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J.B. Edmond Undergraduate Student Paper Competition

Evaluation of Cover Crops in High Tunnel Vegetable Production Rotation

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Organic vegetable production within high tunnels allows for an extended growing season, crop protection and more precise environmental control. The USDA National Organic Program standards require the soil to be maintained and improved over the course of production. Previous studies have indicated the potential of cover crops for reducing competitive vegetation and improving soil quality. However, there has been limited work in the confines of high tunnels as part of a tunnel-system rotation. Ten nitrogen-fixing and 10 non-nitrogen-fixing cover crops were established under a high tunnel and evaluated for their effects on the yield of ‘De Cicco’ broccoli (Brassica oleracea L. var. italica) and ‘Champion’ collards (Brassica oleracea L. var. acephala), plant nutrient status, and soil nutrient status. All treatments received recommended levels of appropriate certified organic fertilizers, water status was maintained, and vegetables received standard organic maintenance for insects and disease. The cover crops hairy indigo (Indigofera hirsuta L.), Catjang cowpea (Viana unguiculata L.), and Sunn hemp (Crotalaria juncea L.) consistently produced higher yields than Tifleaf III hybrid pearl millet (Pennisetum glaucum L.), Dairymaster brown midrib hybrid grain sorghum (Sorghum spp.), and Wild Game Food sorghum (S. bicolor L.). Nitrogen-fixing legumes produced significantly higher yields than the non-nitrogen-fixing grass species. This experiment showed that not all cover crops are equal; they created variation in response. Cover crops provide a viable option to help organic producers maintain or improve soil quality over the course of production.

Descriptive Sensory Analysis and Composition of Blackberry Genotypes

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Blackberries are grown worldwide for fresh-market and processing. Consumer interest in blackberries has been increasing. The objective of this study was to investigate and draw correlations between the descriptive sensory analysis and composition of blackberry genotypes from the University of Arkansas blackberry breeding program. Descriptive panelists evaluated 20 blackberry genotypes according to Spectrum® methods. Composition attributes were evaluated for 22 blackberry genotypes. Descriptive panelists evaluated color/appearance, flavor, and texture. Basic composition, berry and pyrene attributes, and nutraceutical composition were measured. ‘Natchez’ had the most pyrenes/berry and was among the highest for descriptive-evaluated overall seediness. ‘Natchez’ also had the most total ellagitannins, which was likely related to seeds. ‘Natchez’ and ‘Prime-Ark® 45’ had significantly higher levels for ORAC than all other genotypes. Selection A-2215 had the highest score for descriptive-evaluated sweetness, the lowest for sourness, and the highest soluble solids content. A positive and significant correlation was shown between titratable acidity and sensory sourness. Both total ellagitannins and ORAC were moderately correlated to overall seediness, which reflects the potential value of seeds for health-promoting factors. The findings generated by this study can be useful for potential marketability and future cultivar development of Arkansas blackberry genotypes.

Substitution of a Soilless Medium with Yard Waste Compost for Basil Transplant Production

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Pelleted ‘Genovese’ basil (Ocimum basilicum L.) seeds were sown in polystyrene flats in six different media blends of a peat-lite mix (PL) and yard waste compost (C). The proportions of PL:C included 100:0%, 80:20%, 60:40%, 40:60%, 20:80%, and 0:100%. The experiment was conducted twice. Seedling emergence was recorded for 12 d. Plants were harvested 6 weeks after seeds were sown and heights, fresh weights, and dry weights were recorded. Detrimental effects on seedling establishment were not seen until the compost comprised the majority of the blend. Pronounced decreases in seedling height and dry weight occurred with the 80% PL:20% C treatment, and further decreases occurred with higher amounts of compost. Laboratory analyses showed that the compost was stable (carbon:nitrogen ratio = 10.8) and not highly saline (EC = 2.84 dS·m–1), but alkalinity was high (pH = 8.3). The high pH is believed to be the cause of...
the severe stunting. A further study was done using additions of wettable sulfur to the compost in an attempt to lower the pH, with no success.

Influence of Organic Groundcovers on Mycorrhizal Colonization and Symbiosis of Organically Managed Fruit Crops

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Groundcovers have the potential to impact the rhizosphere, including arbuscular mycorrhizae (AM), which could in turn affect the host plant through symbiosis. There has been evidence that a groundcover that provides a suitable environment for colonization of AM and subsequent symbiosis could be a key tool in organic fruit production. The objective of this research was to compare colonization of AM in strawberry plugs (cv. Radiance) and apple rootstock liners (cv. M. 26) grown in a greenhouse as affected by various groundcover treatments. Inoculation was achieved for half the plants by mixing BioOrganics Endomycorrhizal Inoculant directly into soilless media according to suggested label rates. Following a dormancy period, plants were treated with one of the following groundcover treatments: 1) city-generated green-compost, 2) shredded white paper, 3) woodchips, or 4) an untreated control. Replications were arranged in a randomized design and bottom pot covers were used to avoid contamination of plants without inoculation. Plants received equal amounts of nutrition (1/2 rate Scott’s Water Soluble All-Purpose Fertilizer) twice throughout the study and were watered by hand. Green-compost significantly increased percent colonization of AM compared to other groundcovers, however, AM under this treatment did not have an effect on biomass, root volume, root surface area, root diameter, or leaf area. AM appeared to suppress root length in this study; plants inoculated with AM had a shorter root length but a similar volume to plants that were not inoculated. It can be inferred that nutrition is important to establishing AM due to a higher availability of organic matter in the green-compost, which is also greatly influences plant growth regardless of colonization of AM in young fruit crops. Though the groundcovers in this study had no effect on symbiotic AM benefits, long-term studies with mature host plants could reveal a correlation between groundcover media and symbiosis.

Influence of N Source and Rate on Growth and Leaf Nutrient Content of a Taxodium Clone

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Current nomenclature thought is that the genus Taxodium is comprised of three botanical varieties: 1) Baldcypress [Taxodium distichum (L.) Rich. var. distichum], 2) Pond cypress [T. distichum var. imbricarium (Nutt.) Croom], and 3) Montezuma cypress [T. distichum var. mexicana Gordon], abbreviated as BC, PC, and MC, respectively. The literature indicates that Taxodium in container studies respond to N source and rate with increased growth and the ammoniacal form is preferred. The results for field studies have been less conclusive. In this study, two sources of nitrogen, calcium nitrate (Ca(NO₃)₂) and urea (CO(NH₂)₂), provided a nitrate and an ammoniacal form of N at four rates (0, 50, 100, and 150 lb N/acre) to a first-year field planting of Taxodium along LaNana creek, the stream that transects the University campus. A randomized complete block design with three blocks, two N sources, four rates and two plants per replication was utilized in this study, for a total of 48 plants. The General Linear Model (GLM) procedure of SAS (SAS Institute Inc., 2007) was used to detect significant differences in growth (plant height and trunk diameter increase), and soil and leaf tissue nutrient concentrations. One-gallon container grown plants of Taxodium distichum ‘T405’, a BC x MC selection from the Nanjing Botanical Garden, Nanjing, China, were planted 11 Dec. 2011. Fertilizer treatments were applied 28 Feb. and 30 Mar. 2011. First-year plant height and trunk diameters were measured 1 Mar. and 9 Nov. 2012. Leaf tissue samples were collected 11 June 2012. Soil samples were collected 30 July 2012. All analyses were conducted in the Soil and Plant Tissue Testing Laboratory in the Agriculture Department at SFASU. Trees were drip irrigated throughout the first growing season (1 gal/plant/day) and 2012 was a heavy rainfall year in Nacogdoches (56 inches). All plants performed well in the first year. There were no significant differences in growth, nor were any differences found in soil pH, soil conductivity and nutrient levels, or leaf nutrient content, although there was a slight trend of urea-treated plants to increasing leaf N. The strong growth of all the trees in this very low soil N soil suggests that fertilizer is perhaps less important than water, soil type, soil aeration, and sun exposure. This study will be repeated in 2013 with the same treatments employed.

Effect of 4-CPA on Fruit Set and Yield of Heat Tolerant Tomato Cultivars

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Tomato (Solanum lycopersicum L.) is a favored commercial crop for most producers in the U.S. Virgin Islands and is grown for fresh market sales. Higher temperatures in the summer season are a challenge for flowering and fruit set in tomato. A study was conducted on the effect of 4-chlorophenoxy acetic acid (4-CPA) on heat-tolerant cultivars of tomato in the Virgin Islands tropical climate conditions. Two cherry tomato cultivars, ‘Terenzo’ and ‘Summer Cherry’, were evaluated in the greenhouse in the summer season. Higher yields were obtained for ‘Terenzo’ (255.4 g/plant) than for ‘Summer Cherry’ (117.6 g/plant) for plants treated with 4-CPA. No structural deformities in fruits were observed. Marketable fruit weight was higher in treated plants of both ‘Terenzo’ (10.9 g) and ‘Summer Cherry’ (5.7 g). Both
cultivars produced early fruit set and ripening in 4-CPA-treated plants. Acidity (pH 3.9), brix (7%) and firmness (6 lb.) were recorded and no significant difference in fruit texture and quality was observed for treated and non-treated fruits. The preliminary results suggest that 4-CPA may have potential to increase fruit set and yields in tomato cultivars grown in the summer season.

Norman F. Childers MS Graduate Student Paper Competition

A New Grafting Procedure Decreases Grafting Cost and Increases Grafting Efficiency by Eliminating Rootstock Re-growth in Watermelon

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Rootstock re-growth is a problem in watermelon grafting, and the cost of re-growth control is a reason for the lack of grafted transplants in U.S. watermelon production. Two experiments were conducted on a chemical method of re-growth control to 1) determine the optimal application rate and 2) determine the effect of time after application on rootstock size and carbohydrate content. In the first experiment, two fatty alcohol products (Fair 85® and Off-Shoot T®) at six concentrations (3.75, 5.0, 6.25, 7.5, 8.75, and 10% Fatty Alcohol) were applied to Bottle Gourd (Lagenaria siceraria cv. ‘Emphasis’) and Interspecific Hybrid Squash (Cucurbita maxima × C. moschata ‘Carnivor’) rootstocks as the cotyledons unfolded. On days 1, 7, 14, and 21 after application, rootstocks were rated for both damage and re-growth responses. Results showed a significant decrease in re-growth as concentration increased up to 7.5% fatty alcohol, while damage increased significantly at fatty alcohol concentrations of ≥6.25%. We conclude that the best control of re-growth with a level of acceptable damage is achieved using an application rate between 6.25% and 7.5%, depending on environmental conditions within the greenhouse. In the second experiment, hypocotyl and cotyledon widths, and dry and fresh weights, as well as cotyledon length and leaf area. No change was observed in cotyledon thickness or hypocotyl length. Total rootstock carbohydrates increased with starch increasing most significantly. Fatty alcohol treatment decreases cost by controlling re-growth and can further increase grafting efficiency by increasing the grafting window of rootstocks from 2 d to 3 weeks.

A Physiological Comparison of Heat Tolerance between Two Cultivars of Ivy Geranium (Pelargonium peltatum)

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Pelargonium peltatum, or ivy geranium, has a cascading growth habit with palmately lobed leaves and delicate flowers. Production of this species poses some challenges in warm climates due to its low tolerance of temperatures exceeding 30°C. Foliar bleaching caused by increased temperatures is devastating to the aesthetic value and shelf life of ivy geranium. To gain insight into foliar bleaching, two cultivars, ‘Contessa Red’ (heat tolerant) and ‘Temprano Lavender’ (heat susceptible) (Syngenta Flowers, Inc., Boulder, CO), were compared. Data was collected on each cultivar’s response to heat and drought by measuring photosynthesis, stomatal conductance, SPAD and growth indices. On 13 Feb. 2012, 96 rooted cuttings of each cultivar were potted into 15-cm pots using Sunshine Mix 1 (SunGro Horticulture, Bellvue, WA). Plants were fertilized with Peter’s Peat Lite 20–10–20 (The Scott’s Company, Marysville, OH) at 200 ppm N. Plants were moved into two growth chambers from the greenhouse and acclimated to 15/20°C night/day for 3 d. Using a split plot design, plants underwent temperature treatments of 15/20°C or 25/30°C night/day with moisture treatments of 80% or 30%. Data were collected at day 0 before treatments began and day 7. The data indicated ‘Contessa Red’ had a greater growth potential; however there was no significant difference in SPAD readings or photosynthetic rate between cultivars. This study indicated degradation of the photosynthetic apparatus in developed leaves did not occur in either cultivar and foliar bleaching was not due to an inhibition of photosynthesis. Observations of developing leaves indicated foliar bleaching may occur due to inhibition of photosynthetic organelle development.

Comparing Phenotypical Variation Among Echinacea purpurea and Echinacea angustifolia Varieties Grown as Medicinal Herbs in Two Environments

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Three-year field trials were initiated in 2012 in the southern mountains (Mills River) and upper piedmont (Reidsville) regions of North Carolina to determine the effects of location on six sources of Echinacea purpurea and Echinacea angustifolia (five from commercial seed companies and one from a private farm). The tops and roots of these plants are used in a wide variety of natural botanical products. At each location there are two studies, one for each species. Each study is a split plot
design with years as the main plots and sources as the subplots. Data are being collected on growth stage, plant vigor, plant height, flowering date, number of flowers, and root and top dry weight. After one season of growth, the *E. purpurea* plants at Mills River were more vigorous and had larger top dry weights than their counterparts at Reidsville. Flower numbers and root weights for *E. purpurea*, however, were similar between the two locations. This may indicate that plant vigor and large top weights are not necessarily a predictor for increased root production in *E. purpurea*. In contrast, the top and root dry weights for *E. angustifolia* were similar between the two locations, but the Mills River *E. angustifolia* produced more flowers than those at Reidsville. Some differences were noted among the seed sources, in particular, vigor and top dry weight for both species. This will be an issue for the industry when sourcing seed. The location differences are most likely due to the variations in climate, soil type, and fertility which will be examined as these studies continue.

### Determining Salinity Tolerance of Three High Plains Bedding Plant Species in a Hydroponic Setting

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Increased salinity levels in irrigation water are often attributed to naturally occurring sources, as well as, runoff from industrial and agricultural production. As fresh water sources rapidly deplete on a global scale, availability of quality irrigation water has become an issue in many regions of the United States. Salinity tolerance in plants may be attributed to several mechanisms including increased sodium tolerance in the presence of calcium. Three species of bedding plants, *Artemisia rotundifolia*, *Eustoma grandiflora*, and *Anisacanthus quadrifidus*, were evaluated for their respective salinity tolerance to increased levels of sodium and calcium. Species were suspended in a hydroponic system using a randomized complete block design with a control and three salinity treatments; 3 mS/cm, 6 mS/cm, and 12 mS/cm, respectively with a 2:1 ratio of Na to Ca. Nutrients were provided via a half strength Hoagland’s solution. At 90 days, dry weight and length measurements were taken on root and shoot tissue. Tissue was then dried and ground for % Na, % Ca and Cl ppm to determine salt mobility into the leaves. Regression analyses indicate there was a decrease in root and shoot lengths in *A. quadrifidus* with increasing salinity levels. Additional regression analysis also indicates shoot dry weights decreased with increasing salinity; however, there was no relationship between root dry weight and salinity level. As expected, an increase in salinity yielded a positive slope with % Na and Cl ppm. There was no relationship determined between higher salinity and % Ca suggesting the possibility that limited calcium mobility may have been overwhelmed by sodium influx resulting in the overall decline in plant health.

### Effects of Cover Crops and Reduced Tillage on Yield and Weed Population in Organic Lettuce Production

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A field experiment was conducted at the Plant Science Research and Education Unit in Citra, FL to assess the effect of summer cover crops and reduced tillage on organic lettuce yield and weed suppression in fall 2012. Sunn hemp and sorghum-sudangrass were planted as a biculture in August and terminated in October 10 days prior to lettuce transplanting. Five production systems were evaluated including: 1) incorporated cover crops with raised beds and polyethylene mulch, 2) incorporated cover crops with raised beds and no polyethylene mulch, 3) no cover crops with raised beds and polyethylene mulch, 4) no cover crops with raised beds and no polyethylene mulch, and 5) reduced tillage with cover crops retained as organic mulch. The production systems were arranged in a randomized complete-block design with 4 replications. Two loose leaf lettuce cultivars, Tropicana and New Red Fire, were transplanted into the field on 1 Nov and harvested after 7 weeks. Incorporation of cover crops did not influence lettuce yields. Overall, lettuce grown with polyethylene mulch had higher yields than in systems without polyethylene mulch. Weed density and biomass assessment results showed the effectiveness of using summer cover crops for nutsedge management. The reduced tillage system and the polyethylene mulch system with cover crop incorporation exhibited the lowest density and dry weight of nutsedges towards the end of the lettuce crop. However, by 4 weeks after transplanting, the perennial grass population was highest in the reduced tillage system, whereas broadleaf weeds became a problem in the non-mulched beds. Regrowth of sorghum-sudangrass was observed in the reduced tillage system at 2 weeks after transplanting. The results support a role for sunn hemp/sorghum-sudangrass cover crops for nutsedge control in fall-grown vegetables; however, nutrient and plant management practices need to be developed for minimizing yield loss in systems without polyethylene mulch.

### Evaluation of an Organic Nitrogen Source in a Yellow Squash–Collard Rotation

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In-season nitrogen (N) management is a challenge in organic vegetable production especially when using polyethylene mulch combined with fertigation. There is a need for a highly soluble, quick release N source that is suitable for fertigation in organic vegetable production. Hydrolyzed fish fertilizer (HFF) has been used as a supplemental fertilizer in organic production for many
years. Yield with organic N supplied by HFF was compared to that of inorganic N. A crop rotation of yellow squash (Cucurbita pepo) and collards (Brassica oleracea var. acephala) was used. Three N sources were studied; HFF, Inorganic N source with secondary and micronutrients, and Inorganic N without secondary or micronutrients. The N sources were applied at 100%, 80%, and 60% of the recommended rates for each crop. To evaluate the HFF as an N source it was necessary to equalize other nutrients across all treatments. The form of nitrogen supplied was also considered. All treatments were adjusted to supply a rate of 57% nitrate nitrogen and 43% ammonium nitrogen. The experiment was arranged as a randomized complete-block design consisting of 10 treatments with 4 replicates. White on black polyethylene mulch was installed along with drip tape. Yellow squash had a 30% higher yield with the inorganic N source treatments compared to the HFF. Collards had 21% higher yield with inorganic with minor nutrient treatments compared to the HFF. However, all collar treatments with secondary and micronutrients yielded significantly higher than the treatments with the micronutrients withheld. Though yields were reduced in the HFF treatments, the premium price associated with organic products may offset the reduced yields. Upon completion of the rotation, a detailed economic analysis will be conducted. The analysis will compare yield, costs and the USDA terminal market price for each crop. This data will be used to determine if the use of a HFF is economically feasible alternative in organic production.

**Optimizing Sweetpotato Seed Bed Density for Plant Production**

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An on-farm sweetpotato test was conducted to evaluate seed bed density rates to maximize commercial slip production. Seeding treatment rates were 12, 24, 37, 49, 61, 73 and 85 bushels per 1000 ft² of bedded row. Average seed size ranged from 72.8 to 119.8 g. Varieties evaluated were ‘Covington’ and ‘Evangeline’. Plots were 20 ft long x 3 ft wide and each treatment was replicated three times. A 15-ft² section of each plot was once-over harvested and plants were counted, weighed and categorized into cull (<5 inches), marginal (5–7 inches), optimal (7–14 inches) and long (14+ inches) plants. ‘Covington’ produced the highest number of usable plants (>5 inches) at the 73 bu/1000 ft² level, but was not significantly different from the 61 and 85 bu/1000 ft² treatments. However, this 73 bu/1000 ft² treatment resulted in significantly higher number of plants than 49 bu/1000 ft², which is a common commercially used seeding rate. ‘Evangeline’ produced the most usable plants in the 73 bu/1000 ft² treatment. When comparing varieties, ‘Evangeline’ produced a higher percentage of 7- to 14-inch plants than ‘Covington’ at all seeding rates except 12 bu/1000 ft². ‘Evangeline’ also tended to produce a higher percentage of long plants than ‘Covington’. ‘Covington’ produced a higher percentage of cull and marginal plants at all seeding rates, as well as more total plants than ‘Evangeline’ in all treatments except 12 and 24 bu/1000 ft². However, results show that ‘Evangeline’ had significantly higher mean percent-ages of marketable plants (>5 inches) in all treatments (ranging from 88.9% to 93.6%). The seeding density that was optimum for producing the most marketable size plants for a once-over harvest production system was 73 bu/1000 ft² for ‘Evangeline’ and 61 to 85 bu/1000 ft² for ‘Covington’.

**Phosphorus Uptake by Two Southeastern Native Plant Species in Flooded and Non-flooded Bioretention Substrates**

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Bioretention gardens can mitigate the effects of urbanization by increasing infiltration of stormwater runoff and removal of urban phosphorus (P) pollution from residential area. Bioretention substrates affect plant health and nutrient removal and infiltration capabilities of bioretention gardens. The purpose of this study was to evaluate phosphorus uptake by two native plant species.
Planting/Population Density and Its Effects on Yield and Quality of Sweet Corn (Zea mays)

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Sweet corn population can play an important role in determining marketable yield and quality, and because of this it is important to determine at what population maximum economic yield can be achieved. Two field trials were conducted in Swan Quarter, NC, using two shrunken2 endosperm fresh market sweet corn hybrids: ‘Obsession’ and ‘Garrison’. Six populations were examined, ranging from the lowest density of 12,000 plants/acre (12k) to the highest population of 32,000 plants/acre (32k). What sets this study apart from the previous sweet corn population studies that have been published is our interest in two key factors: secondary ear formation and the effects of “twin row” planting. Maximum primary ear yield was achieved between 24k and 28k plants/acre, with 22831 ears/acre achieved at the 24k population, and 25509 ears/acre achieved at the 28k population. The formation of secondary ears is affected by population, with the number of secondary ears increasing as the population decreases: 6669 secondary ears/acre were produced at the 12k population, as compared with 864 secondary ears/acre at the 32k population. Twin row planting did not have a significant effect on yield or quality, and may not have been a factor due to an abundance of soil moisture throughout the growing season. The ear quality measures included ear length, ear width, ear weight, and kernel row number. The differences in ear quality were due to both population effects and cultivar effects, with the largest ears occurring in the lowest density populations: ear length decreases from a maximum at the 12k population to a minimum at the 32k population. The same trend was seen with ear width and ear weight, with maximum values seen at the 12k populations and minimums at 32k populations.

Response of Hydroponic Bibb Lettuce (Lactuca sativa) to Salt Additives in Integrated Aquaponic Systems

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Aquaponics combines plant and fish production where byproducts of one system are used as inputs for the other. One such system is the combination of tilapia (Oreochromis spp.) production in tanks and greenhouse production of lettuce (Lactuca sativa L.). What has proven to be a “standard practice” for one system may actually be harmful to the other system. In fish culture, it is common to add salt (NaCl or CaCl2) in order to relieve stress. Tilapia have high salt tolerance; however, plants typically do not have such tolerance. We wanted to determine the tolerance of hydroponic Bibb lettuce to various NaCl and CaCl2 concentrations. Lettuce (‘Charles’) was sown in 1-inch oasis cubes. Three weeks later, the cubes were placed in holes cut in styrofoam and placed atop buckets containing a standard hydroponic solution and concentrations of salts from 0 to 500 ppm chloride. Salinity, electro-conductivity (EC) and pH of the solutions were monitored and leaf chlorophyll measured. Approximately 30+ d after transplanting, plants were harvested. Fresh shoot and root weight (FSW, FRW) and a growth index (GI) were taken. Plant tissue was dried and weights (DSW, DRW) taken. Bibb lettuce was not affected by chloride from 0 to 500 ppm. A second experiment was conducted with concentrations of chloride from 0 to 20,000 ppm. Water quality was monitored and growth parameters taken at harvest. Chloride treatments over 5000 ppm chloride were lethal. Significant adverse effects were seen above 2000 ppm for both salts. Regression of the GI, FSW, FRW, DSW, and DRW suggests that decline begins prior to where differences are significant. Our research suggests that managers not view 2000 ppm chloride as a tipping point for lettuce but as the point at which significant adverse responses occur. More research is needed to determine a specific salt level at which growth begins to be adversely affected.

Saline Irrigation of Selected Annual Bedding Plants for the Southeastern United States

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Lettuce ('Charles') was grown in oasis cubes and Oasis Oasis cubes. Three weeks later, the cubes were placed in holes cut in styrofoam and placed atop buckets containing a standard hydroponic solution and concentrations of salts from 0 to 500 ppm chloride. Salinity, electro-conductivity (EC) and pH of the solutions were monitored and leaf chlorophyll measured. Approximately 30+ d after transplanting, plants were harvested. Fresh shoot and root weight (FSW, FRW) and a growth index (GI) were taken. Plant tissue was dried and weights (DSW, DRW) taken. Bibb lettuce was not affected by chloride from 0 to 500 ppm. A second experiment was conducted with concentrations of chloride from 0 to 20,000 ppm. Water quality was monitored and growth parameters taken at harvest. Chloride treatments over 5000 ppm chloride were lethal. Significant adverse effects were seen above 2000 ppm for both salts. Regression of the GI, FSW, FRW, DSW, and DRW suggests that decline begins prior to where differences are significant. Our research suggests that managers not view 2000 ppm chloride as a tipping point for lettuce but as the point at which significant adverse responses occur. More research is needed to determine a specific salt level at which growth begins to be adversely affected.

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Lettuce ('Charles') was grown in oasis cubes and Oasis Oasis cubes. Three weeks later, the cubes were placed in holes cut in styrofoam and placed atop buckets containing a standard hydroponic solution and concentrations of salts from 0 to 500 ppm chloride. Salinity, electro-conductivity (EC) and pH of the solutions were monitored and leaf chlorophyll measured. Approximately 30+ d after transplanting, plants were harvested. Fresh shoot and root weight (FSW, FRW) and a growth index (GI) were taken. Plant tissue was dried and weights (DSW, DRW) taken. Bibb lettuce was not affected by chloride from 0 to 500 ppm. A second experiment was conducted with concentrations of chloride from 0 to 20,000 ppm. Water quality was monitored and growth parameters taken at harvest. Chloride treatments over 5000 ppm chloride were lethal. Significant adverse effects were seen above 2000 ppm for both salts. Regression of the GI, FSW, FRW, DSW, and DRW suggests that decline begins prior to where differences are significant. Our research suggests that managers not view 2000 ppm chloride as a tipping point for lettuce but as the point at which significant adverse responses occur. More research is needed to determine a specific salt level at which growth begins to be adversely affected.
Drought and increase in population have the potential to place strain on the potable water supply of the southeastern United States. Greywater is a renewable, recycled water source that can help reduce the demand for potable water. Use of greywater for irrigation is limited by the potential for salt injury to plants. Research was conducted to evaluate three common horticultural annual bedding plants, over the course of 6 weeks. Species used were *Portulaca oleracea*, *Begonia x semperflorens cultorum*, and *Rumex sanguineus*. Liners were planted in a 5:3:1 pine bark:peat:perlite substrate and amended with controlled-release fertilizer and dolomitic limestone. Plants were irrigated daily 300 mL of tap water containing one of the following concentrations of NaCl: 0, 250, 500, or 1000 mg·L–1. Root dry weight (RDW), shoot dry weight (SDW), and survival were determined at experiment termination. There was no effect of treatment in all three species. All species had 100% survival rate and showed no symptoms of salt stress were observed. Results suggest that all three species can tolerate NaCl levels commonly observed in greywater.

**Utilization of Pigeon Pea (Cajanus cajan L.) and Sorghum Sudangrass [Sorghum bicolor (L.) Moench var. sudanense (Piper) Hitchc.] Summer Cover Crops to Improve Yield of Fall Cabbage**

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The first year of a 2-year field experiment was conducted during fall 2011 at the UF–IFAS Suwannee Valley Agricultural Extension Center in Live Oak, FL to evaluate the effects of pigeon pea (*Cajanus cajan* L.) and of sorghum sudangrass (*Sorghum bicolor* L. Moench var. *sudanense*) summer cover crops on yield of cabbage. The objective was to identify the cover crop planting arrangement and tillage method that resulted in the greatest cabbage yield. Treatments were arranged in a split split-plot design and replicated four times. Main effects included 4 cover crop (CC) treatments: pigeon pea (PP); sorghum sudangrass (SS); PP and SS biculture (SP); and no cover crop (control). Cover crop plots were equally split in week 4 after CC emergence with two levels of nitrogen (N): 57 or 0 kg·ha–1 (subplots). Each subplot was equally split again prior to cabbage transplanting. Cover crops were mowed and soil-incorporated or rolled with a roller-crimper (sub-subplots). Data were collected on CC biomass, weed biomass, and cabbage head variables including yield. Above-ground dry weight of SS, PP, and SP responded positively to 57 kg·ha–1 N application compared to 0 kg·ha–1 N (P ≤ 0.05). SP had greater biomass (2508 kg·ha–1 within fertilized subplots and 1086 kg·ha–1 within unfertilized subplots) than SS (2485 and 801 kg·ha–1 for fertilized and unfertilized subplots, respectively), and biomass of PP was less than SS and SP in both fertilized and unfertilized subplots. Weed biomass was significantly reduced in both SP and SS compared to PP subplots. Weeds were more abundant in rolled compared to incorporated sub-subplots. Tillage and fertilizer increased cabbage head weight within PP (2.6 t·ha–1) and SP (2.6 t·ha–1) compared to remaining plots (P ≤ 0.05). The addition of 57 kg·ha–1 N had a negative impact on yield in rolled sub-subplots. Based on the results of this experiment, PP with 57 kg·ha–1 N and soil-incorporated resulted in the greatest cabbage yield.

**Warren S. Barham PhD Graduate Student Paper Competition**

**Anthocyanin Profile of Organically Grown Blackberries**

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Total and individual anthocyanin contents in organically grown ‘Natchez’, ‘Ouachita’, and ‘Navaho’ blackberries were analyzed at shiny black (SB) and dull black (DB) ripeness stages. Total anthocyanin content was quantified as cyanidin-3-glucoside equivalents, and was highest in ‘Natchez’, followed by ‘Navaho’, and ‘Ouachita’. Anthocyanins in blackberry consist primarily of a cyanidin aglycone with various sugar attachments, and possibly peonidin or pelargonidin aglycones. Freeze dried blackberry drupelet tissue was extracted with acidified methanol and samples run using a high performance liquid chromatograph, diode array detector, and 250 × 4.6 mm Synergi HydroRP 80A column using methanol. Cyanidin-3-glucoside was the predominant anthocyanin in blackberries, representing 95%, 91%, and 90% of total anthocyanins in ‘Natchez’, ‘Ouachita’, and ‘Navaho’, respectively. Cyanidin-3-glucoside and cyanidin-3-rutinoside contents were positively correlated with total anthocyanin content. Cyanidin-3-xyloside content in ‘Navaho’ and ‘Ouachita’ was higher than in ‘Natchez’. Ripeness stage did not affect total anthocyanin content. The results indicate that organically grown ‘Natchez’, ‘Ouachita’, and ‘Navaho’ blackberries are excellent sources of cyanidin 3-glucoside, an anthocyanin considered highly effective in quenching free radicals. Since cyanidin 3-glucoside was the predominant anthocyanin in blackberries, representing 88% to 96% of total anthocyanin content, use of the pH differential method with microplate reader or spectrophotometer offers an accurate and low cost method to follow the anthocyanin profile of blackberries.

**Effects of Nitrogen Rates on Reblooming Iris**

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The U.S. cut flower market is mainly supplied by imported cut flowers. Newly developed specialty cut flower species have been proven to be profitable allowing domestic growers to compete with imports. Iris germanica has great potential as a specialty cut flower because of its fragrance, showy display and multicolors. However, with a short season of availability as a cut flower, scheduled year-around blooming is necessary. There is currently no effective method of regulating reblooming after cutting. Research has shown increased fertilizer rate can increase second bloom yield within the growing season. But limited research has been conducted concerning nitrogen (N) fertilizer guidelines for reblooming cultivars. The main objective of this study was to identify optimal N nutrient management for promoting reblooming and study the chemical composition of N and non-structural carbohydrates and their interaction in response to different N supply. This research was undertaken spring 2012 using ‘Immortality’, a reliable reblooming iris cultivar. The first part of the study focused on the effects of five concentrations (0, 5, 10, 15 or 20 mM) N fertigation on plant growth and reblooming performance. The second part of the study compared the influence of late fall foliar N application (3% urea) to soil fertilization. Research results demonstrated increasing N rate can improve the reblooming flower yield. High N rate treatments not only accelerated the growth rate, but also generated earlier first blooming to extend the growth period of new fans which produce the second bloom. The 20 mM N rate significantly increased the second blooming compared to other rates. Thus, high N fertilizer on reblooming iris cultivars is a feasible method to extend the available season of iris cut flowers. Foliar urea sprays in late fall enhanced N concentration in the plant storage tissues and has potential to improve spring blooming performance.

**Grafting Specialty Melons for Root-knot Nematode Management**

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A recently conducted greenhouse inoculation study demonstrated the effectiveness of using Cucumis metulifer as a rootstock for inhibiting reproduction of root-knot nematode (RKN) Meloidogyne incognita race 1 in honeydew melon ‘Honey Yellow’ (Cucumis melo var. inodorus). A follow-up field experiment further assessed the RKN resistance, yield, and fruit quality of specialty melons grafted with C. metulifer. ‘Honey Yellow’ and galia melon ‘Arava’ (C. melo var. reticulatus) both susceptible to RKN were grafted onto C. metulifer and grown in organic and nonfumigated conventional fields at Citra, FL, during March–June 2012. The organic plot was naturally infested by M. javanica. Compared with non- and self-grafted plants, ‘Honey Yellow’ and ‘Arava’ grafted onto C. metulifer exhibited significantly lower gall ratings and reduced RKN population densities in the soil. However, total and marketable fruit yields were not significantly different from those of non- and self-grafted plants. There was a lack of RKN infestation in the conventional field plot where ‘Honey Yellow’ grafted onto C. metulifer showed a significantly lower total yield compared to non-grafted plants, whereas the fruit yield of ‘Arava’ was not affected by grafting with C. metulifer. Grafting with C. metulifer decreased the flesh firmness of ‘Arava’ in both organic and conventional fields and resulted in a reduction in total soluble solids content under conventional production. In contrast, C. metulifer did not exhibit any significant impacts on the fruit quality attributes of ‘Honey Yellow’. Results demonstrated the potential of using C. metulifer for grafting specialty melons for RKN management. Although the improvement of RKN resistance did not translate into yield enhancement, the reduction in soil RKN population densities could make grafting a viable rotational tool for organic specialty melon growers. More research is needed to better understand the scion-rootstock interaction effect on fruit quality.

**Irrigation and Tillage Regime Affect Soil Compaction and Productivity of Bell Pepper (Capsicum annuum L.)**

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The purpose of this study was to investigate the impact of tillage regime and irrigation management in organically and conventionally managed systems on soil quality and yield of bell pepper (Capsicum annuum L.) ‘Aristotle’. The trial was arranged in a split-plot design with eight treatment combinations. Plants were grown in strip tillage and with plastic mulch under well-watered and drought conditions in organically and conventionally managed systems in 2011 and 2012 in Lexington, KY. Soil compaction, leaf water potential, and yield were determined in this trial. There were significant interactions in soil compaction within and between rows in strip tillage and plasticulture systems. In-row soil compaction was less in the plasticulture than in strip-tillage plots. However, between-row compaction was significantly greater in plasticulture at depths of 15, 20, and 30 cm compared to strip tillage plots. In addition, organically managed plots had significantly less in-row compaction than conventionally managed plots at depths up to 20 cm. Leaf water potential was measured at pre-dawn and mid-day during the growing season. There were no interactions among any treatments for leaf water potential. In addition, there were no treatment effects for pre-dawn leaf water potential, but there were significant differences in mid-day leaf water potential between plants subjected to well-watered and drought conditions. This indicated that irrigation regime impacted plant water status regardless of growing system. There were no significant interactions between treatments for yield. However, there were
significant treatment differences in yield between well-watered and drought-stressed plants, with well-watered plants producing significantly greater yields. Results suggested that while tillage system may impact soil quality characteristics, irrigation regime was the only treatment that significantly impacted plant water status and yield in this trial.

Soil Type and Cultivar Effect on Root Growth and Stomatal Conductance of Muskmelon (Cucumis melo L.)

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Melon cultivars with diverse genetic makeup were evaluated in sandy loam (Weslaco, TX) and clay soils (Uvalde, TX) for root growth, stomatal conductance and fruit yield. Root length density (RLD, cm·cm–3), adaxial and abaxial stomatal conductance (mmol·m–2·s–1), and total fruit yield (TFY; t·ha–1) of six melon cultivars were measured. Melons produced more RLD in clay soils (2.08 cm·cm–3) with an average increase of 41% as compared to sandy loam soils (1.48 cm·cm–3). Cultivars showed no significant differences for RLD; however, TAMU 146, TAMU OC and Journey had numerically more root growth than other cultivars. Most of the RLD (77%) was concentrated in the upper 30 cm of the soil depth indicating an effective rooting depth for subsurface drip irrigated melons. Averaged across soil types and cultivars, adaxial conductance was higher (20%) than abaxial conductance. Melons grown under sandy loam soil had 17% more abaxial conductance than clay soils, but adaxial conductance was similar in both soils. Overall, cultivars had no significant differences for adaxial as well as abaxial conductance. Clay soils produced 19% higher fruit yield (87.9 t·ha–1) as compared to sandy loam soils (74.3 t·ha–1). Cultivar-trait analysis conducted by GGEbiplot showed that high yielding cultivars Journey, TAMU OC and TAMU 146 had better association with RLD however, none of these cultivars showed relationships with stomatal conductance. These results indicate that heavy textured soils are better suited for enhanced root growth and higher fruit yield in melons. The differences in stomatal conductance could be attributed to variation in vapor pressure deficit at the two locations rather than to soil types.

Education Section

Teaching a Greenhouse Management Laboratory Online

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Because of their highly interactive and hands-on nature, laboratories can be particularly challenging to teach as distance courses online. As part of the Alliance for Cooperative Course Exchange in the Plant Sciences (ACCEP), Greenhouse Management Laboratory was taught at the University of Arkansas, Oklahoma State University, Mississippi State University, and Louisiana State University as an online laboratory. The University of Arkansas’ Blackboard system was used as the backbone for offering the laboratory. Blackboard was used to provide general information such as the laboratory syllabus, schedule and grade reports. Blackboard was also used to provide information of the laboratory’s learning activities to be conducted by the students. The first learning activity involved students conduct small research projects that were designed to demonstrate concepts from the lecture or for skill set development. Greenhouse space and laboratory supplies were made available and maintained at each location. Written instructions including learning objectives, materials required and experimental were provided to students. Additionally, videos were recorded in which the instructor walked the students through each experiment and demonstrated how to conduct each experiment. Therefore, students were able to both read and watch in video format how to conduct each experiment. At the termination of each experiment, students provided written lab reports and were then provided feedback from the instructor. The second learning activity involved students participating in virtual field trips. Each virtual field trip was a 25- to 30-min video of a greenhouse operation. Virtual field trips were designed to reinforce what the students learned in the lecture section and to provide students with a broader perspective of the greenhouse industry. Finally, a Greenhouse Management Laboratory YouTube channel was created which allowed the instructor to post video communications for students and provide updates, clarifications, answer questions, or share interesting results from lab experiments.

Extending the International Experience into the Horticulture Classroom: The Creation and Use of Reusable Learning Objects (RLOs)

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Universities are searching for ways to integrate global concepts into curricula. Faculty abroad programs provide faculty members with the opportunity to create culturally and contextually rich course materials while also engaging in experiential professional development. Eight faculty members from Texas A&M University participated in a faculty abroad experience in Trinidad and Tobago where they created short, self-contained, digital lessons known as reusable learning objects (RLOs). Pre-reflective and post-reflective interviews were conducted and qualitatively analyzed to determine the impact of this experience on participants’ teaching style and technology use. The analysis indicated
Using Blogs to Communicate Student International Experiences

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Trip journal is a common way to document student learning during international trips like a study abroad course. However, the trip journal is only read by the professor, who may have required the trip journal as part of the grading rubrics. Since the journal is normally turned in at the end of the trip, although it may be required to be checked periodically by the instructor, there is limited interaction between the instructor and students on how to improve the journal. Instead of a trip journal, students on a recent study abroad course in China were required to have daily posts on a class specific blog. The audience of the blog could the whole world, thus it enables great information sharing and interaction. The blogs received 3,779 views from audience from the whole world, thus it enables great information sharing and interaction. The blog received 3,779 views from audience.

Experiences Teaching Plant Growth and Development Online

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Plant Growth and Development is an online course offered by Mississippi State University (MSU) to ACCEPtS alliance institutions. This course was offered online using course management software. The course textbook was available to enrolled students online free through the MSU Libraries. Plant Growth and Development was set up as a series of topical learning sections each containing recorded video lecture, a reading assignment, a discussion question assignment, a section quiz, and a pdf (Acrobat, Adobe Systems, Inc., San Jose, CA) of the lecture slides with much of the lecture material missing. The lectures were created in PowerPoint (Microsoft, Inc., Redmond, WA) and recorded/edited using Camtasia software (TecSmith Corp., Okemos, MI). Each lecture was structured with a common format starting with an opening slide containing an index for the lecture and a set of expected learning outcomes. This slide was followed by the lecture content and each lecture concluded with a series of summary statements relating to the expected learning outcomes. Each lecture averaged 30 min in length. Tests and quizzes were developed using Respondus software (Respondus, Inc., Redmond, WA) and posted to the course management website. This course has been offered fall semesters for the last 3 years. This course was not a required course for any curriculum at the alliance institutions and enrollment has averaged 46 students per semester split 41% graduate students, 59% undergraduate. The greatest student numbers were from MSU where students reported the convenience of scheduling and use as a restricted elective as primary reasons for taking the course. Students in an online course still want to “see” the instructor, which required adding more pictures of the instructor and inserting picture-in-picture segments into the lectures. Accessability of course materials was a concern alleviated by making lectures downloadable for students with slow internet connections and increasing open availability time for quizzes and exams. Quizzes were limited to 15 min and available over 1 week. The exams were proctored, password protected, and had a 1-h time limit. Grades in the course have averaged 2.06 and 3.14 on a 4.0-point scale for undergraduates and graduate students respectively. Other observations from teaching this course included students were split 50/50 on preferring the course being offered online vs. face-to-face and 50/50 yes/indifferent on preferring the instructor being physically present to teach the course.

Where Did All the Students Go?

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The continuing expansion of distance education programs across the country continues to provide uncharted waters for traditional institutions of higher education. As of 2012, over 32%, or 6.7 million students, are taking online courses. The major shift in online enrollment is in the age of students. About 47% of the students enrolled in online courses are in their 40s. Many of these returning students are pursuing a master’s degree program resulting in a substantial shift in graduate enrollment. Given scholarship policies and military benefits, it is essential to have a minimum of 12 h of online graduate courses available each semester as online graduate students are more likely to be full time students than in previous years. Outstanding students deserving awards and nominations are increasingly going to be found at a distance rather than in the local classroom. Development of policies for advising and developing distance graduate
committees need to be reviewed given the committee chair may have never actually met the student in person. Should the decision be made to require an on campus defense, consider providing an opportunity for the student to meet individually with faculty? The potential for massive open online courses (MOOCs) is also an issue on the horizon.

Opportunities and Challenges in Internationalizing Organic Agriculture Education

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The need to internationalize undergraduate education is increasingly clear. Two interdisciplinary teams at the University of Florida (UF) and Polytechnic University of Madrid (UPM) collaborated in this project. The goal was to integrate global awareness and intercultural competence into the undergraduate program in organic and sustainable agriculture at both institutions. A 2-credit study abroad course about organic production and marketing in Spain was developed to incorporate the European perspective on organic food systems into the organic crop production curriculum program. Blackboard© was the course platform for all content. Several means of creating interaction between the students and instructor, and among students were used. These included frequent emails and announcements, weekly video announcements, video introductions to weekly topics, and recorded content presentations. Students were required to write blogs and respond blogs, and to write journal entries that were evaluated by the instructor. To create a more live interaction between the students and the instructor, the “Collaborate” chat application was used. The instructor conducted five 1-h discussion-interaction sessions weekly. The sessions had an unstructured format with the goals of clarifying content presented in the weekly learning unit, explore additional ideas and content, and build a social network around the course and topics. In the sessions, the students could see and hear the instructor via internet camera and microphone. More than 80% of the home-institution students participated and 68% of all enrolled students participated during the semester. Approximately 42% of the enrolled students participated in multiple sessions. Students who participated had a course grade GPA of 3.00 (±0.51 sd), while those who did not participate had a course GPA of 2.10 (±1.56 sd). Informal survey and review indicated students liked seeing and hearing the instructor. The sessions provided an opportunity for personal yet public discussions. Some students did not participate due to schedule conflicts and some student expressed that they did not want to “connect” in an online class and that the course should be schedule-autonomous and anonymous. The instructor felt the interactive tools allowed a personality to be expressed through the teaching-learning experience, kept the instructor connected to the students and engaged in the class.

Creating Interaction in an Online Course

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An online course, Sustainable and Organic Horticulture, has been offered through the multi-state ACCEPtS shared curriculium program. Blackboard® was the course platform for all content. Several means of creating interaction between the students and instructor, and among students were used. These included frequent emails and announcements, weekly video announcements, video introductions to weekly topics, and recorded content presentations. Students were required to write blogs and respond blogs, and to write journal entries that were evaluated by the instructor. To create a more live interaction between the students and the instructor, the “Collaborate” chat application was used. The instructor conducted five 1-h discussion-interaction sessions weekly. The sessions had an unstructured format with the goals of clarifying content presented in the weekly learning unit, explore additional ideas and content, and build a social network around the course and topics. In the sessions, the students could see and hear the instructor via internet camera and microphone. More than 80% of the home-institution students participated and 68% of all enrolled students participated during the semester. Approximately 42% of the enrolled students participated in multiple sessions. Students who participated had a course grade GPA of 3.00 (±0.51 sd), while those who did not participate had a course GPA of 2.10 (±1.56 sd). Informal survey and review indicated students liked seeing and hearing the instructor. The sessions provided an opportunity for personal yet public discussions. Some students did not participate due to schedule conflicts and some student expressed that they did not want to “connect” in an online class and that the course should be schedule-autonomous and anonymous. The instructor felt the interactive tools allowed a personality to be expressed through the teaching-learning experience, kept the instructor connected to the students and engaged in the class.

Extension Section

Horticulture Extension in China: Two Case Studies

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Funded by a grant from the USDA Scientific Exchange Cooperative Program (SCEP), faculty from four land-grant universities visited Beijing, Shanghai, and Zhejiang in 2012 to study low-cost season extension technologies for local sustainable specialty crop production and marketing. During the 2-week visit to China, two extension systems were observed and compared. Case I was Lijing Grape Specialized Cooperative (jxljpt.com) at Daqiao Town, Jiaxing, Zhejiang Province. Headed by Mr. Zhu Yifeng, the Co-op has 150 farmers and utilizes protected production (rain shelters) to improve grape quality and extend the season from July–August to May–October for the lucrative markets.
in Shanghai and Hangzhou. The Co-op provides “extension” services, ranging from new cultivar selection and propagation, technology transfer and on-site consulting to Co-op members through a range of methods from short message service to workshops. Case II was the ‘Agriculture Extension Alliance’ formed among Zhejiang University, Zhejiang Department of Agriculture and Huzhou Municipality. This alliance, which is based on the US extension system, involves specialists from Zhejiang University and other agriculture colleges working directly with Huzhou Municipality and agriculture enterprises to work on 10 commodities: cereal and oil, vegetable, tea, fruit, silk worm/Morus, aquaculture, poultry, bamboo, nursery, and ag. tourism. In summary, development of an extension service similar to that found in the U.S. is at its infancy in China.

Promoting The Crosby Arboretum through Social Media
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In late fall 2011 and early 2012, initiative was taken to update The Crosby Arboretum image through its website and social media. Measurers were developed in hopes of increasing visitor attendance, enrollment at educational programs, and volunteer participation. The Arboretum encompasses more than 700 acres at seven sites in two coastal Mississippi counties. The stated mission of the Arboretum is as follows: “The Crosby Arboretum is a not-for-profit institution dedicated to educating the public about their environment by: Preserving, protecting, and displaying plants native to the Pearl River Drainage Basin in Mississippi and Louisiana, Providing environmental and horticultural research opportunities, and Offering cultural, educational, scientific, and recreational programs.” In this mission, the Arboretum also meets the goals of the Mississippi State University Extension Service, which: “… provides research-based information, educational programs, and technology transfer focused on issues and needs of the people of Mississippi, enabling them to make informed decisions about their economic, social, and cultural well-being.” Because of limited staff and funding, a goal of recent outreach is to connect as many social media opportunities through the Arboretum website, increasing the Arboretum exposure and annual attendance without taxing the current professional staff beyond what is manageable. Efforts included updating the website, linking to Facebook, adding Wordpress blog, Twitter, Google Plus, LinkedIn, Pinterest, and YouTube channel accounts. Google Alerts, a free email alert monitoring system, is being used to track the Arboretum brand weekly. Google Analytics is being used to track usage of the website. Data are being collected to determine the success of the website and social media outlets. Initial results after one year indicate the biggest impacts are those with the website, Facebook, blog and Twitter accounts. Setting up social media to feed into one another and into the website reduces overall time commitments by staff while keeping these Arboretum sites “fresh.”

Timely Communication to Nursery and Landscape Clientele: Facebook, e-News Updates and Trial Garden Reports

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Communication efforts to clientele in the field of commercial ornamental horticulture (primarily growers, independent retailers, and landscape horticulturist/contractors) has been initiated by the LSU AgCenter via Facebook, e-news updates and trial garden reports. Faculty at the LSU AgCenter’s Hammond Research Station initiated a Facebook social media page in May 2011 (www.facebook.com/pages/LSU-AgCenter-Hammond-Research-Station/22267065425080). The page is updated 3–5 times weekly with ornamental plant of the week postings, interactive discussion questions and posts pertaining to research and extension programs at the station and elsewhere at the LSU AgCenter. 558 people currently like the page and monthly active users number approximately 250. The page results in 2,000 contacts weekly. A separate Facebook page created by LSU AgCenter communication faculty in Apr. 2010 has 4200 friends (likes) with 250–500 monthly active users and 3,000–5,000 contacts weekly. An ornamental horticulture e-news update was initiated in July 2007 and distributes information weekly to 950 e-mail recipients. Updates are formatted as PDFs and dated the Monday of each week. The e-news consist of 8–10 pages with 3–4 photos, a weekly ornamental plant of the week, event calendars, links to landscape horticulture news articles and 2–3 ornamental horticulture timely topics. The LSU AgCenter trial garden report from the Hammond Research Station is sent twice monthly via e-mail to 950 recipients. This media communication was initiated in Sept. 2011. Issues are formatted as one-page, three-columned, letter size PDFs and dated the first and fifteenth of each month. 2–3 photos are included in each issue and along with 3–4 short plant trial related items. The ornamental horticulture e-news update and the LSU AgCenter trial garden reports are archived on the Louisiana Nursery and Landscape Association website (www.lnla.org). These media efforts result in 436,000 primary clientele contacts annually.

Teaching and Demonstration of Urban Nano Farm Techniques

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Consumers are displaying greater awareness and concern where and how their fruits and vegetables are grown. The demand for locally grown produce is increasing. More consumers want to grow at least a portion of their families food needs. This creates a problem as our society becomes more urban with less room for vegetable gardens. The term urban nano farming describes being able to grow more fresh vegetables on increasingly smaller footprints of available land. Growing vegetables in containers may be the choice especially for apartment and condo dwellers.
Container growing saves space and actually can increase the planting density. Traditional-style containers are a natural choice, but sub-irrigated containers are a much better choice. Irrigation systems to precisely control water usage are readily available. Pest control and fertilization are more easily monitored and controlled based on the homeowner’s preferences for synthetic or organic sources. Most seed companies are offering varieties that are more suitable for urban nano farming in containers with plants having smaller stature and full-sized fruits.

Twitter for the Extension Specialist
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Twitter is a poplar micro-blogging social network that has gained acceptance among many Extension personnel. Twitter posts, called “tweets,” are allowed to be 140 characters long and can contain photos as well. One can “follow” other Twitter users and interact with them. Tools to measure Twitter metrics, such as TweetReach, are also available and can help establish the value of using the social network. Twitter as a tool can be viewed in many different ways—as an information network, a newsfeed, a communication tool, and to some, a distraction. Research has shown Twitter users as falling into five different categories: Idea starter, Amplifier, Curator, Commentator, and Viewer. Users often employ multiple styles to deliver information to the appropriate audience. If prudently used as a way to learn and convey information, Twitter can be an extremely vital tool for Extension specialists to keep up-to-date on the latest news in agriculture. Being involved in new technological advances is important for Extension specialists to stay relevant to an ever-changing clientele base.

Integrating Teaching, Research and Community Outreach Using Coastal Roots Nursery Program
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The Coastal Roots Nursery Program is a school-based environmental stewardship program teaching 1st–12th graders about science and the coastal environment since 2000. This project has three goals: 1) conduct an ongoing school-based nursery program growing native plants; 2) involve students in a hands-on habitat restoration planting; 3) engage teachers and students with information on critical coastal environmental issues such as ecological stewardship, wetland functions and values, wetland erosion, habitat restoration and conservation, while learning basic geologic and horticulture concepts and skills. Each participating school has a planting partner where coastal plants are needed. Over 85,000 trees have been grown and planted by more than 10,000 students in more than 50 different schools. There have been over 223 sponsored planting trips since the inception of the Coastal Roots Program. Biannual teacher workshops help develop plant nursery skills, classroom lesson plans, learn current coastal issues, environmental impacts of economic development, wildlife and plant ecosystems, fishery issues, global warming, ethical and political issues. Teachers leave the workshops with provided crop seed and educational materials to integrate into their classroom curriculum. Three graduate students have earned a Master’s of Science or Arts from LSU using Coastal Roots as a model. Over 12 academic papers have been published in academic journals and at least two handbooks have been published by the LSU Sea Grant. Undergraduate, Master’s and Ph.D. students participate in community service projects and educational outreach programs. Schools have been recognized nationally for their nursery and coastal stewardship activities. Local, regional and national presentations and workshops have been presented to audiences sharing information learned in this program. Program Partners are an integral part of our success. Integrating teaching, research, and community outreach has been the key to the success of this program.

Using Electronic Newsletters to Communicate with the School Garden Community.
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Communication with the school garden community is vital to the success and sustainability of individual school gardens. A newsletter titled “Veggie Bytes” is mass distributed through email to over 700 recipients ranging from school garden volunteers, teachers, Master Gardeners to county agents. This newsletter is then forwarded to many other groups including Master Gardeners in surrounding states and Farm Bureau agencies. Veggie Bytes is a quarterly publication that touches on topics such as seasonal vegetable planting guides, how to harvest and prepare vegetables, educational-based garden activities, suggested garden literature and specific activities at individual school gardens around the state. The use of electronic newsletters such as Veggie Bytes is a cost effective means to communicating with county agents and clients throughout the state. Electronic communication is important for Extension specialists to communicate with a diverse and distant audience without incurring high expenses related to both travel and postage.

Floriculture, Ornamentals, and Turf Section

Finding a Fit in Floriculture: A Qualitative Study on Why Graduate Students Struggle to Find Floriculture as a Career Path
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Solutions (30 cuttings per treatment), inserted into Sunshine 2012, received a 1-s basal quick-dip in one of the 10 auxin (star jasmine) were prepared in July. 3.5-inch) cuttings of privet), single-node (1-inch) cuttings of Rosa ‘Red Cascade’ (rose), and subterminal (2-node, 2.75-inch) cuttings of Trachelospermum jasminoides (star jasmine) were prepared using these two products at five rates of IBA: 500, 1000, 1500, 2000, and 3000 ppm. Subterminal (3-node, 3.5-inch) cuttings of Ligustrum japonicum ‘Texanum’ (Texas privet), single-node (1-inch) cuttings of Rosa ‘Red Cascade’ (rose), and subterminal (2-node, 2.75-inch) cuttings of Trachelospermum jasminoides (star jasmine) were prepared in July 2012, received a 1-s basal quick-dip in one of the 10 auxin solutions (30 cuttings per treatment), inserted into Sunshine Redi-Earth Professional Growing Mix in 50-cell plug trays, and rooted in a greenhouse under intermittent mist for 6 to 7 weeks. Upon harvest, cuttings of Texas privet exhibited no significant difference in number of roots or total root length between the two products or among the different rates of IBA. Cuttings of rose exhibited no significant difference in number of roots and a marginally significant increase in total root length using the Hortus product compared with technical grade K-IBA; number of roots and total root length showed highly significant and marginal increases, respectively, with increasing rate of IBA with both products. Cuttings of star jasmine exhibited no significant differences in number of roots or total root length between the two products, but significant increases with increasing rate of IBA with both products. Results indicate similar rooting results can be obtained using technical grade K-IBA and Hortus Water Soluble Salts at the same rates of IBA.

**Alternative Irrigation Sources for Urban Landscape Water Conservation**

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The production and landscape maintenance of ornamental plants is characterized the use of massive inputs of water, fertilizers, chemicals and labor. Dwindling water supplies, severe droughts, water competition and pollution concerns significantly challenges the future of these activities. In Texas there are some 135,000 and 1.4 million acres of irrigated golf courses and managed landscapes/lawns, respectively, which together account for about 21% of the total projected annual water demand by all activities in this state in 2010. The recent 2012 State Water Plan addresses the need for additional water supplies in the next decades, and calls for significant efforts in urban and agricultural irrigation water conservation and other management strategies that include the use of alternative irrigation sources, such as reclaimed water, rainwater and desalinized waters, which are projected to provide ~38% of the additional water needs for the next 50 years. Regarding landscape irrigation, in addition to conservation practices using drought-tolerant plants materials and efficient irrigation technologies and management practices, the increased use of reclaimed water and graywater offers the most potential. The supply of these water sources is considered more reliable and not as affected by rainfall and drought patterns. Reclaimed and gray waters, however, can be subject to wide fluctuations in water quality parameters, including total salt content and potential specific ion toxicities, and thus will require systematic monitoring to adjust irrigation management practices and programs.

**Landscape Performance of Caladiums in Full Sun in Southern Louisiana**

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Graduate student enrollment in specialized fields of agriculture, like floriculture, continues to remain low nationally. To investigate the phenomena of low enrollment and to develop better recruitment strategies, a qualitative study utilizing in-depth interviews was conducted with six graduate students enrolled in these specialized areas at two land grant institutions, one in the mid west and one in the southeast. The objectives that guided this study were to 1) determine what factors influenced graduate students to enter a specialty academic program of agriculture like floriculture and 2) determine what barriers exist for graduate students to enter these specialty programs of agriculture. Interview transcripts were analyzed utilizing Glazer’s Constant Comparative Method. Themes identified as influential in the decision making process of graduate students included inspiring undergraduate courses, personal interactions with faculty, and testimonials from alumni. Barriers to entering these specialized programs included the desire for more information to be available online about careers and the industry, the lack of visible recruitment in all areas of the country, and student difficulty finding floriculture programs. Implications for recruitment efforts include the need for a national recruitment model, increased visibility of the industry both online and on campuses, the need for faculty and alumni to be involved in recruitment efforts, and a need to increase the availability of introductory courses for non-majors in specialized academic programs like floriculture.
Caladiums are known for shade tolerance and have provided color to the long summer season in the South. Many new varieties released from UFL caladium breeding program and Florida growers in the last ten years are sun tolerant or adaptive to full sun. However, Louisiana landscape professionals are reluctant to use caladiums in full sun because of a lack of information on their performance under full sun in Southern Louisiana. Two trials were conducted at the Hammond Research Station, 35 varieties in 2011 and 55 varieties in 2012, to evaluate their emergence earliness, sun damage, and overall visual quality under full sun and compared to partial shade. Changes in plant size, leaf size, number of leaves, and foliage color under full sun vs. shade were also compared. Top performing varieties were selected for each leaf type x color class: Fire Chief and Hearts Delight for fancy-leaf red, Moonlight and White Cap for fancy-leaf white, Carolyn Whorton and White Queen for fancy-leaf pink, Celebration, Tapestry, and Creamsickle for fancy-leaf multicolor; Lance Whorton and Red Ruffle for lance-leaf red, Mt. Everest, White Diamond, White Dynasty, White Marble, White Pearl, and White Ruffles for lance-leaf white, Florida Sweetheart and Cherry Tart for lance-leaf pink, and Candyland for lance-leaf multi. Best-in-class varieties were also selected for partial shade. Results were communicated with the industry through LSU AgCenter Lawn and Garden web site and field day handouts. The full sun trial will be repeated in 2013. Currently, growers and landscape professionals from South Louisiana and surrounding region are using our recommendations to choose caladiums for their production or customers.

Effects of Topflor G on KnockOut Rose Growth in Container Production
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KnockOut rose is a popular landscape shrub rose and a major nursery crop in Louisiana. It needs several sheering during production to have dense foliage and abundant flower buds. Growers are interested in using PGRs to reduce pruning, improve plant quality, or manage crop scheduling. Topflor G (flurprimidol, SePRO) is the first granular type II growth retardant and has shown size reduction effects in some crops. The first experiment was conducted in early spring 2011 on Knock Out Red at a local nursery. Plants were treated with Topflor G 5 weeks after potting from 4-inch liners to KO pots, at 0, 3.5, 5.25, and 7 g per 3-gal KO pots. No differences were found for plant growth (increased height and increased width) among treatments by 6 weeks after treatment (WAT). Large variation in growth response was observed among plants within each treatment. In spring 2012, three groups of plants: Knock Out Red 4-inch liners, Knock Out Double Red 4-inch liners, or quart liners, were potted into KO pots and treated with Topflor G at 0, 7, 14, and 28 g/pot at 4 weeks after potting. Growth and number of flowers were recorded at 2, 4, and 6 WAT. Interactions were not found between group and PGR rate, but significant among Group and Sample date. Analyses for each group found no PGR treatment effects in Knock Out Red. All three rates resulted in less height growth in Knock Out Double Red compared to the untreated, but no effect on width growth. Percentage of growth reduction was smaller for Double Red quart liner than 4” liner. Double Red (quart) treated at 7 and 14 g/pot had more flowers than the untreated control at 4 and 6 weeks after treatments. These results suggest that vigorously grown variety such Double Red responses better than weaker variety. However, plant response is not uniform enough for the growers to change from hand pruning to this PGR. Further research is needed to identify key factors affecting plant response and improve uniformity.

Determining the Carbon Footprint of a Field-grown Colorado Blue Spruce Tree Using Life Cycle Assessment
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The carbon footprint of production system components of a field-grown, 2-m-tall, 5-cm-caliper, Picea pungens (Colorado blue spruce) in the Upper Midwest (liner) and Lower Midwest (finished tree) U.S. was analyzed using life cycle assessment protocols. The carbon footprint is a measure of the global warming potential of a product and the seed-to-landscape carbon footprint of this tree was calculated to be 13.558 kg carbon dioxide equivalent (CO₂e), including sequestration of 9.14 kg CO₂e during production. Equipment use would be the dominant contributor to the carbon footprint of production in the defined model system. Seventy-six percent of CO₂e emissions associated with field production would occur at harvest. Querying the model revealed that adding one year to the assumed 5-year field production phase would add less than 3% to the seed-to-landscape carbon footprint of the product. The weighted positive impact of carbon sequestration during a 50-year life would be -593 kg CO₂. Take down and disposal after the tree’s useful life would result in greenhouse gas emissions of 148 kg CO₂e; therefore, the positive life-cycle impact on atmospheric greenhouse gases would be approximately -431 kg CO₂e.

Response of Herbaceous Perennials to Growth Retardants Applied at Different Developmental Stages When Grown under Night-interrupted Lighting Outdoors in the Southern United States
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A study was conducted in 2004 and 2005 to determine how Coreopsis grandiflora ‘Early Sunrise’ and Rudbeckia fulgida ‘Goldsturm’ responded to two plant growth retardants (PGR) applied at three stages of plant development (SOD) when plants were exposed to night-interrupted lighting (NIL) while grown outdoors under nursery conditions in the southern U.S.
Plant growth retardants treatments were 5000 ppm B-Nine or 20 ppm Sumagic applied at the beginning of a period of rapid shoot elongation (SOD 2) and 2 weeks before (SOD 1) or 2 weeks after (SOD 3) SOD 2. B-Nine was applied three times to ‘Goldsturm’ at 7- to 14-day intervals beginning at each SOD. Otherwise, the PGRs were only applied once to each cultivar at each SOD. ‘Early Sunrise’ and ‘Goldsturm’ were taller at 6 or 8 weeks, respectively, after first PGR treatment in all plants receiving NIL when compared to those receiving natural photoperiods. However, vegetative height was suppressed by B-Nine and Sumagic application when compared to NIL only. Applying either PGR at SOD 2 was more effective in suppressing vegetative height of ‘Early Sunrise’ and ‘Goldsturm’ when compared to SOD 1 or SOD 3. There was no PGR difference in plant height at first flower for ‘Early Sunrise’, but there was a difference for ‘Goldsturm’. ‘Early Sunrise’ and ‘Goldsturm’ were shortest at first flower when PGRs were applied at SOD 2 for ‘Early Sunrise’ and at SOD 3 for ‘Goldsturm’, and these treatments were not different in height from those under the natural photoperiod. All NIL treated plants flowered earlier than those under NP. B-Nine delayed flowering by 6 days in ‘Early Sunrise’ and ‘Goldsturm’ when compared to NIL. Sumagic delayed flowering by 3 days in ‘Early Sunrise’ when compared to NIL, but there was no delay in ‘Goldsturm’.

Gas Exchange and Growth of Two Field Grown Oak Species in Response to Post Establishment Applied Organic Mulch and Drought

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Under limited irrigation conditions, organic mulch is thought to provide many benefits to urban landscapes. However, limited research has been conducted to determine if organic mulch placed below established landscape trees provides desired benefits. Under non-irrigated conditions, our research objective was to compare gas exchange and growth of established oak trees which had, and which did not have organic mulch placed on the soil surface surrounding each tree. Containerized trees were planted in 2002. English oak (Quercus robur L.) and chinquapin oak (Q. muehlenbergii Engelm.) trees were grown for 8 years prior to application of organic mulch. In Fall 2009 three trees of each species were randomly assigned a mulch treatment: no mulch (2.4-m diameter area around tree kept weed free), or mulch (2.4 m diameter area around each tree covered with 10 cm of cypress bark mulch). From Fall of 2009 through Fall of 2011 trees received weekly irrigation. Beginning 1 Jan. 2012, trees were not irrigated. Below a mulch and a non-mulch tree soil moisture and temperature sensors were placed 2.54 cm below the soil surface. Six times throughout the 2012 growing season, mid-day gas exchange data were measured with a Li-Cor 6400. At the end of the growing season, shoot growth, leaf area, and fruit weight were measured. All data were exposed to ANOVA. When significant treatment differences were observed, means were separated by Fisher’s Least Significance Difference procedure. Throughout the growing season, soil sensor data indicate soil under mulch was cooler, had greater soil moisture, and less extreme fluctuation extremes when compared to soil under non-mulched trees. Gas exchange means indicate no differences between mulch and non-mulched trees. Shoot growth for each species was greater for mulch trees when compared to non-mulch trees. Leaf area for non-mulch chinquapin oak was greater when compared to leaf area for mulched chinquapin oak trees. However, leaf area for mulched English oak trees was greater when compared to leaf area for non-mulched English oak trees. Fruit weight was similar for chinquapin trees, while fruit weight for non-mulched English oak trees was greater when compared to fruit weight for mulched English oak trees. Our data suggest further research is required to determine benefits of organic mulch placed under established oak trees under non-irrigated conditions.

Landscape Evaluation of Acalypha (Copper Plant) Cultivars

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Copper plants (Acalypha wilkesiana and similar species) are popular semi-tropical plants for the summer and fall landscapes with home gardeners in Louisiana. These are considered long time “pass around” plants with popular cultivars such as ‘Louisiana Red’ and ‘Opelousas Red’. There are as many as 40–50 cultivars on the market but these are not generally grown in large numbers by nursery growers in Louisiana and the neighboring states. Plants are grown for the single, bicolored and tricolored foliage patterns of green, yellow, reddish, bronze and similar shades. Since 2011, the LSU AgCenter’s Hammond Research Station, Hammond, LA has evaluated landscape performance of 24 cultivars with an additional 10–15 cultivars being included in 2013. Proven Winners cultivars studied have included ‘Bourbon Street’, ‘Sizzle Scissors’, ‘Beyond Paradise’, and ‘LaBamba’. A various assortment of 16 bronze and reddish foliage cultivars have been studied. Green and yellowish foliaged cultivars have included ‘Tequila Sunrise’, ‘Kona Coast’, ‘Tahiti’, ‘Hoffmanni’, and ‘Fairy Dust’. The new collection of cultivars from Plug Connection for consideration include ‘Peach Whirl’, ‘Firestorm’, ‘Island Sunrise’, ‘Jungle Cloak’, ‘Lava Flow’, ‘Tropical Typhoon’, ‘Tahitian Halo’, and ‘Tropical Tempest’. Data collected have included time of late season flowering, degree of mutation/sporting, plant height, and plant spread. Heavy flowering (considered undesirable) was observed on ‘Jungle Dragon’ and ‘Curly Q’. Mutation was very common on ‘Swizzle Scissors’ and ‘Peach Whirl’. Taller growing copper plant cultivars are ‘Hoffmanni’, ‘Raggedy Ann’, ‘Jungle Dragon’, ‘Ceylon’, ‘Haleakala’, ‘Kona Coast’, ‘Tequila Sunrise’, ‘Curly Q’, ‘Tahiti’, ‘Opelousas Red’, and ‘Louisiana Red’.

Easy Elegance Roses—Landscape Observations on Cultivars Recommended for the South

Allen Owings*, Roger Rosendale, and Regina Bracy
Easy Elegance roses represent a group of primarily landscape shrub type cultivars marketed by Bailey Nurseries. Cultivars tested in landscape trials at the LSU AgCenter’s Hammond Research Station, Hammond, LA in 2011–12 included ‘Sweet Fragrance’, ‘My Girl’, ‘All the Rage’, ‘Sunrise Sunset’, ‘Centennial’, ‘Macy’s Pride’, and ‘Super Hero’. Plants were planted in raised landscape beds located in full sun and supplied with typical pruning, fertilization and cultural practices recommended for growing landscape roses in Louisiana. Fungicides were not applied. Replicated studies included observations of blackspot susceptibility and visual quality ratings. Blackspot ratings (based on a scale from 1–6 with 1 = 0% foliage with leaf spot, 2 = 1–10% foliage with leaf spot, 3 = 11–25% foliage with leaf spot, 4 = 26–50 foliage with leaf spot, 5 = 51–75% foliage with leaf spot and 6 = 76–100% foliage with leaf spot) were taken twice annually (mid-May, mid-October). Visual quality ratings (based on a scale form 1–5 with 1 = dead, 2 = below average, 3 = average, 4 = above average, 5 = superior) were taken April, June, August and October. Pooling data from 2011 and 2012, ‘Sweet Fragrance’ had the most significant blackspot disease presence in mid-May while ‘Sunrise Sunset’, ‘Sweet Fragrance’, ‘Macy’s Pride’, and ‘Centennial’ had the most blackspot disease in mid-October. Less than 10% of foliage on ‘Super Hero’, ‘My Girl’, and ‘All the Rage’ exhibited blackspot symptoms in mid-May. These three cultivars exhibited 10% to 25% foliage with blackspot at the mid-October evaluation. Visual quality ratings were best for ‘Super Hero’, ‘My Girl’, and ‘All the Rage’ early in the year and best for ‘Super Hero’, ‘My Girl’, ‘All the Rage’, and ‘Sunrise Sunset’ in the fall of the year.

The Gardens at the LSU AgCenter Hammond Research Station

Allen Owings*, Regina Bracey, Yan Chen, Roger Rosendale, and Joey Quebedeaux

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Landscape horticulture research and extension efforts have been the new focus of efforts at the LSU AgCenter’s Hammond Research Station, Hammond, LA over the past 8 years. Research programs and demonstration projects are conducted at the station in service to the commercial ornamental horticulture industry in the state and surrounding region. Areas and gardens at the station developed in support of these efforts have include a collection of Louisiana Live Oak Society registered southern live oaks, southern homestead planting, retention pond and constructed wetlands, fireside landscaping demonstration, pheno-ology garden, crape myrtle demonstration garden, urban forest, sun garden, shade garden, the Margie Jenkins azalea garden, an easy care rose garden, the “Hody Wilson” camellia garden, a care and maintenance area and the new piny woods garden. Much of this development has been supported with outside funding from various agencies and associations including the Louisiana Department of Agriculture and Forestry, Louisiana Nursery and Landscape Association, Louisiana Nursery and Landscape Foundation for Scholarship and Research and more. The Margie Jenkins azalea garden is named for nationally known nurserywoman Margie Jenkins, Amite, LA and includes azaleas, native shrubs, trees and companion plants. This garden debuted in 2006 and was supported by $56,000 in contributions from friends of Margie Jenkins. The “Hody” Wilson camellia garden at the station dates its beginnings to the late 1930s but has been renovated and is being used to provide educational opportunities for home gardeners. The sun garden and shade garden is the location for annual bedding plant trials, perennial evaluation and similar studies. Over 600 cultivars of warm season annuals and 300 cultivars of cool season annuals are evaluated each year in these gardens. The LSU AgCenter will be participating in the National Plant Trials Database starting in 2013.

Use of Artificial Shade for Heliconia Cut-flower Production

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Many Heliconia species native to tropical areas of Mexico, Central and South-America are commercially grown there for cut-flower production. While many heliconia species generally grow as understory plants, and occasionally in small open forest spaces, most producers in these regions typically grow them in open, non-shaded production areas with higher levels of irradiance, lower relative humidity and warmer and desiccating summer winds. In this study we are evaluating the growth performance, flower productivity and quality of three soil-grown heliconia species [H. psittacorum L.f. × H. spathocircinata Aristeguieta ‘Golden Torch Adran’ (PST); H. stricta Huber ‘Las Cruces’ (SLC) and H. stricta ‘Los Reyes’ (SLR)] under five levels of shading: 0%, 35%, 50%, 70% and 90%. After 12 months of planting our preliminary results show that the number of pseudostems produced per plant was reduced by approximately 20%, 40% and 50% in plants grown under 50%, 70% and 90%, respectively, compared to the full sun plants. On the other hand, shading increased pseudostems diameter on average by 12%; total leaf length by 24% in PST, and 40% in SLC and SLR, with most of this increment observed in the leaf sheath. As for leaf color, full sun plants had greater L* and b* (higher brightness and yellow hue), and lower a* (higher green hue) values than shaded plants. Chlorophyll index, chlorophyll fluorescence and stomatal conductance increased in shaded plants by up to 129%, 7% and 300%, respectively. Leaf adaxial temperature was reduced by incremental shading on average by 3.2 °C with a maximum temperature reduction of 14% (4.5 °C) at 90% shade. Most of these growth and physiological variables values reached a plateau between 70% and 90% shade. Flower productivity and quality parameters are currently under evaluation.
Field and GIS-based Surveys Implicate Anthropomorphic Causes for Population Losses and Decline of Georgia Plume, *Eliottia racemosa*, a Rare Endemic Tree

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Georgia plume, *Eliottia racemosa*, is a rare threatened plant endemic only to the state of Georgia. Accurate mapping, census information, and habitat descriptions are important for the development of conservation strategies of rare plants. In this study, a Geographic Information System (GIS)/Global Positioning System (GPS)-based conservation management tool was developed capable of inventorying and recording habitat conditions of Georgia plume populations. Field visits were made to 32 of 57 known recorded populations. Populations not visited by ground were evaluated using aerial photography. Census data of extant populations verified many populations have few individuals (75% contain fewer than 45 individuals; over 1/3 contained 12 or fewer individuals); over 80% of populations have an area of less than 0.3 ha. Field ground visits in conjunction with aerial photography assessments indicate that about half of previously known populations no longer exist. Potential causes for population losses and decline were assessed by relating previously described historic locations containing Georgia plume with currently inactive sites. Population losses were associated with anthropomorphic causes including land use conversion to pine plantations and agricultural cropland.

**Fruit Section**

Is it Feasible to Grow Pierce’s Disease Resistant 87% *Vitis vinifera* Grapes within the High Disease Pressure Southeastern Region?

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Three recently developed Pierce’s disease (PD) resistant 87.5% *V. vinifera* selections from the U.C.–Davis grape breeding program ‘502-10’, ‘502-01’, and ‘501-12’, were established at the Chilton Research and Extension Center (CREC) near Clanton, Alabama in 2010. The experimental vineyard utilizes a RCBD with 6 blocks and 5 vines per block, and is trained to a vertical shoot positioning trellis. The first commercial crop was produced in 2012. Our preliminary results suggest selection ‘502-10’ had the lowest pruning weight of 0.75 kg in 2012, while ‘501-12’ had the highest (1.2 kg). Selection ‘502-10’ started to mature early in the season, while ‘501-12’ initiated the veraison in mid-August and ripened late in September. The three selections differed in total yield per vine. The late maturing ‘501-12’ produced the largest crop of 5.8 kg/vine. Bird feeding caused a considerable crop loss for the early ripening ‘502-10’. Selection ‘501-12’ produced the highest number of clusters per vine – 76.8, while ‘502-10’ had 12.5 clusters. Mid-season selection ‘502-01’ had the largest cluster weight of 173 g and produced the largest berries, while the late season selection ‘501-12’ had the sweetest berries in 2012. The preliminary results for the recently developed PD resistant *V. vinifera* selections in Alabama are very encouraging. The newly introduced grapes are expected to improve the grape production sustainability in the southeastern region and enhance the agriculture and food systems by advancing the environmental and economic sustainability through implementation of advanced technologies.

**Alternative Flood Irrigation Strategies That Improve Water Conservation in Citrus Production**

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Texas citrus production is concentrated in the southern region of the Lower Rio Grande Valley (LRGV). This area is well known for its high quality horticultural crops due to the close proximity to water supplies along the Rio Grande River. Two reservoirs hold water back for irrigation and serve growers near the Rio Grande River on both sides of the U.S./Mexico border. During periods of extended drought the reservoirs become depleted to the point that water restrictions are placed on growers. However, for perennial crop producers deciding not to irrigate citrus trees is not an option for growers in South Texas if they want to maintain good tree health, make money and keep trees alive. The majority of citrus groves are irrigated using traditional flood irrigation practices. Because water is relatively cheap in the LRGV and the system was designed for flood irrigation practices that allocate a large volume of water over short periods of time, the incentive to change to a more conservative irrigation practice like drip or micro-sprinklers does not get traction among growers. The purpose of this study was to compare an alternative form of flood irrigation to traditional flood (TFd) called border flood (BFd) that channels water faster down the tree row. In this research study, water was metered to evaluate total water applied in a replicated field study comparing TFd and BFd. The water savings results observed in this research study was very similar to on-farm demonstration investigations of water use comparing TFd and BFd irrigators in the LRGV. It was found that using BFd irrigation method saved about 36%
of water compared to TFd irrigation practices. This amount is equivalent to the amount of water saved by current growers using more expensive drip and microjet sprinklers systems.

Assessing the Crop Potential and Vigor of Selected Pierce’s Disease Tolerant Bunch Grape Cultivars in North Alabama’s Environment during the Years of Vineyard Establishment

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Eleven Pierce’s disease (PD) tolerant American and French-American hybrid bunch grape cultivars including ‘Black Spanish’, ‘Blanc du Bois’, ‘Champanel’, ‘Conquistador’, ‘Cynthiana’, ‘Favorite’, ‘Lake Emerald’, ‘Stover’, ‘Villard Blanc’, ‘Seyval Blanc’, and ‘Seyval Blanc’ grafted on Coudrec 3309 rootstock (‘Seyval Blanc’/3309C) were planted at the Sand Mountain Research and Extension Center (SMREC) in Crossville, AL in 2008 to study the feasibility of growing PD tolerant hybrid bunch grape cultivars in the Alabama environment. Our results indicate that ‘Champanel’ had the most vigorous vegetative growth, while ‘Seyval Blanc’ had the weakest. ‘Stover’ had the earliest shoot development, while ‘Champanel’ and ‘Cynthiana’ had the latest. ‘Stover’ and ‘Seyval Blanc’ flowered earliest, while ‘Cynthiana’ and ‘Lake Emerald’ flowered late in the season. ‘Seyval Blanc’ and ‘Seyval Blanc’/3309C had the earliest fruit maturity, while ‘Lake Emerald’ matured late. ‘Villard Blanc’ produced the largest yield of 12.7 kg/vine and had the largest cluster weight of 287.1 g. ‘Champanel’ produced the largest berries of 4.8 g. ‘Cynthiana’ and ‘Lake Emerald’ had the highest soluble solids content (SSC) with 19.8% and 18.8%, respectively, while ‘Champanel’ had a SSC of 13.1% at harvest. ‘Blanc du Bois’ and ‘Stover’ had the highest pH of 3.58 and 3.49, respectively. There were no significant differences in titratable acidity (TA) among cultivars tested which ranged from 0.56 to 1.36 g/100 mL. ‘Villard Blanc’, ‘Cynthiana’, and ‘Black Spanish’ were the best performing cultivars combining vigorous vegetative growth, high yields, and good fruit quality at the SMREC in the two study years.

‘Osage’ Thornless Blackberry and ‘Hope’, ‘Faith’, ‘Joy’, and ‘Gratitude’ Table Grapes

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‘Osage’ is the newest thornless, erect blackberry released from the University of Arkansas blackberry breeding program. Selected in 2003 from a 2000 cross of A-1719 × A-2108, ‘Osage’ offers a complement to the popular ‘Ouachita’. ‘Osage’ ripens on average 10 June at Clarksville, AR, 5 d after ‘Natchez’ and 3 d before ‘Ouachita’. Yields have been very good in replicated trials, equal to or exceeding those of ‘Natchez’ and ‘Ouachita’. Berry size averages 5.0 g. Flavor of ‘Osage’ is a major attribute, having a lower acidity flavor and noteworthy aromatic components. ‘Osage’ has shown exceptional postharvest storage performance, comparable to better than other Arkansas cultivars. It should be valuable for shipping and local-market production. The seedless table grape cultivars Faith, Hope, Joy, and Gratitude were released to provide additional local-market options for growers. ‘Faith’ is blue, mostly neutral in flavor, has medium clusters, and excellent plant health along with early ripening (late July at Clarksville). ‘Hope’ is white (green), has a light fruity flavor, and has produced exceptional yields. It ripens on average 20 Aug. at Clarksville. Clusters are often tight to well filled and medium-large. ‘Joy’ is blue, has a very thin skin, and has an exceptional light fruity flavor. ‘Joy’ ripens on average 11 Aug. at Clarksville and has medium clusters. ‘Gratitude’ is white (green), is very crisp, and is neutral in flavor. ‘Gratitude’ has large clusters and ripens in late August. These table grapes have very good resistance to fruit cracking at maturity, a major limitation of many table grape cultivars.

Investigations to Determine the Performance of Recently Released Seedless Table Grapes and Advanced Selections from the University of Arkansas Breeding Program

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Three recently released seedless table grape cultivars, ‘Hope’, ‘Joy’, and ‘Gratitude’; two previously released cultivars, ‘Mars’ and ‘Neptune’; and eight advanced grape selections from the University of Arkansas breeding program, ‘A 2817’, ‘A 2245’, ‘A 2359’, ‘A 2467’, ‘A 2574’, ‘A 2602’, ‘A 2632’, and ‘A 2786’, were planted at the North Alabama Horticultural Research Center (NAHRC) in Cullman, AL in 2008 to study the feasibility of growing advanced table and processing grape selections in the Alabama environment. Two Pierce’s disease (PD) tolerant cultivars ‘Conquistador’ and ‘Stover’ were also included as controls. Vegetative growth, cropping potential and fruit quality of the tested cultivars and selections were evaluated during 2011 and 2012 seasons. Our results indicate that ‘Joy’ (‘A 2494’) had the most vigorous vegetative growth, while ‘A 2786’ had the least. ‘Stover’ had the earliest shoot and flower development in both seasons. Selection ‘A 2359’ had 3.5 fruiting clusters per shoot that was the highest fruiting cluster number among all the cultivars and selections. ‘Mars’ and ‘Faith’ were early ripening and early maturing, while ‘Conquistador’ started to develop late in the season. The highest yielding selections and cultivars recorded were ‘A 2574’, ‘A 2359’, ‘Neptune’, ‘A 2245’, and ‘Conquistador’ that produced 12.0 kg/vine or higher in both experimental years. Seedless table grape cultivars ‘Gratitude’...
and ‘Neptune’ had the largest cluster size of 490 g. ‘Gratitude’ and ‘A 2817’ produced the largest berries of 4.9 g. ‘A 2632’ had the highest soluble solids content, while ‘Conquistador’ had the lowest sugar concentration at harvest. Fruit pH level of all cultivars and selections ranged from 3.28 to 3.95. ‘A 2817’ had the highest number of seed traces, 3.2, while ‘Gratitude’ had the lowest number of seed traces. Our preliminary results suggest ‘Neptune’ and ‘Gratitude’ were the best performing seedless table grape cultivars in North Alabama based on their vegetative growth, cropping potential, and fruit quality.

Comparison of Population Densities of Strawberry Cultivars

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Two studies were conducted to determine the effects of planting densities on the performance of strawberry cultivars in Florida. Densities were achieved by changing in-row distances between plants (30 and 37.5 cm), which resulted on populations of 54,450 and 43,500 plants/ha, respectively. Cultivars were Strawberry Festival, Florida Radiance, and Winterstar. Data from both seasons indicated that there were significant effect of the cultivars on growth and yields but densities by itself and the interaction between cultivars and densities did not influence the response. Both densities resulted on average strawberry early and total fruit weights of 1.4 and 16.5 t/ha, respectively. Early fruit weight per plant did not vary with in-row distances, whereas total fruit weight per plant was the highest in the lowest density. Across cultivars, ‘Winterstar’ had the highest early fruit weight (2.0 t/ha), while ‘Strawberry Festival’ resulted on only 0.9 t/ha. However, seasonal production of ‘Florida Radiance’ reached 28.4 t/ha, which was 60% higher than the other two cultivars.

Influence of Late Nitrogen and Potassium Rates on Strawberry Cultivars

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The performance of strawberry cultivars under late-season nitrogen (N) and potassium (K) fertilization programs was assessed over two seasons in Florida. Cultivars were ‘Strawberry Festival’, ‘Florida Radiance’, and ‘Winterstar’. Strawberry transplants were set on early October and late-season fertilization programs consisted of drip-applied N and K rates applied from 1 Dec. to 1 Mar. of each season. All plots received the same N and K rates prior to 1 Dec. Rates of N and K were: a) 1.1 and 1.1 kg/ha; b) 1.1 and 1.4 kg/ha; c) 1.1 and 1.7 kg/ha; d) 1.4 and 1.1 kg/ha; e) 1.4 and 1.4 kg/ha; and f) 1.4 and 1.7 kg/ha. There were no significant cultivar by fertilization interactions for all studied variables. Changing N and K late-season fertilization programs did not alter plant diameter, total fruit weight, and soluble solid content from mid-December to mid-March. These results suggested that the widely-used practice of changing N:K ratios from 1:1 to 1.5 during late-season to improve strawberry fruit yield and quality was not supported by the data.

An Improved and Efficient Micropropagation System for Grapevine (Vitis sp.)

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In vitro micropropagation of grapevine cultivars (Vitis vinifera and Vitis rotundifolia) was examined on five media reported to promote shoot multiplication. Cultures were grown for 4 weeks and the number of shoots produced by each apex were counted. Grape apices developed rapidly when cultured on modified DKW medium containing 4 µM of benzyladenine (BA) for 4 weeks. The average number of shoots produced per apex was 6 to 7 for all grapevine cultivars. It was observed that this rate of shoot production continued through 3 subcultures. Whereas modified DKW medium containing 1 and 2 µM of BA and C2D medium containing 4 µM BA produced only 1 to 2 shoots in the same time period. In addition, shoot fresh weight on DKW medium at low levels of BA and on C2D with 4 µM BA was drastically decreased in all cultivars. The optimum medium for efficient micropropagation was modified DKW medium containing 4 µM of BA for all grapevine cultivars. This protocol is useful for the rapid multiplication and later embryogenesis of desirable grapevine cultivars.

‘Amoore Sweet’ and ‘Bowden’ Nectarines and ‘Souvenirs’ Peach Offer New Options for Mid-South Growers

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New nectarines ‘Amoore Sweet’ and ‘Bowden’ and yellow peach cultivar Souvenirs are three recent releases from the University of Arkansas peach and nectarine breeding program. The nectarines are siblings resulting from a 2001 cross of A-699 × A-663 and were selected in 2004. Both nectarines are clingstone, have non-melting flesh originally derived from processing peach, and were selected in 2004. Both nectarines are siblings resulting from a 2001 cross of A-699 × A-663 and were selected in 2004. Both nectarines are siblings resulting from a 2001 cross of A-699 × A-663 and were selected in 2004.

The fruit of ‘Amoore Sweet’ is clingstone, has a unique “mango-like” low-acid flavor. ‘Bowden’ is the program’s first white nectarine release, with very good flavor and standard acidity. ‘Bowden’ matures on average 4 July and ‘Amoore Sweet’ 6 July at Clarksville, AR. ‘Souvenirs’ is the program’s first yellow-flesh, fresh-market peach. It also has low-acid flavor along with 90% skin blush. The flesh type of ‘Souvenirs’ is slow melting, and fruit are very firm at maturity but soften when fully ripe. The fruit is freestone. These new releases all have bacterial spot resistance, a key attribute for production in areas of the U.S. and world where this disease is present. Chilling hours are estimated at 800 for these new cultivars.
Preliminary Results of Performance of Three Arkansas Grape Cultivars (‘Faith’, ‘Hope’, and ‘Mars’) under High Tunnel Conditions

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A study was initiated in Apr. 2011 to determine the feasibility of growing table grapes under high tunnel (HT) conditions. Root cuttings of the newly released University of Arkansas table grape cultivars ‘Hope’ and ‘Faith’ were planted along with ‘Mars’ (control) under HT and ambient conditions at Fayetteville, AR. The experimental design was completely randomized with three replications and two plants per replication at 2.44-m spacing between plants using the Geneva double curtain training system. Standard cultural practices were followed for fertilizer application and pest management. In 2012, the vines under HT conditions produced a crop and two fungicide applications were applied to prevent diseases. Vines under ambient conditions did not bear a crop. Yield per HT vine was significantly higher for ‘Hope’ (37.4 kg) than for ‘Faith’ (18.1 kg) and ‘Mars’ (5.9 kg). These preliminary results indicate high tunnels provide a highly suitable environment for table grape production by advancing production by at least one year and reducing the number of fungicide applications necessary to obtain a high quality product.

Correlating Fruit Maturity at Harvest with Fruit Quality in Peach

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Peach maturity at harvest affects fruit quality and consequently consumer preference in the market. Fruit size and red coloration of skin are the most common indicators of fruit maturity used to decide when to harvest in everyday orchard operations. These attributes do not allow for fully reliable assessment of maturity, especially in newly released varieties with extensive red skin color. Fruit firmness (FF), soluble solids concentration (SSC) and/or total acidity (TA) are better indicators of fruit maturity. Their simple and rapid assessment, however, does not provide all necessary information and requires fruit destruction. The DA meter, a newly developed portable spectrometer, has been evaluated in 10 peach cultivars grown and marketed in South Carolina over three years for its ability to determine fruit maturity (IAD) and correlate maturity index to ripening related changes in fruit quality parameters. Data revealed that few cultivars were harvested at the correct maturity and genotype influence on IAD. FF was positively correlated with maturity index, while SSC and TA showed no difference between fruit of different maturities. SSC/TA ratio, however, was negatively correlated with fruit maturity index suggesting better taste of more mature fruit having an IAD index ≤0.6, which was valued most by consumers. Feasibility of using an IAD index in everyday orchard practices to determine when to harvest will be discussed.

Effects of Irrigation Regime on Gas Exchange of Field Grown Olea europaea L.

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Commercially grown olives to produce olive oil have gained recognition as an emerging crop in Texas. Producers are looking to expand production acreage and distinguish the best suited varieties to the southern regions of the state. Limited research has been done to determine best management practices for Texas olives trees, specifically regarding irrigation regime. Established Olea europaea L. ‘Arbequina’ trees from two orchard locations (Carizzo Springs and Asherton, TX) were used for this study. The experiment was a randomized block design utilizing 3 trees in adjacent rows with 2 guard trees on either side of experimental trees. Trees within rows were exposed to one of three irrigation treatments: high (3 emitters per tree), medium (2 emitters per tree), and low (1 emitter per tree). Throughout the 2012 growing season, mid-dy Li-Cor 6400 gas exchange measurements were taken once per month (May–September). At the end of the growing season shoot growth was also measured. Gas exchange and shoot growth data were exposed to ANOVA. Fisher’s LSD was used to separate means when significant differences were observed. Pooled data from throughout the growing season indicate no differences in stomatal conductance for trees grown at the Asherton, TX orchard. However, there was a difference between the high and low irrigation treatments for trees grown in Carrizo Springs, TX. Photosynthetic rates for Asherton, TX trees were greatest for high irrigation regime trees, while rates for Carrizo Springs, TX trees were greatest for trees exposed to the medium irrigation regime. No differences were shown for either orchard with regard to transpiration rate, or water use efficiency. As expected, trees receiving the greatest amount of irrigation volume produced the greatest shoot growth at each orchard location. Our data suggests there may be an opportunity to reduce irrigation volume without compromising productivity. However, further research is needed to quantify the impact of lower irrigation levels on oil quantity and quality.

Evaluation of Freeze Protection Methods for Strawberry (Fragaria xananassa) Production in Florida

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Florida is the second largest strawberry (Fragaria xananassa) producer in the United States. Production fields are concentrated in Plant City and Dover in west-central Florida. Water resources in this area are shared between agricultural production and urbanization. During freeze protection, the standard practice is the use of sprinklers delivering water at 4.5 gal/min. This activity is highly inefficient due to the use of large volumes of water. There are alternatives to reduce water usage such as
reduced-volume sprinklers, row covers, and crop protectants. A study was conducted in the 2011–12 season to assess the effect of these techniques on strawberry growth and yield. Treatments were: a) 4.5 gal/min sprinkler heads (control), b) 3.5 gal/min sprinkler heads (1/8-inch nozzle), c) light row covers on the crop canopy (0.6 oz/yd²), d) light row covers on 1.5-ft high minitunnel hoops, e) heavy row covers on the crop canopy (0.9 oz/yd²), f) heavy row covers on 1.5-ft high minitunnel hoops, and h) crop protectant polymer (desikote Max®, 40% di-1-p-menthene). There were five freezing and near freezing nights (<34 °F) at the experimental site with a minimum air temperature of 27 °F. Row covers provided a protection between 5 to 8°F at the canopy level. Early and total marketable fruit weight were 21% and 25% higher in non-irrigation treatments with an average of 1.9 and 9.3 tons/acre respectively. These results could be due to the water damage caused to flowers and on the skin of young and mature fruit due to the impact of high velocity droplets on these plant organs.

**Chestnut Gall Wasp Susceptibility of Castanea Cultivars and Seedlings**

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Between 1995 and 2000, 28 grafted Castanea spp. cultivars and 8 OP seedling populations were planted on a Cecil loamy sand soil near Clemson, South Carolina. The design was completely randomized with 2 replications per genotype and 4–20 trees for each seedling population. The orchard was not irrigated and received no fertilizer after establishment. Weeds were controlled but no cover sprays were applied. A few trees appeared to have died from Phytophthora spp., and some genotypes died from chestnut blight (e.g., ‘Nevada’). In Summer 2004, twig galls of the oriental chestnut gall wasp (Dryocosmus kuriphilus) were found in the planting. Chemical controls and pruning were not implemented. Years 2006 and 2007 had the most infestation with galling noticeably decreasing in 2008. No galling was observed after 2009. Ratings of the number of twig galls from 0 (none) up to 5 (severe) were taken for each tree in Mar. 2009. All trees were galled except ‘Lockwood’, which was the only C. crenata cultivar planted. The next least galled cultivars were all C. mollissima (‘AU-Leader’, ‘AU-Cropper’, ‘Meiling’, ‘AU-Cropper’ seedlings), Hybrids ‘Colossal’ (C. crenata × C. sativa) and ‘Layeroka’ (C. mollissima × C. sativa) were severely galled. The gall wasp infestation began, peaked and collapsed within 6 years. Though not verified, native or introduced parasitic wasps were suspected to have been biological control agents.

**Postharvest/Plant Biotechnology Section**

**Postharvest Curing, Treatment, and Storage of Short-day Onions**

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Vidalia onions are very susceptible to storage diseases. Botrytis neck rot caused by Botrytis alli is most destructive. Controlled atmosphere storage (CAS) can be effective in controlling the disease. Curing before storage can also be helpful in reducing the risk of Botrytis neck rot. Postharvest chemical treatments can also be helpful in controlling diseases, which in turn can increase marketability. In these experiments, curing onions either in the field or with heated air helped increase marketability. Storing onions in CAS, or using SO₂, improved storability in both years of the study. Ozone improved storability in only one year. In general longer storage time decreased marketability as did increased post-storage shelf-life. Postharvest drench treatments with fungicides Luna, Pristine, or Scholar improved storability. This was particularly evident when heat curing was not used. Use of copper based compounds Kocide or Clearblue as postharvest drenches did not improve storability of onions.

**Effectiveness of Ethephon for De-greening Satsuma (Citrus unshiu)**

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Early season satsuma fruit are often at an optimum consumption stage prior to complete peel color development. Most consumers prefer a darker yellow-orange peel color. To allow for expanding the marketing season of Alabama-grown satsumas, postharvest de-greening studies were conducted to determine appropriate methods for enhancing peel coloration of green and color-breaking satsumas. Green fruit were totally green and color-breaking fruit were mostly green with slight yellowing (initial color break). Green and color-breaking satsumas were dipped in a solution of 0, 500, 750, or 1000 ppm ethephon for 30 s and stored at 90% to 95% RH and 23 °C. Each of these solutions contained either 0 or 2% chlorine (16 treatments total). A separate study was conducted to determine the effects of ethylene gas (5ppm) on peel coloration of green and color-breaking satsumas. Submersion of fruit in 750 ppm ethephon de-greened color-breaking fruit in 72 h. Ethephon treatments of 500 and 1000 ppm de-greened color-breaking fruit in 96 h. Submersion of fruit in water (control) did not reach adequate peel color in 168 h. Chlorine had no effect on de-greening process. Ethylene (5 ppm) adequately de-greened color-breaking satsumas in ≥ 120 h, compared to ≥ 240 h without ethylene. The effectiveness of ethylene and ethephon for de-greening green satsumas was
quite variable. Ethephon appears to be efficient for de-greening color-breaking satsumas.

Subjective and Quantitative Methods to Estimate Peach Fruit Browning

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Yellow fleshed peaches have traditionally been ranked by North Carolina breeders for browning of puree. The present study was done at the request of peach growers to determine the browning of new releases from the NC breeding program. A total of four white-fleshed and 18 yellow-fleshed varieties were harvested from the Sandhills and Mills River NC research stations from 5-year-old trees. Most cultivars were harvested at least twice for the study. A total of 10 fruit per selection and harvest were selected that were free of injury and near 3 kg firmness. After cutting through the suture and peeling, one-quarter of the peach was used for soluble solids and pH determination, one quarter pureed, and one quarter freeze dried. A subsample of the puree was diluted and color measured using transmission through cuvette on a Hunter Ultrascan colorimeter. Non diluted purees were ranked for degree of browning (0 to 5) after 4 h at room temperature then again after 4 d refrigeration followed by warming to room temperature. Cultivars that were evaluated 35 years ago were also included in this trial. Those that expressed little or no browning in original trials, such as ‘Candor’, had little browning in the current trial. One of the new white peach selections (NC97-25) showed almost no browning, even when left at room temperature for several days. In yellow fleshed peaches, the “b” color value was positively and linearly correlated (0.67) to brown ratings, increasing in value as browning increased. In white fleshed peaches, correlation of “b” and brown ratings increased to 0.80. Our results indicate that colorimeter values can easily and quickly be used to obtain a quantitative value for peach browning. Proanthocyanidins (flavanols) and hydroxycinnamic acids (chlorogenic and neochlorogenic) were the dominant peaks in freeze dried peach extracted with acidified methanol and run on HPLC

Anthocyanin Profile of Organically Grown Blackberries

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Total and individual anthocyanin contents in organically grown ‘Natchez’, ‘Ouachita’, and ‘Navaho’ blackberries were analyzed at shiny black (SB) and dull black (DB) ripeness stages. Total anthocyanin content was quantified as cyanidin 3-glucoside equivalents, and was highest in ‘Natchez’, followed by ‘Navaho’, and ‘Ouachita’. Anthocyanins in blackberry consist primarily of a cyanidin aglycone with various sugar attachments, and possibly peonidin or pelargonidin aglycones. Freeze dried blackberry drupelet tissue was extracted with acidified methanol and samples run using a high performance liquid chromatograph, diode array detector, and 250 × 4.6 mm Synergi HydroRP 80A column using methanol. Cyanidin-3-glucoside was the predominant anthocyanin in blackberries, representing 95%, 91%, and 90% of total anthocyanins in ‘Natchez’, ‘Ouachita’, and ‘Navaho’, respectively. Cyanidin 3-glucoside and cyanidin 3-rutinoside contents were positively correlated with total anthocyanin content. Cyanidin 3-xyloside content in ‘Navaho’ and ‘Ouachita’ was higher than in ‘Natchez’. Ripeness stage did not affect total anthocyanin content. The results indicate that organically grown ‘Natchez’, ‘Ouachita’, and ‘Navaho’ blackberries are excellent sources of cyanidin 3-glucoside, an anthocyanin considered highly effective in quenching free radicals. Since cyanidin 3-glucoside was the predominant anthocyanin in blackberries, representing 88 to 96% of total anthocyanin content, use of the pH differential method with microplate reader or spectrophotometer offers an accurate and low cost method to follow the anthocyanin profile of blackberries.

Fresh Market Muscadines: Evaluation of New Selections and Postharvest Treatments for Longer Shelf Life

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Fresh market muscadine fruit are much larger and firmer than juice type cultivars. The current recommended shelf life for fresh market muscadines is 2 weeks at 2 to 5 °C. The purpose of this work was to evaluate shelf life and quality of new selections and cultivars of muscadines adapted to North Carolina. A total of 9 bronze, 1 red, and 12 purple cultivars and selections were harvested from a 3-year-old vineyard and held from 14 to 87 d at 5 °C, evaluated weekly for market appearance. The primary loss of storage quality was softness then leak and browning. In bronze types, brown patch development was found in 42% of berries rated. This condition appears to be related to chill injury and starts as light brown discolored spots below the peel, usually after 14 to 28 d, and ultimately becoming a split. Leak, softness, scar tears, mold, and brown patch were negatively correlated with storage life. ‘Farar’, ‘Early Fry’, ‘Granny Val’ and ‘NC1006’ had good shelf life (24–36 d). Addition of 15% carbon dioxide to the storage atmosphere extended shelf life by 7 d. An overall score of 100%—sum (soft, brown patch, mold, leak) was used to
Melon cultivars with diverse genetic makeup were evaluated in normal and egusi seed phenotypes. With KP and seed size, but KP is associated with different loci. 33% of phenotypic variation in KP was localized on LG 7. The QTL associated with KP and seed size traits in normal seed were co-localized with a previously mapped locus for SOP. QTL associated with KP and seed size traits showed significant negative correlations with SOP in both egusi and normal seed types while seed size showed significant negative correlations with SOP in both egusi and normal seed types although its basis remains to be elucidated. A high correlation between kernel percentage (KP) and SOP has been observed in watermelon and other crops, and recent data also suggest association between seed size and SOP in watermelon. The aim of this study was to elucidate the relationship between SOP, KP and seed size traits in watermelon and to identify quantitative trait loci (QTL) associated with the latter traits to facilitate marker assisted selection (MAS) for traits correlated with SOP. KP showed a significant (α = 0.05) positive correlation with SOP in both egusi and normal seed types while seed size traits showed significant negative correlations with SOP. QTL associated with KP and seed size traits in normal seed were co-localized with a previously mapped locus for SOP on linkage group (LG) 2, but in egusi seed, a QTL explaining 33% of phenotypic variation in KP was localized on LG 7. The results of this study show that SOP in watermelon is correlated with KP and seed size, but KP is associated with different loci in normal and egusi seed phenotypes.

Genetic Factors Associated with Seed Oil Percentage in Watermelon
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Egusi watermelon (Citrullus lanatus subsp. mucospermus var. egusi) is known for its distinctive fleshy-pericarp seed phenotype and high seed oil percentage (SOP). The seed is part of daily diet in West Africa where it is used in soups and stews or processed for cooking oil. Genetic mapping studies have revealed that most of the variation in SOP between egusi and normal, non-egusi seed is explained by the egusi (eg) locus, which is also associated with the unique seed phenotype. However, variation in SOP is also observed within egusi and normal seed types although its basis remains to be elucidated. A high correlation between kernel percentage (KP) and SOP has been observed in watermelon and other crops, and recent data also suggest association between seed size and SOP in watermelon.

The aim of this study was to elucidate the relationship between SOP, KP and seed size traits in watermelon and to identify quantitative trait loci (QTL) associated with the latter traits to facilitate marker assisted selection (MAS) for traits correlated with SOP. KP showed a significant (α = 0.05) positive correlation with SOP in both egusi and normal seed types while seed size traits showed significant negative correlations with SOP. QTL associated with KP and seed size traits in normal seed were co-localized with a previously mapped locus for SOP on linkage group (LG) 2, but in egusi seed, a QTL explaining 33% of phenotypic variation in KP was localized on LG 7. The results of this study show that SOP in watermelon is correlated with KP and seed size, but KP is associated with different loci in normal and egusi seed phenotypes.

Vegetable Crops Section

Soil Type and Cultivar Effect on Root Growth and Stomatal Conductance of Muskmelon (Cucumis melo L.)
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Melon cultivars with diverse genetic makeup were evaluated in sandy loam (Weslaco, TX) and clay soils (Uvalde, TX) for root growth, stomatal conductance and fruit yield. Root length density (RLD, cm·cm⁻³), adaxial and abaxial stomatal conductance (mmol.m⁻².s⁻¹), and total fruit yield (TFY; t·ha⁻¹) of six melon cultivars were measured. Melons produced more RLD in clay soils (2.08 cm·cm⁻³) with an average increase of 41% as compared to sandy loam soils (1.48 cm·cm⁻³). Cultivars showed no significant differences for RLD; however, TAMU 146, TAMU OC and Journey had numerically more root growth than other cultivars. Most of the RLD (77%) was concentrated in the upper 30 cm of the soil depth indicating an effective rooting depth for subsurface drip irrigated melons. Averaged across soil types and cultivars, adaxial conductance was higher (20%) than abaxial conductance. Melons grown under sandy loam soil had 17% more abaxial conductance than clay soils, but adaxial conductance was similar in both soils. Overall, cultivars had no significant differences for adaxial as well as abaxial conductance. Clay soils produced 19% higher fruit yield (87.9 t·ha⁻¹) as compared to sandy loam soils (74.3 t·ha⁻¹). Cultivar-trait association analysis conducted by GGEbiplot showed that high yielding cultivars Journey, TAMU OC and TAMU 146 had better association with RLD however, none of these cultivars showed relationships with stomatal conductance. These results indicate that heavy textured soils are better suited for enhanced root growth and higher fruit yield in melons. The differences in stomatal conductance could be attributed to variation in vapor pressure deficit at the two locations rather than soil types.

Grafting Specialty Melons for Root-knot Nematode Management
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A recently conducted greenhouse inoculation study demonstrated the effectiveness of using Cucumis metulifer as a rootstock for inhibiting reproduction of root-knot nematode (RKN) Meloidogyne incognita race 1 in honeydew melon ‘Honey Yellow’ (Cucumis melo var. inodorus). A follow-up field experiment further assessed the RKN resistance, yield, and fruit quality of specialty melons grafted with C. metulifer. ‘Honey Yellow’ and galia melon ‘Arava’ (C. melo var. reticulatus) both susceptible to RKN were grafted onto C. metulifer and grown in organic and nonfumigated conventional fields at Citra, FL, during March–June 2012. The organic plot was naturally infested by M. javanica. Compared with non- and self-grafted plants, ‘Honey Yellow’ and ‘Arava’ grafted onto C. metulifer exhibited significantly lower gall ratings and reduced RKN population densities in the soil. However, total and marketable fruit yields were not significantly different from those of non- and self-grafted plants. There was a lack of RKN infestation in the conventional field plot where ‘Honey Yellow’ grafted onto C. metulifer showed a
significantly lower total yield compared to non-grafted plants, whereas the fruit yield of ‘Arava’ was not affected by grafting with C. metulifer. Grafting with C. metulifer decreased the flesh firmness of ‘Arava’ in both organic and conventional fields and resulted in a reduction in total soluble solids content under conventional production. In contrast, C. metulifer did not exhibit any significant impacts on the fruit quality attributes of ‘Honey Yellow’. Results demonstrated the potential of using C. metulifer for grafting specialty melons for RKN management. Although the improvement of RKN resistance did not translate into yield enhancement, the reduction in soil RKN population densities could make grafting a viable rotational tool for organic specialty melon growers. More research is needed to better understand the scion–rootstock interaction effect on fruit quality.

Effects of Cover Crops and Reduced Tillage on Yield and Weed Population in Organic Lettuce Production

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A field experiment was conducted at the Plant Science Research and Education Unit in Citra, FL to assess the effect of summer cover crops and reduced tillage on organic lettuce yield and weed suppression in fall 2012. Sunn hemp and sorghum-sudangrass were planted as a biculture in August and terminated in October 10 d prior to lettuce transplanting. Five production systems were evaluated including: 1) incorporated cover crops with raised beds and polyethylene mulch, 2) incorporated cover crops with raised beds and no polyethylene mulch, 3) no cover crops with raised beds and polyethylene mulch, 4) no cover crops with raised beds and no polyethylene mulch, and 5) reduced tillage with cover crops retained as organic mulch. The production systems were arranged in a randomized complete block design with 4 replications. Two loose leaf lettuce cultivars, ‘Tropicana’ and ‘New Red Fire’, were transplanted into the field on 1 Nov. and harvested after 7 weeks. Incorporation of cover crops did not influence lettuce yields. Overall, lettuce grown with polyethylene mulch had higher yields than in systems without polyethylene mulch. Weed density and biomass assessment results showed the effectiveness of using summer cover crops for nutsedge management. The reduced tillage system and the polyethylene mulch system with cover crop incorporation exhibited the lowest density and dry weight of nutsedges towards the end of the lettuce crop. However, by 4 weeks after transplanting, the perennial grass population was highest in the reduced tillage system, whereas broadleaf weeds became a problem in the non-mulched beds. Regrowth of sorghum-sudangrass was observed in the reduced tillage system at 2 weeks after transplanting. The results support a role for sunn hemp/sorghum-sudangrass cover crops for nutsedge control in fall-grown vegetables; however, nutrient and plant management practices need to be developed for minimizing yield loss in systems without polyethylene mulch.

Opportunities for Broccoli Production in Florida

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Most U.S. broccoli (Brassica oleracea L.) production occurs in the western U.S., however rising fuel and transportation costs may make it difficult for distribution to eastern markets to remain economically viable. This situation provides an opening in the eastern markets that Florida growers may have an opportunity. The estimated area devoted to broccoli production in Florida is less than 2,000 acres, which is located primarily in the northeast and central-south Florida. Broccoli production in northeast and central Florida occurs from August to March, while in south Florida from September to January. The objective of this study was to evaluate the yield and quality of broccoli varieties in two production regions in FL. Seven broccoli varieties: BZ 1001 and 1004 (Enza Zaden), Emerald Crown, Green Gold, Green Magic, Imperial (Sakata) and Ironman (Seminis) were tested in Felda (southwest) and Hastings (northeast). Both trials were planted on Nov. 2011 with 6-inch spacing between plants in a single row 3 ft apart with a plant population of 29,040 plants/acre. Broccoli florets were harvested manually, and weighed for marketable and unmarketable yield. Postharvest evaluation consisted of head diameter, color and density, and stalk internal cavity. Hasting produced higher yields than Felda due to higher head diameter (6–7 inches/head). In Felda, the highest marketable yield were from BZ 1001, Emerald Crown, Green Gold and Green Magic; however, head diameters were between 4.0 to 4.5 inches. The varieties with the highest color rating and head density were Imperial, BZ 1001, and Emerald Crown. In Hastings, the average broccoli yield was 10.7 ton/acre with an average weight of head of 1.12 lb. There were no differences in marketable yield and head weight among varieties. Florida has the potential to produce high broccoli yields and quality during the winter season.

Evaluation of Three Foliar Fertility Programs in Bell Pepper in North Carolina

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Soil application of fertilizers is a common and effective way to deliver plant nutrients and achieve maximum economic crop yields. However, foliar fertilization is frequently used by com-
commercial growers who view it as a potentially economical and effective method of nutrient delivery. A field study was conducted to evaluate the effectiveness of three different approaches of soil-applied fertilizer regimes with a combination of three different foliar programs on nutrient status and yield of bell peppers. Twelve different treatment combinations were arranged in a randomized complete block design with 4 replications. Preplant (PRE) treatments consisted of 100% nutrients applied prior to transplanting; Split (SP) treatments, consisted of 50% nutrient applied prior to transplanting and 50% of nutrients applied post-planting as liquid fertigation; and Liquid Fertigation (LF) treatments consisted of 100% nutrient applied post-planting, all in combinations with three different foliar application schedules. The three foliar application schedules included Foliar Program 1 (FP1), which used conventional chelated minerals, and Foliar Program 2 (FP2) and Foliar Program 3 (FP3) which used MetaALosate chelated minerals. Programs FP1 and FP2 were delivered on a calendar schedule, while FP3 was delivered based on the results of foliar tissue (leaf) nutrient analysis. Early yields from SP and LF treated plots were significantly greater than PRE while late yields were only greater for SP compared with PRE treatment combinations. Total yield (Early + Late) for SP and LF were significantly greater than PRE. Generally, the FP2 and FP3 treated plots tended to have the greatest yields when used with SP and LF compared with the non-foliar and FP1, however statistical differences were not measured. A strong linear relationship (R² = 0.90) between mean leaf N concentration at the first flowering stage and mean early yield was observed, indicating a potential means for predicting early yield in bell pepper. Regardless of the foliar application from Foliar Program 1, 2, or 3, no yield advantage was obtained.

**Poblan Pepper (Capsicum annum L.) Yield as Affected by Cultivar and Color of Plastic Film Mulch**

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Poblan pepper is widely consumed in Mexico and is of increasing popularity in the U.S., but there is limited information on this type of pepper. The objective was to determine the effects of plastic film mulch and cultivar on fruit yield. The experiment was conducted in Tifton, GA during the spring of 2011. The experiment was randomized complete block with a split plot arrangement. Whole-plot was plastic film mulch (black or silver reflective) and split-plot was cultivar (‘Ancho’, ‘Don Emilio’, ‘Don Mattias’, ‘Masivo’, ‘San Ardo’, ‘Tiburon’). Plants were planted on 13 Apr. and were grown on raised beds and drip irrigation, following the UGA extension recommendations for bell pepper. Plants were harvested eight times from 22 June (71 DAT) to 16 Nov. (218 DAT). ‘San Ardo’ had highest marketable yield, while ‘Ancho’ produced the lowest marketable yield, largest number of marketable fruit, and the smallest fruit size. ‘Masivo’ had the fewest number of marketable fruit. Mulch color had no effect on number of fruit, fruit marketable yield or individual fruit weight. Black mulch had higher percentage of marketable fruit than silver mulch. Fruit production rate and individual fruit weight decreased quadratically with increased mean air temperature for the period of 30 d before harvest. Optimal air temperature for fruit production was 17.0 °C for the period of 30 d before harvest.

**Microgreens: Specialty Crop for the Local Food Market**

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The increased consumer interest in locally grown foods has resulted in local producers expanding the variety of vegetables being grown for the market. A crop group that is gaining attention are microgreens. Microgreens are a high value crop composed of various cruciferous vegetables, Asian greens, and herbs that are harvested 10 to 25 d after germination. These are adaptable to different growing strategies, from nutrient culture to production in soilless media in trays or containers. Consumers are interested in the increased levels of vitamins and carotenoids compared to the full grown plant. Their colors and sharp flavors make them an attractive crop for restaurant sales and useful in commercial cuisine. Microgreen production has the potential to be a 12-month product which is a highly desirable characteristic for local food producers to maintain market visibility.

**Effects of In-Row Distances on Bell Pepper (Capsicum annum) Cultivars under High Tunnels in Florida**

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Two studies were conducted to assess the effect of in-row distances on the growth and yield of determinate and indeterminate bell pepper cultivars under high tunnels. In-row distances were 20, 25, and 30 cm with rows separated 1.50 m apart, resulting on densities of 14,520, 11,616, and 9,680 plants/ha. Determinate cultivars were ‘Crusader’ and ‘Lafayette’, while ‘Maria’ was indeterminate. Determine cultivars were planted in two successive seasons (9-month total), which were compared to one 9-month season of the indeterminate cultivar. Results showed that ‘Maria’ had the highest fruit number per plant and per acre but the lowest fruit weight per fruit in comparison to the other two cultivars. There were no significant in-row distance by cultivar interactions for marketable fruit number and weight. However, as in-row distances increase there was a significant decrease on these two variables. Marketable fruit weight averaged 27% more in rows with plants separated 20 cm apart than in the standard 30-cm between-plants treatment. Planting two
Three-year field trials were initiated in 2012 in the southern breeding project, also performed well in this study. Developed by Oregon State University through a participatory process, the varieties to test and did the final evaluations. To date, the Carolina additional funding permitted the addition of an organic participatory variety screening project. Organic farmers chose the varieties to test and did the final evaluations. To date, the Eastern Broccoli Project trials have helped identify breeding lines or varieties planted at five times. The Phase III trials will start in 2013 with large on-farm trials of three varieties. In North Carolina additional funding permitted the addition of an organic participatory variety screening project. Organic farmers chose the varieties to test and did the final evaluations. To date, the Eastern Broccoli Project trials have helped identify breeding lines and existing varieties that perform well in individual locations as well as across a wide geographic range and conditions.

The majority of broccoli consumed in the U.S. is grown in California and Arizona. Rising costs of transportation and a strong local food movement present an opportunity for east coast farmers to produce broccoli. Most available broccoli varieties were developed for growing conditions in the western part of the country. The Eastern Broccoli Project, a multi-state effort led by Cornell University, is working with private and public breeders to develop and test varieties in five states from Maine to South Carolina. The North Carolina trials are being conducted in the mountains in the western part of the state. The Phase I trials were started in 2011, with over 30 varieties and advanced lines planted twice each year, targeting an optimum time and heat-stressful time. The Phase II trials were started in 2012 with 12 breeding lines or varieties planted at five times. The Phase III trials will start in 2013 with large on-farm trials of three varieties. In North Carolina additional funding permitted the addition of an organic participatory variety screening project. Organic farmers chose the varieties to test and did the final evaluations. To date, the Eastern Broccoli Project trials have helped identify breeding lines and existing varieties that perform well in individual locations as well as across a wide geographic range and conditions.

Data are being collected on growth stage, plant vigor, plant height, flowering date, number of flowers, and top and root dry weight. After one season of growth, the E. purpurea plants at Mills River were more vigorous and had larger top dry weights than their counterparts at Reidsville. Flower numbers and root weights for E. purpurea, however, were similar between the two locations. This may indicate that plant vigor and large top weights are not necessarily a predictor for increased root production in E. purpurea. In contrast, the top and root dry weights for E. angustifolia were similar between the two locations, but the Mills River E. angustifolia produced more flowers than those at Reidsville. Some differences were noted among the seed sources, in particular, vigor and top dry weight for both species. This will be an issue for the industry when sourcing seed. The location differences are most likely due to the variations in climate, soil type, and fertility which will be examined as these studies continue.

Yield, fruit count, and nutrient assimilation of Beit Alpha cucumber (Cucumis sativa ‘Manar’) was compared between plants grown with conventional hydroponic fertilizer and aquaculture effluent. Aquaculture effluent was from a 100-m³ biofloc system producing Nile tilapia (Oreochromis niloticus). Plants receiving the conventional hydroponic fertilizer received 30 mg/L N from Total Grow Tomato Bag Special (3–13–29) and 150 mg/L N from calcium nitrate (15.5–0–0). Plants were arranged in a completely randomized design with years as the main plots and sources as the subplots. Population studies have shown that yields and marketable heads can be increased by increasing plant populations. The organic study revealed that the researchers were more critical in their evaluations about what is marketable or not than the growers. A number of the varieties tested in the organic study produced higher yields, more marketable heads, and better tasting broccoli than did the standard variety Packman. Two open pollinated lines, developed by Oregon State University through a participatory breeding project, also performed well in this study.

Phytoremediation of Aquaculture Effluent Using Beit Alpha Cucumber Production

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Yield, fruit count, and nutrient assimilation of Beit Alpha cucumber (Cucumis sativa ‘Manar’) was compared between plants grown with conventional hydroponic fertilizer and aquaculture effluent. Aquaculture effluent was from a 100-m³ biofloc system producing Nile tilapia (Oreochromis niloticus). Plants receiving the conventional hydroponic fertilizer received 30 mg/L N from Total Grow Tomato Bag Special (3–13–29) and 150 mg/L N from calcium nitrate (15.5–0–0). Plants were arranged in a completely randomized design with years as the main plots and sources as the subplots. Population studies have shown that yields and marketable heads can be increased by increasing plant populations. The organic study revealed that the researchers were more critical in their evaluations about what is marketable or not than the growers. A number of the varieties tested in the organic study produced higher yields, more marketable heads, and better tasting broccoli than did the standard variety Packman. Two open pollinated lines, developed by Oregon State University through a participatory breeding project, also performed well in this study.

Comparing Phenotypical Variation among Echinacea purpurea and Echinacea angustifolia Varieties Grown as Medicinal Herbs in Two Environments

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Three-year field trials were initiated in 2012 in the southern mountains (Mills River) and upper piedmont (Reidsville) regions of North Carolina to determine the effects of location on six sources of Echinacea purpurea and Echinacea angustifolia (five from commercial seed companies and one from a private farm). The tops and roots of these plants are used in a wide variety of natural botanical products. At each location there are two studies, one for each species. Each study is a split plot design with years as the main plots and sources as the subplots. Data are being collected on growth stage, plant vigor, plant height, flowering date, number of flowers, and top and root dry weight. After one season of growth, the E. purpurea plants at Mills River were more vigorous and had larger top dry weights than their counterparts at Reidsville. Flower numbers and root weights for E. purpurea, however, were similar between the two locations. This may indicate that plant vigor and large top weights are not necessarily a predictor for increased root production in E. purpurea. In contrast, the top and root dry weights for E. angustifolia were similar between the two locations, but the Mills River E. angustifolia produced more flowers than those at Reidsville. Some differences were noted among the seed sources, in particular, vigor and top dry weight for both species. This will be an issue for the industry when sourcing seed. The location differences are most likely due to the variations in climate, soil type, and fertility which will be examined as these studies continue.
the hydroponic fertilizer was 61.7 mg/L. Low levels of reactive phosphorus in aquaculture effluent could be attributed to high Ca concentration (418 mg/L) and a high pH (6.7).

**Micropropagation of Artemisia annua, a Medicinal Plant with Anti-malarial and Anti-cancer Activities**

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Artemisia annua L., also known as Sweet Annie and annual wormwood, has long been recognized for its medicinal properties. It is a critical medicinal plant because it is the only commercial source of artemisinin, a potent compound used against drug-resistant malaria. In addition, Artemisia produces bioactive metabolites possessing anti-cancer, anti-inflammatory and anti-parasitic activities. Plant material is currently the only economical source of artemisinin, thus supply is reliant upon agricultural crop production. Unfortunately, farming A. annua from seeds leads to plants with a wide range of artemisinin content. Cloned plants have the potential to produce consistently high artemisinin crops, increasing yield, and facilitating predictions of artemisinin yield. With demand growing, satisfying the need for artemisinin will require propagation of improved plant material that contains consistently high artemisinin levels, leading to better utilization of land and resources. We have developed an efficient method using in vitro tissue culture that is capable of producing large numbers of shoots. Regenerated plants performed well in the greenhouse and field. High performance liquid chromatography analyses proved that tissue culture propagation methods produced uniform plants with the same high artemisinin contents as the parent plants.

**Evaluation of Pollenizer Varieties for Triploid Watermelon (Citrullus lanatus) Production in Southwestern Indiana**

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Watermelon production accounts for 48% of the total fresh market vegetable acreage planted in the state of Indiana. Additionally, it accounts for 52% of the total value for fresh market vegetables, at $29.7 million in 2012. Based on the importance and economic significance in the state, there is a need for applied research to provide practical information for producers and the industry. Various production practices could be investigated to improve and maintain productivity and profitability. Specifically the focus of this project was to evaluate timing and number of flower production for various pollenizer varieties in addition to their susceptibility to a common pathogen, anthracnose (Colletotrichum obiculare). The experiment was established (May 2012) in the field in Vincennes, IN, at the Southwest Purdue Agriculture Center. Specifically the focus of this project was to evaluate timing and number of flower production for 15 pollenizer varieties in addition to their susceptibility to a common pathogen, anthracnose. The field site was prepared by tillage, bed formation, and installation of plastic mulch and drip tape. All fertilizer was applied pre-plant in the following amounts: 350 lb (46–0–0), 100 lb (0–0–60), and 200 lb of pelletized lime. Transplants were taken to the field on 16 May 2012, and planted in the designated plots as dictated by the randomized complete-block design. Plants were irrigated as needed throughout the season and treated with insecticides as dictated by scouting reports. Accomplise and SP-5 had statistically greater number of total male flowers throughout the growing season as compared to the other varieties. Additionally, Accomplise had greater total male flowers in the first four weeks of the season as compared to all other varieties except Pollen Pro. SP-5 had greater total male flowers in the middle 4 weeks of the season. Sidekick and Accomplise had greater total male flowers as compared to 10 of the varieties evaluated in the late season. Ace had the greatest susceptibility to anthracnose having more than 37% disease. SP-5 and SP-4 being two varieties that expressed greater resistance having less disease as compared to 11 of the varieties evaluated. The experiment will be replicated in the next season to verify consistency.

**Degradable Mulches May Have a Place in Southern Vegetable Farming**

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Three mulch types were evaluated for watermelon and tomato production on raised beds with drip irrigation. Treatments included standard black polyethylene mulch, a degradable starch-based mulch similar in feel and appearance to black polyethylene, and a coated paper mulch that was thicker and somewhat more rigid than either of the other products. All were applied with a mechanical mulch layer over raised beds with a 24-inch flat top. Drip irrigation tubing was placed under the bed mulches at the time of application. Watermelon and tomato transplanted into the mulch plots and managed with standard local practices through harvest. Compared to the other two products, the paper mulch was more difficult to apply with a standard bedder/mulching machine and required some additional hand labor to secure the sides well. Paper mulch reduced or eliminated nutsedge populations in the early season. Paper mulch began to break down within 40 days of application, with starch-based mulch also showing degradation. Tomato yields were significantly higher in paper mulch
plots than in others, while watermelon yields were unaffected by mulch type. The polyethylene mulch required significant labor and effort to remove. The paper and starch mulch degraded and did not need to be removed at the end of the season. The paper mulch and starch mulch have promise in southern horticulture, but the paper may need some reformulation to improve how easy it is to work with its longevity in the field.

High Tunnel Vegetable Update from Mississippi: Crops, Fertilizers, and Production Techniques

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Mississippi now has more than 200 high tunnels scattered throughout the state. High tunnels are unheated structures for growing high value crops over an extended season. Over the last five years, researchers at Mississippi State University have studied several aspects of high tunnel production. At the Truck Crops Branch Experiment Station, south of Jackson, we have seven high tunnels. We have organic and non-organic tunnel production, centered on vegetables and cut flowers. The team has had success at extending the growing season in the spring and the fall, and growing warm season crops over winter using secondary covers. We have tested more than 20 crops in the tunnels, from beans to papayas to snap dragons, and evaluated more than 50 cultivars for high tunnel production. We have tested organic and conventional fertilizers, and are now conducting evaluations of cover crops and shade systems for tunnel production as well. The team has hosted more than 2,000 people for field days, tours and trainings. The team has created a high tunnel information website and several print-on-demand publications. We have and are hosting several high tunnel construction demonstrations around the state as well.

Sensory Attributes of Tomato and Muskmelon Fruits as Affected by Grafting

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Grafting as an effective tool for soilborne disease management has been used successfully in solanaceous and cucurbitaceous vegetable production. As more rootstocks become available, limited information is available regarding the rootstock impacts on fruit quality particularly the sensory attributes. In this study, consumer sensory analyses were preformed on tomato and muskmelon fruits from grafted plants during the spring production seasons in 2010 and 2011 in north Florida. For the grafted tomato experiment, organic heirloom tomato ‘Brandywine’ (2010 and 2011) and ‘Flame’ (2011) were grafted onto tomato hybrid rootstock ‘Survivor’ and interspecific tomato hybrid rootstock ‘Multifort’, respectively. Two interspecific squash hybrid rootstocks ‘Strong Tosa’ and ‘Tetsukabuto’ were used to graft ‘Athena’ cantaloupe (2010). Non-grafted and self-grafted tomato and melon plants were grown as controls. Overall appearance and acceptability, firmness, flavor, and sweetness of tomatoes and melons were assessed in the consumer sensory evaluations using a 1–9 hedonic scale. In 2010 (75 panelists), fruit from ‘Brandywine’ grafted onto ‘Survivor’ received significantly lower ratings in appearance, acceptability, and flavor than fruit from non-grafted ‘Brandywine’, while grafting with ‘Multifort’ resulted in a significant decrease in acceptability and flavor. The rootstock effect was not detected in 2011 with ‘Brandywine’ fruit (69 panelists); however, flavor of ‘Flame’ fruit (75 panelists) from plants grafted with ‘Survivor’ was scored significantly lower compared to non-grafted treatment. Grafting led to significantly reduced scores for acceptability, sweetness, and flavor of ‘Athena’ fruit (100 panelists). Moreover, differential rootstock effects were observed. Overall, self-grafting of scions showed much fewer effects than the use of rootstocks. Further studies are warranted to elucidate the rootstock influence on fruit ripening and consumer perceived sensory properties.

Nitrogen Rates Effects on Yields and Profitability of Tomato with Subsurface Irrigation in Florida

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Nitrogen (N) fertilizer management is considered extremely important issues by the Florida tomato industry. Currently, the “Optimum fertilization management and application” section of the Florida BMP manual includes the University of Florida, Institution of Food and Agricultural Sciences (UF/IFAS) recommendation of pre-plant 224 kg·ha⁻¹ of N plus a 13.7 kg·ha⁻¹ supplemental N application under specific conditions (post-planting). However, growers often use N fertilizer rates above the UF/IFAS recommended rate due to N losses by leaching and/or denitrification. Therefore, a partnership was created with growers, State agencies and UF/IFAS. The objectives of this study were to identify a range of N rates that would result in highest yields, acceptable postharvest quality, and maximum economical return for tomato, grown with seepage irrigation (management of a perched water table above an impermeable soil layer or hard pan) during spring season (low probability of leaching rain events). The study was conducted in spring 2007 and 2008 in Palmetto, FL with N rates ranging from 22 to 470 kg·ha⁻¹ at pre-plant as NH₄NO₃ (ammonium nitrate). Weather conditions were typical of a dry spring season in Central Florida with no leaching rain events recorded in either year. In the absence of leaching rain and frost protection (either may raise
Production in Oklahoma

Evaluation of Colored Shadecloth on Tomato
Production in Oklahoma

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Colored shadecloths have shown a potential to lengthen the growing season of many crops. This study was designed to evaluate three different colors of shadecloth on the production of tomatoes in Oklahoma. Black, red, and aluminet shadecloths were compared to a control. There was no significant difference in total production among the treatments. The control plants produced 25% more total fruit per plant than the plants grown under the black shadecloths. There was not a difference in total fruit production per plant grown under any of the shadecloths.

There was no significant difference in weight per fruit among the treatments. All colored shadecloths increased percent marketable fruit and marketable yield compared to the control. Marketable fruit grown under black shadecloth was 12.5% higher than the control. Marketable yield of tomatoes grown under black shadecloth was 9.5 percent higher than the control. This is the first year of the study and data does not support that utilization of colored shadecloth increases production of tomatoes. However, colored shadecloth does increase marketable fruit.

Nitrogen Rate Effect Using a Hybrid Controlled-release and Soluble Fertilizer Program on Tomato Production in South Florida

Luther C. Carson*, Monica Ozores-Hampton, and Kelly T. Morgan
Southwest Florida Research and Education Center, University of Florida, Immokalee, FL 34142

Florida best management practices include the use of controlled-release fertilizers (CRFs), which are soluble nutrients coated with a resin, polymer, sulfur or a hybrid of sulfur and polymer. A hybrid CRF/soluble nitrogen fertilizer (SNF) system (HS) was developed to ameliorate low soil test nitrate levels found in other CRF studies. The purpose of this study was to evaluate the effects of three CRF rates in a HS compared with two SNF rates using seepage irrigation on tomato (Solanum lycopersicum L.) yields, petiole sap nitrate (NO₃-N) content, and postharvest fruit quality. Treatments of 100, 150, and 200 lb/acre CRF plus 50 lb/acre of SNF for total N of 150 (CRF100/SNF50), 200 and 250 lb/acre were compared with IFAS (230 lb/acre) and grower standard (250 lb/acre) of SNF applied pre-plant. Tomatoes were planted on 29 Aug. 2011 using polyethylene mulch. Petiole sap NO₃-N contents were above the IFAS sufficiency range for all treatments and sample dates. Soil temperatures ranged from 59.4 to 104.2 °F and averaged 79.1 °F during the trial, which is higher than the temperature at which manufactures demonstrate N release. There were no differences in extra-large and total marketable yield at first harvest and total extra-large yield (three harvests combined) among treatments. However, total marketable yield for IFAS, CRF100/SNF50, CRF150/SNF50, and CRF200/SNF50 was greater than the grower standard, which ranged from 1.830 to 2.175 25-lb boxes/acre. Grower standards had greater firmness (less fruit deformation) than CRF200/SNF50 13 d after harvest (DAH). Treatment CRF100/SNF50 and CRF200/SNF50 had the greatest red color among

Effect of Plant Population and Pruning on Grafted Tomatoes for Open Field Production

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The use of grafted tomatoes has shown great promise as a tool to manage soil-borne disease in the absence of soil fumigation. The most appropriate cultural practices for grafted tomatoes remain unclear. This project was initiated to answer some questions regarding plant population and pruning. Experiments were conducted during the summer of 2011 and 2012. Two graft combinations, ‘FL 47’ grafted to ‘Cheong Gang’ and ‘FL 47’ grafted to ‘Shin Cheong Gang’, were compared to ungrafted ‘FL 47’ at three plant populations and were either pruned or not. Pruning consisted of removal of cotyledon suckers plus two additional suckers. Plant populations used were 8966, 7172, and 5977 plants/ha, respectively. During both years, pruning significantly reduced fruit yield in large, extra-large, and total marketable categories. Reducing plant population from 8966 to 7172 plants per hectare reduced total marketable yield in 2011 but not 2012. Reducing plant population from 8966 to 5977 plants per hectare significantly reduced tomato fruit yield in all size categories in both years. In 2011, grafting did not improve fruit yield in any category while in 2012 ‘FL 47’ grafted to ‘Cheong Gang’ increased yield of extra-large and total marketable fruit compared to un-grafted ‘FL 47’ or ‘FL 47’ grafted to ‘Shin Cheong Gang’. These data do not provide conclusive evidence for the reduction of plant population when grafted plants are used. It is also unclear whether grafted tomatoes will consistently increase yield over un-grafted tomatoes when used in open field culture.

Evaluation of Colored Shadecloth on Tomato Production in South Florida

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the treatments 13 DAH. A HS containing a significant portion of CRF plus SF allows for a reduced N application with yields similar to IFAS recommended rates.

**Improved Nutsedge (Cyperus spp.) Control on Bed Edges with Metam Potassium and Soil Surfactants**

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Gulf Coast Research and Education Center, IFAS, University of Florida, 14625 County Road 672, Wimauma, FL 33598

Soil fumigants, including metam potassium, are widely recommended to manage purple and yellow nutsedges (Cyperus rotundus and C. esculentus) in vegetable and strawberry production in Florida. Lateral movement of metam potassium is closely related to water capillarity, but when applied with a single drip tape in fumigated beds for vegetables and strawberry, two untreated strips (each 10 to 15 cm wide) on the sides of beds occur. The soil surfactant Integrate (triblock copolymer 61% and glucoethers 19%) is used to improve soil wetting. Two studies were conducted to evaluate the performance of metam potassium against nutsedge when Integrate was applied to the soil. Treatments consisted of 1) metam potassium, 2) Integrate followed by metam potassium, and 3) a non-fumigated control was added. The surfactant was applied at a rate of 9.5 L/ha (5.5% v/v) and metam potassium at 568 L/ha (5.5% v/v). Integrate was applied 1 d before the fumigant. Addition of Integrate to the soil prior to the fumigation improved nutsedge control and soil moisture at 5 inches deep. In the first study, plots treated with the soil surfactant and metam potassium had consistently between 20% and 28% less nutsedge than plots treated with metam potassium alone. In the second trial, nutsedge populations were 50%, 52%, and 39% less in plots treated with Integrate + metam potassium at 14, 21, and 28 d after treatment than in plots applied with metam potassium only.

**Methods for Controlling Soil Moisture-based Irrigation in Field-grown Vegetables**

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1N-318 Agriculture Sciences North, Department of Horticulture, University of Kentucky, Lexington, KY 40546; 2128 C.E. Barnhart Building, Department of Biosystems and Agricultural Engineering, Lexington, KY 40546

Methods for automating soil-moisture based irrigation are necessary to conduct field-based research for irrigation management. Manually operated irrigation systems rely on continuous monitoring by humans, which may increase the variability of water applications in field-settings. Two automated irrigation control systems were developed to reduce human-induced variability. One system, used two-switching tensiometers (Irrometer, Riverside, CA) to control irrigation. Using this system, researchers can set values to turn irrigation on and off, resulting in the ability to maintain a variety of soil moisture levels; allowing field plots to be maintained in narrow (–45/–40 KPa) or wide (–45/–10 KPa) ranges within the same trial. Irrigation run times were logged using state dataloggers, (Hobo U9; Onset, Cape Cod, MA) which record voltage changes corresponding to the initiation and termination of irrigation. This system has allowed researchers to maintain soil volumetric water content (±1%) of a predetermined set-point when rainfall is not present. A second system was developed using Watermark™ (Irrometer) sensors with battery-powered controllers (WEM-B; Irrometer) and irrigation timers (SVC; Hunter Irrigation, San Marcos, CA). In this system, the controller is preset to irrigate up to eight times daily; however, when soil moisture levels are greater than a predetermined set point (as measured by the Watermark™ sensors) the irrigation cycle is skipped. This method has allowed for maintenance of soil volumetric water content (±0.5% to 2%) of a predetermined set point under rain-free conditions depending on depth of measurement. Both systems provide sufficient management of water applications for field-based study of irrigation scheduling in vegetable crops and significantly less variability than manually operated irrigation treatments with similar set-points.

**Irrigation and Tillage Regime Affect Soil Compaction and Productivity of Bell Pepper (Capsicum annuum L.)**

Zheng Wang* and Timothy Coolong
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The purpose of this study was to investigate the impact of tillage regime and irrigation management in organically and conventionally managed systems on soil quality and yield of bell pepper (Capsicum annuum L.) ‘Aristotle’. The trial was arranged in a split-plot design with eight treatment combinations. Plants were grown in strip tillage and with plastic mulch under well-watered and drought conditions in organically and conventionally managed systems in 2011 and 2012 in Lexington, KY. Soil compaction, leaf water potential, and yield were determined in this trial. There were a significant interactions in soil compaction levels within and between rows in strip tillage and plasticculture systems. In-row soil compaction was less in the plasticulture plots than in strip-tiltage plots. However, between-row compaction was significantly greater in plasticulture plots at depths of 15, 20, and 30 cm compared to strip tillage plots. In addition, organically managed plots had significantly less in-row compaction than conventionally managed plots at depths up to 20 cm. Leaf water potential was measured at pre-dawn and mid-day during the growing season. There were no interactions present among any treatments for leaf water potential. In addition, there were no treatment effects for pre-dawn leaf water potential, but there were significant differences in mid-day leaf water potential between plants subjected to well-watered and drought conditions. This indicated that irrigation regime impacted plant water status, regardless of growing system. There
were no significant interactions between treatments for fruit yield. However, there were significant treatment differences in yield between well-watered and drought-stressed plants, with well-watered plants producing significantly greater yields than drought-stressed plants. Results suggested that while tillage system may impact soil quality characteristics, irrigation regime was the only treatment that significantly impacted plant water status and yield in this trial.

**Inheritance of Pericarp Thickness and Fruit Shape Traits of Consumer Interest in Capsicum annuum**

Denee K. Salazar1*, Ann M. Greene1, Lucianne B. Vilarinho1,2, and Bala Rathinasabapathi1

1Horticultural Sciences Department, University of Florida, Gainesville, FL 32611-0690; 2Universidade Federal de Roraima, Aeroporto-Boa Vista 69304220, Brazil

“Building Better Peppers” was designed as a plant breeding program where undergraduate students could explore different areas of research while focusing on the long-term goal of designing novel, commercially viable pepper cultivars. The objective of this research was to evaluate the inheritance of fruit shape and pericarp thickness in the progeny of a cross between two heirloom cultivars Round of Hungary (ROH) and Bulgarian carrot (BUC). ROH fruits had red ripe fruit color, thicker pericarp, a fluted shape and no pungency. BUC fruits had orange yellow ripe fruit color, thin pericarp, smooth shape and high pungency. Data on ripe fruit characteristics were collected from parents, F1 and F2 population plants grown in a greenhouse. The data on “fasicled” fruit shape trait of ROH fitted a two-gene model, with semidominance and pericarp thickness behaved as multigenic trait. Light microscopy of wet sections of pericarp indicated that increased pericarp thickness of ROH was more influenced by larger cell size than increased number of cell layers compared to BUC. Though the cuticular wax thickness was comparable between ROH and BUC, there were significant differences in the arrangement of cell layers below the epidermis and the distribution of chromoplasts. It appeared that the cellular structure of the F1 fruit was a delineated combination of the parental types, with the first three to four cell layers resembling BUC and the remaining cell layers resembling ROH. Additional research is in progress for selecting offspring with the goal of creating a highly nutritious pepper with excellent keeping quality and attractive fruit shapes. Funding support from the College of Agriculture and Life Sciences to B.R. and D.S. and University of Roraima to L.V. is gratefully acknowledged.

**National Sweetpotato Collaborator Group**

Sweetpotato Tip and End Rot Incidence in Response to Pathogen Inoculations and Preharvest Foliar Applications of Ethephon

Ramón Arancibia1*, Chris Clark2, Beth Stokes3, Lori Grelen1, Washington da Silva2, Richard Baird3, and Jeff Main1

1Pontotoc Ridge–Flatwoods Branch Experiment Station, North Mississippi Research and Extension Center, Mississippi State University, Pontotoc, MS 38863; 2Department of Plant Pathology and Crop Physiology, LSU AgCenter, Baton Rouge, LA 70803-1720; 3Department of Biochemistry, Molecular Biology, Entomology and Plant Pathology, Mississippi State University, Mississippi State, MS 39762

Sweetpotato tip rot is a disease/disorder with unknown etiology that has been observed in recent years. Tip rot or restricted end rot is manifested as a small sunken and irregular lesion at or close to the proximal end of the storage root that appears after 2–4 weeks in storage. The lesion is usually shallow and progresses onto the root asymmetrically, but sometimes extends into the interior of the root. Tip rot is distinct from unrestricted end rot since the later is usually deep (spans the storage root) and progresses onto the storage root symmetrically. Stress-inducing factors such as ethylene and fungal pathogens appear to be involved to some extent in predisposing and/or causing the syndrome. Several pathogenic (Fusarium spp., Diaporthe, Lasiodiplodia, Macrophomina) and non-pathogenic fungi (Fusarium spp.) have been isolated from symptomatic storage roots in Mississippi and Louisiana. Inoculation studies were conducted to determine the relationship between these isolates and tip rot or end rot development. Greenhouse and field plants were inoculated by inserting a PDB-saturated toothpick colonized with the fungus in the main stem at 1 to 2 inches above ground. Ethephon was applied 1 or 2 weeks before harvest to half of the plants. Storage roots were stored at 60 °F for 2 months and evaluated for rot incidence. Tip and end rot incidence in roots from inoculated plants varied significantly depending on isolate and ethephon application. Tip rot and proximal end rot in Mississippi varied from 0% to 64% and 0% to 46%, respectively, and rot incidence was higher in roots from ethephon-treated plants. Incidence of distal end rot was low and ranged between 0% and 8%. Tip rot and distal end rot incidence in Louisiana ranged from 0% to 33% and 0% to 48%, respectively. In contrast to Mississippi, incidence of proximal end rot was lower than distal end rot and ranged between 0% and 20%.

**End Rots, Tip Rot, and Internal Necrosis: Investigations into Cause and Resistance**

Chris Clark1*, Washington da Silva1, Ramón Arancibia2, Jeff Main2, Jonathan Schultheis3, Zvezdana Pesic-VanEsbroeck3, and Chen Jiang3

1Department of Plant Pathology & Crop Physiology, LSU AgCenter, Baton Rouge 70803-1720; 2Pontotoc Ridge–Flatwoods Branch Experiment Station, North Mississippi Research and Extension Center, Mississippi State University, Pontotoc, MS 38863; 3North Carolina State University, Department of Horticultural Science, Box 7609, 2721 Founders Drive, Raleigh, NC 27695-7609.
A complex of disorders has been observed in recent years that develop at or near the ends of sweetpotato storage roots during storage. There are four predominant syndromes: 1) distal end rot (DER) involving a dry rot progressing symmetrically from the distal end of the root and affecting the entire cross section of the root; 2) proximal end rot (PER) involving a dry rot progressing symmetrically from the proximal end of the root and affecting the entire cross section of the root; 3) tip rot (TR) which occurs at or near the proximal end of the root, develops asymmetrically, is usually restricted and shallow but sometimes extends into the interior of the root, and 4) internal necrosis (IN) which is a discoloration having dark brown margins developing within the root extending from the proximal end, often with little or no external symptoms. The cause of these disorders is not firmly established and multiple factors including exposure to ethylene, curing, and fungal pathogens may be involved to some extent in predisposing and/or causing these syndromes. This study was undertaken to assess the susceptibility of major cultivars and breeding lines of sweetpotato and measure the influence of pre-harvest application of ethephon and curing immediately after harvest on these disorders. Field tests were conducted with an early harvest and late harvest in Louisiana, Mississippi, and North Carolina. About 2 weeks prior to harvest, ethephon was applied to vines in half the plots. At harvest, two samples of roots were collected from each plot; one was cured for 5–7 days before storage and the other was placed immediately into storage at 60 °F. After 2–3 months, roots were washed and incidence of end rots and tip rot was determined. Roots were then sliced and incidence and severity of internal necrosis was recorded. Ethephon increased PER, TR, and IN. Curing reduced DER, PER, and TR but increased IN. Cultivars varied significantly for incidence of all four disorders.

**Lenticel Proliferation and Flooding Associated Soft Rot in Sweetpotato**

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¹Department of Plant Pathology and Crop Physiology, LSU AgCenter, Baton Rouge, LA 70803-1720; ²LSU AgCenter Sweet Potato Research Station, Chase, LA 71324

When sweetpotato fields are flooded shortly before harvest, catastrophic losses can occur, as has happened several times in Louisiana since 1998. There are many physiological responses that occur in sweetpotatoes in response to flooding, but the rapid soft rot that ensues destroys the storage roots. Anaerobic, soil-borne, bacteria in the genus *Clostridium* can cause soft rotting on roots in hypoxic conditions. The decay develops so rapidly in the field that it is difficult to see the point of origin, but when roots were exposed to hypoxia by submergence in water, the soft rot most often emanated from lenticels. Since proliferated lenticels have been described as points of entry into potato tubers by soft rot bacteria, this study was undertaken to examine their role in flood associated soft rotting of sweetpotato.

In submergence tests at 30 °C using roots from storage, soft rot appeared in ‘Beauregard’ in 3 to 7 d but took 6 to 10 d to appear in ‘Evangeline’. In field tests, yield loss was similar between the two cultivars under severe flooding stress, but a low incidence of soft rot occurred in ‘Beauregard’ but not in ‘Evangeline’ in mild flooding stress. Penetration of aniline blue stain into storage roots was used to estimate the incidence of lenticels open to water diffusion. Prior to submergence, 12% of lenticels of ‘Beauregard’ roots were penetrated by stain while at 2, 4, and 6 d after submergence, the incidence increased to 58%, 70%, and 93%, respectively. Storage roots from plants treated with ethephon before harvest had erumpent lenticels, suggesting lenticel proliferation. Preliminary tests in which granules of 1-methylcyclopropene (blocks ethylene binding) were applied on the soil surface immediately before flooding resulted in reduced yield loss of ‘Beauregard’ in low and moderate flood stress plots and for ‘Evangeline’ in moderate flood stress plots. Flooding stress also increased incidence of end rots on surviving roots that were cured and stored.

**Evaluation of Various Insecticides in Sweetpotato Production for Control of Wireworms in the Mid-South, 2012**

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In the mid-South several species of wireworms cause losses in sweetpotato production. The tobacco wireworm, *Conoderus vespertinus* (F.), is a significant insect pest of sweetpotato, *Ipomoea batatas* L., in Louisiana and Mississippi sweetpotato production. Adults, known as click beetles, do not feed on the crop but oviposit in the soil near the crop, weeds, or other vegetation. Larvae produce small, shallow feeding holes on the root surface from the time they enlarge until harvest. The life cycle lasts for 2–3 years. During the 2012 growing season USDA, ARS, Southern Insect Management Research Unit (SIMRU) and LSU AgCenter collaborated to evaluate six insecticides regimes for efficacy against tobacco wireworm in sweetpotato. A cage study was conducted at the SIMRU location in Stoneville, MS. Beauregard sweetpotatoes were transplanted to four row plots in the 1/8 acre field cages (14 plots per cage) and treatments were applied. Treatments were arranged in a RCB design and replicated four times. Sweetpotatoes were harvested from the two center rows of each plot. Yield, quality and insect damage were recorded and analyzed. Twenty-five US#1 sweetpotatoes per plot were chosen randomly and evaluated for insect damage after washing. Wireworm damage ranged from 8.0% to 26.00% in this study. Preplant applications of Belay 2.13 SC, Lorsban 4E, Lorsban 4E plus Admire Pro and Admire Pro resulted in significantly less damage compared to the untreated control plots. All of these treatments included a foliar layby application of Belay and the Lorsban 4E plus Admire Pro also included a weekly foliar application of a selected insecticide.
Evaluation of Selected Insecticides Regimes for Management of Sugarcane Beetle in Sweetpotato

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The sugarcane beetle, (Euetheola humilis rugiceps Burmeister) is a significant insect pest affecting sweetpotato in Louisiana. Adult sugarcane beetles feed on sweetpotato roots late during the production season. Sugarcane beetle feeding damage compromises the aesthetic quality of sweetpotato roots, often leaving them unsuitable for market. Producers currently rely on traditional labeled soil insecticides and planting date recommendations to manage this insect in commercial fields. More information is needed on monitoring techniques and chemical control options for this insect. Several insecticides currently labeled for use on sweetpotato in Louisiana were evaluated at several locations in 2011 and 2012 for their efficacy against sugarcane beetle. Preplant and layby applications of various labeled insecticides were evaluated. Treatments were arranged in a RCB design and replicated four times in all trials. Preplant and layby insecticides were applied as a band along the row center or as a broadcast application prior to rowing, to the two center rows. At harvest, 25 roots were chosen at random from the two center rows of each plot and evaluated for insect damage after washing. In 2011, sugarcane beetle damage ranged from 0% to 40.00%. In 2012, sugarcane beetle/white grub damage ranged from 6.00% to 37.00% in a trial conducted in Ville Platte, LA, with the majority of damage attributed to sugarcane beetles. The Lorsban/Admire preplant treatment followed by Belay layby resulted in 88% less damage compared to the non-treated control in the Ville Platte trial. Damage in a trial conducted in Gilbert, LA, 2012, ranged from 12.00% to 57.00%. Results at the Gilbert location were variable; however, the preplant, broadcast treatment of Belay resulted in 73% less damage than the non-treated control.

Field Survey and Detection of Sweetpotato Viruses in North Carolina

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North Carolina is the major sweetpotato producer in the U.S. Sweetpotato is prone to virus infections due to vegetative propagation that results in cultivar decline. There is limited information on the status of sweetpotato viruses in North Carolina in the last two decades. The goal of this study was to evaluate the virus infection status in sweetpotato through a field survey in North Carolina using biological, serological and molecular detection methods. Susceptible indicator plants (Ipomoea setosa) were evenly distributed in sweetpotato experimental plots at two different locations in North Carolina during the summer 2012. Naturally infected indicator plants showing virus-like symptoms were collected and brought to the greenhouse for further studies. Indicator plants (n=129) were tested for virus detection by NCM-ELISA, PCR and multiplex RT-PCR. Preliminary results suggested that potyviruses and a geminivirus were widespread in both experimental locations. Single viral infections were found in 34% of the samples and mixed viral infections were detected in 66% of the samples, with potyviruses mixed infections being the most common. Sweetpotato feathery mottle virus (SPFMV) was the most prevalent followed by Sweetpotato virus G (SPVG), Sweetpotato virus C (SPVC), Sweetpotato leaf curl virus (SPLCV), and Sweetpotato virus 2 (SPV2). This study showed the wide occurrence of the potyviruses SPFMV, SPVG, SPVC and the geminivirus SPLCV in North Carolina. Detection methods used in this study demonstrated the applicability of standardized protocols to investigate virus infection in sweetpotato production areas. Further research includes the detection of Sweetpotato chlorotic stunt virus (SPCSV) by real time RT-PCR and storage root development studies in mixed viral infections.

Evaluation of Weed Control and Sweet Potato Tolerance to Alternative Herbicides I.

D.K. Miller*, T.P. Smith, M.S. Mathews, and T. Arnold
LSU AgCenter, St. Joseph, LA

Field studies were conducted in 2012 at the Sweet Potato Research Station near Chase, LA, to evaluate weed control and crop tolerance with alternative herbicides applied in sweet potato. Treatments in study one included Zidua at 2 oz/acre, Balance Pro at 2 oz/acre, Fierce at 3 oz/acre, Prefix at 2 pt/acre, Valor at 2 oz/acre, and Corvus at 3 oz/acre, all applied PRE-transplant. Study two evaluated same treatments except Fierce and Valor were replaced with Dual Magnum and Reflex each at 1 pt/acre with all applied immediately POST-transplant. In both studies, Valor at 2 oz PRE-transplant followed by Command at 2 pt/acre immediately POST-transplant was included as a standard. Variety 07-146 was planted on 18 July on silt loam pH 5.8. Measurements included crop injury 14 and 42 d after treatment (DAT) weed control 42 d after planting (DAT), and yield. Injury was not observed in study one. Equivalent control of barnyardgrass (88% to 100%), yellow nutsedge (88% to 93%), carpetweed (100%), entire leaf morning glory (100%), spiny amaranth (67% to 97%), and goosegrass (92% to 100%) was observed for all treatments. Zidua, Corvus, and Balance Pro resulted in no greater than 58% control of cutleaf groundcherry, while other treatments controlled the weed at least 85%. Yield of U.S. no. 1 and total yield for the standard was 159 and 302 bu/acre, respectively, which was equal to Fierce (169 and 294 bu/acre) and Valor (146 and 264 bu/acre), and greater than other treatments (48 to 75 and 113 to 163 bu/acre). In study two, Balance Pro and Corvus resulted in 72% and 82% injury, respectively, 14 DAT. All other treatments, with the exception of the standard (0% injury), injured the crop 15% to 40%. At 42 DAT, injury was 73% and 85% for Balance Pro and Corvus, respectively. Zidua resulted in 30% injury while other treatments resulted in no greater than 8% and equal to that for the standard. All treatments resulted in equivalent control of barnyardgrass (85% to 100%), spiny amaranth (77% to 95%),...
Evaluation of Weed Control and Sweet Potato Tolerance to Alternative Herbicides II
D.K. Miller*, T.P. Smith, M.S. Mathews, and T. Arnold
LSU AgCenter, St. Joseph, La.

A field study was conducted in 2012 at the Sweet Potato Research Station near Chase, LA to evaluate weed control and crop tolerance with alternative herbicides applied in sweet potato. Treatments included Zidua at 2 oz/acre, Balance Pro at 2 oz/acre, Dual Magnum at 1 pt/acre, Reflex at 1 pt/acre, Prefix at 2 pt/acre, Valor at 2 oz/acre, and Corvus at 3 oz/acre, all applied 15 d POST-transplant following Valor at 1 oz PRE-transplant and Command at 1 pt/acre immediately POST-transplant. Valor at 2 oz PRE-transplant followed by Command at 2 pt/acre immediately POST-transplant was included as a standard comparison. Variety 07-146 was planted on 18 July on silt loam pH 5.8. Measurements included crop injury 28 and 42 d after treatment (DAT), weed control 42 d after planting (DAT), and yield. Corvus resulted in 83% injury, greater than all other treatments. Reflex injured the crop 8%, which was greater than all treatments (0% injury) 28 DAT. At 42 DAT, injury was 65% for Corvus and the only one to result in injury. All treatments resulted in equal control of spiny amaranth (83% to 97%), cutleaf groundcherry (55 to 92%), carpetweed (100%), entire leaf morning glory (100%), and goosegrass (87 to 100%). Control of barnyardgrass with the standard was complete, which was equal to that for Zidua (100%), Dual Magnum (93%), and Prefix (95%), and greater than other treatments (77 to 85%). Yellow nutsedge was completely controlled by Zidua, Dual Magnum, and Reflex, and control was equivalent to Balance Pro (95%) and Prefix (98%), and greater than other treatments (82% and 83%). Corvus resulted in no yield. All other treatments resulted in equal yield ranging from 132 to 247 for U.S. no. 1 and 263 to 373 for total.

Effects of S-Metolachlor Rainfall and Temperature on Sweetpotato Storage Root Development
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The herbicide S-metolachlor controls yellow nutsedge (Cyperus esculentus), annual grasses, and several broadleaf weeds in sweetpotato. However, a decline in quality storage roots is suspected with the use of this herbicide following an excessive rainfall event within 24 h after transplanting slips. Symptoms associated with quality decline are shorting or rounding of roots and malformations such as extreme root elongation (carrot-shaped). Research has not been conducted to determine the specific cause of these symptoms that render storage roots as unmarketable culls. Therefore, the objective of this study was to determine S-metolachlor effects on sweetpotato growth and storage root development under low (25/17 °C), optimum (30/22 °C) and high (35/28 °C) day/night temperatures with no-rainfall and rainfall immediately after application. The sweetpotato cultivar ‘Beauregard’ was transplanted in white polyvinyl chloride (PVC) pots (20 cm diameter × 30 cm height) filled with sandy loam soil. Five levels of S-metolachlor (0.0, 0.86, 1.72, 2.58 and 3.44 kg ha⁻¹) with and without rainfall were imposed immediately after transplanting. S-metolachlor treatments were applied POST and half of the pots were then subjected to 38 mm rainfall at 50.8 mm h⁻¹ intensity within the first 24 h. All pots were transferred into sunlit, computer-controlled plant growth chambers that were maintained at the respective temperatures and ambient carbon dioxide concentration (380 ppm) for 60 d. An evapotranspiration-based irrigation and fertigation system was used to supply nutrients and water as required at each temperature regime. Plant biomass components and quantity of storage roots were recorded at the end of the experiment. Storage root yield was highest for the optimum temperature with rainfall treatment and declined with treatments that included low and high temperatures. Plant total, shoot and root biomass yields declined with increasing concentration of S-metolachlor in all temperature treatments. Yield and quality of storage root decline were aggravated by rainfall event in all temperature regimes; 65% and 100% decline in marketable storage roots at 2.58 kg ha⁻¹ S-metolachlor concentration with and without rainfall event, respectively, when averaged across temperatures. These results can be used to improve management decisions that optimize yield under variable temperature and rainfall conditions as well as mitigate risk of injury that could be associated with the use of S-metolachlor in sweetpotato weed management systems.

Changes in the Level of Lignification/ Suberization in Sweetpotato Skin with Preharvest Defoliation and Ethephon Induced Stress Confocal Microscopy
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Sweetpotato [*Ipomoea batatas* (L.) Lam] is an important crop in the U.S. southern states, and Mississippi contributes about 15% of the country’s total production. Skinning at harvest is one of the main factors influencing postharvest losses to shrinkage (moisture loss) and diseases (wound susceptible to infections). In addition, when a root is not properly cured immediately after harvest, the skinned area becomes dark and sunken, and unappealing to consumers. The objective of this study was to determine the changes in skin lignification/suberization in response to different treatments applied before harvest. Sweetpotato Beauregard B14 was used in this study and was grown at the NMREC-Pontotoc research station. Pre-harvest treatments consisted in foliar application of ethephon, defoliation and untreated control. Storage roots were sampled directly from the field 3 and 7 d after treatment and the skinning force was measured immediately with a torquometer. The level of skin lignification/suberization was determined by confocal microscopy in the fluorescence mode. The level of skin lignifications/suberization increased with pre-harvest foliar application of ethephon as well as with defoliation when compared to roots from untreated plants.

Effect of Cultivar, Curing, and Preparation Method on Water-soluble Vitamin Content in Sweetpotatoes

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Nutritional information is increasingly becoming an important quality characteristic that consumers use to purchase food products. Sweetpotato consumption has significantly increased during the last decade, partly due to its perceived nutritional value. Several older studies have provided a general reference for the nutritional value of sweetpotatoes, including various B vitamins and vitamin C (ascorbic acid). However, it is not clear to what extent postharvest storage conditions, cultivar, and processing methods affect the B vitamins and ascorbic acid content. Significant differences were found between sweetpotato cultivars and processing methods in thiamine (vitamin B1), riboflavin (vitamin B2), pyridoxine (vitamin B6), and vitamin C content. The information generated from this research may be useful to sweetpotato breeders, marketers, agro-processors, and consumers interested in more detailed vitamin nutrition information on sweetpotatoes.

Modeling Respiration Rate of Five Varieties of Sweetpotato [*Ipomoea batatas* (L.) Lam] at Different Temperature Ranges by Applying the Mass Balance Principle

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Respiration rates of five different varieties of sweetpotato [*Ipomoea batatas* (L.) Lam], ‘Beauregard’, ‘Covington’, ‘Evangeline’, ‘Hatteras’, and ‘Carolina Rose’, were calculated applying the principle of mass balance. The sweetpotato roots used in the study were grown and stored in central North Carolina. All the roots were U.S. No 1 grade. The roots were stored in an environmentally controlled room at the following temperature ranges: 14.4–16.6, 16.7–18.8, 18.9–21.1, and 21.2–23.3 °C and 85 ± 5% relative humidity. Variables were measured every hour for a period of 10 months by a data acquisition system designed and built for this specific application. Mass balance was achieved applying the respiration equation and assuming that the substrate loss was entirely glucose. Temperature and variety significantly (*P < 0.05*) affected respiration rates calculated. Respiration rates were lower at low temperatures and increased as temperature increased. Covington had the lowest respiration rate at the 14.4–16.6 °C temperature range from the tested varieties. ‘Carolina Rose’ showed the highest susceptibility to temperature during the study. Calculating respiration rates by measuring the substrate consumed in respiration as glucose is a valid and accurate method. This method is especially suitable for commodities that can be stored for long periods, such as sweetpotatoes. Environmental conditions are a determining factor in the respiration rate of sweetpotatoes, but the genetic characteristics are the most important contributing aspect in the respiration rate of sweetpotato roots. Modeling respiration rate applying the mass balance principle in sweetpotatoes revealed differences in the respiration rate of sweetpotato varieties at different temperatures.

Evaluation of Irrigation Scheduling Regimes for Drip Irrigated Sweetpotatoes in Eastern North Carolina

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There is growing interest among North Carolina sweetpotato producers in the potential benefits of drip irrigation, but limited understanding on how to properly manage it. A study was conducted in 2011 at the Cunningham Research Station in Kinston, NC to evaluate three different soil moisture management regimes on yield of ‘Covington’ sweetpotatoes. No irrigation (Control), timer based irrigation (Timer), and “smart” irrigation (Smart) treatments were replicated five times for two planting dates (7 and 28 June). Each planting was harvested three times (approximately 13, 16, and 19 weeks after transplanting) and drip tape was laid on the surface of each irrigation row. The Timer treatment ran on a fixed schedule except during rainfall events that exceeded 0.5 inches. The Smart treatment was controlled remotely based on daily readings from soil-moisture sensors in each row. Irrigation regime did not affect root set (*P = 0.50*); however, planting date and weeks to harvest within planting date were determining factors (*P < 0.0001 and P = 0.03*, respectively). Early plants yielded 7.7 roots per hill compared to 6.5 roots per hill for late plants across all harvests and ir-
irrigation regimes. Irrigation did affect total yield ($P < 0.0001$). Plants that received no irrigation averaged 402 cwt a$^{-1}$, while the Timer and Smart treatments yielded 264 and 303 cwt a$^{-1}$, respectively. Soil-water retention curves developed during the second week of July revealed that field capacity (FC) was lower than originally estimated. Irrigation schedules were promptly adjusted, but it is likely that nutrient leaching and water stress had already adversely affected yields. Planting date and weeks to harvest within planting date also affected total yields ($P < 0.0001$ for both). Plants that were set early and harvested 16 and 19 weeks after transplant yielded more than those that were set early and harvested early. They also yielded more than the plants set later, regardless of time to harvest, probably due to receiving more heat units. Across all plantings and harvests, significantly less irrigation was applied by the Smart system compared to the Timer system. The importance of accurately characterizing soil-water holding capacity and properly scheduling planting and harvests were highlighted in this study and should be points of emphasis moving forward.

**Development of a Mechanical Undercutting System to Minimize Sweetpotato Skinning during Harvest**

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Sweetpotatoes have been an important high-value crop in Mississippi and future growth is expected. Industry growth has created the need for a continuous supply of sweetpotatoes throughout the year. Therefore, managing the harvest process and postharvest storage environment is critical to maintaining a year-round supply of quality sweetpotato roots. This has been a challenge in Mississippi and growers have been experiencing post-harvest losses due to excessive root shrinkage (weight loss) and bacterial and fungal rots. Studies indicate that 20% to 25% of sweetpotatoes are lost to moisture loss and decay during postharvest storage. This is directly related to skinning at harvest procedures that cause cuts and abrasions (skinning) to the delicate skin of the sweetpotato root. These wounds provide a way-of-entry for diseases to infect the root, as well as moisture loss that results in root shrinkage. De-vining sweetpotatoes prior to harvest is a commonly used method to halt root growth and to begin toughening the skin. This method is viable for producers using manually-assisted harvesting for the fresh market. Producers using bulk harvesting prefer to leave vines on to reduce the amount of foreign material going into storage. A new method of halting plant growth and allowing the root to cure in the ground prior to harvest is needed. The objective of this study was to design and test a mechanical root pruning blade to halt plant growth and initiate skin set prior to harvest of sweetpotatoes and to quantify the effects of undercutting sweetpotatoes on skin strength relative to de-vining. It was hypothesized that cutting the deep root of the sweetpotato plant would allow this process to begin. Therefore, two different undercutting implements were designed and fabricated. One was assembled from currently available off-the-shelf components and the other was a modified commercially available sweetpotato digger. These implements were tested in experimental plots and the skin strength was directly measured. Root skin strength was measured at 3 d and 6 d after treatment. There was a significant rainfall event on the fifth day after treatment, meaning that no comparison between the time periods can be made. One of the tested varieties responded to undercutting. Results indicated that at 3 d after treatment, undercutting had no significant effect on skin strength for both vine conditions (vine-on and de-vined). At 6 d after treatment, undercutting with the newly developed implement significantly increased skin strength for roots in which the vine had been left on. There was no difference between using the modified digger and no treatment. Additionally, there was no treatment effect on roots which were de-vined. These results indicate that in a bulk harvesting system, undercutting with the new implement will increase skin strength after the roots have cured in the ground.

**Selected Insecticides for Soil Insect Control in Sweetpotato**

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US No. 1 grade sweetpotato roots give the best economic return. To qualify for a US No. 1 grade, sweetpotatoes must be free of insect damage. However, soil borne insect pest is a major limiting factor in sweetpotato production in the southern United States where significant yield and quality effects are associated with soil borne insect damage. In an effort to control this damage, sweetpotato field experiments were conducted in the U.S. and in Guyana, South America. The objective was to evaluate selected insecticides for control of soilborne insects. The experimental design was a randomized complete block with five replicates. Treatments included methyl parathion (20.9%), phosmet (70%), chlorpyrifos (44.9%), imidacloprid (42.8%), and beta-cyfluthrin (12.7%). In Guyana, these treatments were compared with a local insecticide, fipronil (80%), commonly used by farmers. Each treatment was applied prior to planting and incorporated into the soil. After harvest, roots from each treatment plot were examined for insect feeding damage and insecticidal efficacy was determined by counting marketable roots with insect feeding scars and converting this number to a percent damage value. In the Guyana trials, fipronil provided the best results, while there was significantly less damage to sweetpotato roots harvested from plots treated with chlorpyrifos, compared to the other plots. In the U.S. trials, which excluded fipronil, there was also significantly less damage to sweetpotato roots harvested from plots treated with chlorpyrifos. No other treatment reduced soil borne insect damage below that of the control in both locations. These results verify the recommenda-
Implementing Irrigation on Small-scale Farms: An Economic Feasibility Study Using Sweet Potato Irrigation

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Economic challenges have contributed to an alarming decline in small farms, particularly in the Mississippi Delta, due to barriers that hinder them from realizing production viability and economic success. While small farms have difficulty competing with large farms in national and international markets, they can compete in local and regional food markets. This source of local food is especially critical in the Mississippi Delta, a region identified as having substantial food deserts. In order for small farms to survive, strategies are required that yield high value fruits and vegetables and enable farmers to remain economically solvent. This research was undertaken to identify potential yield improvements and economic return in small-scale vegetable production systems. We use as a case study supplemental irrigation in sweet potato (Ipomoea batatas L. Lam) production. Irrigation costs were incorporated into enterprise budgets, and potential return on investment calculated. Even very modest (10%) improvements in yield are sufficient to economically justify implementing irrigation. Improving vegetable crop productivity will benefit individual farmers by improving economic returns. It will also enhance rural communities by providing a better selection of vegetables and reduce food deserts. Implementing irrigation may be a simple tool that farmers can use to enhance their management practices and maximize profits. Access to startup capital and knowledge are still critically needed, however, to allow small, limited resource farmers access to tools and skills that will improve the output and economic return of their production systems. The results from this research will be used to develop management tools for farmers to improve access to production information and assist in making crop management and business decisions.

Internal Necrosis in ‘Covington’ Sweetpotato; Its Occurrence and Severity in the Commercial Industry and in Response to Various Chemistries

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A series of studies were conducted to understand the occurrence and causes of internal necrosis (IN) in ‘Covington’ sweetpotato. A survey was conducted for two seasons across 25 North Carolina commercial facilities in each season in order to understand the occurrence of IN in ‘Covington’ during storage. Results indicated the problem was widely spread throughout North Carolina but both incidence and severity were generally low, with some exceptions in which a few businesses were impacted by a high percentage of IN with high severity. Storage conditions (temperature and relative humidity) were monitored in commercial facilities that were surveyed and no relationship was found between the occurrence of IN and storage conditions. Internal tissue of symptomatic roots was cultured in both moisture chambers and acidified PDA medium and there was no consistency in the types of pathogens that were isolated. Laboratory studies which stored sweetpotato roots in air-tight barrels with 100 ppm ethylene did not find any relationship between ethylene gas in storage and the occurrence of IN. Field studies tested the effects of the growth regulator Prep (ethephon compound) as well as various kinds of commonly used pesticides (herbicides and insecticides) on the occurrence of IN. Besides Prep, no other pesticides induced IN. IN symptoms were rarely detected at harvest; the earliest significant incidence was found 8 days after harvest, with symptoms becoming even greater 30 days after harvest. Curing enhanced the incidence and severity of IN. Anatomical work was approached using DAPI (4’,6-diamidino-2-phenylindole) fluorescent dye to detect cell death in roots which had been applied with Prep but prior to the presence of visual IN symptoms. This approach was not successful and could be attributed to the variation in cellular structure from one root to the other, and the variation in the specific region on the root where IN occurred.

Sweetpotato Variety Development in California

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The California market for sweetpotatoes is somewhat unique compared to the rest of the U.S. by the greater amount of varieties offered. Varieties, particularly those used for market use, fall into one of four categories based on skin color and flesh characteristics. “Red yams” are sweetpotatoes with red-skin and orange flesh, and are a dominant category – annual production is about 40% to 50% of the total. Currently, ‘Diane’ is the cultivar that mainly represents the red-yam category. Introduced from the University of Maryland via the Collaborators Trial ca. 1987, it is characterized by dark-red, smooth skin with deep orange flesh. ‘Diane’ is marketed mainly in California, where red-skinned sweetpotatoes are popular and frequently command a higher price. While UC Cooperative Extension has been a participant in the National Sweetpotato Collaborators Trial since its inception and it continues to be the source for new cultivars for the industry, the emphasis on yam-types left little to evaluate for the other market classes. This is unfortunate, as both the LSU and NCSU breeding programs routinely screen a variety of new potential varieties that could have tremendous potential in the...
California market, but which were never evaluated here because they did not have a fit in the typical yam markets that dominate their respective states. This lack of variety evaluation was especially detrimental for the red yam category, and growers have continuously listed a replacement for ‘Diane’ as the number one priority in industry surveys. Thus, beginning in 2005, a separate collaborative variety evaluation trial began with LSU specifically to evaluate new varieties other than yams, called the Advanced Line Trial, or ALT. In that first year, 11 numbered lines from crosses made in 2002 and 2003 were grown in small plots in a commercial field—all were considered inferior at harvest and were dropped out of the trial. Subsequent evaluations have continued each year with greater success, with approximately 10–12 entries that are evaluated in non-replicated plots for skin color, skin texture, flesh color, shape, and general production. Promising entries are saved and reevaluated the following year before moving to replicated plots. The ALT has been an effective way to evaluate a greater number of potential new varieties for the sweetpotato market. Such collaborative projects have been beneficial for both UC and LSU while also serving the needs of the sweetpotato industry throughout the U.S.

Comparison of Light-emitting Diode, Fluorescent, and Ambient Light Treatments for Sweetpotatoes Grown in Greenhouse Conditions
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Recent advances in light-emitting diode (LED) technology have allowed this equipment to become commercially available. The current work compares LED and fluorescent supplemental lighting as well as ambient lighting for sweetpotatoes grown in greenhouse conditions during the off-season. LED technology allows the precise control of light quality, quantity and combinations thereof. Specific light combinations can be adjusted to potentially optimize specific traits like plant height and growth rate. It has also been documented that LED technology provides increased energy savings relative to conventional lighting technologies. In Louisiana, the sweetpotato virus-tested foundation programs routinely begins with in-vitro derived plants that are grown in greenhouses during winter. During this period, light can be a limiting variable to growth and development. We will describe the use of commercially available LED lighting technology with adjustable light intensity and color ratio. We will report on the performance of sweetpotato plants derived from cuttings as well as in vitro cultures. The results of these experiments can be used to develop precise lighting management strategies to optimize sweetpotato grown in greenhouses during the off-season.

Influence of Nitrogen Rates on Lateral Root Development in ‘Beauregard’ Sweetpotato Adventitious Roots
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Lateral root (LR) development is influenced by internal cues and external factors. The spatial configuration and distribution of LRs help to determine root system architecture which in turn influences the capacity of the root system to exploit soil nutrients and moisture. The overall objective of this study was to assess the relationship between LR attributes and different rates of nitrogen in the growth substrate at the onset of anomalous cambium during the critical period of storage root initiation in ‘Beauregard’ sweetpotato. In model systems, it has been shown that external nitrogen supply and internal nitrogen status directly influence LR development. In particular, high rates of nitrate supply have been shown to inhibit early LR development. We will present data on the effect of low, intermediate, and high rates of nitrogen on ‘Beauregard’ LR development during the critical storage root formation stage. This information can be used for further optimize storage root yield by identifying optimum nitrogen rates associated with desirable LR development during the critical storage root initiation stage.

Yield Response to Potassium Sidedressing in Sweetpotato under Drip Irrigation
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Sweetpotatoes require high rate of potassium fertilizer to promote storage root growth and improve yield. Potassium is applied pre-planting, but some growers apply it again later in the season with the belief that will improve storage root development and yield. We tested this hypothesis and evaluated the yield response to continuous potassium fertilization applied through drip irrigation from 20 to 70 d before harvest until harvest for 2 years. In both years standard pre-planting fertilization (40–100–250) was applied to the whole field prior to experiment set up. Beauregard (B-14) and Evangeline, and Beauregard (B-14) and 07-146 were used in 2011 and 2012 respectively. In 2011, potassium was applied 20 d before harvest. In 2012, potassium side-dressing started at 70 d after planting and the experiment was extended to three harvest times (90, 115, and 140 d after planting) to determine the effect of potassium side-dressing over time. There were no differences in yield due to potassium side-dressing for any grade in both years. These results suggest that the standard pre-harvest fertilization rate is enough to satisfy the sweetpotato potassium requirements.

Use of Confocal Microscopy to Determine Skin Characteristics and the Degree of Lignification/Suberization in Sweetpotato
Ramon A. Arancibia*, Nestor Bonilla2, Don LaBonte3, and Jeff L. Main
Skinning, or surface abrasion, is the most frequently observed blemish of sweet potato storage roots for fresh market since the root becomes visually unappealing. In addition, the skin is the first line of defense against pathogens and moisture loss where suberin/lignin content plays an important role. The root periderm is composed by the phellem or the outer cell layers (skin), phelloderm or inner cell layers and phellogen in between that generates the periderm. Since suberin/lignin is deposited in the phellem, histological studies with a confocal microscopy in the fluorescence mode were conducted to investigate the characteristics of the root’s native as well as wound periderm among varieties and during curing. Autofluorescence of the phenolic domain of suberin and/or lignin was distinctly detected in the cell walls of the phellem but not in the phelloderm. The phellem of a skinning resistant variety (L07-6R) was significantly thicker (number of lignified/suberized cell layers) than commercial varieties. This suggests that skin thickness may influence the susceptibility to skinning by resisting rupture across the phellem (tensile fracture). Similarly, separation of the phellem from the phelloderm occurs along the phellogen (shear fracture) which showed no lignification/suberization features. Therefore the phellogen appears to be the weakest plane in the periderm due to its cambial nature. Once skinning has occurred, the healing process (periderm formation and suberin/lignin deposition) differed depending on the conditions the root was kept. Curing at high humidity resulted in wound periderm formation with minimal scar tissue.

Three Years of Winter Cover Crops Effect on Soil Characteristics and Sweetpotato Production in North Mississippi

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Sweetpotato is a high value, high input crop, with an estimated production value of more than $478 million in 2010 (USDA, National Agricultural Statistics Service). Mississippi production of sweetpotato has increased from 13,000 acres, in 2000 to 22,400 acres, in 2012. Sweetpotato fields are generally left bare after mechanical harvest, allowing soil erosion and overwintering sites for insect and rodent pests in culled roots. In 2009, studies of cover crops and tillage were begun at Mississippi State University’s Pontotoc Branch Experiment Station; Pontotoc County Miss. Cover crops included brassica, legume, and grass species. In all years cover crops were destroyed by mowing then disk incorporated prior to bed formation. Soil organic matter was not different among treatments, in 2012 ranging from 1.2 to 1.7, for mustard and fallow treatments, respectively. Nitrate nitrogen varied among treatments in 2012. Nitrate nitrogen ranged from 8 to 44 ppm for the wheat and the fallow treatments, respectively, in 2012. Total marketable sweetpotato yield ranged from 497 to 1011 boxes/acre for wheat and ‘Dwarf Essex’ rape cover crops, respectively. In 2012, sweetpotato yields were comparable between cover crops and conventional tillage.

Three Years Sweetpotato Production with Winter Cover Crops and Stale Beds in North Mississippi

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Sweetpotato is a high value, high input crop, with an estimated production value of more than $478 million in 2010 (USDA, National Agricultural Statistics Service). Mississippi production of sweetpotato has increased from 13,000 acres, in 2000 to 22,400 acres, in 2012. Sweetpotato fields are generally left bare after mechanical harvest, allowing soil erosion and overwintering sites for insect and rodent pests in culled roots. In 2009, studies of cover crops and tillage were begun at Mississippi State University’s Pontotoc Branch Experiment Station; Pontotoc County Miss. Cover crops included legume and grass species and mixtures of the two species. In all years cover crops were established following the formation of fall beds by broadcast seeding and then rolling the tops of the beds. In 2011 phosphorous and potassium were applied broadcast before bed formation while nitrogen was applied in a band prior to the 2012 sweetpotato crop transplant using a liquid UAN applicator calibrated for 40 lb actual N/acre. Cover crops were destroyed using herbicides then rolling the resulting in a mulch formation. Soil organic matter was not different among treatments, in 2012 ranging from 1.5 to 1.7, for Crimson clover with ryegrass and wheat treatments, respectively. Nitrate nitrogen ranged from 4 to 12 ppm for the Crimson clover with ryegrass and the hairy vetch treatments, respectively, in 2012. Total marketable sweetpotato yield ranged from 647 to 723 boxes/acre for Crimson clover with ryegrass and wheat cover crops, respectively.

Adapting Open Source Image Processing and Analysis Components for High-throughput Root Phenotyping in Sweetpotatoes—An Example for Discriminating Storage Root Formation at the Initial Root Bulking Stage in ‘Beauregard’ Subjected to Varying Daily Light Integral Treatments

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High-throughput phenotyping of root systems represent an important tool for studying sweetpotato storage root formation response to management variables under greenhouse conditions. Such methods allow the automated or semi-automated evaluation of large quantity of samples over a period of time by means of image acquisition and analysis techniques. During the analysis phase, images of plant tissue are analyzed by applying sophisticated image analysis algorithms. Proprietary software systems are available but these are expensive and cannot be easily modified. We will describe the use of ImageJ and HTPheno, open source software applications, for the semi-automated analysis of storage root formation at the early bulking stage in ‘Beauregard’ sweetpotatoes subjected to two daily light integral treatments. ‘Beauregard’ sweetpotato cuttings were planted in sand contained in transparent pots that were covered during the treatment period. Two daily light integral environments were created by the use of fluorescent lamps and light emitting diode grow lights, respectively. We describe problems encountered during the image acquisition phase, including light reflection in pictures and pot condensation. We will present experimental results that show the ability of the open-source components to discriminate storage root formation during the initial bulking stage. These results demonstrate the potential of using properly-calibrated high-throughput phenotyping systems for studying root architecture and storage root formation in sweetpotatoes.

Diversity and Density Indices of the Pathogenic Microbial Community Present in Tip/End Rot Disease of Sweetpotato

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The objective of the 2-year study was to determine the microbial communities with emphasis on pathogenic bacteria and fungi suspected as causal agent(s) for tip/end rot disease. Using selective media, the microbes were sampled from different positions of sweetpotato roots during specific growth stages. Most commonly associated taxa associated with necrotic tissues were evaluated in growth chamber and greenhouse trials for their pathogenicity potential. Species richness and diversity values across growth stages (including storage) varied between and among bacteria and fungi. Bacillus spp., Lysobacter enzymogenes, and Paenibacillus lentimorbus accounted for more than 50% of total bacteria identifications. Average densities for the three most dominant species had twice the population values than all other bacterial isolates across all sampling periods. Identifications were confirmed for all microbes using molecular sequence data, cultural characteristics and, for bacteria, MIDI fatty acid profile comparisons. The most commonly occurring confirmed pathogenic fungi were three morphological forms of Macrophomina phaseolina, one type each of Aspergillus flavus, A. niger, A. tubingens, and A. japonicus, and six species of Fusarium. From growth chamber trials on disease-free sweetpotato tissue, two taxa, later identified as *F. oxysporum* and *F. solani*, consistently produced necrotic lesions in sweetpotato root tissue. The latter species accounted for nearly 70% of the isolates from early season samples originating from seed stock and bedding plants. Postharvest samples showed differences in relative abundance of the dominant species. *Macrophomina phaseolina* increased to an average of 6.5% in samples originating from storage, and the confirmed pathogens *F. oxysporum* and *F. solani* decreased to an average of 27% between 60 and 90 d postharvest. Diversity indices are being calculated for individual identified pathogens, benefitting growers by showing potential trends in the development of the pathogenic fungal communities within their crops. Since selective media can miss potentially important taxa, pyrosequencing (Illumina) data is being gathered from corresponding cultured tissues previously used for the selective media isolations.

Evolutionary Relationships among *Ipomoea batatas* and Closely Related Species

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Sweet potatoes and their wild crop relatives form a monophyletic syngameon, a hybridizing species complex that includes fourteen named species. The taxonomy of these species is challenging, as one would expect. Furthermore, evolutionary relationships among these species is poorly understood. A total of 229 accessions of germplasm of the *Batatas* group were obtained from national centers as well as our own collections. From this larger collection, 72 accessions were selected for detailed analyses representing as many replicate populations of the named species from as wide a geographic sample as possible. DNA sequence data was obtained for four gene regions, DFR-B, ANS, UF3GT, and trnD-trnT to examine evolutionary relationships among these populations. A Bayesian phylogenetic analysis of each gene region revealed that in no case did replicate populations of a named species form a monophyletic group. Furthermore, some taxa such Ipomoea batatas were placed throughout the phylogenetic hypotheses represented by the four gene trees. A consistent pattern was that the accessions, irrespective of species, formed two groups representing populations from the United States and Mexico versus populations from Central and South America with the greatest phylogenetic structure being observed among the later populations. These phylogenetic analyses clearly indicate a population genetic approach is warranted for examining rela-
relationships within the Batatas group. These analyses demonstrated the greatest genetic diversity was found in Central and South American populations. Also the populations of Ipomoea batatas were highly diverse. Some directions for future research include integrating population genetic analyses of molecular data with an analysis of morphological variation, carrying out crossing studies retaining the information for individual populations in the experimental design, and expanded study of populations from Central and South America.

**Vegetable Crops Section—Watermelon**

**Texas Statewide Watermelon Trials for 2012**

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Texas usually ranks 3\(^{rd}\) or 4\(^{th}\) in U.S. production of watermelons with 27,000 to 38,000 acres annually planted with a wide range of harvest dates. It is estimated that over 100 of the state’s 254 counties are involved with commercial watermelon production. Most of the commercial production uses plastic mulch and drip irrigation but some dryland production continues to exist. Seedless watermelon production has been the biggest change in the industry. Texas often ranks 2\(^{nd}\) in seedless watermelon production in the U.S. with over 90\% of its total production being seedless. Usually seeded watermelon varieties are used as the pollenizers but newer pollenizers that give no marketable production are also used to provide pollen for the pollen sterile seedless varieties. During 2012, the statewide watermelon trial had 31 variety evaluations and was conducted in four locations to include Weslaco, Uvalde, College Station, and Lubbock. Harvests start in April in the Lower Rio Grande Valley (Weslaco area), in June in the Winter Garden (Uvalde area), July in East Texas (College Station area), and July through September in the Rolling High Plains (Lubbock area). Industry standards such as the seeded variety Summer Flavor 800 and seedless varieties such as Summer Sweet 5244 and Tri-X 313 continue to perform in yield in comparison to the other 28 varieties in the trial.

**Optimum Plot Size and Number of Replications for Watermelon Trials and 2012 Watermelon Trial Results**

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Three methods were used to estimate optimum plot size and number of replications for watermelon yield. Bartlett’s test for homogeneity of variance, which is traditionally used to insure homogeneous treatment variances, can be used to determine optimum plot size by assessing significant differences in variances as plot size is increased. Using 3.34 m\(^2\) as the basic unit, Bartlett’s test indicated that plot sizes of 14–20 basic units would be optimum. This size is larger than what is routinely used with watermelons. Hathaway’s method calculates a percent of the mean for detecting a true difference. Hathaway suggests that the optimum percent is 20\%. Plotting trend lines of different replications with the true difference on the y-axis and the number of basic units on the x-axis were constructed. Using a basic unit of 3.34 m\(^2\), the 20\% threshold occurs at approximately 12 basic units with 3 replications and 10 basic units with 4 replications. Using 6.69 m\(^2\) basic unit results in plot sizes of approximately 6 basic units with 3 replications and 5 basic units with 4 replications. These results are in line with current practices. The final method calculated Least Significant Differences (LSDs) with 15 treatment degrees of freedom. Calculated LSDs that are 5\% or less of the mean for a specific plot size are considered appropriate. Calculated LSDs, using a 3.34-m\(^2\) basic unit plot size, suggests that 10 basic units and 5 replications would be appropriate. Other combinations that met these criteria included 14 basic units and 2 or more replications.

**Delaware Triploid Watermelon Cultivar Evaluations**

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Thirty-three triploid (seedless) watermelon cultivars were evaluated in a replicated trial located in Georgetown, DE in 2012. Similar trials have recently been conducted in 2005, 2006, 2008, and 2010. Cultivars were evaluated for yield, size, soluble solids and hollow heart, a physiological defect. The highest yielding cultivar in the 2012 trial was ‘Maxima’ and the following ten varieties were not significantly different from ‘Maxima’ in terms of marketable yield: ‘SS 7187’, ‘Troubadour’, ‘SS 7387’, ‘SugarRed’, ‘ACX 6177’, ‘Tri-X 313’, ‘Crunchy Red’, ‘WDL-408’, ‘Crisp’n Sweet’, and ‘Sweet Polly’. ‘SS 7187’, ‘Crunchy Red,’ and ‘Tri-X 313’ were also among the top yielding cultivars in the four trials previous to 2012. Yields of these three cultivars are not significantly different than one another in analysis of the data from all five trials. ‘SugaRed’ and ‘Crisp’n Sweet’ have been evaluated in previous trials, and were among the top yielding varieties in all years they were tested. In the 2012 trial there were significant differences between the cultivars in percent soluble solids, although all of the cultivars in the trial averaged above 10\% soluble solids. ‘SugaRed’, ‘Crisp’n Sweet’ and ‘SS 7387’ were the cultivars with the highest soluble solids which were also high yielding. None of the highest yielding varieties in the 2012 trial had high incidence of hollow heart. Detailed reports on the trials conducted in Delaware are available at: http://extension.udel.edu/ag/vegetable-fruit-resources/vegetable-small-fruits-program/variety-trial-results/.
**MelCast Fungicide Application Scheduling for Mid-Atlantic Watermelons: A Re-evaluation**

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Gummy stem blight (caused by *Didymella bryoniae*) and anthracnose (caused by *Colletotrichum orbiculare*) are the most prevalent foliar diseases of watermelon in the eastern United States. MelCast, developed at Purdue University, is a weather-based forecasting model for fungicide application scheduling to manage both diseases. Watermelon growers in Maryland and Delaware have received MelCast information since 1998. At the time the program was initiated, the predominant fungicide used was chlorothalonil, and growers who used the model reported an average fungicide reduction of two applications. Fungicide use patterns have changed in the 14 years since the MelCast program began, and the current grower practice is to spray Folicur or Inspire Super in alternation with chlorothalonil. An experiment was conducted in 2012 to evaluate disease management and yield of watermelons sprayed according to a MelCast schedule when Folicur or Inspire Super were used. PGRs were tested in 2012 with chlorothalonil according to MelCast or weekly, Inspire Super alternated with chlorothalonil according to MelCast or weekly, or not sprayed. Anthracnose, gummy stem blight, and Cercospora leaf spot severities were rated individually until the lesions coalesced. At that time, severity of defoliation was assessed on a whole plot basis. Anthracnose was the most severe disease throughout the season. All fungicide schedules reduced anthracnose compared to the nontreated plots on 3 Aug. On 20 Aug. all treated plots had less defoliation compared to the nontreated plots. Folicur programs reduced defoliation compared to the Inspire Super programs on 20 Aug. (*P* = 0.0107). On 27 Aug., watermelons sprayed according to MelCast had significantly more defoliation compared to watermelons sprayed on a weekly schedule (*P* = 0.0030). Downy mildew, which was first observed on 17 Aug., may have contributed to defoliation. The experiment will be repeated in 2013.

**Staminate Flower Production and Fusarium Wilt Reaction of Diploid Cultivars Used as Pollenizers for Triploid Watermelon**

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Several cultivars of nonharvested watermelon (*Citrullus lanatus*) pollenizers were compared for staminate flower production in field tests and disease reaction to Fusarium wilt [*Fusarium oxysporum* f. sp. *niveum* (FON)] in both greenhouse and field tests. Differences were observed in staminate flower counts and Fusarium wilt reactions in both years of field evaluations and to Fusarium wilt among cultivars evaluated in the greenhouse. ‘SP-1’, ‘Sidekick’, and ‘SWDL 6146’ were the cultivars with high staminate flower counts in the field both years. These cultivars also were among the most resistant to Fusarium wilt in both years of field tests. Significant correlations occurred between the rankings of the cultivar’s Fusarium wilt reactions in both the two field and three greenhouse experiments, indicating a high degree of correlation between field and greenhouse tests.

**The Effect of Particle Films, Growth Regulators, and a Bacterial Inoculant on Stress Indicators, Fruit Yield, and Fruit Quality in Triploid Watermelons**

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Field studies were conducted in triploid watermelons in 2011 and 2012 on the effects of growth regulators, bacterial inoculants, and particle films on plant stress, fruit set and yield. The effects of plant growth regulators (PGRs) and limiting pollen were examined on Liberty and SS7187 triploid watermelons. Plants were transplanted 0.9 m apart with one diploid pollenizer plant, cultivar SP5 or Accomplice, planted to every 10 plants. PGR’s were broadcast sprayed weekly 3x from first flower and included 1) Maxcel (a cytokinin), 2) Promalin (cytokinin + gibberellins), 3) Radiate (auxin + cytokinin). At maturity, watermelon fruits from test plots were split and hollow heart incidence (hhi), length and diameter; melon diameter and length; node of attachment; distance from seedless mother plant crown, and distance from the nearest pollenizer crown were recorded. There was a delay in fruit set and an increase in hollow heart with increasing distance from the pollenizer plant. Early fruit set was improved by all PGRs. PGR 1 and 2 did not impact hhi in 2011 but caused increases in 2012. PGR 3 increased hhi in both years. All three PGRs tested improved yields where pollen was less limiting but not where pollen was more limiting. A *Bacillus subtilis* bacterial inoculant was trialed in 2011 and 2012 as a planting hole treatment or plant tray drench. In 2011, significant increases in yield were seen in 2 triploid cultivars, SS7187 and Fascination but no significant yield increases were found in 2012 over 4 cultivars tested. In a stress reduction study, particle film products, Screen Duo and Surround, were tested on 3 triploid cultivars in 2012 along with Maxcel cytokinin. Products were applied 3x at 10-d intervals starting 14 d after transplanting. First harvest fruit weights were increased by Screen Duo over all cultivars, by Surround in Crunchy Red watermelon, and by Maxcel in the cultivar Troubadour. Overall yields were not increased by any of the treatments.
Using Genomic Tools to Identify and Exploit Wild Watermelon Genotypes Useful in Enhancing Disease or Pest Resistance among Watermelon Cultivars

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There is a continuous need to enhance watermelon cultivars for disease and pest resistance. U.S. Plant Introductions (PIs) representing the different groups of watermelon (Citrullus spp.) are considered a useful source for enhancing disease or pest resistance in watermelon cultivars. In this study, we have used high frequency oligonucleotides - targeting active gene (HFO-TAG) primers in polymerase chain reaction (PCR) experiments to produce over 560 polymorphic markers among the Citrullus genotypes. Also, we used the next generation sequencing technology "genotyping by sequencing" (GBS) to produce over 10,000 single nucleotide polymorphism (SNP) markers that represent most parts of the watermelon genome. The HFO-TAG and SNP data were used in cluster and multidimensional scaling plot and population structure analyses to produce distinct groups of Citrullus PIs. The SNP and HFO-TAG marker results are consistent with our recent findings using fluorescence in situ hybridization (FISH) technology showing major differences in configuration of ribosomal DNA markers between the Citrullus groups. Overall, a wide genetic diversity exists among Citrullus spp. and different sources should be useful for enhancing disease or pest resistance in elite watermelon cultivars.

Flowering Time in Watermelon

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US watermelon production is worth approximately half a billion dollars annually to growers and nearly all of them are dependent on reliable synchronized flowering time of triploid cultivars and diploid pollinizers in their production fields. One aspect of this synchronization is time to flowering, the change from the vegetative to reproductive phase of a plant. We used the previously mapped ‘Klondike Black Seeded’ × ‘New Hampshire Midget’ recombinant inbred line population to map quantitative trait loci (QTL) associated with days to first male flower (DMF), days to first female flower (DFF) and the interval between the appearance of the first male and female flower (MFI). Three QTL associated with DMF and DFF, including a co-localized major QTL on LG 11 explaining ~50% of the phenotypic variance observed in the population were identified. A QTL associated with MFI co-localizes with a QTL for DMF on LG 9. The region of the major QTL on LG 11 corresponds to a region on chromosome 3 of the draft genome sequence containing a homologue (Cla009504) of the FLOWERING LOCUS T associated with flowering time in various other species. Cla009504 represents an excellent candidate gene towards the development of a functional marker for marker-assisted selection for flowering time in watermelon.

2012 Evaluation of Triploid Watermelon (Citrullus lanatus) Varieties in Southwestern Indiana, 2011

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Watermelons account for 48% of the total fresh market vegetable acreage and 52% of the total value of fresh market vegetables in Indiana. In 2012, Indiana was ranked 7th in the U.S. in acres harvested (7,000) and had a total value of approximately $29.7 million. Growing watermelons takes considerable planning and decision making to be successful. One of the primary decisions is the selection of a suitable variety to meet the needs of the producer with respect to yield and fruit quality. A randomized complete-block design experiment was established (May 2012) in Vincennes, IN at the Southwest Purdue Agriculture Center. The objective of the project was to evaluate 33 experimental or newly released varieties to assess adaptability to growing under southwestern Indiana conditions. Raised-beds were formed and covered in black plastic mulch after pre-plant fertilizer application of 350 lb (46–0–0), 100 lb (0–0–60), and 200 lb of pelleted lime. Plants were harvested four times from 17 July to 8 Aug. at which time each fruit was weighed. Additionally nine fruits from each variety were evaluated for quality characteristics including percent soluble solids, size, rind thickness, and firmness. Overall yield in 2012 was from 15,700 to 55,500 lb/acre and average fruit weight ranged from 12.9 to 17.8 lb. AC 5234 Plus had the highest numerical yield (489 lb/plot) and was statistically greater than 22 of the 33 varieties. However, AC 5234 Plus was ranked last of all varieties with regard to soluble solid content. Olympia and SVR-8039-0257 had higher brix (11.1%) than 16 other varieties; however, yields were relatively low. Varieties with higher yields and high soluble solids include Crunchy Red (413 lb/plot, 10.4% brix), Sugared (402 lb/plot, 10.8% brix) and WDL 9408 (397 lb/plot, 11.1). Maxima had the highest numerical yield (146 lb/plot) and had statistically greater yield compared to 29 of the varieties evaluated in the first harvest period. Other high early yielding varieties were Sugar Coat, RWT 8231, and Sugared (Table 3). In the second week of harvest, Maxima (150 lb/plot) continued the same trend and although it was not numerically the highest with respect to yield, it was not statistically different from the highest AC 7387 HQ (193 lb/plot). Yield for all varieties in the third and fourth individual harvests did not differ statistically.
North Carolina Triploid Watermelon Cultigen Evaluations for 2012

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A triploid, standard size watermelon cultigen evaluation study, which included 44 entries, was conducted at the Central Crops Research Station, Clayton, NC in 2012 to determine yield and quality attributes. The key production practices used were: black polyethylene mulch with drip irrigation, 10 ft between row centers, 2.5 ft in-row spacing, and total seasonal fertilization of 110 lb/acre N and 240 lb/acre K2O. The transplants were set in the field on 8 May, and four harvests were taken 7, 17, and 26 July, and 23 August. There were 10 triploid plants per plot which were interplanted with three plants of the pollenizer Ace. Plot design was a randomized complete plot design with four replications. Each fruit was harvested and weighed, and yield per acre was determined. Quality attributes evaluated were fruit size, flesh firmness, and hollow heart incidence and severity. The top 11 yielding cultigens over four cumulative harvests on a fruit per acre and tonnage basis were Affirmed, Declaration, SVR-0241, HMX 1915, WDL 9409, Summer Sweet 5234, Super Seedless 7177, WDL 9408, Crunchy Red, and Super Seedless 9651 and 6177. Yields of these cultigens ranged from 3267 to 3790 fruit per acre. The cultigens which produced larger fruits (>15 lbs) were Sugared, WDL 9405, Fascination, Crunchy Red, Super Seedless 6177, Maxima, Sugar Coat, and WDL 9408. Three of these cultigens which produced large fruits also were some of the highest yielding; they were WDL 9408, Super Seedless 6177 and Crunchy Red. Some of the cultigens with the smallest average fruit size were Citation, Middie Sweet, Lil Red Rock and Fusion. The cultigens with the firmest flesh were Distinction, Fusion, Crunchy Red, Maxima, Super Seedless 6177, and WDL 9409, while the cultigens with the most incidence of severe hollow heart which render the fruit unmarketable were (20%+) were Sugar Coat, Sugared, Cut Master, CS 741704, and Gilboa. It is critical to have cultivars that are both high yielding and outstanding quality.

Response of Citrullus lanatus var. citroides Rootstocks for Grafted Watermelon to Root-knot Nematodes

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Since the ban of methyl bromide for pre-plant fumigation of soil, the southern root-knot nematode (RKN), Meloidogyne incognita has re-emerged as a serious pest of watermelon in the U.S. and worldwide. Many countries in Asia, the Mediterranean, and Europe, commonly use cucurbit rootstocks for grafted watermelon to control soil-borne diseases. Our program at the U.S. Vegetable Laboratory (USVL), ARS, USDA, has focused on selecting and developing RKN-resistant wild watermelon (C. lanatus var. citroides) lines for use as rootstocks for grafted seedless watermelon. In this study, we tested the concept of employing F1 hybrids, derived from crossing our most resistant C. lanatus var. citroides lines, as rootstocks for seedless watermelon. We evaluated the performance of four resistant parental lines (RKVL 301, RKVL 316, RKVL 317, and RKVL 318) of C. lanatus var. citroides and F1 hybrid crosses of these lines as rootstocks for the scion ‘Tri-X 313’ seedless watermelon in RKN-infested fields at USVL, Charleston, SC in 2011 and 2012. The commercial rootstocks ‘Emphasis’ bottle gourd (Lagenaria siceraria), ‘Strong Tosa’ squash hybrid (Cucurbita maxima × C. moschata), ‘Ojakkyo’ wild watermelon rootstock (C. lanatus var. citroides), and self-grafted and non-grafted ‘Tri-X 313’ also were included in the studies. In 2011, three parental lines, three wild watermelon F1 hybrids, and ‘Ojakkyo’ had lower (P < 0.05) numbers of RKN eggs (range: 5–12 eggs/gram fresh root) than ‘Tri-X 313’ seedless watermelon (self-grafted and non-grafted, 34 and 41, respectively), ‘Emphasis’ (1144), and ‘Strong Tosa’ (2653). One parental line (RKVL 301) and ‘Strong Tosa’ had lower fruit weights (P < 0.05) than eight of the wild watermelon rootstocks; however, RKVL 301 produced high yields of grafted ‘Tri-X 313’ seedless watermelon in previous years. In 2012, six wild watermelon rootstocks had lower (P < 0.05) percentages of root galling (range: 2%–7%) than ‘Tri-X 313’ seedless watermelon (self-grafted, 16% and non-grafted, 32%), ‘Emphasis’ (74%), and ‘Strong Tosa’ (87%). Although significant differences were not observed for watermelon yields in 2012, two of the crosses (RKVL 301 × RKVL 316 and RKVL 316 × RKVL 301) ranked first and second of 18 rootstock/scion combinations for fruit weights. The bottle gourd and hybrid squash rootstocks were highly susceptible to RKN with severe root galling, high RKN reproduction, and low yields. Thus, bottle gourd and hybrid squash are unsuitable for use in RKN-infested fields without methyl bromide or other nematicide treatment. Overall, the wild watermelon rootstock lines (parents and F1 hybrids) exhibited resistance to RKN and performed well as rootstocks for grafted seedless watermelon. These wild watermelon lines should be useful sources of RKN-resistance for development of rootstocks for grafted watermelon.

Poster Section

Effect of Ethylene on Adventitious Root Formation in Abelia

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This study was aimed at determining if ethylene applications would reduce flower formation in Abelia ‘Raspberry Profusion’ in the propagation environment and increase adventitious root formation. Cuttings were taken from stock plants grown in a field plot in July. A total of 90 cuttings (4-node, tip cuttings) were treated with 3,000 ppm IBA and stuck in a rooting media
and placed under mist (10 s at 5 min) under natural light. The following treatment schedule and chemical rates were used: 30 cuttings were treated on day 0 (day of sticking, 7 and 14 d after sticking), 30 cuttings were treated 7 d after sticking (day 7, and 7 d after), and 30 cuttings were treated on day 14 (14 d after sticking) with 0, 2,500, 5,000, 7,500 or 10,000 ppm of ethephon (Florel) applied as a foliar spray. Therefore, Day 0 cuttings received a total of 3 treatments, Day 7 cuttings received a total of 2, and Day 14 received one ethylene treatment. Adventitious root formation, shoot growth and flowering data were collected after 6 weeks. Ethephon was not effective in increasing rooting in Abelia cuttings. In addition, shoot growth and flowering were reduced by ethephon. Rooting was not enhanced by timing of ethephon application (day 0, 7, or 14). Untreated cuttings developed the largest quantity of roots, shoots and flower buds. Root and shoot mass decreased as rate of ethephon increased. The number of flower buds followed the same trend.

Characterization of Seediness Attributes of Blackberry Genotypes

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Fresh market blackberries can feel “seedy” when consumed depending on the pyrenes. A pyrene is comprised of the endocarp and the seed which it encloses. Small seed size (<3 mg) is preferred for both the fresh market and processed industries. Yet, the proportion of pyrene weight to total berry weight can be more important than pyrene size. The objective of this study was to determine and compare descriptive sensory analysis and pyrene characteristics of blackberry genotypes from the University of Arkansas blackberry breeding program. Panelists were trained according to Spectrum® methods and evaluated twenty genotypes for overall seediness. Pyrene characteristics, including weight and dimension, were measured for twenty-two genotypes. Seven of the 22 genotypes had an individual pyrene weight of 3.0 mg or less. Pyrene weight to berry weight ratio ranged from 2.7% (‘Tupy’) to 5.4% (‘Prime-Ark® 45’). ‘Tupy’ had low individual pyrene weights and a low ratio which are most likely factors that contribute to its widespread popularity. Pyrene weight to berry weight ratio was positively correlated to descriptive overall seediness (r = 0.70) but not to pyrenes/berry. Therefore, finding a desirable pyrene weight to berry weight ratio is integral to decreasing perceived seediness by consumers.

Papaya: The Influence of Sex on Plant Height and Production

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The genders of papaya plants are male, female, or hermaphrodite (bisexual) with the latter two as the main fruit-bearing types. The objective was to study the relationship between the female and hermaphrodite papaya gender and its effect on height and fruit production. Four varieties of importance to the US Virgin Islands, ‘Maradol’, ‘TW’, ‘Tainung 5’ and ‘UVI’ and four hybrids, FW × C, ‘Maradol’ × ‘Tainung 5’, ‘Maradol’ × ‘Young Nong 1’, and ‘TW’ × ‘Tainung 5’ were evaluated. The plants were transplanted into the field on 4 Apr. 2012. Data were collected monthly for 10 months and included plant sex, plant height, height to first fruit and number of fruit set. Female papaya plants began to flower a week or two before hermaphrodite papayas. The females had a trend to be shorter than hermaphrodites over time. The height to the first fruit was significantly lower for female ‘Tainung 5’, ‘Maradol’ × ‘Tainung 5’, ‘Maradol’ × ‘Young Nong 1’. Female trees had a trend for greater fruit set but female ‘Tainung 5’ set significantly more fruit than hermaphrodite plants. Even though differences were observed between female and hermaphrodite trees, these differences were minimal for most varieties and hybrids. This research was supported by USDA–NIFA–Hatch.

Characterization and Lineage Verification of NC Raspberry Germplasm Using Microsatellite Markers

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The Rubus breeding program at North Carolina State University has diverse offerings in terms of germplasm and breeding goals. The distinct Coastal Plain, Central Piedmont, and Western Mountain regions of the state allow for selection trials in different climate types, and the breeding of raspberries and blackberries intended for particular regions of North Carolina and the surrounding states. The program has relied heavily on traditional field breeding techniques in the past, and is working towards the goal of integrating molecular breeding technologies into the program in order to supplement methods already in place. In order to catalogue the current germplasm collection and verify the parentage of advanced selections in the program, a SSR fingerprinting technique was chosen. SSRs, or microsatellite markers, are robust, codominant, and highly polymorphic markers that have many applications for DNA fingerprinting and linkage mapping, and have been found numerously in many fruit crops. Because of the diversity of the North Carolina Rubus germplasm collection, we chose to use the SSR fingerprinting panel identified by Bassil et al. (2012) that successfully amplifies across a variety of Rubus species. Six SSRs were multiplexed in two PCR reactions, separated by capillary electrophoresis, and analyzed with Beckman and PowerMarker software. Through this preliminary study, we were able to fingerprint 19 previously undescribed Rubus selections and cultivars, and verify parentage of 11 NC Rubus selections. Future research will focus on expanding SSR genotyping to the remainder of the NC germplasm collection, verification of parentage within this collection, and determining the adaptability of the primer set to our R. parvifolius hybrids and blackberry cultivars.
Blueberry Cultivar Trial in Central Mississippi: 2012 Yield and Fruit Quality Update

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Seventeen rabbit-eye blueberry cultivars are being tested in a replicated trial at Crystal Springs, Mississippi. The plants were planted in 2005. They are being raised using standard local practices, and are mulched, irrigated, pruned and fertilized as needed. In 2012, plants were harvested weekly from mid-May until early July. Yield of the plants ranged from over 9000 g/plant for Rahi, down to 2110 g/plant for Onslo. The mid-point of harvest ranged from May 28 for Alapaha to June 24 days for Onslow. Only four entries have 25% or more plant loss from 2005 through 2012. Overall, the trial shows that growers in central Mississippi and similar growing areas should choose cultivars carefully, and that they have several excellent choices for rabbit-eye blueberry cultivars that mature over a range of seasons.

Evaluation of Antioxidant Potential of Selected Georgia-grown Banana Cultivars: An Underutilized Fruit Crop

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Banana (Musa sp.) is known globally as an excellent dietary source of antioxidants. To date, no comparative studies have been reported on the health promoting effects of short-cycle and long-cycle banana cultivars cultivated in Georgia as a potential utilized fruit crop. In order to obtain preliminary data in regard to cultivar selection and performance with respect to antioxidant content and capacity from four bananas, the present study was initiated to provide further information. The antioxidant properties of methanolic extracts from four selected Georgia-grown banana cultivars were determined with antioxidant assays, including vitamin C, total phenolics, antioxidant capacity, vitamin C equivalent Antioxidant capacity for ABTS (2,2’-azino-bis) and DPPH (2,2-diphenyl-1-picrylhydrazyl) radical. Significant variation in vitamin C, total phenolics and antioxidant capacities were noted. The highest vitamin C content was observed for ‘Viente Cohol’, ‘Ice Cream’, and ‘Blue Torres Island’. The highest total phenolics content was noted for ‘Cacambou’. The highest vitamin C equivalent Antioxidant capacity for ABTS was noted for ‘Viente Cohol’ and the highest vitamin C equivalent Antioxidant capacity for DPPH was noted for ‘Viente Cohol’. Overall the results of this study confirm the importance of diverse cultivars is needed to establish a commercial industry. In addition, establishment of optimal harvest maturity is needed for optimal quality, nutrition and consumer acceptance. This study will assist in the development Best Management Practices for superior cultivars having enhanced health benefits and shelflife of adaptable cultivars of banana suitable for southeastern United States.

Response of Muscadine Grape (Vitis rotundifolia Michx.) Cultivars to Cane Pruning

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Studies were conducted in 2012 at McNeill, MS to evaluate the effects of cane vs. three-bud spur pruning on yield and quality of 43 muscadine grape cultivars. Yields resulting from cane-pruning were significantly higher (P ≤ 0.01) than three-bud spur pruning when pooled across cultivars; 41 of the 43 cultivars tested had numerically higher yields with the cane-pruned method, and on average resulted in a 35% yield increase. Berries from cane pruned vines were significantly (P ≤ 0.05) smaller than fruit from three-bud spur vines by an average of 6.5%. Both soluble solids content and berry pH were also significantly (P ≤ 0.05) lower in caned pruned vines vs. the three-bud spur pruned vines. Berry quality attributes including titratable acidity, berry firmness and berry juice content were not affected by pruning method.

Storage Retention of Stilbene, Ellagic Acid, Flavonol, and Phenolic Content of Muscadine Grape (Vitis rotundifolia Michx.) Cultivars

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The objective of this study was to determine the retention of some of the important phytochemical compounds such as anthocyanins, phenolics, flavonols, stilbenes and organic acids in postharvest storage period on different varieties of whole muscadine fruit and individual fruit parts. Stilbene, ellagic acid, flavonol, and phenolic compounds were analyzed in 11 muscadine cultivars. Analysis was carried out on muscadine fruit skin, pulp and juice partitions. The major phenolics in muscadine juice, pulp and skins were identified by their retention times and characteristic spectra. Quantification was made by calibration curves of external standards for each of the analyzed compounds: trans and cis resveratrol, trans and cis piceid, ellagic acid, myricetin, quercetin and kaempferol. The total phenolics decreased in six varieties and increased in five varieties, perhaps indicating differences in decay development and fruit deterioration in the different varieties. The anthocyanin content showed an overall decrease in the varieties tested with the exception of ‘Eudora’. The stilbenes showed an overall decrease as well. Flavonol content after cold storage was cultivar and compound specific. Free ellagic acid increased in most cultivars, with the exception of ‘Pollyanna’. Total ellagic acid also increased or remained constant in all cultivars. The
presence of ellagic acid and other nutraceutical compounds in muscadine grape could add value and marketability to the crop due to the possible health benefits. This southern specialty crop could fast become the next “super fruit.”

**Growth of Seedling Vaccinium arboreum Influenced by Provenance and Substrate pH**

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Alkaline soil pH is a limiting factor in commercial blueberry production and tolerance of these growing conditions would benefit growers in areas with higher pH soils, as well as expand the amount of available land that is suitable for growing blueberries. One SE native species, sparkleberry (Vaccinium arboreum), has been found growing in soils with a pH as high as 7. Coupled with its alkaline soil tolerance, sparkleberries also exhibit other characteristics that make it a suitable species for use as a rootstock, such as a monopodial trunk and excellent drought resistance. The purpose of this experiment was to determine the effects of substrate pH on growth characteristics of open-pollinated populations of sparkleberry seedlings from different provenances. This study was arranged in a 4 × 4 factorial (provenance × pH level) in a completely randomized design with 10 replications, using a single plant per replicate. Plants were placed into a deep-water culture hydroponic system containing a nutrient solution buffered to a pH level of 5.5, 6.0, 6.5, or 7.0. The interaction of pH × provenance affected final fresh weight, root fresh weight, and the root dry weight. The main effects of pH and provenance affected root:shoot ratio and photosynthesis. Results of this study indicate that provenance does affect the growth of V. arboreum in different substrate pH levels.

**Pitaya (Hylocereus sp.) Cultivation in the CNMI**

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The Commonwealth of the Northern Mariana Islands (CNMI) consists of a group of islands in the Western Pacific north of Guam. Pitaya or Dragon fruit (Hylocereus undatus), is an exotic fruit and gaining increased attention from the growers due to its economic potential and nutritional benefits. Local and new cultivars raised through seeds and stem cuttings, which include red, white (traditional), yellow and pink fruits. Germplasm of all four red, yellow, white, and pink fruits collected and vegetatively propagated in the island of Saipan. Seed germination observed 3 weeks after seeding. Seedlings attained 1-inch size in 2 months after planting. Stem cuttings (12–14 inch) collected from the field grown vines throughout the islands and planted in the nursery. Pitaya cultivation method adopted from South East Asia where pitaya is produced commercially. Well grown vines transferred in the field using concrete cement posts (6 ft) for support. Plants raised from stem cuttings observed vigorous, healthy and produce fruits earlier in 2 years compared to seedlings raised from the seeds. Concrete cement poles found suitable for the support of vines due to long life, durability, economical and free from risk of termites and pests infection. Red and white fruit cultivars identified as being the most economically important in the CNMI.

**Differences in Phenotype, Growth, and Maturation among Five Accessions of Mucuna pruriens (Velvetbean) Grown in Middle Tennessee**

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*Mucuna pruriens* (Velvet Bean) is largely unknown in the Middle Tennessee growing region but has the potential to benefit organic and conventional growers alike. In this study, we investigated *M. pruriens* growth, maturation, and seed viability in our local growing region. Seeds were obtained from the Germplasm Resources Information Network (GRIN) and grown for a period of 205 d. Dry weights were recorded for the foliage, stems, and fruit for each of the five accessions. Only accessions with seed counts allowing for 100 per treatment were used for germination test. They were separated into four replications consisting of 25 seeds each, rolled in moist paper towels and checked daily for radicle emergence (designated at 5 mm in total length). T50 and T90 counts were analyzed. Germination ranged from 27% to 50%. The rates of germination (T50) did not differ significantly between accessions, while the uniformity of germination (T90) varied significantly between accessions (Mozambique: Osceola) (2.78) and b (Mozambique: Branco) (4.84). All accessions were separately tested for viability. Seeds were allowed to imbibe water for 24 h before being submersed in 1.0% tetrazolium solution. Seeds were evaluated based on degree of staining consistent with the International Seed Testing Association Tetrazolium Committee. Seed viability ranged from 4.0% to 43.0%.

**Use of Fatty Alcohol Treatments to Control Rootstock Regrowth in Grafted Watermelon [Citrus lanatus (Thunb.)]**

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Rootstock regrowth is a major problem in watermelon grafting, and the cost of re-growth control is a major reason for the lack of grafted transplants in U.S. watermelon production.
Chemical methods of re-growth control could alleviate this cost and increase the efficiency of watermelon grafting in the U.S. Fatty alcohol solutions are used in tobacco as a contact sucker control, and could be used to burn out the rootstock meristem and control regrowth. This study was conducted to determine the optimal fatty alcohol application rate for rootstock regrowth control. Two fatty alcohol products (Fair 85® and Off-Shoot T®) at six concentrations (3.75%, 5.0%, 6.25%, 7.5%, 8.75%, and 10% fatty alcohol) were applied to Bottle Gourd (Lagenaria siceraria ‘Emphasis’) and Interspecific Hybrid Squash (Cucurbita maxima × C. moschata ‘Carnivor’) rootstocks as the cotyledons unfolded. On days 1, 7, 14, and 21 after application, rootstocks were individually rated for both damage and re-growth responses. Results showed a significant decrease in re-growth as concentration increased up to 7.5% fatty alcohol, while damage increased significantly at fatty alcohol concentrations of 6.25% and above. Based on this data, we conclude that the best control of re-growth with a level of acceptable damage is achieved using an application rate between 6.25% and 7.5%, depending on environmental conditions within the greenhouse.

Pigeon Pea (Cajanus cajan L.) and Sorghum Sudangrass [Sorghum bicolor (L.) Moench var. sudanense (Piper) Hitchc.] Management Changes Populations of Pest and Beneficial Insects in Cabbage

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During the fall 2011 growing season, the effect of cover crop planting arrangement and tillage on management of key pests and beneficial insects were investigated in a cabbage, Brassica oleracea system in Live Oak, FL. The experimental design was a split, split-plot with four cover crop treatments and four replicates. Cover crop treatments (main effects) included: 1) single planting of pigeon pea (Cajanus cajan L.); 2) single planting of sorghum sudangrass (Sorghum bicolor L. Moench var. sudanense); 3) mixed planting with pigeon pea and sorghum sudangrass; and 4) no cover crop (control). Cover crops were grown with and without fertilizer (subplots) and before planting the cabbage the cover crops were either tilled and incorporated in the soil or rolled and laid on the soil surface (sub-subplots). We sampled for key pests on cabbage including 1) Diamond-back moth (DBM), (Plutella xylostela L.); 2) Cabbage looper (CL) [Trichoplusia ni (Hübner)]; and 3) cabbage aphids (CA) (Brevicoryne brassicae L.); and beneficial insects using yellow sticky cards, pitfall traps, and foliar counts. Results from traps indicated that no significant differences were observed between treatments for DBM and CL. However, sorghum sudangrass and mixed cover crop treatment plots recorded significantly higher numbers of CA than the control. The most common beneficial insects were ground beetles, spiders, red imported fire ants (RIFA), parasitic wasps, syrphid flies, big eyed bugs, and Colembola. Significantly higher syrphid flies were recorded on the Sorghum sudangrass plots than all the other plots but these did not affect the aphid population. Ground beetles and spiders were significantly higher in no-till plots than tilled plots. Overall, tilled plots had the least number of pests and pigeon pea appeared to be the best cover crop to manage pests in cabbage.

Growth of Tomato (Lycopersicon esculentum) Seedlings in Commercial Substrate Amended with Dewatered Aquaculture Effluent

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Dewatered aquaculture effluent (AE) could amend commercial substrates for tomato seedling production. In two separate experiments, tomato seedling (Lycopersicon esculentum Mill. ‘Bolzano’) growth response was evaluated when a commercial potting mix was amended with different amounts (0 to 75%) of AE (v/v) and fertigated with a water soluble, inorganic fertilizer. In the first experiment, a difference existed for plant height, leaf area (LA), leaf dry matter (LDM), stem dry matter (SDM), and total dry matter (TDM) 2 weeks after transplanting seedlings. Plant growth indices decreased when amounts of AE increased up to 75% container volume. In the second experiment commercial mix replaced with 5% AE consistently outperformed all other treatments with plant height, LA, LDM, SDM, and TDM increasing 26%, 124%, 87%, 75%, and 83%, respectively, compared to the Control. The AE could amend commercial substrates at levels < 20% by providing optimal physio-chemical properties.

Can Exogenous Abscisic Acid Application Improve Survival Rate and Quality of Grafted Tomato Transplants?

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Although interest in vegetable grafting has emerged recently in the U.S., high cost associated with grafted transplants still remains as a major concern. This study was conducted to explore the potential of plant growth regulator application for improving efficiency of grafted tomato transplant production. Abscisic acid (ABA) is known for initiation and maintenance of stomatal closure, and may reduce scion water loss during graft healing,
thus reducing the burden of protected environment maintenance during healing. In this experiment conducted during fall 2012 in Gainesville, FL, water and ABA solutions at 400, 800, and 1200 mg/L concentrations were applied to ‘Florida 47’ tomato scions at least 12 h before grafting onto ‘Maxifort’ tomato rootstocks. Stomatal conductance of non-grafted scion plants following ABA applications was measured. Grafted seedlings were placed on the greenhouse bench without any covering, while grafted plants sprayed with water were also placed inside a healing chamber in the greenhouse as a control. Plant wilting and recovery were monitored daily for 10 d after grafting, and plant chlorophyll content was measured on day 11. Completely healed grafted seedlings were transplanted into 0.4-L plastic pots, and chlorophyll content and leaf area were assessed after 3 weeks. ABA application reduced stomatal conductance in scion seedlings prior to grafting. Among grafted seedlings kept outside, ABA applications delayed the onset of wilting, and resulted in faster recovery from wilting compared to those with water application. However, ABA applications at 800 and 1200 mg/L reduced leaf chlorophyll content. Interestingly, under greenhouse conditions in this study, grafted tomato transplants healed with survival rates over 90% without a healing chamber, regardless of ABA application. ABA application did not show any significant impact on growth of grafted transplants compared to plants kept inside or outside the chamber with water application.

Economics of Growing Microgreens for the Local Food Market

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The hardest aspect of growing fresh produce for the local food market is establishing appropriate selling prices. New crops are put into the production rotation based on customer recommendations and seed catalog promotions. Many fresh market growers do not take the time to consider, let alone calculate, the ultimate costs to produce these new crops. One crop that is getting a lot of attention from both the restaurant market and consumers are microgreens. A case study was performed with a local grower of microgreens. Market prices depend on variety and production management. Market prices range from $2.00 to $6.00/oz with a resulting margin ranging from 35% to 75%. Ultimate customer preferences for microgreen variety are based on the end use.

Grower Trials for Heat-Set Capabilities in Tomato

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Tomatoes have been a staple crop in Oklahoma since farming began in the state. Farmers have always had problems obtaining tomato fruit set during the hotter periods of June and July. In 2011, few tomatoes if any were available at market due to the early and intense hot weather that was experienced. Farmers continue to request help with this ongoing problem. The objective of this study was to trial tomato varieties with heat-set capabilities and use plasticulture to manage soil temperature and moisture levels to determine if gains can be made in tomato yield during the hot months of summer. Transplants were grown at the Oklahoma State University research greenhouse. Tomatoes were transplanted into commercial field plots on 26 Apr. 2012 at Stillwater and on 8 May 2012 at the Coyle site. The study was organized in the field as a randomized block design with three replications. Plots were 6 ft wide and 12 ft long and included six transplants with an in-row spacing of 2 ft between plants. Plot areas utilized black plastic mulch and drip irrigation for both sites. Water and fertility needs of the study were met following normal production practices of each operation. Trials were harvested seven times between 24 June 2012 and 20 July 2012 at the Stillwater location and six times between 11 July 2012 and 3 Aug. 2012 for the Coyle location. Harvest data included number of marketable fruit, weight in pounds of marketable fruit, weight in pounds of cull fruit and reasons for culling. Results varied between sites for marketable yields except for the variety ‘Tribute’ which was in the group of higher yielding varieties at both sites. Yields did not vary for overall or cull yields at either site. Early yield differences were significant at the Stillwater site, but not at the Coyle site. ‘Tribeca’ and ‘Tasti-Lee’ recorded the highest yield at Stillwater.

Heavy Pest Pressure in 2012 Pumpkin Variety Trial

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The highest yielding entry was ‘Orange Bulldog’, a variety released by the University of Georgia. This was significantly greater than any other varieties in the trial. The next greatest entry was 18-4-3, an advanced line, which is being considered for release. Among the commercial varieties, ‘Field Trip F1’ had the greatest yield, which was significantly better than the other commercial entries. The best entries based on disease rating in Attapulgus were ‘Orange Bulldog’ and ‘Field Trip F1’. In conclusion entries developed at the University of Georgia continue to perform well with the potential for new releases in the near future.

Comparison of Tomato Varieties under Organic Production Practices

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This trial evaluated tomatoes under organic production practices on plastic mulch. Varieties chosen included both commercial varieties commonly grown in the Southeast, as well as, entries that are popular among organic growers. Included were varieties that were both determinate and indeterminate with some that could be characterized as semi-determinate. Overall common commercial types produced greater yield with more uniform fruit (e.g., ‘Celebrity’, ‘BHN 602’). Varieties popular with organic growers included pink varieties, varieties with more sutures, and smaller types. Many of these were indeterminate types, which were not well suited to staked tomato production. Although varieties popular with organic growers did not produce as well as conventional commercial entries, they often will command much higher prices resulting in greater return per acre for the grower.

**Cool Season Organic Vegetable Rotation for the Southeast: A Holistic Assessment**

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This study was to investigate crop rotations that included other cool season vegetables with onions that would command relatively high prices as organic commodities, comparable to organic Vidalia onions. In general, crops performed better in the second year (2011–12) than in the first year (2010–11) primarily due to better management and earlier planting. Strawberries were an exception. In year 2 an attempt was made to estimate the fertility that would be contributed from the previous crop. The amount of fertilizer was reduced accordingly, by approximately 45%. This highlights one of the problems with banking on the previous crop’s (southernpeas) contribution to fertility. It is difficult to assess this because of factors such as temperature, moisture, and time between crops. In conclusion, our research suggests that reasonable yields of cool season vegetables are possible under organic conditions, but still lag behind conventionally produced vegetables. Production costs, particularly labor costs, for this study have not been compiled.

**Effect of Preemergence Herbicide on Weed Control in Eggplant (Solanum melongena L.)**

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Eggplant (Solanum melongena L.) is a highly valued vegetable and grown for fresh market in the US Virgin Islands (USVI). Weed competition has a significant effect on the growth and yield of eggplant for USVI growers. Sandea is known for suppression of nutsedges and varied range of broadleaf weeds in several vegetables. Field studies conducted to evaluate preemergence application of Sandea on eggplant. Three cultivars, ‘Nadia’, ‘Hansel’, and ‘Magal’, were grown in conventional management system at the Agricultural Experiment Station of the University of the Virgin Islands in St. Croix. The experimental design was complete randomized block and three replications (Sandea treated) and a control (weedy) for each cultivar. Sandea applied at a rate of (0.5 oz/acre) a day prior to transplanting eggplants into field. No emergence of weeds was observed in Sandea treated plots within the first 3 weeks after application. Plants recovered from initial injury (yellowing and necrosis) a few weeks after transplanting. Yields were significantly higher in all three cultivars grown in Sandea treated plots. ‘Hansel’ produced highest yield (30.57 ton/ha) and lowest in ‘Magal’ (12.16 ton/ha). Average marketable fruits number was also higher (14/plant) in ‘Hansel’. Spider mite infestation (2% to 3%) occurred in plots and was controlled by miticides. Data on plant height, marketable fruit weight, length, diameter, and biomass of weeds were recorded. Sandea effectively controlled a range of broadleaf and grasses in eggplant field. The results suggests Sandea is economical and suitable for preemergence weed control in eggplant in the US Virgin Islands, however, further study is needed before adopting this practice in eggplant.

**Evaluation of Reflex (Fomesafen) Herbicide for Watermelon in Oklahoma**

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Effective preemergence herbicides are needed for weed control in watermelon grown from transplants. Reflex was found to be effective and to exhibit crop safety in southeastern US. Trials were conducted during 2011 and 2012 in southeastern Oklahoma to determine if this product would be useful in this geographic location. Watermelon ‘Delta’ transplants were planted into a fine sandy loam soil 10 days after surface application of herbicides that included Reflex at 0.1875, 0.25, 0.375 and 0.5 lb active ingredient (ai), Sandea (halosulfuron-methyl) at 0.024 lb a.i. + Reflex at 0.1875 lb a.i., Sandea at 0.024 lb a.i. + Reflex at 0.025 and Lorox (linuron) at 0.05 lb a.i. Lorox was not injurious in 2011 but killed watermelon plants in 2012. In both years all rates of Reflex provided 90% or greater control of spiny amaranth Amaranthus spinosus and carpetweed Molugo verticillata. Each of Sandea and Reflex at 0.25 lb a.i. or greater gave 90% or better control of yellow nutsedge Cyperus esculentus. No detrimental effects on vine growth were found in 2011. In 2012, crop stunting was observed 2 weeks
after transplanting in all Sandea treatments and Reflex at the 0.0375 rate and greater. Vine length at 1 month after planting was reduced as much as 30% in all Sandea treatments and in the Reflex 0.5 rate. Watermelon yields ranged from 68,970 to 79,161 lb/acre in 2011 and 41,231 to 76,572 lb/acre in 2012. No yield differences were detected among treatments in either year. Differences in crop effects may be explained by greater rainfall in 2012 following herbicide application. These studies show that Reflex should be a useful herbicide for transplanted watermelon in this area.

**Hibiscus sabdariffa Breeding for Plant Improvement**

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**Hibiscus sabdariffa**, commonly known as sorrel, is an edible fruit that is popular in the Caribbean and used to make juices, jams, and jellies. Sorrel is a good source of vitamin A, vitamin C, calcium, and potassium, as well as antioxidants and bioflavonoids. Sorrel sheds pollen before the flower opens to self-pollinate resulting in inbred varieties. The objective of this research was to evaluate sorrel F1 hybrids with their parent for plant height, branching and floral initiation to determine if hybrids will outperform parents. Plant varieties studied include TTB, 128 (PI 291128) and 100 (PI 268100) as well as hybrid varieties 128 x TTB and 100 x 128. The seeds were planted in Aug. 2012 and seedlings transplanted to the field on 6 Sept. The row spacing was 0.67 m between plants and 1 m between rows. Drip tape distributed the water and nutrients via fertigation. Measurements were recorded at 2-week intervals for height, branch number, and floral initiation. Neither hybrid produced height nor branching that were greater than the strongest parent, 128. Regardless of being the female or pollen parent, 128 was more vigorous than F1 hybrids. Continued research is needed to determine hybrid combinations that will be more vigorous and productive than the present varieties. This research was supported by USDA–NIFA–Hatch.

**Freezing Characteristics of Soils with Various Moisture Content**

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This study was undertaken to investigate how soil characteristics and moisture content impact soil freezing process. Three types of soils, sand, loam, and clay loam, were collected from various locations in Georgia. Soils were brought to 30% or 40% field capacity by adding various quantities of water to achieve the same bulk density for both treatments. Custom-made containers were designed from PVC pipe, open at the top and capped at the bottom. The thermocouples were placed inside rigid nylon tubing and further secured at their location with a custom-designed right-angle shaped PVC bracket. Each thermocouple was inserted in the center of each container at a depth of 5.08 cm (2 inches). Four replicates per soil type (3) and moisture content (2) were used for a total of 24 containers. The containers were placed in an ESPEC temperature chamber set at a –5 °C for 18 h. The three soil types revealed unique freezing profiles at both 30% and 40% field capacity. In general, all soil types at 40% FC remained at higher temperatures for longer periods of time compared to the same soil type at 30% FC. Previous study showed that bare, non-acclimated tropical plant roots and rhizomes did not survive temperature exposure of –1.5 °C. However, the same roots and rhizomes survived temperature exposure of –1.5 °C in frozen soilless media. Even though plants may not have cold hardiness, they may escape cold injury simply by the fact that the soil temperature (even though frozen) remains above –1.5 °C for extended periods of time. After the freezing process was initiated, soil texture could have affected the freezing profile of each soil type until killing temperature of the plant roots was reached.

**Overview of the ASHS Local Foods Working Group**

Christine Coker

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The Local Food Systems Working Group promotes academic and research information exchange on scientific development, scholarship, and educational activities related to and regarding local and regional production systems, including definition and measurement of food systems, foodsheds, small and mid-scale production systems, beginning/new farmers, local farmers and farmers markets, farmers expanding from direct sale to local/regional wholesale, scale neutral technologies, agriculture at the urban/rural interface, urban horticulture production (community gardens, school gardens, home gardens), farm-to-consumer marketing, farmer-to-institution/school marketing, local food system and farmland policy, and relationships of local horticulture to rural and urban communities and economies. A Local Food Systems session is being conducted at the 2013 ASHS meeting in Palm Desert, CA. We invite posters and oral presentations on topics including but not limited to: Famers markets, direct markets and CSA; Community and school gardens; Economic development with local foods; Consumer demands and market trends; Economic and social Implications of local foods; Point of origin - local heritage crops and regional labeling; Heirloom cultivars; New products for local markets; Season extension production systems; Nutrition education; Quality and safety of local foods; Defining and assessing food systems; New farmers programs; Academic programs for local food producers; and Comparative advantages/disadvantages of local foods.
The Role of Universities in Local Food Systems
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University personnel, particularly Extension and Experiment Station faculty and staff, are on the front lines in terms of current trends in agriculture, including the local food movement. Horticulturists are no longer only interested in the production of fruits and vegetables, but also in the local value chain and consumer preferences. Scientists and specialists are now finding consumers to be as much a part of their audience and clientele as the farmers they have traditionally served. The local food movement has created new opportunities for training producers for selling to their local markets. We are also presented with the challenge of educating consumers about agriculture in general, and local products, specifically. Additionally, more home gardeners are becoming interested in backyard food production and urban farming practices. Schools and churches, civic organizations, and neighborhoods are showing increased interest in community gardens. While Extension and Experiment Station personnel have traditionally been a resource for gardening advice and expertise, this new interest in urban agriculture takes basic gardening to the next level. New issues are being raised including food safety, postharvest handling and storage, marketing, and more. Horticulturists must become part of a team of experts to serve the varied interests involved in local food systems.
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