN SWEETPOTATOES  
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In two experiments, 16 sweetpotato genotypes (*Ipomoea batatas* L.) were evaluated for drought tolerance using the detached-leaf water loss method. Dry weight loss was also determined. Difference in the rate of leaf water loss over a 48 hour period were found. 'Vardaman' had the greatest amount of dry weight loss and the least amount of water loss. No relationship between dry weight loss and water loss was found.

When measuring chlorophyll fluorescence using two sweetpotato genotypes, 'Vardaman' had a higher rate of photosynthetic transport activity.

IN VITRO BLACKSPOT DISEASE RESISTANCE OF ROSES  
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The objective of this study was to determine if blackspot (*Diplocarpon rosae*, Wolf) resistance and susceptibility is expressed in callus derived from known resistant and susceptible genotypes of roses. Established callus lines of blackspot susceptible hybrid tea roses 'Pascali' and 'Tropicana' and blackspot resistant species roses *Rosa roxburghii* and *R. setigera* were inoculated directly with a blackspot conidia suspension. Uninoculated callus served as controls. Cultures were incubated at 25°C for 28 days in the dark. An evaluation of the appearance and percent change in fresh weight indicated that for all genotypes tested, inoculation resulted in a decline in tissue appearance and rate of weight increase. These results indicated that *in vitro* resistance to blackspot differs from the resistance found in whole plants.

THE EFFECT OF COPPER SULFATE FILTERS ON GROWTH OF TOMATO AND PEPPER TRANSPLANTS  
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Tomato and pepper transplants were grown in an environment with a high red to far-red light ratio, to determine if this was an effective method for controlling plant height. This light environment was provided by placing plants under copper sulfate filters, which absorb most of the light in the far-red region of the spectrum. Copper sulfate solutions were 4%, 8%, and 16% w/v. Tomato transplants grown under the filters were approximately 40% shorter than control plants, had less dry weight and leaf area, and increased leaf chlorophyll. Leaf number data was less clearly affected. Differences were not observed among the three different CuSO<sub>4</sub> concentrations. Similar results were observed for peppers. Field trials on tomatoes indicated that total yield, earliness of fruiting, and fruit quality were not affected by growing transplants under the CuSO<sub>4</sub> filters.

THE EFFECTS OF DIURNAL LIGHT ON PHOTOSYNTHESIS AND GROWTH OF GREENHOUSE GROWN APPLE  
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Greenhouse grown 'Lawspur Rome'/M.111 trained to single shoots were given the following shade (73%) treatments: 1) sun-all-day (control), 2) shade in the morning (am-shade), 3) shade in the afternoon (pm-shade) and 4) shade-all-day. All shade treatments increased shoot length and decreased dry weight/leaf area (DW/LA). Shade-all-day increased leaf no., LA/leaf and shoot dia. DW partitioning to leaves in shade-all-day was 19% greater than control and to roots was 34% less than control. Pn of am-shade did not increase in the afternoon when PFD was maximal. Saturated net photosynthesis (Pn) was 72% of control in am-shade, 84% of control in pm-shade and 62% in shade-all-day. Shade reduced Pn by 40% of control.

COMPENSATORY GROWTH AND PHYSIOLOGICAL RESPONSES TO DEFOLIATION OF APPLE TREES.  
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Defoliation by pests was simulated with potted tree model systems and field-grown trees. 'Redchief'/M.7 apple trees were grown in 10 l pots as a single shoot. Forty-five days after 25%, 50%, or 75% removal of apical or basal leaf number, new leaf dry weight (produced after treatment) was 23%, 53%, and 45% higher, respectively, for apically treated trees, and -7%, 61%, and 64% higher for basally treated trees, than control trees. Root dry weight was reduced by as much as 59% (apical 75% removed). Photosynthesis following 75% leaf removal was inhibited 1 day after treatment, but increased above the control within 3 days. However, by 35 days after treatment photosynthesis had declined to 53% of control. Leaf removal (50%) June 15 (1990) of 4-year old 'Early Granny'/Mark increased net photosynthesis by 40% within 8 days of treatment. Trunk cross-sectional area increase of June- and twice- (June 15 and July 30) defoliated trees was 35% of control trees. Leaf nitrogen content (% dry wt.) in September was 1.75 for twice-defoliated trees compared to 1.58 for control trees.

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## J.B. Edmond Undergraduate

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FRUITING CHARACTERISTICS OF HOT PEPPERS  
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Hot pepper (*Capsicum annum*) is gaining popularity as a food flavor additive. A study was initiated to determine the fruiting characteristics of two hot pepper cultivars; 'Scotch Bonnet' and 'Brown Lue'. After evaluating 100 fruits of each cultivar, it was found that 'Scotch Bonnet' fruits had 34% more seeds and these seeds weighed 9% more than 'Brown Lue'. Although 'Brown Lue' had longer fruits (3.89 vs 3.33 cm) than 'Scotch Bonnet', this difference was not significant. In addition, 'Scotch Bonnet' had greater fruit circumference and circumference to length ratio than 'Brown Lue'. When fruits were compared for fresh and dried weights, there was no significant difference. However, 'Brown Lue' had a significantly higher percent dry matter. Based on dry matter, if fruits were to be produced for crushed peppers, it might be more advantageous to use 'Brown Lue'.

#### KUDZU IN THE SOUTH: AN OLD ALTERNATIVE CROP

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Kudzu (*Pueraria lobata*) has become a pervasive weed in the southeast US. It has been receiving much attention recently and a study was initiated to evaluate the plant as an alternative food and feed source. Kudzu vines were sectioned into; 0-25, 25-50, 50-75 and 75-100 cm and analysed for acid detergent fiber (ADF), neutral detergent fiber (NDF), ash and crude protein content. Leaf ash content of kudzu increased while stem ash content decreased as the vine was sampled from the growing tip. Stem NDF increased from 44.4% at the 0-25 cm section to 57.83% at the 75-100 cm section of the vine, while leaf NDF declined from 52.23 to 39.01% for the same sections. The trend was reversed for ADF in the kudzu leaf and stem. Crude protein content of kudzu ranged from 18.45% at the 0-25 cm section for leaves to 7.42% for stem sections at 75-100 cm. The high crude protein content of kudzu as well as its abundance in the Southeast makes it a good feed source and a potential food source. However, further studies are needed to determine the vitamin content and digestion coefficient to ascertain its suitability as a food and feed source.

#### EVALUATION OF THE NITROGEN FIXING CAPABILITIES OF PHASEOLUS VULGARIS LINES, DEVELOPED FOR THE CARIBBEAN BASIN

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Chemically fixed nitrogen is a costly import for Caribbean Basin Countries. Increased cost of fertilizer only serves to reduce crop yields in these areas. This greenhouse research was undertaken to evaluate the N<sub>2</sub> fixing capabilities and yield potential of several *Phaseolus vulgaris* lines developed for use in Caribbean Basin countries. Ten common bean lines from breeding programs at the Universities of Puerto Rico and Wisconsin and two efficient *Rhizobium phaseoli* strains were used for the study. Plants treated with *Rhizobium* UMR 1899 and UMR 1632 had significantly higher stem and leaf dry weight than the control plants. Bean lines WBR 22-34, WBR 22-50, WBR 22-55, PR9056-98B and the cultivar Coxstone showed increased dry matter accumulation over that of the control plants. Plants treated with the *Rhizobium* strain UMR 1899 had the highest stem and leaf dry matter accumulation. Nodulation was significantly higher when plants were treated with UMR 1632. The lines WBR 22-34 and PR 9056-98B produced more nodules than the other lines used. Pod yield as measured by number of immature pods was highest for PR 9056-98B when inoculated with *Rhizobium* UMR 1899.