

Abstracts of the 2010 Meeting of the Florida State Horticultural Society

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Using Strawberry Variety Taste Testing to Promote Agricultural Education and Determine Consumer Preferences. Jim DeValerio¹, A. Gazula², E. Simonne³, and A. Simonne⁴.¹UF/IFAS Bradford County Extension Service, Stark; ²UF/IFAS Alachua County Extension, ³UF/IFAS Horticultural Sciences Department, Gainesville, FL; and ⁴UF/IFAS Family, Youth and Community Sciences, Gainesville, FL. (jtd@ufl.edu) [P-9-V]

Strawberry taste tests are popular activities that enlist public participation in learning and promoting agricultural products. Strawberry production has been an integral component of Bradford County's agricultural base for over 100 years. Although the roughly 15 to 18 acres of production pale in comparison to strawberry production in central Florida, the few local producers benefit greatly by direct marketing their crop at an average value of \$12/flat. The local economy benefits indirectly as well: the Bradford Telegraph's boasts "The Sweetest Strawberries This Side of Heaven" in its byline; the Starke Strawberry Festival is attended by about 14,000 people annually and local growers compete for bragging rights by entering their strawberries the Bradford County Fair Horticultural Exhibit. We organized six strawberry taste tests during the 2007, 2008 and 2009 Bradford County fairs and Festivals to determine (1) consumer initial knowledge of strawberry cultivars, and (2) consumer preferences for 'Camino Real', 'Camarosa', 'Festival', 'Sweet Charlie' and #116 varieties. Using a 0 to 9, low to high preference scale, mean ranges were 5.6 to 6.7 (for color), 5.1 to 6.3 (for flavor), 5.1 to 6.8 (for firmness) and 4.4 to 7.2 (for overall score) between all varieties. Surprisingly only 4% of the consumer panelists were able to name a strawberry cultivar prior to testing, indicating that most consumers were unaware of different existing strawberry varieties. Using the strawberry taste tests provided educational opportunities to discuss strawberry production and handling practices during a fun, teachable experience.

Junior Master Gardeners Explore Alternative Gardening Methods for Growing Fruits, Vegetables and Flowers. Alicia R. Lamborn, UF/IFAS Baker County Extension Service, Mcclenny, FL. (alamborn@ufl.edu) [P-10-V]

The Jr. Master Gardener Program began as a 4-H summer camp in Baker County in 2009 and has since evolved into a 4-H club taught by the Baker County Horticulture Agent and Master Gardener volunteers, meeting once per month from November to May. Since many youth have

little gardening experience and do not have an understanding of where the agricultural products they use everyday come from, it was decided that the focus for this program would be increasing the competencies of 4-H youth in the areas of growing edibles and cut flower production. A variety of lesson plans was used, including lessons from the Jr. Master Gardener curricula, lessons and resources from kidsgardening.org and lesson plans created by the Baker County Horticulture Extension Agent. Lessons included topics on basic plant science, plant propagation, transplanting, differences between fruits and vegetables, hydroponic growing systems, container gardening and cut flower production. At the beginning of the program, 62% of 4-H youth participants indicated they had no gardening experience, with 100% indicating they had no experience growing edible plants. All participants in the program have since indicated an increase of knowledge and skills related to gardening, growing environments and alternative gardening methods. A formal evaluation will be completed after the last meeting in May of 2010. Baker County has a unique programming opportunity due to the availability of a greenhouse, several types of hydroponic growing systems, and plenty of outside space. Since the majority of club meetings occur in the evening hours during winter months, adoption of this program by another county could prove difficult without access to a well lit greenhouse unless meeting hours are changed to an earlier afternoon time. The major benefit of adopting this program is making a lasting impression on new young gardeners, providing them with the knowledge and skills needed to be a successful gardener and self-sustaining adult.

Magazine and Online CEU Articles as Possible Models of Educational Opportunities for Pesticide Applicators and ASHS Certified Horticulturists. Mary Lamberts¹, E. A. Skvarch, Jr.², and G. K. England. ¹Miami-Dade County Extension Service, Homestead, FL; ²UF-IFAS St. Lucie County Extension Service, Ft. Pierce, FL; and ³UF-IFAS Sumter County Extension Service, Bushnell, FL. (lamberts@ufl.edu) [P-11-V]

Most certified pesticide applicators in Florida prefer to renew their licenses by earning Continuing Education Units (CEUs) rather than retaking exams. For the past several years, extension agents have worked with three Florida producer-oriented magazines, writing articles and 10 questions which meet standards established by the Florida Department of Agriculture and Consumer Services (FDACS) for CEU approval. Printed articles range from 1 to 2 printed pages while questions vary from strictly objective to somewhat subjective. Agents are responsible for grading exams, signing the appropriate CEU form and returning it to the licensee. The authors consider these articles as a type of group learning experience. They have surveyed their audiences and are able to use these data in annual reports. With the advent of the new ASHS Certified Horticulturist program, a new group of people will need CEUs in various subject areas related to horticulture. These areas are more broadly based than those for pesticide license holders so there is greater potential for extension agents to be able to serve this clientele group with either online or published articles offering CEU credits.

An Educational Model to Facilitate Mandated Environmental Behavior Change. M.S. Orfanedes, UF/IFAS Broward County Extension, Davie, FL. (morf@ufl.edu) [P-1-OGL]

Concern over widespread ongoing tree abuse that was creating safety hazards for the public and threatening the health and longevity of Broward County, Florida's tree canopy led the Board of County Commissioners to adopt an ordinance regulating the tree trimming industry in 2000.

Known as the Broward County Tree Trimmer Licensing Ordinance, this legislation mandated that each organization that performs tree trimming obtain a license. One of the requirements for obtaining a license was passage of a mandatory training class that included a competency exam. Through extensive grass roots planning, a hands-on training curriculum for basic pruning was developed by UF-IFAS Broward County Extension. Curriculum materials were prepared and instructors were recruited and trained. Classes were conducted in English, Spanish and Creole to meet the needs of this diverse industry. The combination of field savvy instructors, lots of visual presentations, and outdoor hands-on pruning demonstrations has served the industry well. To date, nearly 5000 individuals have been trained. Special accommodations in the form of verbal exams, free retakes and skills demonstration exams have been popular with learning impaired and functionally illiterate students. Continuing education classes have been developed to provide training in tree biology and hazard assessment, storm preparedness and recovery pruning and safety. In a random sample of 104 trained tree trimmers, 94% (98) described the classes as providing a significant benefit to their business operations. Nearly the same percentage reported sharp reductions in hat-racking, overlifting and flush cutting of hardwoods and over pruning of palms. This model of education has been successful because of its service orientation and relentless commitment to making every student's experience a positive one. It has professionalized the industry and made tree canopy safer and healthier.

A Hands-on Course to Improve the Professionalism of "Green Industries" Personnel.

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As a response to public demand for basic horticulture classes, the UF/IFAS Miami-Dade County Extension horticulture faculty developed an eight-week "Certificate Course in Horticulture" in 2005. This lecture series was aimed at an audience of landscape professionals, parks department employees, and garden center employees. The course was expanded in 2006 and 2007 to 11-weeks to meet the needs of the participants. The goal of the program was to increase knowledge of basic horticultural practices such as plant selection and installation, pruning, irrigation, fertilization, landscape maintenance, and pest management. Due to space constraints, we limited each course to 60 participants. Each session lasted 3 hours and included hands-on activities. From 2005 – 2007 and 2009, the total enrollment was 257. Eighty-six percent (86%) of the participants passed a comprehensive final exam with an average score of 89%. Program evaluations given during the final class showed that 91.6% of the attendees were very satisfied or satisfied with the course, 98% said they learned something, and 90% said they would make at least one practice change. To document these practice changes, we conducted a 6-month follow-up survey of 40 participants. From what they learned in the course, 75% said they had increased their ability to communicate horticultural information more effectively with their customers and supervisors, 92% selected site-appropriate plants, 96% planted correctly, and 21% received a promotion. In 2008, we were invited to teach a revised version of this course in Spanish in Costa Rica.

Making the Grade: Restricted-use Pesticide Exam Preparation Workshops in Duval County. E.E. Harlow, UF/IFAS Duval County Extension, Jacksonville, FL. (eeeck@ufl.edu) [P-3-OGL]

With the slower economy, many landscape businesses are providing additional services and expanding their qualifications to be more competitive for contracts, particularly in the areas of aquatic and right-of-way weed management. Many of these contracts require a Florida restricted-use pesticide license. The exams can be difficult and challenging for many applicators and the study material can be overwhelming for individuals who have not been in a classroom setting for many years. The objectives of the workshops were to increase participant understanding and confidence with the exam study material and increase the number of licensed applicators in aquatics and right-of-way in the Jacksonville area. Both the aquatics and right-of-way exam preparation classes were taught through lecture, open discussion, and hands-on activities. These classes have been taught once with plans in the future to teach them again. A notebook of activities and hand-outs was provided. A study guide for the aquatics exam was borrowed from another agent and a right-of-way study guide was designed by the presenter. Thirty-three participants attended the Aquatic Herbicide Applicators Training with fifty-two percent taking the aquatics exam after completing the workshop. In comparison, nineteen participants attended the right-of-way training with 63% taking the exam. For both the aquatics and right-of-way exams 59% passed the exam. The average score for both exams was 87%. Sixty-four percent (64%) of evaluation respondents strongly agreed that as a result of the program they were more confident in their abilities to make herbicide calculations and several additional respondents indicated that without the classes they felt they could not have passed their exams. By adopting these classes into an extension program, the chance for business opportunities by participating companies is increased. These classes also provide much needed continuing education units for existing licensees and increases industry professionalism.

Commercial Ornamental Plant Diagnostic Clinic. L. Parker, UF/IFAS Orange County Extension, Orlando, FL. (l.parker@ufl.edu) [P-4-OGL]

Greenhouse and nursery growers are affected by many plant pest and disease problems. If ignored, these issues can be extremely costly to overall crop production and health. The Commercial Plant Diagnostic Clinic at the Mid-Florida Research and Education Center (MREC) in Apopka, FL works to serve commercial horticulturists and those in the landscape and interiorscape industries. The primary objectives of this program are to diagnose plant problems and give recommendations that will consist of the least toxic measures to control diseases and pests. Integrated Pest Management (IPM) methods and good practices are encouraged. Growers can bring plants into the clinic on Tuesdays from 1:00 p.m. to 4:00 p.m. Insect questions, pH & EC analysis, and other inquiries that do not require laboratory analyses are free of charge. Research faculty assists with the plant clinic whenever extension agents have difficulty diagnosing plant problems. Samples that require disease testing are shipped overnight to the Plant Disease Clinic in Gainesville for a nominal \$30.00 charge. Each sample submitted must have a completed "Plant Diagnostic Clinic Form" that details plant symptoms, recent pesticide/fertilizer applications and any other pertinent sample information. The poster explains the major disease and insect problems that occurred within the past twelve months. It also shows the results of a random survey given to clinic participants who demonstrated behavior change

and applied the recommendations given at the plant clinic. The more growers are able to receive diagnoses of plant problems, the more proactive they may become in preventing future occurrences so they can utilize more time on other facets of plant production. This program will continue to help educate growers on disease and pest issues.

The Urban Conservation Unit: Promoting Water Conservation for Residential Irrigation Systems. Mary Shedd McCready and Don Pybas, UF/IFAS Miami-Dade County Extension, Homestead, FL. Laura Vasquez, Jesus Lomeli, and Kati Migliaccio, UF/IFAS Tropical Research and Education Center, Homestead, FL. Michael Dukes, UF/IFAS Agricultural and Biological Engineering Department, Gainesville, FL. (mlshedd@ufl.edu) [P-5-OGL]

Due to increasing demand and a limited supply of water in Miami-Dade County, the Water Use Efficiency Plan (WUEP) was developed in 2006 to promote indoor and outdoor water conservation. The Urban Conservation Unit (UCU) was formed at the UF/IFAS Miami-Dade County Extension Service with funding from the Miami-Dade Water and Sewer Department (MDWASD) to provide the outdoor portion of the WUEP. The UCU provides participants [single family homeowners (SFH) and homeowners associations (HOA)] with a free irrigation system evaluation and a free soil moisture sensor (SMS) system. During the evaluations participants were informed of Florida-Friendly Landscaping™ principles as well as irrigation Best Management Practices (BMP). The soil moisture sensor systems measure the amount of water in the soil and, based on that information, can prevent unnecessary irrigation from occurring. The UCU also conducts a second visit to each site to ensure that the SMS system has been installed and is programmed correctly. Since the program inception, 249 participants have received irrigation assessments and educational materials pertaining to proper irrigation and landscape maintenance based on IFAS recommendations. A total of 77 SMS systems have been installed in the Miami area. Educational materials including, instructional videos (6), installation diagrams (7) and an EDIS publication, were developed to assist homeowners with understanding their irrigation system and their new SMS system. An irrigation contractor training program was developed to teach BMP irrigation practices and proper installation of soil moisture sensors. This program is assisting the County in reaching its conservation goals. In general, homeowners are interested in irrigating more efficiently but are in need of education on how to improve their irrigation practices. This program requires a lot of time and hands-on-work with each individual SFH and HOA. Water savings from the educational materials and irrigation control technology should offset the necessary inputs to the program.

Creating Wildlife Habitat and Reducing Mowing Costs. J.V. Morse, R. Albanese, J. Murphy, UF/IFAS Pinellas County Extension, St. Petersburg, FL; and S. Robinson, Environmental Management, Pinellas County Government, St. Petersburg, FL. (jvmorse@ufl.edu) [P-6-OGL]

McKay creek divides the site that contains the Florida Botanical Gardens and the Pinellas County Extension office. The creek sides had been maintained with regular mowing in the past. This all but eliminated wildlife habitat and refuge. Mowing also killed wildlife that was nesting in the area where the grass had grown before each mowing. Mowing to the waterline also created a situation that was dangerous to visitors, encouraging them to venture too close to the creek's edge to try to touch the alligators. Mowed areas also encouraged alligators to venture further up the slope. A wildlife specialist, soil specialist and horticulturists were consulted

regarding selection of native plants to establish habitat and promote wildlife. Plants were chosen for wildlife needs, division of areas and additionally were selected according to plant growing requirements. They were also selected to slow water movement and to sequester nutrients. Plants were placed in a random pattern by volunteers under the supervision of a trained horticulturist. Immediate monetary savings were seen when mowing was completely stopped. Over a five-year period, the area has developed a diverse plant community with maturing trees and shrubs. Wildlife now have undisturbed nesting areas and significant cost savings have been realized with the elimination of mowing.

Designing an Integrated Pest Management Program for Hispanic Landscape Maintenance Professionals. R.L. Jordi, UF/IFAS Nassau County Extension, Callahan, FL; H. Mayer, UF/IFAS Miami-Dade County Cooperative Extension, Homestead, FL; and, E.A. Skvarch, UF/IFAS St. Lucie County Cooperative Extension, Ft. Pierce, FL. (eask@ufl.edu) [P-7-OGL]

According to a 2005 University of Florida Nursery and Landscape Industry Economic analysis report, Florida's landscape sector accounts for \$5.255 billion in sales per year; of which nearly 30% is related to landscape maintenance businesses. The use of IPM principles to maximize pest management by applying chemicals when appropriate is an essential component to a sustainable environment. Traditionally, IPM educational publications have been produced and directed towards English speaking audiences. However, a demographic change is rapidly occurring in Florida where the number of landscape management companies employing Hispanic speaking personnel is increasing annually. In Southern Florida, the Hispanic employees in landscape businesses represent nearly 60% of all employees. Central and North Florida are seeing increasing numbers of Hispanic employees in landscaping companies as well. The purpose of this project is to develop a basic IPM Scouting Kit to educate the growing number of urban Hispanic landscape personnel. The goal is to increase the Hispanic employee's knowledge of the importance of identifying and protecting beneficial insects, using appropriate cultural landscape practices and applying pesticides properly. Several classes have been conducted and the results show: 50% of participants indicated they were better able to identify beneficial insects and described their skill as good or excellent; 40% stated they would now scout for insects prior to applying pesticides; and, 90% stated their ability to do their job had improved. All of the participants stated the IPM program was beneficial to them and the scouting kit would be useful on their job.

Environmental Horticulture Production Needs Assessment Survey. S.T. Steed, UF/IFAS Hillsborough County Extension Service, Seffner, FL, and G. Israel, UF/IFAS Professional Development and Evaluation Center, Gainesville, FL. (ststeed@ufl.edu) [P-8-OGL]

A needs assessment survey of all registered nursery producers of Hillsborough and Polk Counties was conducted to document the current horticulture industry needs and how best the multicounty agent would be able to serve those needs. The survey was developed from the request and guidance of the Environmental Horticulture Production Extension Advisory Committee with the collaboration of the UF/IFAS Professional Development and Education Center. Over five hundred (524 total) producers were sent an introductory letter, two days later they were sent the survey and cover letter, thirty days after that the nurseries were sent a follow up postcard. The survey requested information about their operation, demographics, production issues, marketing methods, extension delivery format, and other pertinent informational requests.

Ninety two responses were received (18%). Producers most requested programs in relation to pests such as weeds, insects and diseases. Producers least favored needs included foreign trade and labor relations. The most favored delivery method for extension information was a newsletter (3.88 on a 1-5 scale). Total cost of a returned survey was approximately \$6.00 per survey.

Annie's Project - UF/IFAS Extension Program for Women Producers in Horticulture.

R.A. Kluson UF/IFAS Sarasota County Extension, Sarasota, FL and N.M. Wilson UF/IFAS-Marion County Extension Service, Ocala, FL 34470 (rkluson@scgov.net) [P-12-V27]

Annie's Project is an interdisciplinary educational program in risk management for strengthening women in modern agricultural enterprises. Annie's Project provides a comprehensive curriculum that encompasses all five risk management issues such as: human, legal, marketing, production and financial. Originally developed in Iowa for a grain commodity-based market, the curriculum for Annie's Project was expanded and taught by a UF/IFAS Extension team to reflect the specific needs for the Florida agricultural market, including vegetables and fruits for local food markets. In 2010 Annie's Project was launched in five counties: Marion, Sumter, Suwannee, Hernando and Sarasota. Each county had 20 participants and the success of this program have far exceeded any expectations. The women students were taught the need for risk management, a business plan, a network and improved methodologies through science to increase their yield and to add value to their products. Based upon evaluation results the participants plan to implement QuickBooks Pro as their record keeping system, write or update their wills, change or update their farm liability insurance, have a clearer understanding of financial statements, write or update their farm business plan.

Finding Optimum Ratios of Soil Extractants to Determine Plant Available Phosphorus in Florida Calcareous Soils. Assma Zekri¹, Kelly Morgan¹, Shinjiro Sato¹, and Mongi Zekri².

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Phosphorus (P) is a plant essential nutrient, but can also be a pollutant. Therefore, best management practices (BMPs) are being developed by the University of Florida and adapted by Florida farmers to efficiently manage the fertilizer applied to their crops and minimize environmental pollution. The C-139 Basin in southwest Hendry County, a tributary to the Everglades, contains soils with high pH and calcium content. In this type of soil, applied P can precipitate with calcium and become unavailable to plants. Most soil extracting solutions are acidic and dissolve precipitated P causing an overestimation of the P available to plants.

Objective: The purpose of this research was to determine the optimum ratios of soil to extraction solutions that will provide a reliable analysis of bio-available P in calcareous soils. Soil P contents using ten soil-to-extractant ratios were determined and compared with plant available P using sequential analysis. For Mehlich 3, Bray, Olsen, and ABDTPA, the optimum solution to soil ratios were 40:1, 40:1, 50:1, and 30:1, respectively. With the exception of Mehlich 1, the selected optimum ratios (for Mehlich 3, Bray, Olsen, and AB-DTPA) were superior to the standard ratios. These findings are of critical importance to Florida farmers growing crops on calcareous soil because this will allow them to apply the correct amounts of P if needed and reduce excess P application.

International Horticulture Training on Landscape Maintenance in Guayaquil, Ecuador. L.M. Seals¹, A. Bolques², P. Vergot³, W. Bowen⁴. ¹UF/IFAS Brevard County Extension, Palm Bay, FL; ²Florida A&M University, Quincy, FL; ³UF/IFAS Northwest District Extension Director, Quincy, FL; ⁴UF/IFAS International Programs, Gainesville, FL. (lseals@ufl.edu) [P-14-OGL34]

Guayaquil is the largest and most populous city in Ecuador. City renovations such as expansions of levees, squares, parks, and some districts have turned Guayaquil into a national and international tourist destination. The expansion of green spaces has produced an appetite for new and exotic plant materials, which has created a shortage of trained landscape personnel. Horticultural research and educational training programs are very limited, resulting in fewer opportunities for quality landscape training for landscapers and homeowners. Quality training, especially for landscapers, is critical to the economic viability of the horticulture industry. To this end, a two week training program was developed for commercial landscape and nursery workers and for homeowners. A team of two Extension Agents conducted a two week landscape maintenance short course for commercial and homeowner groups. The first week of training targeted the commercial group, n=45, while the second week included the homeowners, n=40. At the end of the programs, at least 30% (n=27) of the participants indicated a better understanding of water issues. As is typical in Latin America, machete pruning was the main method for trimming trees and shrubs. A large part of the hands-on training was devoted to pruning techniques. These hands-on sessions provided an excellent opportunity to emphasize learned techniques and an opportunity to provide additional information that they could use in the trade. End of program survey showed that at least 90% (81) of the participants increased their knowledge and gained new skills for the green industry. The program was also beneficial for the Extension agents. The agents gained experience in creating and delivering programs for Spanish-speaking audiences, and the materials developed can be used throughout Florida to educate Spanish-speaking clientele.

What's In A Name? Using Focus Groups to Brand an Educational Garden. L. Felter, C. White, and R. Tyson, UF-IFAS Orange County Extension, Orlando, FL. (lfelter@ufl.edu) [P-15-OGL35]

Extension's use of marketing analysis, implementation, and evaluation will improve its ability to adjust to the many factors in the marketing environment. This proactive approach will improve extension's ability to recognize and address its stakeholders' needs. Using focus group methodology, this study asked participants with years of horticultural experience and with minimal horticultural experience to name a demonstration garden. Their input would take the guess work out of naming the garden and save precious dollars. To remain viable, Extension must find new ways to reach its consumers, as well as potential new clientele. Members from the Residential Horticulture and Demonstration Garden Advisory committee were recruited to participate in the two focus groups. This purposive sample was used because the Extension Service has advisory committees to guide Extension programs. The members of these advisory committees represent the clientele and interact with the general public. This interaction insures that educational programs meet the needs of the customers. Each session lasted two hours, each had 10 participants. Participant demographics were fairly representative with four males and 6

females, ages ranging from 30 to 75. The group contained novice gardeners 40 percent and career horticulturalists 60 percent. Preliminary results are as follows. The participants agreed that visitors would see many gardens and innovative ideas in action. The gardens would be ever changing. The name could not use learning, discovery, educational or demonstration garden. The garden was named, Exploration Gardens. The tagline was determined to be “Cultivate. Experience. Grow”. The future will continue to bring shrinking budgets and the information provided by the focus groups allow for targeted marketing efforts and fiscal responsibility of those budget dollars.

Can Social Marketing Educate Consumers About Complicated Behaviors? The Difficulties of Watering Your Lawn While Conserving Water. L. Felter, UF-IFAS Orange County Extension, Orlando, FL. P. Monaghan, UF/IFAS, Department of Agricultural Education & Communication, Gainesville, FL. (lfelter@ufl.edu). [P-16-OGL36]

Orange County, Florida is facing a looming water crisis. The St. Johns River Water Management District has determined that Orange county, which includes metropolitan Orlando, will reach the limit of its consumptive use permit in 2013 and no additional groundwater withdrawals will be allowed. This will mean that population growth beyond the current 1.2 million residents will have to secure water from sources other than ground water. While the immediate response has been to seek withdrawals from surface water in the St. Johns River watershed, there is also a renewed effort to conserve existing water resources. For many households in the region, the largest waste of water is not in the home but outdoors, in the landscape, specifically on the lawn. Homeowners can't keep up with home owner association demands and do not always understand the maintenance needs of their yards or the technology of their irrigation system. The most common behavior of homeowners is to set their irrigation timer and forget it, not making adjustments based on rainfall or the needs of the lawn. Traditional public education programs used by County Extension offices face a daunting task when confronted with these complicated behaviors and attitudes. Seven classes were held throughout the county. Participants were informed about how much water, when to water and efficient irrigation heads. Each class had 15 irrigation clocks all functioning. Participants worked in small groups based on the type of clock they had at home. All participants touched the clock and made adjustments. Mean pre-test knowledge score was 50% and the mean post test score was 85%, which showed a mean 30% gain in knowledge score.

Building Your Own Farm's Food Safety Manual and Plan. E. Toro, and K. Allen, UF-IFAS Suwannee County Extension, R. Hochmuth and L. Landrum, UF-IFAS North Florida Research and Education Center – Suwannee Valley, Live Oak, FL (etoro@ufl.edu) [P-17-V29]

Recent food borne illnesses have led to tightening of food safety regulations for agricultural operations nationwide. Most intermediate or large chain store buyers now require some level of food safety program from each farm before they buy. For small and medium scale farmers, complying with food safety protocols is especially challenging, as the steps to develop and implement an on-farm food safety plan are complex, costly and time consuming. The workshops “Building Your Own Food Safety Manual and Plan” were conducted to help farmers understand how to comply with food safety regulations, build their own food safety manual and prepare for a third-party audit. Two-day workshops were offered to 2 groups of growers: watermelon and

mixed vegetables groups. A third workshop was offered to packing house operators to cover food safety protocols and plans designed for these facilities. All attendees had access to a computer and the “Food Safety Manual Development Program” software available from Primus Labs. A team of Extension agents helped attendees as they worked their way through the software. A handbook to clarify food safety terminology was designed to help in this process. In addition, group discussions were held to clarify questions and to revise the ranch and crew self- audits that should be conducted before a third-party audit. An auditor attended the last session to clarify additional questions from growers. A total of 24 growers attended the workshops and were able to design food safety plans customized to their farm situations. Growers learned how to use this software to continue developing their food safety plans and adequately prepare for a third-party audit at a reduced cost. These classes are supported by a grant through the Florida Specialty Crops Block Grants program from the Florida Department of Agriculture and Consumer Services.

Starting a Successful Hydroponic Business. Hochmuth, R., L. Landrum, and W. Laughlin, UF/IFAS North Florida Research and Education Center – Suwannee Valley, Live Oak, FL. (bobhoch@ufl.edu) [P-18-V30]

This new program was initiated in 2009 to teach farmers and prospective farmers how to start a successful hydroponic business. The short course was conducted in 2009 and 2010 as a two-day, intensive, hands-on class and included an optional half day tour of two local hydroponic farms. The classes were primarily conducted inside the greenhouses at the North Florida Research and Education Center – Suwannee Valley. These greenhouses were set-up to be used specifically for this short course and were used to teach topics such as: greenhouse and shade structures, production systems, soilless media, growing transplants, integrated pest management, water and nutrient management, crop selection and culture, and marketing strategies. The registration fee for the short course was \$295 and reflected the actual costs of establishing the greenhouses to teach the course. Registration for the course in 2009 was so high that a second course option was offered to accommodate 70 participants. Likewise, interest was very high in 2010 with an additional 68 registrants. A post course on-line survey showed participants rated the value very high and greatly appreciated the hands-on teaching component. The participants requested additional classes covering advanced topics be offered and for Extension to develop a social networking tool for participants. The interest in learning about growing and marketing crops using hydroponic techniques is great. Attendees were willing to pay \$295 for a hands-on course of this quality. As a result of initiating this program, the availability of locally grown produce will be increased in Florida.

Vegetable Water Quality/Quantity Best Management Collaboration in West Central Florida. Crystal Snodgrass, UF/IFAS Manatee County Extension, Palmetto, FL; Alicia Whidden, UF/IFAS Hillsborough County Extension, Seffner, FL; and, Jemy June West Hinton and Darren Cole, UF/IFAS BMP Implementation Team, Wimauma, FL (crys21@ufl.edu) [P-19-V31]

Water Quality/Quantity Best Management Practices (BMPs) for Florida Vegetable and Agronomic Crops were created as a result of the Federal Clean Water Act (FCWA) developed in 1972 requiring states to assess the impact of nonpoint sources of pollution on surface and ground

waters and establish prevention measures. This led to the development of Florida's Nonpoint Source Management Program which requires the use of BMPs to minimize nonpoint source pollution. A FDACS-registered BMP plan gives producers a "presumption of compliance" with state water quality standards. Growers may also be eligible for costshare programs to help defer the cost of BMP improvements. Through collaboration among Hillsborough and Manatee County Extension Agents and the BMP implementation team, producers are educated on BMPs by face-to-face interaction. They are then guided through a checklist and asked to sign a Notice of Intent to implement BMP practices specific to their operation. Growers are educated through the use of BMP workshops, newsletter articles, updates on regulatory changes and most importantly, on farm visits. Since the onset of the statewide vegetable BMP program in 2005, over 35,000 acres of fruits and vegetables in Hillsborough and Manatee Counties have been signed with the BMP program, thus reducing nonpoint source pollution to the waterways of West Central Florida. This team approach and trust in County Extension agents has allowed growers to see that the BMP program is not just another government regulation. The group will continue to work together to educate growers and sign up additional acreage. This will be beneficial as the industry see more changes and stricter regulations on water and nutrient use.

[Vegetable Section \(Monica Ozores-Hampton, 2010 Sectional Vice-President\)](#)

A-Cultural Practices

Growing and Marketing Pole Beans at Local Green Markets in Southeast Florida. K.D. Shuler, P.N. Shuler, and J. Stephen. Stephen's Produce, 12657 158th St N Jupiter, FL 33478. (skshuler@aol.com) [V1]

The growers for Stephen's Produce grew and marketed pole beans from 2005 to 2009 to help supply local green markets with a weekend supply of "garden-fresh" produce. 'Fortex,' a French gourmet cultivar was grown. The beans were trellised on bamboo stakes which were supported by utility wire. The wire also supported snow peas. In 2007-08 twenty plantings were made from 27 Aug. to 29 Jan. Pole beans were sold on 25 weekends from 10 Nov. to 26 April. The beans were sold in gallon sized plastic storage bags at \$3.00-\$3.50 per lb. In 2007-2008, an average of 9 lbs. was sold each week for an average of \$31.60 per week.

A Survey of the Effectiveness of Current Methods Used for the Freeze Protection of Vegetables in South Florida. M. Ozores-Hampton, G. McAvoy, M. Lamberts and D. Sui. UF/IFAS South West Florida Research and Education Center, Immokalee, FL. (Ozores@ufl.edu) [V2]

Florida ranks second nationally in fresh market vegetable production with 192,600 acres planted with a farm value of \$1.4 billion in 2008-2010. Seventy percent of the Florida vegetable production is grown in South Florida counties of Collier, Hendry, Lee, Glades, Charlotte, Miami-Dade and Palm Beach. Florida's season is from October to June during which vegetable growers have to deal with possible hurricane, drought, and extremes of temperatures. Vegetables growers often suffer losses due to freezes between December and February when vegetables production is at various stages of development. The cold weather affecting winter vegetable production in

South Florida is controlled primarily by frontal systems that bring cold air from the North and is not always predictable. Therefore, the objective of the survey is to document the effectiveness of current methods of vegetable freeze protection used in South Florida. This season, the longest stretch of cold weather in all three Counties was between January 4 to 13, 2010 and freezing temperature were recorded the morning of January 11 in Collier and Miami-Dade Counties and January 13, 2010 in Palm Beach. Overall, losses and damage crops were 15%-100%, 40%-90%, and 15%-70 % of the total vegetable production in Collier, Miami-Dade and Palm Beach Counties, respectively. The freeze protection methods and reported effectiveness varied by County and crops. The most common methods (effectiveness) in Collier County were elevated water table (fair to poor) and depending of the crop (and on a trial basis) row cover/hoops, styrofoam cups, compost, soil and hay cover, tissue paper (very good to good), and chemical treatments (poor); Miami-Dade County were solid set irrigation (non-acceptable) where available and styrofoam or nursery pot cover (very good); Palm Beach County were elevated water table (fair), helicopter flights (good), row cover (tunnels) and hill cultivation (good). In conclusion, the effectiveness of current freeze control methods provided fair to poor protection in Collier and Miami-Dade County and fair to good in Palm Beach during the 2010 freezes. Several promising freeze-protection methods that resulted in good-to-very good levels of protection need to be studied in the near future.

Estimating Freeze Losses to Vegetable Crop Values and Farm worker Income. F. Roka, M. Ozores-Hampton, and G. McAvoy. UF/IFAS South West Florida Research and Education Center, Immokalee, FL. (fmroka@ufl.edu) [V3]

On January 11, 2010, a freeze devastated the southwest Florida vegetable industry and destroyed an estimated 30% of the region's annual production of round tomatoes, bell peppers, sweet corn, and green beans. Local and state officials requested an estimate of crop value lost and expected financial impact on the area's farmworkers as part of a declaration for federal disaster assistance. The extent of crop damage was estimated by UF/IFAS vegetable Extension agents for the Cooperative Extension Service based on information in enterprise budgets developed by UF/IFAS. Pre-harvest crop losses of fresh market vegetables exceeded \$145 million, and if harvest costs were included, the value of crop losses would have exceeded \$209 million. Farmworkers lost the opportunity to harvest and pack fruit, whose income was estimated to have been nearly \$24 million. The need estimate values of crop losses and farmworker income highlights the importance of maintaining these crop budgets with most current price and production information available. The process by which these estimates of crop loss and farmworker income were derived can become a template for local and state official to value future crop losses and impacts to worker incomes due to natural or man-made events.

Rootstocks Improve Fruit Yield and Quality of Greenhouse-produced Determinate and Indeterminate Tomato Cultivars. D.J. Cantliffe¹, N.L. Shaw¹, Q.N. Vinh², S.A. Sargent¹, A. Berry¹ and X. Zhao¹. UF/IFAS Horticultural Sciences Department, Gainesville, FL; ²Institute of Agricultural Science for Southern Vietnam, 121 Nguyen Binh Khiem, District 1, Ho Chi Minh City, Vietnam. (djcant@ufl.edu) [V4]

Two indeterminate cluster-type tomato (*Solanum lycopersicon* L.) cultivars ('Compari' and 'Westland') and one determinate beef-steak-type tomato cultivar ('Tasti-Lee') were grown in a

passively-ventilated greenhouse and harvested 29 times from 12 November to 20 May 2009. ‘Tasti-Lee’ was double-cropped and harvested as a spring and fall crop. Each of the three cultivars was grafted onto two popular rootstock cultivars, ‘Maxifort’ and ‘Beaufort’, and compared to non-grafted scion plants. Both ‘Tasti-Lee’ and ‘Compari’ are marketed as high-lycopene fruit cultivars. ‘Compari’ had the smallest fruit size, while both ‘Westland’ and ‘Tasti-Lee’ had similar fruit size over the entire experiment. Total fruit weights were similar for all three cultivars; however, fruit numbers were double to triple from ‘Compari’ compared to ‘Westland’ and ‘Tasti-Lee’, respectively. Use of ‘Maxifort’ as a rootstock led to improved yields (number and weight) compared to scion plants of ‘Compari’ in late winter and spring harvests. Both rootstocks led to improved yields of ‘Tasti-Lee’ compared to scion plants in spring harvests (number and weight) while use of ‘Beaufort’ improved yields (weight) of ‘Westland’ in fall harvests. Fruit firmness and pH were similar for both cultivars regardless of rootstock and season. In fall and spring, ‘Compari’ had greater soluble solid concentration and titratable acidity than ‘Tasti-Lee’, but ‘Tasti-Lee’ had deeper red color (greater hue values) and greater lycopene content than ‘Compari’ regardless of rootstock. Thus, rootstock had a seasonal affect on tomato fruit yields wherein ‘Maxifort’ led to improved yield as the season progressed. Rootstock had no effect on fruit quality; only cultivar differences led to differences in soluble solids concentration, acidity, color and lycopene content. Use of a determinate cultivar as a fall and spring crop netted the same yields over fewer harvests as two indeterminate cultivars. Labor for pruning was greatly reduced by using a determinate cultivar.

Performance of Specialty Melons Cultivars in High Tunnels and Open Fields. T.P. Salame-Donoso¹, B. Santos¹, and D.J. Cantliffe². ¹UF/IFAS Gulf Coast Research and Education Center, Wimauma, FL; ² UF/IFAS Horticultural Sciences Department, Gainesville, FL. (tsalame@ufl.edu) [V5]

Two studies were conducted to compare the performance of three specialty melons cultivars under two production systems. The cultivars were ‘Lorio’, ‘Atello’ and ‘Velsat’, whereas the production systems were open-field and high-tunnel culture. The cultivars were harvested at least eight times per season and fruit were counted and weighted. On the same day, their soluble soil content was measured in five marketable fruit per experimental unit. The 2009 results indicated that there were significant effects of each of the main factors, but not by the interaction between them on the collected variables. Marketable fruit number was the highest for plots planted with ‘Velsat’, whereas there were no differences between plots inside and outside the high tunnels. Marketable fruit weight increased by 12% inside high tunnels in comparison with fruit produced in open fields, and ‘Lorio’ and ‘Velsat’ had the heaviest fruit. In contrast, ‘Atello’ showed the highest soluble solid content (14°Brix), while fruit produced inside high tunnels were sweeter (14°Brix) than those obtained in open field plots (11.5°Brix).

‘Tasti-Lee’ Tomatoes: Potential Consumer Demand for an Improved UF-Developed Shipping Tomato. L. Harrison¹, J. Scott², and E. Harrison³. ¹UF/IFAS Leon County Extension, Tallahassee, FL. ²UF/IFAS Gulf Coast Research and Education Center, Wimauma, FL. ³Florida Department of Agriculture and Consumer Services, Tallahassee, FL. (harrison@leoncountyfl.gov) [V6]

The objectives were to measure potential middle and upper income consumer demand for the UF/IFAS developed ‘Tasti-Lee’ tomato and estimate its market potential in the Eastern United

States. We utilized focus groups with a standardized survey questionnaire to probe interviewees about their requirements and preferences for choosing tomatoes in a retail venue. Randomly selected individuals were interviewed about their preferences for vegetables in general and, tomatoes in particular, and provided three samples for comparison and evaluation. The samples were a standard 6 x 6 shipping tomato (Sample A), a ‘Tasti-Lee’ (Sample B), a high-end tomato with stem attached (Sample C). Samples were presented without identification. Test sites were Atlanta, GA, Richmond, VA, and Indianapolis, IN, in affluent retail sections of these cities. The USDA - Federal State Market Improvement Program (FSMIP) grant funded this project. ‘Tasti-Lee’ tomatoes have a well defined initial market potential, based on the comments of respondents. Tasti-Lee ranked first overall in the evaluation, with 72% rating it good to excellent, compared to sample A at 45% and Sample C at 61%. The top rated features of ‘Tasti-Lee’ tomatoes were color, flavor and juiciness. The most frequently identified application was as a salad ingredient at dinner. Respondents indicated a willingness to consume ‘Tasti-Lee’ three (or more) time weekly. Acreage forecast depend upon marketing and pricing strategies, and quality control. Ideally from a net revenue perspective, ‘Tasti-Lee’ will be a branded tomato priced for the premium market. Planting potential could reach 1,000 acres in five years.

Post-harvest Qualities of Vegetable Crops Grown With or Without Compost. N. Roe¹, and M.A. Ritenour². ¹Farming Systems Research, Inc. P.O. Box 741112, Boynton Beach, FL 33474. ²UF/IFAS Indian River Research and Education Center, Ft. Pierce, FL. (ner@bellsouth.net) [V7]

Few studies have determined compost effects on the postharvest quality and quality retention of vegetables. This study determined nutrient uptake into tomato (*Solanum lycopersicon* L.), pepper (*Capsicum annuum* L.), and cucumber (*Cucumis sativus* L.) fruit, and lettuce (*Lactuca sativa* L.) leaves grown with or without compost and their quality before and after storage. The experiments were conducted over two seasons in southeast Florida on raised beds with polyethylene mulch and drip irrigation with 1.68 kg·ha⁻¹ N and K applied per day. Treatments were no-compost (NC), single-year compost (SYC), and multi-year compost (MYC). Horse manure compost was applied at 22 wet Mg·ha⁻¹ and 19 dry Mg·ha⁻¹ the second year. Tomato fruit Ca concentration was different only in the first season, P concentration was different in both seasons, and K concentration was different in the second season with similar trends in the first season. In the first season, Ca concentration in the pepper fruit was higher from NC plots, Mn concentration was lower in MYC and Cu concentration was lower in fruit from SYC than the other two treatments. In the second season, Mn concentration was again lower in compost plots, as was that of Zn. There were no differences in cucumber fruit nutrients during the first season, and in the second season only P concentration was higher in the MYC treatment. During the first season, lettuce leaf Ca concentration was higher in MYC than in SYC and NC, with no differences during the second season. There were few differences in postharvest storage quality in any of the crops and no clear trends were observed.

Growing and Marketing Eggplant at Local Green Markets in Southeast Florida. K.D. Shuler, P.N. Shuler, and J. Stephen. Stephen’s Produce, 12657 158th St N Jupiter, FL 33478. (skshuler@aol.com) [V8]

The growers for Stephen’s Produce began growing and marketing eggplant in 2001 to help supply local green markets with a weekend supply of “garden-fresh” produce. A Sicilian type obtained from a local grower was grown from 2001 to 2005 and ‘Rosa Bianca,’ an Italian

heirloom cultivar, was grown from 2005 to 2010. In 2008-09 three plantings were made with transplants set out on 14 Aug., 24 Sept., and 19 Nov. Eggplant was sold at all of the 28 weekends for the sales season which began 20 Oct. and ended on 26 April. Eggplant was usually grown on beds covered with plastic mulch. Eggplants were sold for \$1.00 to 3.00 per fruit and in 2008-2009, an average of 26 eggplants was sold each week for an average of \$36 per week.

The Impacts of Technology Developments in the Florida Pepper Industry on Production Efficiency. J. Vansickle, D.J. Cantliffe, S. Smith, T. Winsburg, and T. Winsburg. UF/IFAS Food Resource Economic Department, Gainesville, FL. (sickler@ufl.edu) [V9]

Costs of producing Florida fresh green peppers have increased significantly over the last half century. We have seen total production costs increase from \$1,101 per acre in 1960 to \$18,526 in 2009. Productivity has also increased as yields over this period increased from an average of 374 cartons per acre in 1960 to 880 cartons per acre in 2009. Unit costs have increased from \$2.65 per carton in 1960 to \$18.53 in 2008. The average sales value for bell peppers has increased from \$2.66 per carton to \$12.40 over the same period. In recent years, production cost increases have outstripped increases in value. Technologies for producing bell peppers have changed significantly over this period. Because Florida has a disadvantage in labor costs for producing bell peppers, technologies have been developed to minimize the influence of this factor. Bell pepper growers have decreased the component share of production cost attributed to labor from 37% in 1965 to 5.5% in 2008. In contrast, crop protection materials and machinery operating costs have increased their component shares of production costs to 18.9% and 21.6%, respectively. Major developments in technology that have contributed to this shift in component costs include hybrid seed development, plastic culture, and use of methyl bromide. Each of these developments has helped to keep Florida producers competitive in the U.S. market.

B-Control and Management of Insects, Diseases and Weeds

Organically Approved and Reduced Risk Pest Control Options from Certis USA for Fruiting Vegetable Production. B.H. Highland, Certis USA, 1069 Eisenhower Dr., Nokomis, FL 34275. (bhighland@certisusa.com) [V10]

Fruiting vegetables, including tomato (*Solanum lycopersicum*) and pepper (*Capsicum annuum*) continue to be very important crops in fresh market vegetable production in Florida and the Southeastern US. Organic fruiting vegetable production comprises a small number of acres in the total production system in the SE US at this time, but this market is rapidly expanding. High demand for organic produce and corresponding high market prices have increased the interest of organic growers. Insect, disease, weed, and nematode pest pressures can be particularly intense in Florida and the SE US due to extended and overlapping growing seasons, and warm and humid climates. This has been of particular concern in organic vegetable production especially in past years, when organically approved pesticide tools were few. Recently, however, major advances in the development of effective and cost competitive products have been achieved, labeled, and marketed by Certis USA for use in organic fruiting vegetable production. Two recent examples are MeloCon[®] WG and SoilGard[®] 12 G, which have been shown to be very effective when used alone or in combination to control nematodes and soil pathogens in tomatoes in the SE US. Certis USA marketed insecticides that are approved for organic fruiting vegetable production include the “Bt” larvacides Agree[®] and Javelin[®], the “neem” based insect growth

regulators Neemazad[®] and Neemix[®], the miticides Trilogy[®] and SilMatrix[®] (organic approval pending), and the insecticidal soap DES-X[®]. Certis USA registered fungicides that are approved for organic fruiting vegetable production include the neem oil extract Trilogy[®], and Cueva[®], a low copper based fatty acid formulation. With these organically approved products and others developed by other companies, SE US fruiting vegetable growers now have an effective and extensive pest control arsenal for use in their production systems. The targeted and proper use of these products makes the goal of achieving a viable organic fruiting vegetable crop increasingly likely, even with the challenge of the pest spectrum and pressure intensity often encountered.

Incidence and Spread of Strawberry Necrotic Shock Virus (SNSV) on Strawberries in Florida. C. Moyer, V. Whitaker and N.A. Peres. UF/IFAS Gulf Coast Research and Education Center, Wimauma, FL. (nperes@ufl.edu) [V11]

Strawberry necrotic shock virus (SNSV), formally known as *Tobacco streak virus* (TSV), has a wide host range and has been reported on strawberries in the US, Australia and Israel. Even though it does not produce symptoms on commercial cultivars, reduction in yield and runner production may occur. The virus is disseminated through seeds, pollen, and thrips. The presence of SNSV on certified strawberry plants of the two newest cultivars released in Florida, ‘Florida Radiance’ and ‘Elyana’, has led to the destruction of nursery planting stock. Thus, the presence of SNSV in strawberry production fields was investigated during the 2009-2010 strawberry season. Leaf samples were collected from 7 cultivars obtained from 8 different nurseries at the GCREC research farm and at a grower’s field in the Plant City area. Samples were collected three times during the season and tested for SNSV by enzyme-linked immunosorbent assay (ELISA). The first samples were collected at the beginning of the season to determine if plants came already infected from the nurseries. SNSV was detected on ‘Florida Radiance’ plants from all nurseries tested but one. ‘Florida Elyana’ was only tested from one nursery and was also found positive. All other cultivars from all nurseries tested were negative. However, SNSV was detected on cultivars other than ‘Florida Radiance’ and ‘Elyana’ at the end of the season suggesting that the virus had spread within strawberry fields. Temperatures during this season were colder than normal which may have prevented a more rapid spread of SNSV.

Bacterial Spot Resistant Pepper Trials in Florida. E. McAvoy¹, M. Ozores-Hampton², R. Raid³, D. Sui⁴, R. Nagata³, K. Pernezny³ and J. Jones⁵. ¹UF/IFAS Hendry County Extension, La Belle, FL; ²UF/IFAS South West Florida Research and Education Center, Immokalee, FL; ³UF/IFAS Everglades Research and Education Center, Belle Glade, FL; ⁴UF/IFAS Palm Beach County Extension, West Palm Beach, FL; ⁵UF/IFAS Plant Pathology Department, Gainesville, FL. (gmcavoy@ufl.edu) [V12]

Bacterial spot caused by the bacterium *Xanthomonas euvesicatoria*, is one of the most serious diseases of pepper in Florida. Infection can markedly reduce yields and fruit symptoms reduce marketability. The traditional recommendation for bacterial spot control consists of frequent applications of copper and maneb. In Florida, the effectiveness of copper sprays has been limited for many years, due to the widespread occurrence of copper tolerance among strains of *X. euvesicatoria*. Researchers have identified no fewer than eleven different races of *X. euvesicatoria*. Since no single variety incorporates resistance to all known races, it is important that growers are knowledgeable about locally occurring races and use varieties that have

resistance to races that occur in their area. Commercial pepper varieties combining resistance to races 1, 2 and 3 have been on the market for several years and have provided growers with partial protection from bacterial spot infection. More recently, several seed companies have introduced new varieties and selections which incorporate additional resistance to races 4 and 5. Numerous field trials were conducted from 2006 to 2010 to evaluate cultivars with this added resistance in South Florida. All experiments were replicated and were conducted in commercial pepper fields containing naturally occurring levels of *X. euvesicatoria* inoculum. These trials demonstrated that cultivars containing the added resistance to race 4 and/or race 5 performed better, dramatically reducing bacterial spot infection rates, allowed increased number of harvests and increased yields over those varieties with resistance to bacterial spot races 1, 2 and 3 only.

Evaluation of Herbicides for Management of Weeds in Sweet Basil (*Ocimum basilicum*). D. Sui¹, W. Stall², E. McAvoy³, and R. Raid⁴. ¹UF/IFAS Palm Beach County Extension, West pal beach, FL; ²UF/IFAS Horticultural Sciences Department, Gainesville, FL; ³UF/IFAS Hendry County Extension, LaBelle, FL; ⁴UF/IFAS Everglades Research and Education Center, Belle Glade, FL. (dsui@ufl.edu) [V13]

Sweet basil (*Ocimum basilicum* L.) is one of the world's most popular herbs, with much of the U.S. fresh market basil being produced in Florida. In the field, weed control is a continual problem. With few registered herbicides, growers must rely on mechanical or hand-weeding, which are frequently ineffective and/or expensive. During 2009, trials were initiated to select potential candidates for chemical control. On a commercial sand soil site during spring, eight herbicides were screened for crop tolerance and weed control. Candidates included linuron, S-metalochlor, napropamide, halosulfuron, and dimethenamid applied pre-emergence, and linuron, halosulfuron, and clopyralid applied post-emergence. Of the pre-emergence treatments, all provided good weed control but linuron, dimethenamid, and metalochlor resulted in crop death at the rates tested. Napropamide (2.0 lb ai/A) resulted in the highest crop vigor, followed by halosulfuron (0.375 oz ai/A). Of the post-emergence treatments, all gave some measure of weed control, with clopyralid producing the least crop damage, followed by halosulfuron, and then linuron. In a trial conducted on an organic soil site during winter, linuron was tested at three different rates pre-emergence, followed by linuron, imazethapyr, and prometryn, each at three different rates post-emergence. Linuron as a pre-emergence treatment on muck provided significant weed control and acceptable crop vigor at all three rates tested (0.125, 0.25, and 0.375 lbs ai/A). Of the post-emergence treatments, only linuron at 0.125 ai/A provided significant weed control with minimal reductions in crop vigor. Prometryn resulted in crop death and imazethapyr significantly reduced crop vigor at the rates tested.

Searching for an Ideal Soil Extractant for Determining Sulfur in Sandy Soils. C.E. Esmel¹, B.M. Santos¹, J.E. Rechcigl¹, G. Toor¹, E.H. Simonne² and J.W. Noling³. ¹UF/IFAS Gulf Coast Research and Education Center, Wimauma; ²UF/IFAS Horticultural Sciences Department, Gainesville and, ³UF/IFAS Citrus Research and Education Center, Lake Alfred. (Student competition entry; cam13@ufl.edu) [V14]

When based on plant available sulfur (S), soil testing can provide useful information for developing fertilization programs for S. No reliable correlations have been found between soil extractable S or SO₄-S and plant yield under field conditions. The current recommendation for

vegetables is not based on soil test results, but relies on the results of leaf analysis (0.3% to 0.8% S is the adequate range). Since $\text{SO}_4\text{-S}$ may leach from sandy soils establishing a soil test for S may reduce the risk of S deficiency. The objectives of this study were to 1) compare soil extractants for $\text{SO}_4\text{-S}$ for selected Florida soils and 2) compare these $\text{SO}_4\text{-S}$ values to total S in plant tissues and tomato (*Solanum lycopersicum* L.) yield. Fifty-two paired soil from Spodosols and tomato leaf samples were collected for total S and $\text{SO}_4\text{-S}$ determinations. Extractants used were Mehlich-3, deionized water, and 0.025 M KCl. Linear regression analysis and slope comparison against an ideal linear regression line were used. Relationships between various soil extraction solutions and plant tissue S or tomato yield were found to be variable with most $R^2 < 0.70$. These results suggest that the predictability of any soil extractant with tomato plant tissue S or yield is low, thereby rendering a soil test based on these extractions unpractical. Hence, the current Florida recommendation for S using plant analysis should continue to be utilized, regardless of current S responses being found with the addition of S to the fertilizer regime.

Movement of the Wetted Front under Drip-irrigated Tomatoes Grown on a Sandy Soil. B.L. Poh¹, A. Gazula¹, E.H. Simonne¹, R.C. Hochmuth², and M.R. Allgood¹. ¹UF/IFAS Horticultural Sciences Department, Gainesville, FL. ²UF/IFAS North Florida Research and Education Center-Suwannee Valley, Live Oak, FL. (Student competition entry; pohbeeling@ufl.edu) [V15]

Keeping water and nutrients within the root zone of vegetable crops is the main goal of nutrient Best Management Practices. How deep irrigation water moves through the soil profile depends on the volume of water applied and how much water is taken up by the plant. It is possible that reducing drip irrigation system operating pressure (OP) may result in slower vertical water movement because of (1) greater lateral water movement, (2) reduced water application rate, and (3) increased plant water uptake. Without a crop, water moved in a deep sandy soil at 0.3 to 0.9 inches for every 10 gal/100ft of water applied, implying that in a 60-day crop cycle, the wetted soil depth would be 86 to 260 inches (assuming daily 2-hour irrigation at 24 gal/100ft/h). In this study, tomato plants were grown for two seasons using plasticulture. Replicated treatments were OP (6 and 12 psi; 41 and 82 kPa) and two irrigation rates of 100% and 75% UF-IFAS recommended rates. A blue dye was injected on 14 and 21 DAT and the soil was dug on 70 and 84 DAT in 2008 and 2009, respectively. The depth of water front was significantly affected by OP ($p=0.01$) with greatest wetted depths of 52 and 63 inches at 6 psi, and 64 and 67 inches at 12 psi, respectively for 2008 and 2009. Irrigation rate did not have any significant effect on the depth of waterfront. While reducing OP significantly reduced the downwards movement of water in the soil, it was not sufficient to keep the water from moving below the crop rootzone on a sandy soil.

Callus Formation and Plant Regeneration from Kurrat (*Allium ampeloprasum* var. kurrat) and Leek (*Allium ampeloprasum* var. Porrum). M.Y. Yasseen, Genetic Engineering and Biotechnology Research Institute, Sadat City, P.O. Box 79/22857, Minufiya University, Egypt. (mohamedyasseen@hotmail.com) [V16]

A procedure for plant regeneration of kurrat and leek from inflorescence, seedlings, bulb and leaf base is described. Callus was induced from florets and seeds cultured on MS containing 0.5, 3, 6, 10 mg/l 2,4-dichlorophenoxyacetic acid (2,4-D), 3 mg/l naphthaleneacetic acid (NAA),

naphoxyacetic acid (NOA), with 0.5 mg/l kinetin, 300 mg/l casine hydrolyste and 200 mg/l glutamine. Leaf base, stem base segments and roots were excised from seedlings germinated on MS alone and cultured on callus induction medium. Callus produced from all type of explants were then transferred into shoot-induction medium composed of MS containing 0.5 mg/l kinetin. Direct shoot formation was accomplished from immature inflorescence explants cultured on MS containing 0.0, 0.5, 1.0, 1.5, 2.0, and 3.0 mg/l BA. Shoots were produced after five to six weeks from culture. Produced shoots from all type of explants were rooted in MS containing 1 mg/l indole acetic acid (IAA). Rooted shoots were either transferred into bulb-induction medium containing 90 g/l sucrose and 1 g/l activated charcoal or acclimatized and transferred to soil. This procedure has the potential for improving plant characteristics through shoot regeneration from callus and clonal propagation of elite mature kurrat and leek through direct shoot proliferation.

Effect of Early Season Weed Competition Duration on Onion Yield. J.J. Sander, J. S. Ludger, and J. Benord. Mont Gerand Université Notre Dame d'Haiti, B.P. 151 Les Cayes, Haiti. (sanderht@yahoo.fr) [V17]

An experiment was conducted at Mersan, South Haiti to determine the effect of early season weed competition duration on the yield of onion (*Allium cepa* L.). The experimental design was a randomized complete block of 7 treatments (weed-free from planting to harvest, weed competition up to 2 weeks after planting, weed competition up to 4 weeks after planting, weed competition up to 6 months after planting, weed competition up to 8 weeks after planting, weed competition up to 10 weeks after planting, and weed competition from planting to harvesting) in 4 replications. Onion yield decreased as the duration of early season weed competition increased. Yield loss was 14.45% when weed removal was initiated at 2 weeks after transplanting the crop, and 88% when the onion crop was in the presence of weeds season long.

Novaluron for Control of Larval Sap Beetles in Strawberries. J.F. Price and C.A. Nagle, UF/IFAS Gulf Coast Research and Education Center, Wimauma, FL. (jfprice@ufl.edu) [V18]

Strawberries valued at \$327 million were produced on 7,900 acres in Florida during 2007-2008. Most fields experienced episodes of sap beetles (Nitidulidae principally *Lobiopa insularis* and *Haptoncus luteolus*) entering fields in late winter, chewing holes in ripe berries and reproducing there. The presence of small numbers of adults or their larvae in fresh berries inflicts significant economic damage. Pesticides presently available for control have been inadequate and growers have relied largely on field sanitation, including removal of all ripe berries regardless of sales value, to reduce losses. Those measures sometimes result in unacceptable damage. Experiments were conducted in each of 2006 - 2009 to determine the usefulness of aqueous sprays of novaluron, the benzoylurea inhibitor of chitin biosynthesis insecticide (an insect growth regulator), for management of sap beetle larvae. Results indicated that Rimon[®] 0.83EC novaluron insecticide applied at 12 fluid ounces per acre up to three times in the late season provides excellent control of larvae. Additional investigations are underway to discover effective companion insecticides to reduce numbers of initially invading adults.

Effect of Added Elemental Sulfur on Soil pH and Phosphorus Availability in Sandy Soils. K. Morgan. University of Florida/IFAS, South West Florida Research and Education Center, Immokalee, FL. (conserv@ufl.edu). [V19]

Phosphorus (P) precipitates out of soil solution and becomes unavailable for plant uptake as soil pH and Calcium (Ca) content increase. The reduced P plant availability in soils with pH greater than 7.0 and Ca concentrations >1000 mg/L renders soils tests using Mehlich 1 extractant ineffective because the acids that make up this extractant can dissolve precipitated P and reflect soil P concentrations not available to plants. The effect of lowering soil pH with sulfur (S) and other cultural practices to increase plant availability of fertilizer P is of interest to growers, environmentalists, regulators and the general public because of improved P availability and possible impact of increased S concentrations on the environment. The objective of this field study was to determine the length of time soil pH is migrated by application of sulfur in plastic covered beds and the subsequent affect on growth and productivity of tomato. Sulfur was applied to two selected fields at two rates in combination with four P rates. It was determined that the soil pH reduction from the initial S applications rates equivalent to 125 and 250 pounds of S per acre applied only in the planted row lasted less than 60 days and had minimum effect on P availability during the entire crop growing season. The application rates at the second site were increased to 250 and 500 pounds per acre in the planted row. The reduction in soil pH lasted less than 90 days, and again had little impact on final plant growth and yield.

Monitoring Nutrient Availability and Leaching Below the Root Zone in Organic Vegetable Production. D. Treadwell¹, M. Alligood¹, E. Simonne², R. Hochmuth³, E. Toro⁴, C. Saft⁴ and B. Hoover⁵. ¹UF/IFAS Horticultural Sciences Department. ²UF/IFAS Florida Cooperative Extension Service, Gainesville. ³UF/IFAS North Florida Research and Extension Center - Suwannee Valley, Live Oak, UF. ⁴UF/IFAS Suwannee County Extension. ⁵Hoover Farms, Live Oak, FL. (ddtreadw@ufl.edu). [V20]

The combined risk of leaching in Florida's sandy soils and the poor predictability of nutrient release from plant and animal-based pre-plant fertilizers may result in a shortage of N and K during the growing season, thus reducing crop yield and quality. The goal of this project was to increase crop quality and nutrient management efficiency by monitoring nutrient availability and leaching below the root zone. Four drainage lysimeters were installed on a certified organic farm in Live Oak, FL in Fall 2008 directly under beds for cropping in spring and fall 2009. Composted poultry litter (2-2-1.4) was broadcast incorporated at a rate of 4 t/ha both seasons. Soil moisture was maintained between 8% and 12%. In March, cucumber (*Cucumis sativus* L.) and zucchini squash (*Cucurbita pepo* L.) were planted each over two lysimeters. Cabbage (*Brassica oleracea* L.) was planted over all the lysimeters in October. Plant petiole sap K and NO₃-N content as well as K, NO₃-N and NH₄-N concentration in leachate from drainage lysimeters were measured throughout both seasons. Petiole K and NO₃-N remained within sufficiency ranges for all crops. Leachate volume and nutrient content were variable among lysimeters. Leachate K was less than 6.0 mg/L on 15 of 17 sampling dates, 9.3 mg/L once and 27.4 mg/L once. Leachate NO₃-N and NH₄-N combined ranged from 25.7 – 37.7 mg/L on 3 of 17 sampling dates, indicating that the farmer's irrigation and fertilization practices are efficient and nutrients are most likely remaining in the root zone.

Improving Irrigation Management for Strawberry Production in Florida. B.M. Santos¹, M. Ramirez-Sanchez¹, T.P. Salame-Donoso¹, and A.J. Whidden². ¹UF/IFAS Gulf Coast Research and Education Center, Wimauma, FL. ²UF/IFAS Hillsborough County Extension Office, Seffner, FL. (bmsantos@ufl.edu) [V21]

The necessity of exploring alternative production systems to improve sustainability and economic returns for strawberry production exists in Florida. High tunnels offer an opportunity to improve water use for plant establishment, freeze protection and growth during the winter production season. In open fields, bare-root strawberry transplants are established with 10 to 14 days of sprinkler irrigation for 8 to 10 hours per day. Rapid urbanization and encroachment into agricultural lands along with efforts leading to improve water utilization and reduce nutrient leaching are the main reasons for exploring alternative strawberry establishment practices. Studies were conducted in high tunnels to determine the effects of: a) crop protectants on strawberry establishment, b) diverse irrigation programs for strawberry production, and c) low temperatures and sprinkler irrigation for freeze protection of strawberry cultivars. Preliminary results indicated that using crop protectants based on kaolin clay reduced the amount of water needed for establishment from 10 to 6 days without affecting yields and quality in comparison with non-treated plots. On the other hand, water loss due to evaporation was about 20% lower inside the tunnels, due to lower air and soil temperatures especially in October and November of each year, resulting in lower water volumes required for crop production in comparison with open fields. After three consecutive years of high tunnel research, sprinkler irrigation for freeze protection was not necessary, providing inside temperatures between 6 to 10°C higher than in open fields, and yields during the following six harvests following a freeze between 45% to 200% higher than in open fields.

Evaluation of Methodologies to Estimate Historical Reference Evapotranspiration in Florida. E. Gelcer, C. Fraisse and P. Sentelhas. UF/IFAS Agricultural and Biological Engineering Department, Gainesville, FL. (cfraisse@ufl.edu) [V22]

The Penman-Monteith (FAO-56 PM) equation is considered by FAO as the standard method to calculate Reference Evapotranspiration (ET_o). The lack of data, especially in long-term historical records, is the basic obstacle for a broader use of the FAO-56 PM equation. Long-term records often include only daily minimum and maximum temperatures and precipitation. In these circumstances empirical methods can be used to estimate ET_o. However, empirical methods are generally calibrated for local conditions and are not readily transferable to other regions. The main objectives of this study were to compare ET_o calculated by Penman-Monteith method (FAO-56 PM) to ET_o estimated by empirical methods (Penman-Monteith using estimated data – ePM; Priestley and Taylor using estimated Solar radiation – PT; and Hargreaves – HA) and calibrate the empirical methods for Florida conditions. The State was divided into three regions (1-South; 2-Central; and 3-North and Panhandle) based on climate characteristics. Data collected by the Florida Automated Weather Network (FAWN) for 29 weather stations between the 2003 and 2009 were used to estimate ET_o by FAO-56 PM and by empirical methods. Daily, 10-day period, and monthly values of ET_o calculated by FAO-56 PM and empirical methods were compared. For all regions ePM and HA methods overestimated ET_o. PT overestimated ET_o in the Central, North and Panhandle regions and underestimated in the South. For 10-day periods, the PT equation yielded the smallest root mean square difference (RMSE) and highest coefficient of determination (R²) values for the Central and South regions.

For monthly ETo, PT and HA equations had the smallest RMSE and highest R² for the Central, North and Panhandle regions. These results indicate that when only minimum and maximum temperatures data are available, PT is the best method to estimate ETo for daily and 10-day period. However, using PT requires the calibration of four empiric coefficients whilst to use HA is necessary to calibrate only one coefficient. For this reason HA was recommended for estimation of monthly ETo.

Nutrient Management Programs for Fresh Market Tomatoes Grown with Plasticulture: Economic Insights. A. Gazula¹, E. Simonne², F. Roka³, G. Hochmuth⁴, M. Dukes⁵, and P. Nkedi-Kizza⁴.¹University of Florida/IFAS Alachua County Extension, Gainesville, FL. ²UF/IFAS Horticultural Sciences Department, Gainesville, FL. ³UF/IFAS Food and Resource Economics Department, Immokalee, FL. ⁴UF/IFAS Soil and Water Science Department, Gainesville, FL. ⁵UF/IFAS Agricultural and Biological Engineering Department, Gainesville, Florida. (agazula@ufl.edu) [V23]

Because the cost of fertilizer represents only a small portion of the fresh market tomato production, growers may apply fertilizer rates in excess of UF/IFAS recommendations to prevent nutrient shortages and maintain productivity. Moreover, because of low water holding capacity of Florida's sandy soils, growers may also apply excess irrigation. With the adoption of BMPs to implement the TMDLs, growers are encouraged to follow UF/IFAS irrigation and fertilizer recommendations. Therefore, the objective of this study was to determine the economic impact of irrigation-nutrient management programs on tomato returns using partial budget analysis. A 2-year experiment conducted in Live Oak, FL, during 2005 and 2006 with irrigation-nutrient programs created by combining fertigation rates (100% or 200% of the UF/IFAS recommended rate), and irrigation rates (100% and 300% of the UF/IFAS recommended rate), found that in both years the 200%-fertigation-100%-irrigation program resulted in net positive effects relative to the UF/IFAS program (\$55/acre and \$561/acre, respectively). However, these positive effects did not differ statistically. Moreover, the high fertigation program resulted in a greater total-N load than the UF/IFAS program. Therefore, there was no economic benefit in applying fertilizer rates in excess of UF/IFAS recommendations in this type of production system. In 2005 and 2006, relative to the UF/IFAS program, the high irrigation alone program (100%-Fertigation-300%-Irrigation) not only increased the cost of the production (\$17/acre), but also lowered net returns by \$1,701/acre-\$4,112/acre, in 2005 and 2006, respectively. These results document the negative economical impact of excessive irrigation programs on tomato production net returns and should encourage growers to first improve irrigation management before using fertilizer rates above the recommended one.

Ornamental, Gardening and Landscape Section (Ed Skvarch, 2010 Sectional Vice-President)

A-Pest Management

Rose (*Rosa spp.*) Nursery Banker Plants. Juanita Popenoe, UF/IFAS Lake County Extension, Tavares, FL, and Lance Osborne, UF/IFAS Mid Florida Research and Education Center, Apopka, FL. (jpopenoe@ufl.edu) [OGL1]

Rose nursery plants typically require frequent chemical applications to control pests. Biological control agents and banker plants have been successfully used in greenhouse production, but have not been proven in outside nursery production. In order to reduce pesticide applications in the nursery setting, the use of banker plants and biological control agents in a rose nursery was explored in trials at the Mid Florida Research and Education Center in Apopka. Knock Out™ and 'Julia Child' rose plants in 3-gallon pots were grown with either overhead or micro-irrigation. Half of the plants was sprayed with Talstar as needed, the other half received no chemical applications. Larraweed (*Spermacoce verticillata*) and field corn (*Zea mays*) banker plants were grown in rows between blocks of eight crop plants. Biological controls *Amblyseius swirskii* mites, *Orius insidiosus* and *Neoseiulus californicus* were introduced onto the banker plants initially and as needed to maintain populations. Rose leaves, flowers and buds were sampled every two weeks to determine pest populations and plant quality was assessed every two weeks and at the end of three months of growth.

Effects of Solarization against Weeds and Root-knot Nematodes Limited by Weather. R. McSorley and H. K. Gill, UF/IFAS Department of Entomology and Nematology, Gainesville, FL. (mcsorley@ufl.edu) [OGL2]

Soil solarization is a useful nonchemical method for managing a variety of soil-borne pest problems. However, it can be difficult for solarization to achieve long-term control of root-knot nematodes (*Meloidogyne spp.*), which are important pests of many landscape and commercial ornamentals grown in Florida. A field experiment with snapdragon (*Antirrhinum majus* L.) was conducted in 2009 to determine if the performance of solarization could be improved by extending duration of solarization from 6 wk to 8 wk, or by combining solarization with other methods, such as incorporating cabbage amendment prior to solarization or by planting a root-knot nematode host such as squash (transplants or seeds) prior to solarization. Frequent cloud cover and low solar radiation during the soil solarization period resulted in relatively low soil temperatures and limited performance of solarization, with weed growth under the clear plastic. A solarization period of 8 wk was more effective ($P < 0.01$) than one of 6 wk in limiting the number of purslane (*Portulaca oleracea* L.) plants under the plastic during solarization and in reducing ($P < 0.05$) number of weed seedlings developing in the subsequent snapdragon crop. Solarization did not have much lasting impact on root-knot nematodes (*Meloidogyne spp.*), although on one sampling date, root galling was slightly reduced when cabbage amendment was combined with solarization or when squash seeds were planted two weeks prior to solarization. These methods should be further evaluated under conditions more favorable for solarization.

Efficacy of Fungicides for the Control of *Myrothecium Roridum* on *Dieffenbachia Compacta*. Robert T. McMillian, Jr. Kerry's Bromeliad Nursery, Homestead, FL 33031. [OGL3]

Myrothecium leaf spot, caused by the fungus *Myrothecium roridum* is a serious disease of *Dieffenbachia picta* Schott cv. Compacta. In 2009, six products were trialed for efficacy against *Myrothecium roridum* in a shadehouse. The *Dieffenbachia picta* plants were started from tissue-cultured liners potted in 6-inch plastic pots. 'Compacta' liners were potted for each of the six treatments including an untreated control. Natural infection was allowed to take place prior to the first application of the chemicals. Fungicides were applied on a 7 to 21 day schedule or on a closer interval depending of disease severity and replicated 4 times per treatment. Chipco 26019 (Iprodione) at 2 lbs per 100 gallon of water, Compass O (Trifloxystrobin) at 1 oz per 100 gallon of water, Daconil 2787 (Chlorothalonil) at 1.5 lb per 100 gallon of water, Heritage (Azoxystrobin) at 4 oz per 100 gallon of water, Medallion (Fludioxonil) at 2 oz per 100 gallon of water and Systhane (Myclobutanil) at 2 oz per 100 gallon of water were significantly more effective in the control of Myrothecium leaf spot than copper at 1.5 lb per 100 gallon of water.

Royal Palm Bug, *Xylastodoris luteolus* (Hemiptera: Thaumastocoridae: Control with Soil Applied Systemic Insecticides. A.D. Ali, Davey Institute, The Davey Tree Expert Co., and Doug Caldwell, UF/IFAS Collier County Extension, Ft. Myers, FL. (dougbug@ufl.edu) [OGL4]

The royal palm [*Roystonea regia* (Kunth) O. F. Cook] is a quintessential tree in South Florida landscapes. While this highly valued palm has relatively few pests, it can be severely damaged by non-predictable population flare-ups of the royal palm bug (RPB; *Xylastodoris luteolus* Barber). Damage appears as frizzled new growth which reduces aesthetics and may affect photosynthetic ability. This study was conducted to evaluate the efficacy of soil-applied neonicotinoid systemic insecticides under moderate to heavy insect pressure. Three active ingredients were tested, Merit 2F (imidacloprid); Safari 2 G (dinotefuran) and Safari 20 SG; and Arena 50 WDG (clothianidin) and all products provided excellent RPB control 30 and 75 days after treatment. ELISA analysis of palm foliage showed that dinotefuran was translocated fastest, followed by imidacloprid then clothianidin. The latter is the least soluble of the neonicotinoids and has a high soil-binding coefficient. Off-target drift, a major concern associated with foliar spraying especially in urban landscapes, is essentially eliminated when soil applications of systemic insecticides are used.

Integrated Impact of Soil Solarization and Organic Mulching on Weeds, Insects, Nematodes, and Plant Parameters. H.K. Gill and R. McSorley, UF/IFAS Department of Entomology and Nematology, Gainesville, FL. (Student competition entry: simgill@ufl.edu) [OGL5]

Soil solarization is a hydrothermal method that increases soil temperature for managing soil-borne plant pests including insects, weeds, nematodes, and fungi. Mulching is an effective way to control weeds along with providing shelter for predatory insects. The integrated impact of soil solarization and mulching on soil-borne pests, plant performance, and soil surface insects was evaluated in a field experiment conducted in Fall 2008 near Citra, FL. The four selected treatments were solarization (S), mulch (M), integration of mulch and solarization (MS), and

control (C). For the mulch treatment, a pre-plant mulch of sunn hemp (*Crotalaria juncea* L.) hay was applied over the bed surface. In the solarization treatment, beds were covered with Polydak® plastic film. After 6 weeks, plastic was removed, and all beds were planted with ‘Potomac Pink’ snapdragon (*Anitrrhinum majus* L.). For the MS treatment, plastic was applied pre-plant, and mulch as post-plant application. Treatments were arranged in a randomized complete block design with five replications. Data were collected on plant mortality, weed ratings, nematodes, plant weight and number of blooms, and visual count of insects, especially buckeye caterpillar (*Junonia coenia* Hubner, Lepidoptera: Nymphalidae) and saltmarsh caterpillar (*Estigmene acrea* (Drury), Lepidoptera: Arctiidae). Solarization or mulching alone reduced weed numbers but integration of solarization and mulching provided the most effective control of weeds. Population levels of large buckeye caterpillars were highest in the MS treatment. Plant mortality and plant parameters did not differ among treatments. Extensive plant damage and mortality due to caterpillars were observed in all plots.

B - Turfgrass / Ornamental Management - Student Papers

Effects of Potassium on Shade Tolerance of ‘Captiva’ St. Augustinegrass. Xiaoya Cai, L. Trenholm, J. Kruse, and J.B. Sartain, UF/IFAS Environmental Horticulture Department, Gainesville, FL. (Student competition entry; xiaoyacai@ufl.edu) [OGL6]

The effects of potassium (K) on stress tolerance of turfgrass has been documented for many environmental stresses, but not for shade tolerance. ‘Captiva’ St. Augustinegrass (*Stenotaphrum secundatum* [Walt.] Kuntze) was evaluated in this research to determine if K increases shade tolerance and how ‘Captiva’ performs under varying shade levels. The study was conducted at the UF/IFAS Turfgrass Research Envirotron in Gainesville. Grasses were planted in 6-inch pots in a climate-controlled greenhouse. Two consecutive studies were conducted, the first from June to Oct. 2009 and the second from Feb. to May. 2010. Grasses were placed in either full sun or under shade structures covered with black fabric to provide 30%, 50%, or 70% shade. Potassium was applied at 4 rates (0, 0.125, 0.25 or 0.5 lb/1000 ft²) every 30 days. Turf quality was highest at 30% shade and lowest at 70% shade. Turf quality increased as K rate increased. Shoot and root dry weights were greatest at 30% shade and under higher K rates and were lowest at 70% shade. Leaf length increased under higher shade levels. Preliminary results from this greenhouse study indicate that ‘Captiva’ can maintain good quality at 30% and up to 50% shade, and that K at 0.5 lb/1000 ft² increased turf quality under shade.

Performance of Low-maintenance Roses in Central Florida. Joser Mangandi and S. Park Brown, UF/IFAS Gulf Coast Research and Education Center, Wimauma, FL. (Student competition entry; mangandi@ufl.edu) [OGL7]

Roses (*Rosa* spp.) are one of the most cultivated flowers in the world. Modern roses cultivars such as hybrid teas are popular, but most demand intensive maintenance. Florida’s climate and soil conditions make many roses particularly difficult to grow in the state. The performance of roses under low maintenance conditions has been assessed in Texas and Mississippi, but little information is available for Florida. An evaluation of twelve rose cultivars in central Florida started in 2008. Selected cultivars were listed as Earth Kind™ roses and/or reliable performers in Florida. The soil was amended prior to planting with cow manure incorporated to a depth of 6

inches and woven landscape fabric was placed over the beds. Ungrafted (own-root) plants were placed on 8- ft wide beds at a between-plant spacing of 8 feet. A three inch layer of fine-ground pine bark was added to the top of the fabric to control weeds. Plants were not pruned, and pesticides were not used. Drip irrigation supplied water at a rate of 0.5 gal per plant per week once during the rainy season and twice during the dry season. Roses were fertilized three times per year with Osmocote Plus 15-6-12 (Scotts Co., Marysville, OH). Weekly evaluations of visual quality and flower coverage were assessed as well as the incidence of black spot and cercospora leaf spot fungal diseases. Data from two years of the study are presented here.

C - Water Quality and Water Conservation Workshop

C1 - Ornamental Production Section

Water Quality Issues Facing Florida Growers. Brian Boman, UF/IFAS Indian River Research and Education Center, Ft. Pierce, FL, and Tom Obreza, UF/IFAS Soil and Water Science Department, Gainesville, FL. (bjbo@ufl.edu) [OGL8]

Point source water pollutant discharges have been regulated for many years under the 1972 Clean Water Act (CWA). Even though limits on point source discharges have become more stringent with time, many water bodies still fail to meet water quality standards defined by their designated use. Therefore, the last decade has seen accelerated efforts to reduce non-point source pollution as a way to further reduce loadings to water bodies. Under the authority of section 303(d) of the CWA, EPA requires that Total Maximum Daily Loads (TMDLs) be developed where technology-based effluent limitations or other legally required pollution control mechanisms are not sufficient to protect water quality. TMDLs describe the amount of each pollutant a water body can receive without exceeding standards, and are characterized as the sum of pollutant loads from existing and future point sources (e.g. discharges from industry and sewage facilities), loads from existing and future nonpoint sources (e.g. runoff from farms and urban areas), and natural background loads. TMDLs have been developed or are on the way for much of peninsular Florida. As a result, agricultural operations will be affected when TMDLs are developed and implemented through Basin Management Action Plans (BMAPs). Management strategies that emerge from the TMDL process may encompass everything from traditional regulatory measures, agricultural best management practices (BMPs) and other pollution prevention measures, land acquisition, infrastructure funding, and pollutant trading. They also will include an overall monitoring plan to test their effectiveness. This paper discusses TMDL/BMAP development and implementation in Florida, the role of agricultural BMPs in meeting the TMDLs, and recent concerns arising from the Numeric Nutrient Water Quality Criteria proposed by EPA.

A Survey of Microbial and Organic Load in Nursery Irrigation Water. P.R. Fisher and D.P. Meador, UF/IFAS Environmental Horticulture Department, Gainesville, FL. (pfisher@ufl.edu) [OGL9]

High levels of organic matter and microbial density in irrigation systems can reduce water quality by increasing the demand for sanitizing agents such as chlorine and limiting the ability of water treatment technologies to control plant pathogens, algae, and biofilm. A field survey was conducted to quantify the organic matter and microbial load in nursery irrigation systems and

compare results with published water reuse guidelines for suitable irrigation quality. Water samples were analyzed from 24 nurseries across the United States, including 7 nurseries from Florida. Samples were collected at up to five different points in each irrigation system. Approved standard methods were used for collection and analysis of total suspended solids (TSS, $\text{mg}\cdot\text{L}^{-1}$), chemical oxidation demand (COD, $\text{mg}\cdot\text{L}^{-1}$), colony forming units of aerobic bacteria ($\text{CFU}\cdot\text{mL}^{-1}$) and yeasts and molds ($\text{CFU}\cdot\text{mL}^{-1}$). Results for TSS ranged from 0 to $40\text{ mg}\cdot\text{L}^{-1}$, COD from 0 to $110\text{ mg}\cdot\text{L}^{-1}$, aerobic bacteria from 0 to $1.7 \times 10^7\text{ CFU}\cdot\text{mL}^{-1}$, and yeasts and molds from 0 to $7.7 \times 10^5\text{ CFU}\cdot\text{mL}^{-1}$. Data were analyzed by ANOVA to compare water quality between municipal or well source, furthest outlet from source, catchment ponds, covered and lined tanks, or subirrigation floor and bench samples. Pond water had mean bacterial counts ($7.2 \times 10^5\text{ CFU}\cdot\text{mL}^{-1}$) and COD ($58.6\text{ mg}\cdot\text{L}^{-1}$), exceeding published guidelines ($0\text{ to }2 \times 10^3\text{ CFU}\cdot\text{mL}^{-1}$) and ($0\text{ to }30\text{ mg}\cdot\text{L}^{-1}$) respectfully. Sanitation would require secondary filtration and higher levels of disinfection. All measurements of organic load increased from source to outlet, indicating biofilm in irrigation lines. Results emphasize the need for research and extension on water treatment technologies as growers increasingly capture and reuse irrigation.

Considerations for Use of Reclaimed Water in the Nursery. Tom Yeager, Dept. of UF/IFAS Environmental Horticulture Department, Gainesville, FL. (yeagert@ufl.edu) [OGL10]

Reclaimed water (processed sewage) can be an effective substitute for municipal, well, and surface water, and its use may improve profitability and conserve natural resources in the container nursery. However, reclaimed water for irrigation of container-grown plants has limited use, probably due in part to its lack of availability to container nurseries. Nonetheless, users and potential users should consider the processor's standards for reclaimed water quality; infrastructure required for reclaimed water use; quantity of reclaimed water required; permits, signage, and costs for the user; and social aspects. A contract with the supplier can be used to address several of the considerations. Contracts may seem burdensome, yet a reliable supply of quality irrigation water during drought restrictions is likely worth the diligence.

Potential Impacts of Nursery Management Practices on Water Quality. P. Chris Wilson, UF/IFAS Indian River Research and Education Center, Ft. Pierce, FL. (pcwilson@ufl.edu) [OGL11]

Water quality is a relative term used to describe the usefulness of water of a specific purpose. Many nursery management practices can potentially impact the quality of water draining from production areas. These practices are often inter-linked, and include irrigation, fertilization, and pest management practices. The most common impact of nursery production on water quality is an increase in the concentrations of nutrients, some pesticides, and other agrichemicals in water draining from the production areas. These increases may not be deleterious if the water is reused for plant production. However, they can increase nursery maintenance costs or present significant risks to non-target organisms and ecosystems if the drainage water is allowed to mix with natural, off-site aquatic systems. This presentation will introduce several of the chemical and environmental properties that favor agrichemical enrichment of nursery drainage water. Results from several research projects will be used to illustrate actual impacts related to nutrient and pest management programs. Specific examples will be given for nitrate enrichment associated with fertigation and slow-release fertilizer programs, and non-target deposition of

pesticides on production floor surfaces and subsequent losses in irrigation runoff water at a commercial foliage plant nursery.

The Importance of Water Quality for Food Safety. Alicia Whidden, UF/IFAS Hillsborough County Extension Service, Seffner, FL. (awhidden@ufl.edu) [OGL12]

Food safety has become an important issue to consumers and is reported on frequently by national media. Because from 1990-2005, there were 713 documented produce-related food borne illness outbreaks in the United States, food safety has become a major initiative of the US government. Now, major retail food chains are requiring third party food safety audits of producers and packinghouses before buying produce from a company. One criterion of food safety audits is the safety of the water that is used to irrigate produce or wash produce for packing. Issues relating to producers meeting food safety audit standards and state mandatory food safety standards when required and the water permitting constraints that the state Water Management Districts impose will be discussed as well as public opinion on food safety and water issues.

Nutrient Leaching from Lawngrasses – 6 Years of Data. Laurie E. Trenholm, UF/IFAS Environmental Horticulture Department, Gainesville, FL. (letr@ufl.edu) [OGL13]

The fate of fertilizer applied to lawn grasses has been under increasing scrutiny in Florida in recent years. Numerous local ordinances and a state law now regulate fertilizer application, with little research to accurately quantify nitrate-nitrogen ($\text{NO}_3\text{-N}$) leaching under specific conditions. With the development of the Green Industries Best Management Practices (GIBMP) educational program, a research study was designed to quantify the actual contribution to N and phosphorus (P) leaching from lawn grass fertilization. The research is funded in partnership with the Florida Department of Environmental Protection (FDEP) and is currently being conducted at three locations statewide (the West Florida Research and Education Center in Jay, the Plant Science Research and Education Unit in Citra, and the Ft. Lauderdale Research and Education Center in Ft. Lauderdale). Several studies have been completed or are still ongoing, with focus on nitrate leaching due to N rate in newly planted grasses, nitrate leaching due to N rate in established grasses, nitrate leaching in winter months, nitrate leaching due to N source, and P leaching. Research results show that nitrate-N leaching from ‘Floritam’ St. Augustinegrass ranged from 6.5 to 57.0 kg N ha^{-1} when N was applied at rates of 24.5 to 196.0 kg N ha^{-1} (0.5 to 4 lbs N 1,000 ft^{-2}) to newly planted turf. In contrast, nitrate-N leached from established ‘Floritam’ ranged from annual losses of 0.6 to 6.1 kg N ha^{-1} when N was applied at annual rates ranging from 49 to 490 kg N ha^{-1} (1.0 to 10.0 lbs N 1,000 ft^{-2}). Leaching during winter months ranged from 0.9 to 18.7 kg N ha^{-1} for a 5-month period from Nov-Mar when N was applied at 0 to 98 kg N ha^{-1} (0 to 2 lbs N 1,000 ft^{-2}) per month. When there were differences in nitrate-N leached between the two grasses, zoysiagrass was had significantly higher losses than ‘Floritam’. These results suggest that nitrate-N leaching will be minimized if fertilizer is applied at the N rates currently recommended by UF-IFAS and if Best Management Practices are followed. These BMPs include not fertilizing newly planted turf for 60 days after planting, not leaving fertilizer granules on paved surfaces, timing fertilizer application to the warm-season grass growing season, and correctly irrigating fertilizer after application.

Using Reclaimed Water in the Urban Landscape: Issues and Opportunities. G. J. Hochmuth, UF/IFAS Soil and Water Science Department, Gainesville, FL. (hoch@ufl.edu) [OGL14]

Florida is the leading state in the nation for production of reclaimed municipal wastewater. Reclaimed water can be returned to the aquifer, used for various purposes as a replacement for potable water, such as fire extinguishing, building cooling systems, or for irrigation of plants. One of the fastest growing uses is for irrigation of landscape plants and turf in urban environments. Reclaimed water contains various concentrations of essential plants nutrients. These nutrients, such as phosphorus and nitrogen, can be used to benefit plant growth, thus serving as a potential fertilizer offset. The concentrations of these nutrients will vary from a few ppm to more than 20 ppm, depending on the type of treatment process employed by the utility company. Other considerations are needed, including the high pH of the reclaimed water, and the potentially high concentrations of soluble salts and other elements such as boron and sodium. Excessive irrigation amounts with reclaimed water can lead to leaching of nutrients in the reclaimed water and also to leaching of previously applied fertilizer nutrients. Reclaimed water represents an opportunity to reduce the demand on potable water for irrigation and to reduce the purchased fertilizer needs. These opportunities come with challenges for proper management.

The Limited Commercial Fertilizer Applicator Certificate and the Green Industries Best Management Practices (GI-BMP) Training Requirements. D.P. Rainey, UF/IFAS Sarasota County Extension Service, Sarasota, FL. (drainey@ufl.edu) [OGL15]

In 2009, the Florida legislature passed a new law requiring all commercial fertilizer applicators to have a Limited Commercial Fertilizer Applicator Certificate (LAFAC), issued by FDACS. In accordance with this new law, the GI-BMP training, or its approved equivalent, is required to apply for this FDACS certificate. The Florida-Friendly Best Management Practices for the Protection of Water Quality by the Green industries program, commonly known as the “Green Industries Best Management Practices” (GI-BMP) was designed to provide landscaping professionals with knowledge, skills and tools to minimize the impacts of nonpoint sources of pollution related to their business practices. “By the Green Industries” on the program’s title highlights the active involvement of the Green Industries and their leading role in training, disseminating, and implementing these practices.

Monitoring the Concentration of Sanitizing Agents and Oxidation-reduction Potential (ORP) in Irrigation Water. Paul R. Fisher, J. Huang, and D.P. Meador. UF/IFAS Environmental Horticulture Department, Gainesville, FL. (pfisher@ufl.edu) [OGL16]

Monitoring the concentration of sanitizing agents applied to irrigation water is important for the control of pathogens, algae, and biofilm; phytotoxicity risk; worker safety; and environmental impacts. Many sanitizing agents are used in horticulture, including activated peroxygens, chlorine (calcium hypochlorite, chlorine gas, hypochlorous acid, and sodium hypochlorite), chlorine dioxide, copper, hydrogen dioxide, ozone, and quaternary ammonium products. Direct measurement of concentration is possible using sensors, test strips, and colorimetric kits. Oxidation reduction potential (ORP, mV) is also a useful measurement of the sanitizing power of the oxidants chlorine, chlorine dioxide, and ozone. Sanitizing agents are affected by water pH

and electrical conductivity (EC, $\text{dS}\cdot\text{m}^{-1}$); therefore, these two parameters should also be measured. Sources for testing equipment and tips on use of these methods are discussed.

New Techniques for Determining Microbial Levels in Irrigation Water. P.R. Fisher, D.P. Meador, and R.E. Raudales. UF/IFAS Environmental Horticulture Department, Gainesville, FL. (pfisher@ufl.edu) [OGL17]

The concentration of algae, bacteria, fungi, and other microorganisms has important effects on horticulture management, including increased risk of pests and disease, biofilm buildup and clogging of irrigation lines, and reduced crop quality. Microbiological monitoring is typically analyzed with specialized testing by plant pathology or microbiology laboratories. Onsite microbial testing methods would assist growers through reduced sample cost, rapid results, and increased sampling frequency. A sampling protocol was developed using 3M™ Petrifilms, which are designed to detect the number of living microbes per volume of solution. Petrifilms include a dehydrated microbial substrate that incorporates a tetrazolium salt on a flexible plastic sheet. Irrigation water was tested on the aerobic bacteria and yeast and mold count plates, although tests are also available for specific microorganisms such as *Escherichia coli*. Key components of the testing protocol include collection with sterile materials and culturing in a hygienic environment. The plating method uses 1 mL of raw sample, and 1 mL for a dilution series for water with high microbial load. Incubation is provided in a dark environment at room temperature for 3 to 5 days. Colony-forming units ($\text{CFU}\cdot\text{mL}^{-1}$) are quantified by the number of red (aerobic bacteria) or blue and black dots (yeast and mold). Results can reveal population changes over time or between sampling sites in an irrigation system, and can also be compared with recommended microbial loads for irrigation water. Further testing of Petrifilms is ongoing, including comparison against traditional agar plating methods with known microbial species and concentration. Preliminary results have shown that growers can readily use this method with a simple test kit, and results help growers to visualize and manage microbial water quality

Measuring and Managing pH, Electrical Conductivity, and Alkalinity. Connie Johnson and Tom Yeager, UF/IFAS Environmental Horticulture Department, Gainesville, FL. (yeagert@ufl.edu) [OGL18]

Management of container plant nutrition entails monitoring pH of substrate and irrigation water, electrical conductivity (EC), and alkalinity, usually achieved using a saturated substrate extract or pour-through extraction procedure. These procedures, use of pH and EC meters, and protocols for submission of water samples for laboratory analyses will be demonstrated. Interpretation of results and strategies to prevent and correct nutrient deficiencies or toxicities will be discussed along with best management practices (BMPs) for greenhouse and nursery crop production.

D - Recycling/Energy

Installation of a Bioretention/rain Garden to Mitigate Agricultural Irrigation Runoff from a Container Plant Nursery. Alex Bolques^{1,2}, J. Cherrier², M. Abazinge², and G. Matungwa²,¹UF/IFAS Gadsden County Extension Service, Quincy, FL; ²Environmental Sciences Institute, Florida A&M University, Tallahassee, FL. (abol@ufl.edu) [OGL19]

Bioretention and rain garden systems are shallow planted areas designed to capture, retain or detain stormwater to encourage soil infiltration of water that would otherwise runoff. Benefits to the environment associated with rain gardens include: improved water quality, enhanced groundwater recharge, suspended particle reduction, reduced surface flows and associated erosion, habitat creation for birds, butterflies and beneficial insects. In 2008, a rain garden was installed at a container plant nursery in North Florida to evaluate the effectiveness of bioretention to mitigate irrigation-associated nutrient loading to adjacent wetlands, water bodies and groundwater. Irrigation runoff from an impervious production bed that is 360' x 50' (10,972.8 cm x 1,524 cm) flows into 1 of 2 rain gardens that are approximately 15' x 25' (457 cm x 762 cm) in size. The garden soil consists of ASTM C-33 sand and is approximately 24" (62 cm) deep with under-drains. The gardens are side-by-side, separated by a constructed 3' (91 cm) wide clay soil partition, with one designated as planted and the other non-planted. Three native plants species, *Hydrangea quercifolia* (oakleaf hydrangea), *Serenoa repens* (saw palmetto), and *Canna flaccida* (canna lily) were installed in the planted garden. Studies are currently underway to monitor nitrogen, phosphorus and zinc, pre and post exposure to the rain garden. It is anticipated that results from this study would supplement current best management practices for container plant nurseries in Florida for associated nutrient loading from container plant nursery production bed irrigation runoff.

Description and Performance of Four *Eucalyptus grandis* Cultivars Released by UF/IFAS in 2009. Bijay Tamang and D. L. Rockwood, UF/IFAS School of Forest Resources and Conservation, Gainesville, FL. (bijay@ufl.edu) [OGL20]

Genetic improvement of *E. grandis* for Florida conditions started in the 1960s. Substantial improvements in the species' growth, form, and freeze resilience have been achieved, culminating in the release in 2009 of the four commercial cultivars *E.nergy*TM 'G1'^{PPAF}, 'G2'^{PPAF}, 'G3'^{PPAF}, and 'G4'^{PPAF}. While G1, G2, G3, and G4 have exceptional growth rate, stem form, freeze tolerance, and coppicing ability compared to 4th-generation *E. grandis* seedlings, the four cultivars have important differences in these characteristics, their genetics, and wood chemistry. Three cultivars planted at five locations throughout peninsular Florida in 2009 survived well, were up to 20-foot tall in 8 months, and typically tolerated the exceptionally cold weather of January-February 2010. Their deployment expanded in 2010, and they will be widely availability for future commercial energywood farms and other uses in southern, central, and even northern Florida. Research continues to develop even more superior *E. grandis* cultivars including hybrids with *E. amplifolia*.

Bringing Master Gardening to Costa Rica. A. Bolques, FAMU, Dan F. Culbert, A.G.B. Hunsberger, H. Mayer, D. Marshall, L. Seals, and P. Vergot, UF/IFAS; L.N. Bulgarelli, and B.K. Singh, EARTH University, Cost Rica. (indianco@ufl.edu) [OGL21]

The University of Florida Cooperative Extension Service initiated Costa Rica's first training program for non-formal landscape management in 2008. Three County Faculty members and two administrators spent a week in April 2007 visiting EARTH University's new LaFlor Campus near the Pacific coast. Similar to Florida, the region is experiencing rapid growth in tourist development. Stresses of growth, decreased water quality and quantity, misuse of horticultural chemicals now impact the local economy and environment. County Agents sought to provide

informal training for landscape maintenance workers, ornamental producers and homeowners that lacked gardening experiences. Two concurrent seven-week multidisciplinary educational programs were implemented beginning in January 2008. Seven County Agents each spent two weeks at LaFlor preparing and presenting two concurrent training tracks. Florida agents rotated in and out each week for program continuity, developed course materials, and taught lessons in Spanish. The “Master of Gardens” program was designed for nursery and landscape professionals. A “Gardeners of Costa Rica” course focused on homeowners and ecotourism personnel. Curriculum was similar to US Master Gardener programs. Participants learned about best management practices suitable to the dryland tropics, then practiced concepts with hands-on exercises including the installation of demonstration gardens. After seven weeks a graduation ceremony was held and 47 participants received completion certificates. Pre/post test data showed a up-to 61% improvement in test scores on concepts taught. Follow-up activities including enhancement of a website are still on-going. Materials developed will be utilized in Florida to deliver programs to Spanish-speaking audiences. The programs also provided an international experience for faculty to broaden their knowledge of different environments and cultures.

Communicating Landscape Freeze Damage to the Public in Charlotte County. Ralph E. Mitchell, UF/IFAS Charlotte County Extension Service, Port Charlotte, FL. (shadowed@ufl.edu) [OGL22]

The freezing and frosty weather of January, February and March, 2010 resulted in nighttime temperatures in the 30’s and as low as 23 F in the Charlotte County area. This was the second year in a row with widespread damaging freezes. The 2010 cold spell was worse however, with longer cold temperatures that certainly laid waste to our local landscapes. Communicating how to deal with our potentially cold weather in Charlotte County is an annual event. Besides communicating verbally to our customers on the phone, in person and in group programming, we expanded our outreach with additional written media releases and by using electronic media and techniques to take advantage of this “teachable moment”. This was an opportunity to market Extension and educate our public as we emphasized EDIS publications through our newspaper articles, used educational slide shows on our website, and took advantage of special press releases by State Extension Specialists. A timely group program on landscape palms, as well as a PolyCom© session with a State Extension Specialist rounding out the educational experience related to freeze damage. In addition to a measurable spike in website hits linked to an increase in customer information searches, an electronic survey of 500 customers was conducted related to the freeze damage which documented interesting results.

A Methodology for Building Community Leader Support for Good Tree Care. Michael S. Orfanedes, UF/IFAS Broward County Extension Service, Davie, FL. (morf@ufl.edu) [OGL23]

Good urban tree canopy does not happen by itself. Rather, it must be planned for by people who place a high value on trees, have a vision for building an urban forest and have the time and resources needed to make their vision reality. Transforming a personal vision for tree canopy into reality at the community level requires community buy-in. Stakeholders and decision makers in the community must share the vision or at least support it in order for that vision to become reality. Building support for community tree canopy begins with education and a

community landscape committee is a good way to start. Volunteers plan and conduct outreach to teach others in the community, especially decision makers, about the value and beauty of trees, the important environmental services they provide and the best practices needed to establish and maintain them. The committee can also communicate ideas for beautification projects, identify maintenance needs, and make observations about contractor performance to property managers and the board of directors. This presentation will focus on one South Florida community's journey to rebuild its canopy in the aftermath of Hurricane Wilma and the role that outreach and an active landscape committee played to achieve that goal.

Evaluating How Accurately Lawn Fertilizers Are Applied Using Homeowner Equipment. K. Stauderman, UF/IFAS Volusia County Cooperative Extension Service, Deland, FL; R. Royal, Sunniland Corp., Sanford, FL; and, S.P. Arthurs, UF/IFAS Mid Florida Research and Education Center, Apopka, FL. (kstauderman@ufl.edu) [OGL24]

Inappropriate use of fertilizers in urban environments is a contributing factor to increased nutrients loads in Florida water bodies. We tested how accurately lawn fertilizers were applied by 36 master gardeners and other horticultural professionals. Volunteers were asked to apply a label rate of fertilizer (Scotts® Turfbuilder 32-0-10 at 2.81 lbs/1000 sq. ft. and Sunniland 10-0-10 at 6.5 lbs /1000 sq. ft.) using three spreaders (Scotts HandyGreen® Hand-Held rotary, Scotts Basic™ Broadcast Rotary and Scotts AccuGreen® 1000 Drop). On average, applications using the hand-held rotary spreader were relatively accurate (103% of target rate), while applications using basic broadcast rotary spreader tended to be excessive (160% of target rate) and applications using the drop spreader tended to be insufficient (42% of target rate). There were also some differences between the slow release (fine granular) and high volume low N quick release (coarse granular) fertilizers, although this difference depended on the type of equipment used. Our simple study highlights that fertilizers are not always accurately applied; sources of individual error included variability in applicator walking speed, inaccurate swath widths [either too narrow (with rotary push) or too wide (with drop spreader)], and the amount of pesticide loaded into containers. A good approach to test individual equipment and allow a quick check of over-application or under-application is for applicators to (1) determine lawn area to be treated and (2) calculate and weigh required amount of fertilizer needed accurately, before application.

Water Quality Ordinances Affecting the Lawn & Ornamental Care Service Industry. E. Santella, TruGreen Region Technical Manager, 2820 US Highway 441/27, Fruitland Park, FL 34731. (erica_santella@landcare.com) [OGL25]

In 2002, a uniform set of Green Industry Best Management Practices was developed through the concerted efforts of the Florida Department of Environmental Protection, Green Industry Professionals, University of Florida IFAS faculty, and other stakeholders. In 2009, State legislators put into effect senate bill 494 establishing a model ordinance by which counties and municipalities could adopt Best Management Practices. This model ordinance can be found in Florida State Statutes 403.9337. The rationale behind this working group and the model ordinance was to develop a uniform set of Best Management Practices to enhance water quality throughout the state of Florida. However between the Summer of 2007 and March 2010, over 30 separate landscape ordinances relating to water quality and Lawn & Ornamental practices have been passed by local governments in Florida. These ordinances have added different language and

varied significantly from the model, making them difficult for Green Industry workers to understand and follow. This study will compare the differing ordinances and how their language may thwart landscape professionals from heeding the original set of Best Management Practices established by the BMP working group.

Krome Memorial Section (Peter Andersen, 2010 Sectional Vice-President)

Preliminary Field Evaluation of *Jatropha* (*Jatropha curcas* L.) Under South Florida Environmental Conditions. Jonathan H. Crane, Wagner A. Vendrame, Wanda Montas, Ania Pinares, and Edward A. Evans, UF/IFAS Tropical Research and Education Center, 18905 SW 280 St. Homestead, Florida. (jhcr@ufl.edu) [K1]

Seventeen *Jatropha* selections were planted 25 June 2009 at the Tropical Research and Education Center to evaluate their growth, development, and adaptation to a warm subtropical climate and calcareous soil conditions. Plants were grown from seed and 1 to 12 plants were planted per cultivar. Trunk diameter and plant height, and number of seeds and fresh and dry weight of seeds produced were periodically recorded. The mean percent change in plant height over the first 8 months ranged from 49% (India-Kerry and Brazil KP) to 84% (Brazil EPB). The mean percent change in trunk diameter was from 9.5% (India) to 45% (Guatemala). Fruit were first harvested about 5 ½ months after planting. The mean number of fruits produced per plant varied by selection with the selection from Ethiopia producing the least (0.25 fruits/plant) and Brazil-Plain producing the most (43 fruits/plant). Mean dry weight of harvested seed varied with Ethiopia producing the least (0.58 g seed/plant) and Indian-Kerry the most (51.7 g seed/plant).

Preliminary Characterization of a Chinese Jujube (*Ziziphus jujuba* Miller). Tomas Ayala-Silva, Raymond Schnell, Alan W. Merrow, Garry Gordon and Michael Winterstein. USDA, ARS, National Germplasm Repository, Subtropical Horticultural Research Station, 13601 Old Cutler Road Miami, FL 33158. (Tomas.Ayala-Silva@ARS.USDA.GOV) [K2]

Jujube (*Ziziphus* Mill.), the most important genus of family Rhamnaceae, consists of more than 170 species. The species has a wide geographical distribution in the subtropics and semiarid tropics and is cultivated in numerous regions. The jujube is found in forested areas of temperate regions and in desert scrub and waste areas worldwide. It is common in many of the tropical and subtropical areas of the Old World. In Africa, it is found mainly bordering the Mediterranean. In Asia, it is especially common in the drier parts of India and China. The jujube is also found throughout the East Indies. Jujube is becoming increasingly popular because of its outstanding advantages including early bearing, rich in nutrition, multi-use, long flowering season, as well as high tolerance to drought and barren soils. China and India are two of the origin and distribution centers of *Ziziphus*. There are at least 14 species of genus *Ziziphus* in China, of which Chinese jujube (*Z. jujuba* Mill.) is the most important one. Jujube, *Ziziphus jujuba* Mill., is a multipurpose tropical fruit tree used primarily for its fruits, which are eaten fresh or processed, used as a seasoning or spice, or the fruits and seeds are processed for non-food uses. The naturally drooping tree is graceful, ornamental and often thorny with branches growing in a zig-zag pattern. Jujube cultivars vary in size and conformation, with some being very narrow in

habit and others being more widespread. Because it is a fruit tree species highly resistant to drought and salinity, Chinese date is a good alternative to other water consuming crops in South Florida. Selection for the best genotypes and modern cultivation techniques are a must. In this paper, we announce the formal recognition and release of a different and superior form of these species. *Ziziphus jujuba* 'Kong' is a seedling selection from progeny grown from seed received in 1994 from Thailand. While the majority of the seedlings grown produced had inconsistent soluble sugars contents, this selection showed consistently high sugar content (Brix) and yield that warranted the recognition as a distinct cultivar. This selection ('Kong') is of smaller height than other known cultivars. We believe that this fast-growing cultivar have great potential for use commercially and as a landscape tree in USDA Hardiness Zones 9A-12 and for similar geographical areas with same edaphic/environmental conditions.

A Comparison of the Morphological and Physicochemical Characteristics of 13 Carambola Cultivars. Tomas Ayala-Silva, [Garry Gordon](mailto:Garry.Gordon@ARS.USDA.GOV), Ray Schnell, Alan Meerow, Michael Moore, Michael Winterstein. USDA, ARS, National Germplasm Repository, Subtropical Horticultural Research Station, 13601 Old Cutler Road, Miami, FL 33158. (Garry.Gordon@ARS.USDA.GOV) [K3]

A trial of 13 different carambola (*Averrhoa carambola*, L.) cultivars was conducted at the National Germplasm Repository, Subtropical Horticultural Research Station in Miami, FL. The study compared the morphological and physicochemical characteristics of 13 carambola varieties grown at the research station. The research took place over a two year period with the carambola trees grown on a Krome gravely loam soil. In both years, there was a correlation between fruit weigh with fruit length and fruit weight with fruit diameter. 'Wheeler' gave significantly higher b* (yellow) values in both years than any other cultivar. In year one, 'Tean Ma' had the highest positive a* (red) value, where in year two 'Wheeler' had the highest a* value. 'Hart' had significantly higher L* values in year two compared to all the other carambola cultivars. In year two, 'Arkin' had the lowest L* value to all the other cultivars except for B-10. Our data did not show one cultivar to consistently produce a higher BRIX reading when juxtaposed to the rest of the cultivars in the experiment. The use of carambola cultivars not used in this experiment may produce significantly different morphological and physicochemical readings than those recorded from this research.

ASBVd Infection Among Avocado Accessions in the National Germplasm Collection in Florida. [Cecile L. Tondo](mailto:Cecile.Tondo@ARS.USDA.GOV), Raymond J. Schnell, David N. Kuhn. USDA, ARS, National Germplasm Repository Subtropical Horticultural Research Station, 13601 Old Cutler Road, Miami, FL 33158. (Cecile.Tondo@ARS.USDA.GOV) [K4]

The presence of Avocado Sunblotch Viroid (ASBVd) infection among the avocado (*Persea americana* Mill.) accessions in the National Germplasm Repository at Miami (NGR-Mia) was established in previous studies. An ASBVd specific reverse transcription-polymerase chain reaction (RT-PCR) protocol was used to detect the viroid. Surveys performed in 1996 and in 2000 found that the proportion of ASBVd positive accessions remained unchanged at 19%, during that time period. The object of the current study was to assess the spread of infection, if any, and the rate and direction of transmission. For this purpose the collection was screened again for ASBVd. The germplasm collection increased from 403 to 505 trees. Forty four newly

infected trees were detected. Forty three percent of the newly infected plants were found to be adjacent to previously infected plants, other newly infected plants, or plots from which infected plants had been removed. No pattern in direction of spread was discerned for non-adjacent new infections. The proportion of plants found to be positive for the viroid in the current study is 21%. Twenty seven plants previously found to be infected, were found to be negative in this survey. The proportion of infected plants (historically or present) in the current collection is 26%. Real-time PCR is currently being employed to investigate the failure to detect ASBVd in plants previously found to be positive. The increase in ASBVd infections reinforces the importance of establishing back-up collections at different locations. Establishment of collections at the NGR in Hawaii is currently underway.

Performance of Owari and Brown Select Satsuma in North Florida on Standard and Flying Dragon *Poncirus trifoliata* Rootstocks. Peter C. Andersen and Brent V. Brodbeck, UF/IFAS North Florida Research and Education Center, Quincy, FL. (pcand@ufl.edu) [K5]

The performance of satsuma (*Citrus unshiu* Marcovitch) cvs. ‘Owari’ and ‘Brown Select’ on *Poncirus trifoliata* (L.) Raf. (standard) and *P. trifoliata* cv. Flying Dragon) was evaluated from 2007 to 2009 at the North Florida Research and Education Center-Quincy Florida. The orchard which was established in 2004 included 20 of each rootstock scion combination. Trees were planted 4.57 and 6.10 m within and between rows, respectively. Trees were not subjected to freeze protection and, withstood minimum temperatures of -9 °C (15.8 °F) without appreciable damage. ‘Owari’ and ‘Brown Select’ trees were substantially smaller when grafted on the dwarfing Flying Dragon rootstock. Average yield per tree across all genotypes was about 12 kg in 2007, 8 kg in 2008 and 60 kg in 2009. Fruit weight was variable from year to year, but tended to be higher for ‘Brown Select’ than for ‘Owari’. Soluble solids concentration and pH of orange juice were about 9.4 °Brix and 3.8, respectively, and did not vary with cultivar or rootstock. Satsumas are a specialty crop with potential for expansion in the northern Gulf Coast region.

The Role of Research and Extension in Establishment of a Florida Stone Fruit Industry. Mercy A. Olmstead, UF/IFAS Horticultural Sciences Department, Gainesville, FL. (mercyl@ufl.edu) [K6]

The University of Florida stone fruit breeding program has successfully bred low-chill varieties for over 50 years, with extensive plantings in low-chill production areas worldwide. Although a small stone fruit industry (~4,000 acres) was originally established in North Florida, successive cold events in the 1980s reduced plantings to less than 500 acres. Recent releases from the stone fruit breeding program now target Central and South Central Florida for orchard development, where the risk of spring freeze events is lower. Short fruit development periods, non-melting flesh texture, and a unique marketing window in April and May with little worldwide competition for fresh fruit will allow growers to take advantage of favorable market prices and maximize profits. However, cultivation of stone fruit is intensive and requires constant monitoring to manage both abiotic and biotic production challenges. In addition, economic analyses, development of marketing tools, fertilization techniques, frost protection, and cultural management are important issues that need industry input as research and extension programming expands. As stone fruit acreage increases in Florida, communication between the research and extension community, producers, marketers, and buyers will enable development of applied projects that successfully address industry challenges.

Damage to Low Chill Peach Trees From Ice Accumulation During Severe Winter Freezes in North and North Central Florida. Jeffrey G. Williamson¹, Robert C. Hochmuth² and E. Paul Miller¹. ¹UF/IFAS Horticultural Sciences Department, Gainesville, FL. ²UF/IFAS North Florida Research and Education Center-Suwannee Valley, Live Oak, FL. (jgrw@ufl.edu) [K7] Extreme cold weather during January and February, 2009, required overhead irrigation for freeze protection of flowers and young fruit in the peach orchard at the Plant Science Research and Education Unit (PSREU) in Citra, FL. Severe freezes on January 22 and February 6, with minimum temperatures of approximately 23 F and 10-11 hour durations of sub-freezing temperatures each night, resulted in heavy ice loads following these freeze events. Additionally, there were 9 other freeze/frost events at the PSREU between January 15 and March 4 where overhead irrigation was used. Ten low-chill peach and nectarine cultivars, and three low-chill plum cultivars were evaluated for limb breakage from excessive ice loads that resulted from freeze protection with overhead irrigation. Broken limbs with diameters greater than seven-eighths inch (peach) or one-half inch (plum) and split scaffold limbs were counted on individual trees. Sample size per cultivar ranged from 2 to 47 trees. Trees were also rated for percent full canopy and percent full crop just prior to harvest. Peach and nectarine cultivars varied in the number of limb breaks and split scaffolds. 'FlordaPrince' had the highest incidence of scaffold limb splits (almost 3 per tree) while 'UFSun' had the highest incidence of limb breaks (approximately 5.5 per tree). No scaffold splits were observed for plum, however, the incidence of broken limbs was high (4 to 6.8 per tree) depending on cultivar. Percent full canopy just prior to harvest ranged from 60% ('UFSun' and 'Gulfking') to 80% ('Earligrand', 'Sunraycer', 'FlordaPrince', and 'UFBeauty') and percent full crop ranged from 10% ('UFSun') to 70% ('Earligrand' and 'FlordaKing').

Deciduous Fruit Crop Demonstration Area at Water Conserv II Project in Central Florida Gary K. England¹ and Ryan A. Atwood². ¹ UF/IFAS Sumter County Extension Service, Bushnell, FL. ²UF/IFAS Lake County Extension Service, Tavares, FL. (gke@ufl.edu) [K8]

Interest in the evaluation of alternative crops to produce in the central Florida region as a potential fruit crop and possibly a replacement for citrus has been increasing. Hence, with the cooperation of the Water Conserv II Project, the Mid Florida Citrus Foundation, and UF/IFAS, a Deciduous Fruit Crop Demonstration Area has been dedicated to planting and evaluating potential selections for producers in the area. Fruit crops that have been evaluated include pecan, persimmon, fig, blueberry, peach, plum and muscadine. In 2006, a decision was made to evaluate some of the newer promising fruit crop cultivars from the University of Florida breeding programs. The first phase of the project began with the planting of seven peach, three nectarine and two plum cultivars in mid-December 2006, followed by the addition of three plum cultivars in the summer of 2007. Dr. Dennis Gray from UF provided three numbered muscadine and one bunch grape cultivar that were established in the summer of 2007. A container grown blueberry planting including some of the cultivars adapted to central Florida was planted in the spring of 2008. Some potential persimmon and pomegranate cultivars were added in 2007 and 2009 respectively. To date, observations of appropriate production practices plus field day opportunities that introduced local growers to some of the crops have taken place. As the 2010 spring bloom is progressing, a trial to evaluate different peach and nectarine thinning requirements (no thinning, 4, 6 and 8 inches) and their effect on fruit size is planned.

Summer 2009 Blueberry Herbicide Evaluations. Gary K. England¹, William M. Stall² and K. R. Muzyk³. ¹ UF/IFAS Sumter County Extension Service, Bushnell, FL. ²UF/IFAS Horticultural Sciences Department, Gainesville, FL. ³Gowan Company, Brandon, FL. (gke@ufl.edu) [K9]

The expansion of the blueberry industry in west Central Florida continues. Managing weeds in blueberry plantings, continues to be one of the main production challenges that growers face. A majority of the commercial blueberries are produced in pine bark culture. Drawing from the results of several trials that were conducted between 2007 and early 2009 on blueberry plantings in pine bark culture, two blueberry herbicide studies were initiated to evaluate some of the promising compounds under summer conditions. Just after post-harvest pruning, a trial evaluating four labeled products and one promising herbicide was initiated in a four year old southern highbush blueberry planting in pine bark culture in June 2009. At the 61 day after treatment rating, treatments containing Surflan and Chateau were providing excellent control of spurge *Chamaesyce* sp. significantly better than the other treatments. The same treatments resulted in the best control of spiny amaranth *Amaranthus spinosus* (AMASP) and Brazilian pusley *Richardia brasiliensis* (RCHBR). Rely 200 herbicide is approved as a non-selective postemergence herbicide alternative to products containing glyphosate. A trial was established in a new blueberry planting in pine bark culture to evaluate an experimental additive for Rely 200 that may enhance the control of perennial weed species. At the 34 day after treatment evaluation, Rely 200 at 5 pints/acre plus AA10717 at 5 fl. Ounces/acre was providing good common bermudagrass (CYNDA) control that was significantly better than Rely 200 at 5 pints/acre alone.

Blueberry Gall Midge: A Key Pest of Southern Highbush and Rabbiteye Blueberries. Oscar E. Liburd and C R. Roubos, UF/IFAS Entomology and Nematology Department, Gainesville, FL. (oeliburd@ufl.edu) [K10]

Blueberry gall midge [*Dasineura oxycoccana* (Johnson)] is a key pest of rabbiteye and southern highbush blueberry in the southeastern United States. Adults emerge in early spring and females oviposit eggs between developing flower and leaf bud scales. Larvae feed inside the buds causing leaf deformities and restricting bud development. To determine the temperature at which blueberry gall midge larvae will emerge from flower buds, we exposed flower buds to various temperatures in environmental chambers. Experimental design was completely randomized with 3 treatments (temperatures) 29, 21 and 12°C and 5 replicates. Large quantities of flower buds were randomly collected from an infested blueberry gall midge commercial rabbiteye (*Vaccinium virgatum* Aiton) planting. Buds were thoroughly mixed together to allow equal distribution of infested buds to the various treatments (temperatures). Approximately 30 buds were placed into each Petri dish, which was lined with filter paper #12. Petri dishes were examined every 72h for three weeks to count the number of larvae that emerge. More midges emerged at the lower temperature of 12°C, which may indicate that adults favor cooler temperatures. There were no differences between the sexes of the adults that emerged from flower buds. Subsequently, growers may need to begin their management operations for blueberry gall midge much earlier in the season when temperatures are still low.

Blackberry Production Using Primocane Suppression. Robert T. Boozer¹ and Arlie A. Powell². ¹Chilton Research and Extension Center, Auburn University, Clanton Alabama. ²Retired Professor, Department of Horticulture, Auburn University, Clanton, Alabama. (boozer@auburn.edu) [K11]

Blackberries (*Rubus sp.*) are unique plants in that they have a perennial root system and biennial vegetative and fruiting growth habit. Standard production practices of hedge or modified hedge systems are comprised of both one and two year old canes. Under the primocane suppression production system floricanes are allowed to occupy a trellis or modified trellis during 80% of the fruit harvest period. Primocane growth is suppressed by cutting them back near the ground until close to the end of harvest. Benefits include ease of harvest, increase in fruit size, and reduction in certain diseases. Disadvantages include cost and some reduction in yield.

Benefits and Challenges of Sheltered Blackberry Production. Robert T. Boozer and J. A. Pitts, Chilton Research and Extension Center, Auburn University, Clanton, Alabama. (boozer@auburn.edu) [K12]

Being native to southeast conditions, blackberries (*Rubus sp.*), seem an unlikely crop benefitting by being grown under a shelter or high tunnel. Data collected at the Chilton Research and Extension Center in central Alabama are showing benefits in plant growth and marketable berries of two cultivars ‘Kiowa’ and ‘Prime-JanTM’, under shelter production. Fruit yields were close to twice as high from these cultivars grown under sheltered conditions compared to standard production. Shelters or high tunnels offer additional heat units and protection from rains but, they also favor certain pests like two-spotted spider mites (*Tetranychus urticae*). The Cost of shelters makes crop selection extremely important for profitable returns. Blackberries look promising as one of those crops to select.

Assessment of Genetic Diversity among Selected Raspberry Cultivars. Gohar Umar¹ Hemanth KN. Vasanthaiah², Devaiah Kambiranda², Sheikh M. Basha², Bobby R. Phills¹ and Wayne Hunter³. ¹Small Fruit Laboratory, Center for Viticulture and Small Fruit Research, Florida A&M University, 6505 Mahan Drive, Tallahassee, Florida 32317. ²Plant Biotechnology Lab, Center for Viticulture and Small Fruit Research, Florida A&M University, 6505 Mahan Drive, Tallahassee, Florida 32317. ³U.S. Horticultural Research Laboratory, 2001 South Rock Road, Fort Pierce, Florida 34945. (gohar1@hotmail.com) [K13]

Growing raspberry in southern United States is a challenging task as they are high chill-loving plants. Cultivation of raspberry in Florida is significantly hampered due to prevailing hot and humid conditions. The characteristics of raspberry cultivars have been categorized based on morphological descriptions which are dependent on the environment. With this in view, a molecular approach was used to assess genetic diversity among commercial raspberry cultivars being evaluated for in our breeding program for low-chill and high temperature tolerance. A high quality DNA was isolated from raspberry leaf tissue and subjected to molecular analysis. DNA typing was carried out using RAPD assay. Of the 100 primers screened, 10 primers yielded 142 usable DNA bands. Pairwise comparisons of unique and shared amplification products were used to construct a phylogenetic tree using Euclidean linkage distances which clearly separated low- and high-chilling raspberry genotypes. These data showed the potentiality

of RAPD markers for assessing genetic diversity among raspberry cultivars. Further studies coupled with field analysis would aid in identifying low-chill and high temperature fruit set raspberry genotypes useful for developing raspberry cultivars suitable for growth in Florida. In addition, application of molecular markers will enable breeders to expand genetic diversity in breeding material and allow the selection of new perspective forms in our breeding program. Supported by a USDA/CBG.

Development of New Muscadine Wine Grapes. Zhongbo Ren, J. Lu, X. Xu, F. Bradley. Center for Viticulture Florida A&M University, Tallahassee, FL 32317. (zxren@hotmail.com) [K14]

FAMU's muscadine breeding program indicated that some breeding lines advanced either horticultural and / or wine characteristics over standard cultivar 'Carlos' and 'Noble', these selections could be the new premium wine grapes in the future.

Identifying Constraints Involved in Sugar Metabolism in Muscadine Grape. Devaiah Kambiranda, Hemanth K. N. Vasanthaiyah and Sheikh M. Basha. Plant Biotechnology Laboratory Center for Viticulture and Small Fruit Research, Florida Agriculture and Mechanical University, 6505 Mahan Drive, Tallahassee, Florida 32317. (Devaiah29@gmail.com) [K15]

The sugar content of grapes is of great importance in winemaking not only because its fermentation by yeast produces alcohol but also it augments the flavor profile of final product. Muscadine (*Muscadinia rotundifolia* Michx.) grapes are native to the southeastern United States, and wine continues to be a major market for muscadine grapes. Muscadine wines are gaining popularity because of their unique fruity flavor and nutraceutical value. But establishment of large scale processing market for jam, jelly, juice and wine has been a problem because of the low sugar content of muscadine berry. Our previous research has shown major differences in the sugar content among the *Vitis* species where bunch grape contained the highest amount followed by hybrid bunch and muscadine. The present study was carried out to investigate differences in sugar content and sugar metabolizing enzyme levels among *M. rotundifolia* (Muscadine), *Vitis* spp (Florida hybrid bunch) and *Vitis vinifera* (Bunch) grape genotypes to determine the factors limiting sugar production in muscadine berry. Sugar analysis of the berry showed lower sugar levels and low glucose:fructose ratio in muscadine grape compared to bunch and Florida hybrid bunch grapes. Gene expression analysis revealed low expression of sugar metabolizing enzymes (Invertase, Sucrose synthase, Sucrose phosphate synthase etc.) in muscadines compared to the Florida hybrid bunch and bunch grape berries. Differences in expression level of these enzymes are believed to play a vital role in sugar synthesis, transport and sucrose breakdown in grape berry.

Fruit Rot Disease Incidence in Muscadine Grapes (*Vitis rotundifolia* Michx.) of Florida. Xia Xu, Jiang Lu, Barbara Smith, Zhongbo Ren and Fitz Bradley. Center for Viticulture and Small Fruit Research, Florida Agriculture and Mechanical University, 6505 Mahan Drive, Tallahassee, FL 32317. (xia.xu@famuedu) [K16]

Muscadine grape (*Vitis rotundifolia* Michx.) is a major fruit grape in Florida. Although far more resistant to most diseases than are bunch grapes (*V. vinifera*, *V. labrusca* or their derivatives),

muscadine grape suffers extensive economic losses every year due to fruit berry rotting diseases that significantly reduce fruit yield and marketability for both wine and fresh consumption. Three berry rot diseases including black rot (*Guignardia bidwellii f. muscadinii*), bitter rot (*Greeneria uvicola*), and macrophoma rot (*Botryosphaeria dothidea*) were evaluated in 45 commercially available muscadine cultivars at the research vineyard of Florida A&M University in order to develop a disease-resistance breeding program. The cultivars were randomly arranged in three blocks and data were collected in five randomly picked clusters on each tree according to Kummuang et al. (1996) in 2009 harvesting season. Bitter rot was the most prevalent fruit rot disease that occurred on 38 muscadine grape cultivars, followed closely by black rot which could also be observed on vine leaves. The incidence of macrophoma rot was low. The most susceptible cultivar to bitter rot was 'Early Fry'. Cultivars 'Pride', 'Noble', 'Albemarle', 'Sothern Home', and 'Cownt' showed resistance to bitter rot while it was too early to make conclusions for the cultivars 'Late Fry' and 'Tara'. In addition, co-occurrence of ripe rot on the same berry often makes identification of bitter rot more difficult, especially during the later harvest season.

[Handling and Processing Section \(Michelle Danyluk, 2010 Sectional Vice-President\)](#)

A – Citrus Juice and Juice Products

A Comparison of Commercially Processed and Fresh Squeezed Juice: Quality

Components. [Jinhe Bai](#), Elizabeth Baldwin, Anne Plotto, Bryan L. Ford, John Manthey, Randall Cameron, Jan Narciso and Sharon Dea . USDA-ARS, Citrus & Subtropical Products Laboratory, Winter Haven, FL. (Jinhe.Bai@ARS.USDA.GOV) [HP1]

'Valencia' and 'Hamlin' oranges were juiced using one of three treatments: fresh squeezed (F), fresh squeezed then pasteurized (FP) or commercially processed/pasteurized (CPP). Headspace volatiles, secondary metabolites, total phenolics, sugar and acid contents were measured right after processing and after 4 days storage at 5°C, and juice was evaluated by a sensory panel. Cloud loss was monitored during 14 days at 30°C. Because of the juicing processes, F and FP juice contained 4-8 times higher peel oil in 'Hamlin' and 'Valencia', respectively, in comparison with CPP. F and FP juices had more stable cloud particles and less insoluble solids than CPP juice. For volatile components in 'Valencia' juice, F and FP juices contained higher esters including ethyl acetate, ethyl butyrate, and ethyl hexanoate aldehyde, and peel oil related volatiles such as α -pinene, linalool and octanol. On the other hand, acetaldehyde, octanal, α -terpineol and most terpenes including sabinene, myrcene, α -terpinene and valencene were higher in CPP juice. Total sugar levels (°Brix) were similar in all samples; however, CPP juice had higher contents of citric, malic and ascorbic acids, followed by F and then FP juice. F and FP juices contained lower levels of flavonoids, limonoids, and alkaloids, but had higher levels of limonin glucoside. The sensory panel perceived the CPP juice to have less peel oil flavor, agreeing with the low peel oil content. There was no significant difference in sensory data for overall preference among the three juice types in both cultivars.

Cellular Metabolism Affects Corporate Profits (Does Money Grow on Trees?). [Elizabeth Berdis](mailto:Elizabeth.BERDIS@fermenich.com), Fermenich, 3919 Kidron Rd, Lakeland FL, 33811. (Elizabeth.BERDIS@fermenich.com) [HP2]

“Money doesn’t grow on trees” is a popular saying. However, in the citrus industry money does grow on trees. The Florida citrus industry and related businesses employs approximately 90,000 people. Citrus generates a \$9 billion impact on the economy and nearly \$1 billion in tax revenues. More than 90% of the country's orange juice is made from Florida-grown oranges. Photosynthesis and the Calvin cycle are vital to many industries within the state of Florida. Environmental conditions affect the rate of cellular metabolism which indirectly affects a company’s cost of good sold (COGS). Fluctuations in COGS directly impact a company’s bottom line.

A Comparison of Commercially Processed and Fresh Squeezed Juice: Nutrients and Phytonutrients. [Jinhe Bai](mailto:Jinhe.Bai@ARS.USDA.GOV), Bryan L. Ford, John Manthey, Gary Luzio and Elizabeth Baldwin. USDA-ARS, Citrus & Subtropical Products Laboratory, Winter Haven, FL. (Jinhe.Bai@ARS.USDA.GOV) [HP3]

This research studied different juicing methods resulting in commercially processed and fresh squeezed juice with or without pasteurization for effect on level of nutrients and phytonutrients in ‘Valencia’ and ‘Hamlin’ orange juices. Commercial processing included use of a juice extractor, finisher, and thermo pasteurizer. The juice extractor longitudinally cut fruit and made multiple wounds and then pressed the fruit to obtain juice. The extractor system is equipped with a mechanism to separate peel oil from the juice, resulting in about 0.015-0.025% oil in the subsequent processed samples. On the other hand, the juicer used for fresh squeezed samples is a combination of fruit half-cutters and automatic self-reversing reamers. There was more peel oil (0.9%-1.5%) and less albedo/membrane tissues in fresh squeezed juice than in the commercially processed juice. Fresh squeezed juice, regardless pasteurization, had >4- and 8-fold higher levels of peel oil than processed juice in ‘Hamlin’ and ‘Valencia’, respectively. However, commercially processed juice had higher levels of particulates and solids (pectin and fiber). Total sugar contents were similar in all samples, expressed as Brix, however, commercially processed juice had higher contents of citric, malic and ascorbic acids, followed by fresh squeezed and then fresh squeezed with pasteurization. The majority of water soluble flavonoids including hesperidin, narirutin, narirutin 4'-glucoside, 6,8-di-C-glucosyl apigenin and isosakuranetin rutinoside, exhibited higher levels in commercially processed juice. On the other hand, flavonoids associated with peel oil, such as quercetagenin hexamethyl ether, sinensetin, nobiletin, tetramethyl-scutellarein, heptamethoxyflavone and tangeretin, had much higher concentrations in fresh squeezed juice because of the high oil content. Upon centrifugation, commercially processed juice had generally higher limonoids and alkaloids in the supernatant (juice serum), while the pellet had lower limonin glucoside. Commercially processed juice also had the highest total phenolic content. Thus, fresh squeezed juice had higher peel oil and associated oil-soluble flavonoids, however, commercially processed juice had higher levels of pectin and solids, water-soluble flavonoids, limonoids, alkaloids, phenolic content, organic acids and ascorbic acid. Pasteurization of fresh squeezed juice caused a slight decrease in the organic acids, but did not influence levels of other compounds.

CC4 Conductivity Detector for Determination of Degree of Esterification of Citrus Pectin. Gary A. Luzio. USDA-ARS Citrus and Subtropical Products Laboratory, Winter Haven, FL. (Gary.Luzio@ARS.USDA.GOV) [HP4]

After removal of soluble sugars and other compounds by washing, citrus peel is largely composed of pectin, cellulose and hemicellulose. In order to utilize the greatest amount of citrus peel product, it would appear reasonable that one or all three of these polysaccharides be converted to a useful material. One of the major components, pectin is relatively easy to modify using pectinesterases which reduces the degree of esterification to produce lower DE pectins which have great utility in the food industry and other applications. These lower DE pectins have been shown to have calcium sensitivity which is an important functional property of pectins for use in applications which require suspension, metal ion binding or water absorption. Thus the measurement of degree of esterification (DE) is an important attribute. Reduction in DE results in production of carboxyl groups which are ionic and conductive. Data will be presented showing that the conductivity as measured by CC4 conductivity meter increases with decreasing degree of esterification. Best curve fit is quadratic with correlation coefficient of 0.994. Size exclusion chromatography showing DE as a function of molecular weight will be shown for a randomly deesterified pectin.

Aseptic Processing of Citrus Pulp. Elizabeth Northeimer. JBT FoodTech, Citrus Systems, Lakeland, FL. (Elizabeth.Northeimer@JBTC.COM) [HP5]

In years past, citrus pulp was thought of as a waste product of juice processing, or at best, pulp was washed to remove juice solids. Due to the growth of beverages with added pulp, citrus pulp is now a commodity which rivals the value of citrus juice. This growth first resulted in the pasteurization of a juice stream concentrated to 350 -600 g/L, which was pasteurized, concentrated even more to remove excess juice, then packed and frozen. Recently, new aseptic processing equipment has been designed to commercially sterilize pulp at 850 g/L. This eliminates the need for the last concentration step prior to packaging. In addition, aseptic pulp can be stored in aseptic packages at refrigerated rather than frozen temperatures. Future challenges include bulk storage and transportation of aseptic citrus pulp.

Laser Labeling of Valencia Oranges does not Facilitate Growth or Penetration of *Salmonella* Present on the Peel Surface. Michelle Danyluk, Preeti Sood, Lisseth Pronoro, Loretta Friedrich, and Ed Etxeberria. UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. (mddanyluk@ufl.edu) [HP6]

In laser labeling of fruits and vegetables the desired information is etched onto the produce surface using a low-energy carbon dioxide laser beam (10,600 nm). Etched characters are formed by surface depressions in the epidermis that seemingly facilitate entrance of decay and pathogenic organisms. The objective of this study was to determine the effect of laser labeling and different post harvest treatments on *Salmonella*'s, ability to survive/grow and penetrate into the fruit. A five strain cocktail *Salmonella* was spot inoculated onto 'Valencia' orange peels in different sequences with wax application and laser etching. Inoculated samples were stored at 10 or 26, and a combination of 10 and 26°C for up to 42 days. Etched peels and corresponding juices were extracted and enumerated for *Salmonella*. No set of conditions promoted the growth of *Salmonella* on the fruit surface, or allowed penetration into the juice. Survival of *Salmonella*

populations on the peel surface did not differ between any of the treatment and control, unlabeled samples. In all cases, *Salmonella* declined between 1.5 and 3.0 log CFU/orange after 30 days, with faster declines noted at 10°C. Based on the data obtained from the many combinations of treatments and under conditions extremely unfavorable and unrealistic in terms of fruit storage, laser labeling citrus fruit peels and subsequent waxing in any order does not allow for the growth nor influence the natural decline of *Salmonella* populations on citrus fruit surfaces as compared to controls.

Improved Removal of Ascorbate Interference in the Folin-Ciocalteu Assay of “Total Phenolic Content”. Bryan L. Ford, Jinhe Bai, John Manthey, Elizabeth A. Baldwin.

USDA-ARS Citrus & Subtropical Products Laboratory, Winter Haven, FL 33881.

(Bryan.Ford@ARS.USDA.GOV) [HP7]

The venerable Folin-Ciocalteu (F-C) assay for total phenolics can have severe limitations due to interference by ascorbic acid (AsA). For common fruit juices AsA interference can easily exceed the magnitude of the total phenolic signal itself. Ascorbate oxidase (AO) has been a promising approach to eliminating the AsA interference, but the oxidation product of AsA digestion by AO is dehydroascorbic acid (DHA) which is itself an F-C reductant, giving an apparent signal implying a molar strength of 10% to 20% of the original AsA. We have successfully used hydrogen peroxide (H₂O₂) to degrade this residual DHA into products that are not themselves F-C reductants. Using a model orange juice we have examined the apparent impact of this small amount of (~600 ppm) of H₂O₂ on actual orange and non-orange phenolics in the model juice. We have sought chemical means to quench the H₂O₂ oxidative activities shortly after they have destroyed the DHA, or to otherwise prevent interaction with the phenolics present without altering the F-C signal. Some promising candidates have been identified, but none yet appears able to protect actual orange juice phenolics completely. The best that can be said is that conditions can be easily set so that the alteration in phenolics represents less than a 10% perturbation in the untreated model juice F-C signal. While this is much better than the large errors originally seen from AsA (100% or more of a typical orange juice phenolic signal) or from the residual DHA (20 to 40% error), we strive to develop an approach to the point that it predictably causes no more than a 5% artifactual error.

B-Graduate Students Presentations

The Relative Contributions of Ascorbic Acid and Phenolic Compounds to the Total Antioxidant Capacity of Acerola (*Malpighia emarginata* DC) Juices. L. Delva and R. M.

Goodrich. UF/IFAS Department of Food Science and Human Nutrition, Gainesville, FL.

(Student competition entry; lemanedelva@ufl.edu) [HP8]

The antioxidant composition and the total antioxidant capacity (TAC) of frozen single strength acerola juices have been studied. Phenolic antioxidants in these juices have been separated, identified and quantified by HPLC-PDA-ESI-MS² and values derived from their relative Trolox Equivalent Antioxidant Capacity (TEAC). The ascorbic acid content was determined using a separate HPLC-PDA system. Three kinds of anthocyanin (cyanidin-3-rhamnoside, pelargonidin-3-rhamnoside, and pelargonidin) were found, while chlorogenic acid was the major non-anthocyanin phenolics identified. The greater part of the antioxidant capacity of the juices was

accounted for by ascorbic acid. In contrast, anthocyanins and the other non-anthocyanin phenolics contributed to a fraction of the non-ascorbic acid antioxidant capacity, suggesting that significant unidentified antioxidant compounds are present in acerola juices.

Daily Intake of Pasteurized Orange Juice Decreases Serum Cholesterol, Fasting Glucose and Diastolic Blood Pressure in Adults. L. G. Basile, C. G. Lima, T. B. César. Paulista University (UNIP), São José do Rio Preto, São Paulo, Brazil, Faculty of Pharmaceutical Sciences, São Paulo State University, Araraquara, São Paulo, Brasil. (Student competition entry; liviabasile13@yahoo.com.br) [HP9]

The objective of this study was to assess the effect of drinking pasteurized orange juice daily on the nutritional status and lipid, glycemic and hemodynamic profiles of 21 healthy women and 20 healthy men that work at the University of São José do Rio Preto, SP, Brazil. During 8 weeks the women drank 500mL/day and the men 750mL/day of pasteurized orange juice. Anthropometric, biochemical and hemodynamic measurements were made and the food consumption of the individuals was assessed. All assessments were made before and after drinking orange juice daily for 8 weeks. After 8 weeks, total cholesterol and LDL-c dropped 8.6% and 8.8% in men and 4.8% and 9.5% in women, respectively. HDL-c increased 4.1% in women; fasting glucose, diastolic blood pressure and triglycerides decreased 4.7%, 7.9% and 9.3% in men. Regarding the anthropometric variables, waist circumference decreased 2.5% in women. Consumption of pasteurized orange juice increased the women's energy intake by 23.5% and the carbohydrate intake by 29.3%. It increased men's vitamin C intake by 262% and women's vitamin C intake by 72%. Folate intake increased 53% in men and 39% in women. At the end of the study the participants reported having approved the quality of the product and that they would easily incorporate the consumption of orange juice into their habitual diet. The regular consumption of 500mL/day of pasteurized orange juice for women and 750mL/day for men reduced some risk factors for atherosclerosis, presenting functional potential for the prevention of cardiovascular diseases.

Effects of Growing Location, Storage Temperature, and Fruit Coating on Postharvest Quality and Quality Retention of Sugar Belle™ Mandarin. Mark A. Ritenour¹, Fred G. Gmitter², Cuifeng Hu¹, Sambhav¹, William S. Castle², and Jude W. Grosser². ¹UF/IFAS Indian River Research and Education Center, Ft. Pierce, FL; ²UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. (Student competition entry; sambhav@ufl.edu) [HP10]

Sugar Belle™ mandarin (previously known as LB8-9) was released to Florida citrus growers in 2009. Fruit were evaluated during the 2008-09 and 2009-10 seasons in terms of growing location and response to different postharvest wax coatings and storage temperatures to determine optimum storage conditions. Fruits were obtained from blocks in Orange or Indian River (IR) counties, washed and coated with either shellac or carnauba wax, and then stored at 35, 40, or 50°F for up to 40 days, and then transferred to ambient temperatures for an additional 7 days. Fruits from the Orange County block maintained quality better than fruit from the IR County block. It is not clear if this is due to location, age of the block, or some other unknown factor. Only fruit from IR County developed chilling injury (CI) and the use of either coating reduced the development of CI symptoms. Storage temperature had different effects depending on the block, with the chilling sensitive fruit from the IR county block performing better at the

warmer temperature (50°F), whereas the non-chilling sensitive Orange County block performed better at 35°F. Lower storage temperatures resulted in less decay in both blocks, but the lowered storage temperatures resulted in much greater CI and peel breakdown only in the IR county block. Fruits from both locations lost water least when coated with carnauba wax and stored at cooler temperatures. However, fruits from Orange County developed better external color when left un-waxed and stored at higher temperatures.

Polygalacturonase Activity Does not Fully Explain Textural Differences of Melting Flesh Versus Non-melting Flesh Peaches. Ming-Wei S. Kao, Jeffrey K. Brecht, Donald J. Huber. UF/IFAS Horticultural Sciences Department, Gainesville, FL. (Student competition entry: kaoming@ufl.edu) [HP11]

Texture is the main distinction between melting-flesh (MF) and non-melting flesh (NMF) peach cultivars. MF peaches soften extensively toward the end of the ripening process while NMF peaches soften more slowly or lack the “melting” stage of fruit softening. Two pectolytic enzymes thought to be involved in peach softening are terminal cleaving exo-polygalacturonase (exo-PG) and random cleaving endo-PG. The decreased capacity of NMF peaches to degrade cell walls (i.e., soften) is thought to be related to a deletion of endo-PG gene or a truncation of the mRNA. Thus, NMF cultivars would be expected to possess lower endo-PG activity than MF cultivars. In this study, the extractable PG activity of two MF cultivars, ‘Flordaprince’ and ‘Tropic Beauty’, and two NMF cultivars, ‘UFSun’ and ‘Gulfking’, during the climacteric ripening stage were determined. ‘Flordaprince’ possessed similar endo- and exo-PG activities as the two NMF cultivars while ‘Tropic Beauty’ had the highest endo- and exo-PG activities of the four cultivars. Surprisingly, the endo-PG activity of NMF ‘Gulfking’ was significantly higher than its exo-PG activity and was also higher than that of MF ‘Flordaprince’. However, the higher endo-PG activity of ‘Gulfking’ did not reflect its texture since it was approximately five times firmer (11.77N) than ‘Flordaprince’, which implies that endo-PG activity does not fully explain the textural differences between MF and NMF peaches. Since cell wall disassembly presumably involves concerted and synergistic action of several different enzymes, other cell wall modifying enzymes may have a more crucial role than PG during peach fruit softening.

Evaluation of Roma Tomato (*Lycopersicon esculentum*) Peeling Methods: Conventional vs. Power Ultrasound. Cheryl Rock, Wade Yang, Akshay Anugu, and Jyotsna Nooji. UF/IFAS Department of Food Science and Human Nutrition, Gainesville, FL. (Student competition entry: cherylrrock@ufl.edu) [HP12]

According to USDA ERS 2009, approximately three-fourths of tomatoes are consumed in processed form (e.g., canned, puree, juice, salsa, sauce and soup) in the U.S., which often requires peeling prior to processing. Conventional methods of peeling tomatoes include the use of lye (NaOH) at a considerably high concentration (10%-15%), which inflicts ever-increasing concerns on caustic disposal and environmental impact besides material costs. Moreover, conventional lye peeling (e.g., 10% lye, 97°C, 45 sec) has been associated with high peeling losses which adversely affect the yield of product. In this study, a comprehensive evaluation of lye (2% and 10%) and ultrasound (1500 W, acoustic energy density ≈ 0.375 W/g) peeling methods was conducted at temperatures ranging from 25 to 97°C and treatment durations from 45 to 75 sec. Both visual inspection protocol and scoring criteria were established and peeling

losses were measured of tomatoes before and after treatments to judge the efficacy of peeling compared to control (conventional). Results showed peeling with much reduced lye concentration (2%) at 97°C for 45 sec. generated statistically comparable ($p < 0.05$) ease of peeling scores or product losses to control (i.e., 10% lye, 97°C, 45 sec.). This indicated the currently used peeling conditions might have been too harsh. At 2% lye, further increase of exposure time to 75 sec. did not significantly improve ease of peeling scores or product losses ($p < 0.05$). It was found in this study that ultrasonic power (amplitude), not duration, was key to effective ultrasonic tomato peeling, and increasing exposure duration did not significantly improve the ease of peeling scores and peeling losses. With the capacity of the ultrasonic probe used in this study, it was still difficult to spit open the tomato surface, which is critical to the success of tomato peeling.

Survival of *Salmonella* spp. on Lime Slices. Rachel McEgan and Michelle D. Danyluk. UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. (Student competition entry: rmcegan@ufl.edu) [HP13]

Lime slices are commonly added to beverages in the food service industry; little is known about microbial risks associated with this practice. The objectives of this study were to determine survival of *Salmonella* on lime slices stored on ice or at room temperature (RT). A five-strain cocktail of *Salmonella* (5 log CFU/slice) was spot inoculated onto the flesh, peel or albedo of sliced limes and held on ice or at RT for up to 24 h. *Salmonella* were enumerated by plating on selective agar during the 24 h of storage. *Salmonella* inoculated onto the albedo and held at RT first decreased by 1 logCFU/slice within the first hour then grew back to 1 logCFU/slice higher than at time zero. When inoculated onto either the flesh or peel and held at RT no significant difference was observed in the counts of *Salmonella* over the 24 h period; counts remained at ca. 5 log CFU/slice. When stored on ice the initial *Salmonella* load (at time 0 h) was ca. 4.5 log CFU/slice and remained with no significant difference over the 24 h storage time. The demonstrated ability of *Salmonella* to survive on lime slices suggests a potential food safety risk associated with improperly handled sliced limes.

C- Citrus Greening and Canker

Fractionation of the Secondary Metabolites of Orange (*Citrus sinensis* L.) Leaves by Fast Centrifugal Partition Chromatography. John A. Manthey, USDA-ARS. Citrus and Subtropical Products Laboratory, Winter Haven, FL. (John.Manthey@ARS.USDA.GOV) [HP14]

There is interest in the detection of changes in secondary metabolites in orange leaves in response to citrus greening disease. Conventional HPLC analysis readily provides detection of major phenolic compounds, but further, more detailed chromatographic analyses show many more compounds, to an extent where peak overlap prevent distinct detection and reliable quantitation of these numerous minor constituents. Hence, to achieve a more complete chromatographic analysis of orange leaf compounds, further fractionation of the complex compound profiles of orange leaves is needed, and this was achieved by Fast Centrifugal Partition Chromatography (FCPC). Separations by FCPC were accomplished with the biphasic system of ethanol/butanol/water (20/80/100). Distribution coefficients, K_d ($K^{\text{upper}}/K^{\text{lower}}$), ranged from 0.20 to >10 for the polar to nonpolar compounds. K_d values did not always correlate with

compound polarity estimated by elution times on reversed phase columns. Early eluted fractions provided recoveries of polar and midpolar hydroxycinnamates. Later eluting fractions contained various clusters of polar and midpolar flavones, many of which, in the intact extract, significantly overlapped. Components of the notorious “humptogram” of leaf extracts were resolved into their flavone and hydroxycinnamate constituents. Such resolution helps provide better chromatographic detection of individual components in this complex region of orange leaf HPLC chromatograms.

Aroma Differences between HLB/greening Symptomatic and Control ‘Valencia’ Orange Juice. Lilibeth Dagulo¹, Michelle Danyluk¹, Renee Goodrich², Charles Sims², Filomena Valim³, Timothy Spann¹, [Russell Rouseff](mailto:Russell.Rouseff@ufl.edu)¹ = UF/IFAS Citrus Research and Education Center, Lake Alfred, FL; 2 = UF/IFAS Food Science and Human Nutrition Department, Gainesville, FL; 3 = Florida Department of Citrus, Scientific Research Department, Lake Alfred, FL 33850. (rlr@crec.ifas.ufl.edu) [HP15]

The aroma volatiles in juices from symptomatic and control ‘Valencia’ oranges were evaluated using high resolution capillary GC-MS and GC-olfactometry. Total volatiles as determined by GC-MS from static headspace solid phase micro extractions, SPME, from the two juice types were similar. However, there were major differences in the volatile composition pattern between the two juice types. Juice from HLB fruit had more than twice the concentrations of terpenes such as γ -terpinene and α -terpinolene but had less than half the concentrations of important aroma volatiles such as ethyl butyrate and hexanal compared to control. The juice from HLB fruit also had less than half the concentrations of important flavor esters such as ethyl hexanoate and ethyl octanoate but had more than twice as much citronellyl acetate. These volatile compounds were identified by matching fragmentation patterns with standards and confirmed by matching standardized retention index values (LRI values). The corresponding aroma pattern from HLB juice also differed than that of the corresponding control Valencia juice. However, no off-flavor was noted in the aroma profiles. Aroma differences appeared to be more quantitative rather than qualitative.

Preharvest Measures for Postharvest Improvement in Marketable Fresh Citrus. J. Narciso, Citrus and Subtropical Products Research Laboratory, USDA-ARS, Winter Haven. (Jan.Narciso@ARS.USDA.GOV) [HP16]

Citrus canker, caused by the bacterium *Xanthomonas citri* subsp. *citri*, (Xcc), was once the scourge of the Florida citrus industry from the early 1900’s on and off until the early 1990’s. It has been replaced, for the most part, by citrus greening but still continues to be a problem for Florida fresh citrus. The canker outbreak peaked soon after the 2004 hurricanes, where the rains and winds spread the disease more quickly than it could be controlled. Although some of the strict quarantines placed on the industry at the beginning of the latest canker epidemic have been lifted, there is still a problem with shipping fruit from cankered areas out of the country. While work is continuing on post harvest measures to insure that no live canker bacteria leave the packing houses, pre-harvest measures are also being improved to decrease the disease pressure in the groves as well as lower incidence of infection on the fruit. Most commonly, a copper formulation is sprayed on the trees soon after petal fall for control of canker. Copper has long been used as an effective fungicide, since fungi are sensitive to metals. However, the sprayed

copper tends to be powdery and a good deal of it is removed from the leaves and fruit when it rains. Since rain and wind are the chief means of carrying the bacteria from diseased to healthy plants, this curtails the efficiency of the copper. In 2009, we began mixing the copper with a carnauba wax based “sticking agent” and using this formulation to spray experimental trees in a commercial grove. At the end of the growing season we had a significant reduction in canker lesions on the fruit as well as a dramatic reduction in melanose. With the emergence of yet another fungal disease on citrus (citrus black spot, *Guignardia citricarpa* Kiely), the increased exposure of these several citrus pests to a prophylactic that is maintained and protects the plant surfaces during times of great disease pressure, will facilitate the harvest of more unblemished and marketable fruit.

Commercial Packinghouse Practices Used to Handle Fresh Citrus Fruit with Canker Symptoms. Mark A. Ritenour¹, Lucimeire Pilon¹, Ron Muraro², and Jan Narciso³. ¹UF/IFAS Indian River Research and Education Center, Ft. Pierce; ²UF/IFAS Citrus Research and Education Center, Lake Alfred, FL; ³USDA, ARS Citrus & Subtropical Products Laboratory, Winter Haven, FL. (ritenour@ufl.edu) [HP17]

To assist in developing best postharvest practices for handling fresh fruit with canker lesions, a packinghouse survey was distributed in summers of 2008 and 2009 to better understand current practices. Approximately 60% of the surveys were returned each year representing about 55% of total fresh fruit shipments. As expected, the percentage of fruit received from blocks certified canker free declined from 2008 to 2009 as canker spread within the state. Sodium-o-phenylphenate was the sanitizer used most (52%) to decontaminate fruit in 2008, but its use declined to 47% in 2009. The use of peroxyacetic acid increased from 21% to 33% over the same period, while chlorine use dropped from 27% to 20%. Most (~50%) of the sanitizers were applied as the fruit were first wetted, but in 2009 managers were increasingly applying during or after fruit washing. For both years, an average of 22 human graders were stationed at difference points on the packingline to evaluate each load, with most (83%) increasing to 27 graders when fruit was known to come from a block with canker infection. All packinghouse managers reported that electronic graders were not useful for removing fruit with canker symptoms. In 2009, packers estimated that 34% of the citrus crop normally packed for the EU market was disqualified because of canker and that 12% of the product packed for the domestic or Japanese markets was either disqualified, or contained sufficient canker infection to make unprofitable to pack for the fresh market.

D – Postharvest

Electronic Nose for Detecting Strawberry Fruit Maturity. X. F. Du, R. L. Rouseff, J. H. Bai, A. Plotto, E. Baldwin and V. Whitaker. UF/IFAS Citrus Research and Education Center, Lake Alfred, FL; USDA-ARS Citrus and Subtropical Products Research Laboratory, Winter Haven, FL; UF/IFAS Gulf Coast Research and Education Center, Wimauma, FL. (Xiaofen.Du@oregonstate.edu) [HP18]

Strawberry is one of the major fresh market commodities in Florida. Strawberry must be harvested at the proper time, to keep its fruit quality and shelf life. Generally, soluble solids concentration (SSC), titratable acidity and/or color are the major indices for fruity quality

control. However, these indices can not guarantee the flavor quality, since fruit aroma is also one of the most important quality factors. Nondestructive and fast detection techniques to determine fruit aroma in a consistent and reproducible manner would benefit the strawberry industry and consumer. In this study, an electronic nose (e-nose) composed of eighteen different metal oxide gas sensors was used to differentiate the volatiles of 'Festival' and 'Radiance' strawberries at five different developmental stages including white, half red, three-quarter red, full ripe, and overripe. One hundred grams of strawberries were blended in a Waring blender. Three gram aliquots of puree were employed for headspace sampling in 10 mL vials, which were incubated at 40°C for 2 min. Each sample was then analyzed by e-nose for 2 min with 18 min instrument recycling. Principal Component Analysis of sensor data could distinguish volatile profiles of strawberries from white to overripe fruit development stages regardless of cultivar. E-nose also detected volatile differences between 'Festival' and 'Radiance' strawberry cultivars at the identical stages of development.

Using a Postharvest Alkaline Wash to Extend Shelf-life of Papaya. Jan Narciso, J. Bai, E. Baldwin, A. Plotto and C. Ference. USDA-ARS Citrus and Subtropical Products Research Laboratory, Winter Haven, FL. (Jan.Narciso@ARS.USDA.GOV) [HP19]

Papaya is a problematic fruit that is difficult to keep for long periods of time in storage and in the market. Some of the diseases the fruit is vulnerable to are *Alternaria* fruit spot caused by *Alternaria alternata*, which is the most important postharvest disease on papaya, anthracnose (*Colletotrichum gloeosporioides*), *Cercospora* black spot (*Cercospora papayae*), and *Fusarium* fruit rot (*Fusarium* spp.). In addition to infection from spores on/in the cuticle, the fruit can be infected in the seed cavity with *Cladosporium* or *Fusarium* and decay internally. This infection will break down the fruit due to internal spread of the fungus. Spores can be produced in these tissues and be carried on the peel causing decay in storage. Traditional chlorine and peroxyacetic sanitizers did not dramatically inhibit the emergence of postharvest decay organisms and a commercial alkaline wash was tried. After washing and rinsing, the fruit were coated with carnauba wax. Several of these fruit were stored at 18°C for whole fruit experiments and the remaining fruit were peeled and cut for processed fruit studies. The alkaline treatment served to decrease decay on the whole fruit in storage and yielded lower microbial counts from fruit cut from these treated fruit. The papaya also had a sweeter taste and less water loss.

Effect of Postharvest Application of 1-MCP on Basil Shoot Quality During Storage at Chilling Temperature. Adrian D. Berry and Steven A. Sargent, UF/IFAS Horticultural Sciences Department, Gainesville, FL. (adberry@ufl.edu) [HP20]

Basil (*Ocimum basilicum*) is one of the most temperature-sensitive of the fresh herbs, developing chilling injury symptoms after several days exposure <10°C, a common occurrence during commercial handling. The objective of this study was to evaluate the potential of increasing the tolerance of cut, basil shoots ('Nufar') to storage temperatures below 10°C by postharvest immersion in an aqueous form of 1-methylcyclopropene (1-MCP), an ethylene-action inhibitor. Shoots were either left dry, dipped in DI water or dipped in a 1-MCP solution of 500 µg L⁻¹ (500 parts per billion) for 30 sec. Dipped shoots were air-dried prior to packing in a commercial, plastic clamshell container and stored at either 5 or 10°C for 12 days. Shoots from all treatments retained good to excellent quality when stored up to 9 days at 5 or 10°C. However, regardless of

treatment, after 12 days at 5°C basil shoots had significant necrosis due to chilling injury and were therefore unmarketable. Basil stored at 10°C remained marketable during the 12-day storage period, but once transferred to 20°C quality was significantly reduced. After 12 days at 5 or 10°C there was no significant difference between treatments for the parameters tested. The following parameters were determined at 5 and 10 °C, respectively: leaf hue angle was 122.33 to 121.08° and 120.48 to 119.28°; total chlorophyll content was 1.12 to 1.32 and 1.12 to 1.17 mg/g; moisture content was 89.18 to 89.45 and 89.52 to 89.63 %. These results showed that dipping basil shoots in a 1-MCP solution of 500 µg L⁻¹ did not reduce susceptibility to chilling injury during storage at 5°C.

Potential of 1-Methylcyclopropene to Delay Ripening and Extend Quality of Avocado Fruit During Refrigerated Storage. Steven A. Sargent, Adrian D. Berry, Marcio E.C. Pereira and Donald J. Huber. UF/IFAS Horticultural Sciences Department, Gainesville, FL. (sasa@ufl.edu) [HP21]

This study was conducted to evaluate the effects of an aqueous 1-methylcyclopropene (1-MCP) formulation on ripening and quality of avocado (*Persea americana* Mill. ‘Monroe’) fruits under simulated commercial conditions. Twenty-four hr after harvest in Homestead, mature-green fruit were either immersed in aqueous 1-MCP at 75 µg L⁻¹ (75 ppb a.i.; 20 °C) or water for 1 min. All fruit were stored at 10°C for 2 wk, then transferred to 20°C until ripe (10 to 15 N firmness). Respiration, ethylene production, softening, and surface hue angle were delayed and/or suppressed in fruit exposed to 1-MCP. Ethylene production was delayed approximately 3 d and fruit ripening up to 6 d, compared with control fruit. Avocado fruit treated with 1-MCP maintained equal or better visual quality during ripening as compared to control fruit.

Maturity and Postharvest Performance of ‘US Early Pride’ Seedless Mandarins. T. Greg McCollum, C. Jack Hearn, and Mark Ritenour. USDA-ARS, USHRL, 2001 S. Rock Rd., Ft. Pierce, FL 34945; UF/IFAS Indian River Research and Education Center, Ft. Pierce, FL. (Greg.McCollum@ARS.USDA.GOV) [HP22]

‘US Early Pride’ is an early season, seedless mandarin developed and recently released by the USDA-ARS. ‘US Early Pride’ resulted from irradiated budwood of ‘Fallglo’ mandarin in 1991. Trees were produced from the irradiated budwood and planted into the field in 1992. In 1995, a seedless mutant (USDA 1-62-122) was identified and subsequently propagated on multiple rootstocks for evaluation. Based upon horticultural performance of the USDA 1-62-122 trees and fruit quality characteristics, especially the absence of seeds, USDA 1-62-122 was released in 2009 as ‘US Early Pride’. Although ‘US Early Pride’ has been found to be essentially identical to ‘Fallglo’ with the exception of being seedless, detailed studies to document time of maturity and postharvest behavior had not been conducted prior to release. We harvested ‘US Early Pride’ and ‘Fallglo’ fruit at intervals from October through late November and standard fruit quality parameters (size, weight, rind color, total soluble solids, Brix and titratable acidity) were quantified for both scions. Data indicated that ‘US Early Pride’ fruit are slightly smaller than ‘Fallglo’. ‘US Early Pride’ and ‘Fallglo’ fruits were both legally mature in early October and maintained acceptable quality on the tree at least until late November. Following harvest, the response to ethylene was similar in ‘US Early Pride’ and ‘Fallglo’. Sugars and acids were fairly consistent in the two cultivars during storage at 10°C for three weeks. Decay and other

postharvest disorders did not develop in either cultivar during storage. Our results document that 'US Early Pride' is equivalent to 'Fallglo' in time of maturity, response to ethylene, and postharvest behavior.

E – Postharvest and Processing

Modified Atmosphere Packaging for Fresh-cut 'Kent' Mango. [Sharon Dea](mailto:Sharon.Dea@ARS.USDA.GOV), Jeffrey K. Brecht, Cecilia do Nascimento Nunes, and Jean-Pierre Émond, UF/IFAS Horticultural Sciences Department; UF/IFAS Department of Food Science and Human Nutrition Department, Gainesville, FL; College of Technology & Innovation, University of South Florida Polytechnic, FL. (Sharon.Dea@ARS.USDA.GOV) [HP23]

A modified atmosphere package (MAP) was designed to optimize the quality and shelf-life of fresh-cut 'Kent' mango during exposure to common retail display conditions. Synergism of the MAP system with an antioxidant treatment (calcium ascorbate + citric acid) was also investigated. Mango slices in trays covered with polyvinylchloride (PVC) film were flushed with N₂ to obtain an initial atmosphere of 2 kPa O₂ and stored at 5 or 15°C for 10 or 5 d, respectively. Overall sensory quality, firmness, composition, and microbial load were evaluated daily. The MAP system maintained 5-6 and 4 kPa O₂ at 5 and 15°C, respectively; however, the CO₂ concentrations were 6-8 and 16-18 kPa. The high CO₂ at 15°C resulted in softer slices compared to samples stored in air. Fresh-cut 'Kent' mango slices treated with the antioxidant solution had better visual quality and the shelf-life was extended by 1 d at 15°C and by 2 d at 5°C compared to non-treated fruit. Storage at 5°C resulted in loss of characteristic mango aroma and development of a plastic-like odor, most likely due to the interaction between the film and the aroma volatiles, suggesting that the type of film used was not suitable for use in a MAP system for fresh-cut mango. The development of a polymeric film with a higher CO₂/O₂ permeability ratio would most likely enhance the positive effect of MAP on fresh-cut mango when exposed to high temperatures during retail display.

Eating Quality of Old and New University of Florida Strawberry Cultivars. [Anne Plotto](mailto:Anne.Plotto@ARS.USDA.GOV), Vance Whitaker and Craig Chandler. USDA-ARS Citrus and Subtropical Products Research Laboratory, Winter Haven, FL and UF/IFAS Gulf Coast Research and Education Center, Wimauma, UF. (Anne.Plotto@ARS.USDA.GOV) [HP24]

The University of Florida strawberry breeding program has developed cultivars highly adapted to west-central Florida since the 1970s. In this trial, four advanced selections and 11 released cultivars, from 'Florida Belle' (1975) to 'Florida Radiance' (2008), were grown in a randomized complete block design with 10-plant plots as the unit of replication. Berries were harvested bi-weekly and evaluated once a month by a trained sensory panel, from January to March 2010. FL-05-107 had the highest ratings for positive attributes (firmness, sweetness and strawberry flavor) in January, followed by 'Earlibrite' and 'Strawberry Festival'. In February, the highest ratings for positive attributes were given to FL-05-85, 'Elyana' and 'Strawberry Festival', and the highest preference score was given to FL-06-38, with a high strawberry flavor. The lowest preference scores were given to 'Dover' both in January and February, with the lowest rating for strawberry flavor both months, a high rating for "overripe/fermented" in January, and "sour" in February. 'Winter Dawn' also had the lowest preference score in January, associated with high ratings for "overripe/fermented" and "woody/musty". A plot obtained from a Principal

Component Analysis showed ‘Carmine’ and ‘Rosa Linda’ having high astringency both months and confirmed descriptors for the above-mentioned varieties and selections.

Citrus Section (Robert Ebel, 2010 Sectional Vice-President)

A - Production

Modeling Loosening of Sweet Orange with CMNP: Variation in Fruit Detachment Force. S. Sharma, R.C. Ebel, and K.M. Morgan, UF/IFAS South West Florida Research and Education Center, Immokalee, FL. (Student competition entry: sush@ufl.edu) [C1]

The efficacy of CMNP is a function of several application and environmental variables that must be considered in maximizing fruit removal of sweet oranges by mechanical harvesters. Fruits require direct contact by CMNP to promote loosening, which has been shown to be best accomplished by multiple fan sprayer technology rather than more commonly used airblast sprayers. Managers scheduling self-propelled mechanical harvesters must consider fruit drop to maximize fruit recovery, that is, fruit that ends up in the goats and removed from the grove. Fruit detachment force can vary significantly throughout the canopy. Once a tree is sprayed with CMNP, it has not been known how the variation in fruit detachment changes over time, which will impact scheduling of self-propelled harvesters. CMNP was applied at 200 and 300 ppm to drip on individual ‘Hamlin’ and ‘Valencia’ trees from Dec. through April and fruit detachment force monitored on 10 fruits/tree, and 4 trees/treatment. Variation in fruit detachment force varied from being so low that the fruit dropped, up to 100 N. After spraying with CMNP, the variation in fruit detachment force decreased over time, indicating that CMNP helps remove variation in fruit detachment force among fruit. The results are explained with respect to scheduling of self-propelled machines to harvest sweet oranges.

Induction of Autotetraploids in Pummelo (*Citrus grandis*) Through Colchicine Treatment of Meristematically Active Seeds *In Vitro*. Divya Kainth and J. Grosser, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. (Student competition entry: talktodivi@gmail.com) [C2]

Tetraploids serve as one of the breeding parents in interploidal crosses in order to produce seedless triploid cultivars. One of the approaches to regenerate autotetraploids is treatment with colchicine. Autotetraploids in pink/red-fleshed pummelo elite selections 5-1-99-2, C2-5-12 and UKP-1 (all derived from Hirado Buntan pink pummelo) were produced by treating the germinated seeds with different colchicine concentrations – control, 0.1%, 0.2% and 0.3% for different treatment durations of 12 and 24 hours. The seedlings emerged when put on rooting media under sterile conditions. The seedling ploidy was determined via flow cytometry at a stage when the seedlings had 1-2 expanded leaves. Higher colchicine concentrations and treatment durations decreased the survival rates of the seedlings compared with the lower concentrations and smaller treatment durations. The seeds that received higher concentrations and longer durations turned brown completely or had a dead meristematic bud. A similar trend was observed for the number of mutated shoots (tetraploids and mixoploids). Colchicine treatment decreased the growth rate of the affected seedlings. The frequency of occurrence of the

autotetraploids varied among the selections. Selections 5-1-99-2, C2- 5-12 and UKP-1 successfully produced 2, 1 and 3 autotetraploids and 1, 2 and 4 mixoploids respectively. The most efficient colchicines concentration was 0.1%. Reversion of the tetraploids and mixoploids into diploids was also observed. The pink/red-fleshed tetraploid plants generated should be useful as breeding parents in grapefruit improvement programs. Use of monoembryonic tetraploids in interploid citrus crosses eliminates the need for embryo rescue to recover seedless triploid progeny; and until now, no pink or red-fleshed monoembryonic pummelo parents are available.

Spatial Variability of Leaf Wetness Duration in Citrus Canopies. V. Santillan and C. Fraisse, UF/IFAS Agricultural and Biological Engineering Department, Gainesville, FL. (Student competition entry: cfraisse@ufl.edu) [C3]

Leaf wetness duration (LWD) is a key parameter to disease warning systems as an input to biological modeling of infection of many plant diseases in crops. However, within-canopy LWD heterogeneity can impact the performance of disease-warning systems. The main objective of this study was to determine the spatial heterogeneity of LWD within citrus canopies during summer and winter conditions. The spatial variability of LWD was evaluated in citrus trees in central Florida at twelve canopy positions during August 2008 and February 2009. Dielectric leaf wetness sensors were used to estimate leaf surface wetness and were placed at three height positions above the ground in a northward leaning position at an inclination of 45 degrees to the horizontal. The analysis of LWD measurements revealed statistical heterogeneity among sensor heights and horizontal positions. LWD was significantly higher ($P < 0.01$) at the top canopy compared to the middle and bottom positions during rainy and no-rain days. The variability of LWD tended to be minimized with rainfall; therefore, the longest LWD at the canopy top during rainy days was result of an early dew formation at the top canopy. The differences in mean daily LWD between top and bottom canopy during a 31-day period of time in the summer were 2.9 h and 2.5 h during no-rain and rainy days, respectively. The difference in mean daily LWD during a 30-day period in the winter with no-rain days was 2.6 h. The comparison by linear regression analysis between sensors within the canopy and a sensor installed at 30 cm above turf grass in a nearby Florida Automated Weather Network (FAWN) station showed that the station sensor provides accurate estimates of LWD at the top of the canopy. These findings accentuate the importance of accounting for the impact of spatial heterogeneity when in-canopy measurements of LWD are used as inputs to disease-warning systems.

Variation in Florida Processing Orange Yields over the Past 46 years: A Standardized Evaluation. L. Gene Albrigo and M. Burani-Arouca, UF/IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C4]

In order to accurately monitor changes in Florida orange production over time, a method was devised to standardize the number of bearing trees in Florida to account for variation in the number of young bearing age trees which have lower yields than mature trees. This was accomplished by accounting for the average percentage of mature tree yields that younger trees produce. Orange trees in Flatwoods counties were assigned partial values compared to mature trees from 5 until 10 years of age and Ridge county trees were assigned partial values from age 5 until 13 years of age depending on studies of yield to tree age in these two major production

areas. The final value for each year is referred to as mature tree equivalents (MTE). These values were divided into the reported annual yields of early-mid (primarily ‘Hamlin’) and late (primarily ‘Valencia’) orange cultivars. Freeze and hurricane events were also rated for severity and all these values are reported in graphic form. Early-mid oranges yields ranged from 2.7 to 5.5 boxes/MTE and late oranges yields ranged from 2.3 to 4.4 boxes/MTE for the period 1963 through 2008. These results are useful for evaluating trends in yields over time, the impact of weather events and assessing yield potential from predicted and actual levels of bloom each year.

Resolving the Current Challenges to Lime Production in Oman. Al-Yahyai, R., F. Al-Said, A. Al-Sadi, A. Al-Wahaibi, M. Deadman, Department of Crop Sciences, Sultan Qaboos University, Muscat, Oman, I. Khan, Vice Chancellor’s Office, University of Agriculture, Faisalabad, Pakistan, M. Al-Wardi, S. Al-Ismaily, Department of Soil, Water & Ag. Eng., Sultan Qaboos University, Muscat, Oman, A. Al-Lawati, A. Al-Matrooshi, A. Al-Zidjali, Directorate General of Agriculture & livestock Research, Ministry of Agriculture, Muscat, Oman. [C5]

Production of lime (*Citrus aurantifolia*) in Oman has been significantly reduced in recent years. Loss of area cultivated with lime trees is currently 50% of that in 1990, mainly due to Witches’ Broom Disease of Lime (WBDL) associated with *Candidatus Phytoplasma aurantifolia*. Moreover, increasing stressful abiotic conditions caused by prolonged drought, increasing soil and water salinity, and loss of soil fertility have contributed to a decline in lime production in the country. While the causal agent of the WBDL disease has long been identified, many aspects of the disease such as epidemiology, vector studies and sustainable control measures have not been tested. A research project aimed at a comprehensive understanding of WBDL in Oman was initiated in 2008. The long-term research objective is to provide practical solutions for lime growers that would enable them to continue production from diseased trees, while new, long-term solutions through resistant cultivars are evaluated and introduced. Several aspects of the current WBDL epidemic have been investigated including DNA fingerprinting of infected trees; interaction between WBDL and other citrus diseases; and quantification of morphological and biochemical changes in infected trees. Field trials have been established to evaluate hybridized and exotic cultivars of Citrus, particularly lime and studies of vectors and hosts have been initiated. Assessments of methods to optimize of fruit production through the management of diseased trees are in progress. Preliminary results that broaden our understanding of WBDL will be presented.

Interaction of CMNP Application and Harvest Date of ‘Hamlin’ Sweet Orange. Robert C. Ebel, UF/IFAS South West Florida Research and Education Center, Immokalee, FL; J.K. Burns, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL; K.M. Morgan, and F. Roka, UF/IFAS, SWFREC, Immokalee, FL. (rcebel@ufl.edu) [C6]

Crop removal by mechanical harvesters is affected by CMNP concentration, harvester setting, and harvest date. We previously evaluated various rates of CMNP concentration and harvester settings of fruit removal of sweet oranges. In this study, we utilized an optimal CMNP concentration and moderate harvester setting to determine the interaction of fruit removal by harvest date. CMNP was applied in mid Dec., 2009 at 0 and 300 ppm and at 300 gal/acre. The trees were harvested using a pull-behind canopy shaker at 200 cpm and 1.0 mph. The experiment was conducted as an RCBD with 4 blocks and 3 trees/block. The interaction

between CMNP concentration and harvest date was significant for fruit detachment force, preharvest fruit drop, and the percent of the total crop removed. Maximum fruit drop was under 6% by the 6th day after harvest for CMNP-treated trees compared to about 1% for the controls. Fruit removal reached a maximum by 4 days after harvest near 80% for CMNP-treated trees compared to 60% for the controls. The man-hours/tree required to glean fruit left on the trees after harvest was 82% for the CMNP treated trees compared to the controls. CMNP was active in loosening fruit up to 4 days but not beyond, increased substantially the fruit removed by the mechanical harvester, and cut down gleaning time significantly compared to unsprayed control trees.

Citrus Stumps Sprout Control. Steve H. Futch, UF/IFAS, Citrus Research and Education Center, Lake Alfred, FL, and S. Weingarten, Orange Co., Arcadia, FL. [C7]

Multiple studies have been conducted during 2008-10 to assess the effectiveness of Remedy Ultra. The first study examined various application rates (25%, 50% and 75% Remedy mixed with diesel fuel) whereas the second study looked at the impact of delaying application of Remedy on the control of sprout formation. During the first year, 12 of the 15 (80%) untreated stumps sprouted. Sprouts were noted over the study period with 0, 5, 3, 1 and 3 of the 15 stumps sprouting at 29, 56, 85, 113 and 141 days after tree removal, respectively. All treated stumps, regardless of the treatment rate, remained sprout free during the study period. During the second year, treatments of Remedy Ultra were applied at 25% or 50% solution mixed with diesel fuel at time of clipping, 24, 48 and 72 hours later. At Lake Placid, 7 (100%) untreated stumps sprouting by 150 days after tree removal. At this site, 4 stumps within the 56 treated stumps had root sprouts but not on the treated stump. Remedy Ultra was slightly less effective in controlling sprouts when applied at the 25% Remedy/75% diesel than at the 50% rate especially. Delaying application using the lower rate also had a slight negative impact on sprout control. At Arcadia, 86% of the untreated stumps sprouted within 90 days of clipping with only one untreated stump sprouting.

Alion 200SC – A Promising New Herbicide for Weed Management in Florida Citrus. Steve H. Futch, UF/IFAS, Citrus Research and Extension Center, Lake Alfred, FL; M. Edenfield and J. Curtis, Bayer CropSciences, Morriston, FL. [C8]

Alion 200SC (indaziflam) is a promising new herbicide under development by Bayer CropScience for proposed use in perennial tree crops including citrus. The new herbicide is for the preemergence control of annual grasses and broadleaf weeds. Alion 200SC belongs to the alkylazines chemical class of herbicides. It inhibits cell wall biosynthesis and acts on meristematic cell growth affecting germinating weed seeds. The herbicide can be used alone or in tank mix combinations with various pre and/or post emergence products. In 2009, a field trial was initiated in a young grapefruit grove in St. Lucie County. Alion 200SC was applied at 3.5 to 6.5 oz/acre with glyphosate and compared to glyphosate alone or with various currently registered residual product combinations. Alion 200SC, when applied with glyphosate, provided greater than 83% overall weed control at 4 months after application at both 5 and 6.5 oz/acre. Weed control ratings were very favorable to other applied residual products.

Estimating Relative Nutrient Uptake by Mature Citrus Trees in Field Conditions. K. Mann, A. Schumann, L. Waldo, K. Hostler, and R. Mann, UF/IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C9]

Knowledge of nutrient uptake by roots is of fundamental importance for development of fertilization programs for commercial crops. However, the nutrient uptake by mature trees in field conditions is difficult to measure due to the large tree size and limited access to the root system in the soil. Nutrient uptake by intact roots of mature citrus trees was estimated using the nutrient depletion method, wherein intact roots were separated from the soil and placed in a nutrient solution of known composition. Two fibrous roots were trained in a root box under a mature citrus tree every month. The roots were allowed to grow into aerated Hoagland's nutrient solution for 4-5 days before starting the actual experiment. Thereafter, the nutrient concentration of the solution was measured at several intervals (0, 4, 8, 12, 24, 48, 72, 96 and 120 hours) to determine the depletion curve. The solution volume was maintained with deionized water using constant head Marriott tubes. The roots were cut at the end of the experiment to measure length and dry weight. Results showed the relative rates and seasonal changes in the uptake ratios of nutrients. A threshold time period (24-84 hrs) and low nutrient concentrations beyond which further nutrient uptake was negligible varied with weather conditions. From these data, guidelines for fertigation in an Advanced Citrus Production System can be optimized based on the nutrient uptake ratios, and fertilizer formulated to meet the plant's requirements.

Phosphite is not a Good Source of Phosphorus for Citrus Rootstock Seedlings. F.C.B.

Zambrosi, F.C.B., Instituto Agronômico, Campinas, San Paolo, Brazil; D. Mattos Júnior and J.P. Syvertsen, UF/IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C10]

Phosphite (Phi; $P-PO_3$), a reduced form of P, can prevent plant infection by pathogenic *Phytophthora spp.* and reduce crop loss in many agricultural commodities including citrus. Although some commercial formulations of Phi have a nutritional label as a source of P, Phi can have negative effects on plant growth. We tested the nutritional value of Phi in 'Carrizo' citrange (CC) and 'Smooth Flat Seville' (SFS) grown in aerated hydroponic nutrient solution or in fertigated native Candler sand soil in a greenhouse. The four P treatments were: No P; 0.5 mM PO_4 (= high PO_4); 0.25 mM PO_4 + 0.25 mM PO_3 (mixed P sources); and, 0.5 mM PO_3 (= high Phi). After 90 days, the plants were harvested, separated into leaves, stems and roots and growth parameters were evaluated. Leaf net gas exchange was measured at the middle and near the end of the experiment. The high PO_4 seedlings had the highest leaf P, net assimilation of CO_2 (ACO_2) and total growth, but the no P seedlings had the highest root /shoot dry weight ratio. Total plant growth was positively related to leaf P in P- PO_4 plants but growth was negatively related to leaf P in Phi plants. High Phi plants had reduced root growth and had higher leaf P than the no P seedlings, but high Phi did not grow more than the no P seedlings. There were few consistent differences between solution culture and sand culture. SFS had more leaf area than the trifoliate CC and accumulated more P in the high PO_4 treatment than CC. Leaf ACO_2 , phosphorus and nitrogen use efficiency were reduced by Phi. Thus, Phi was not a good source of P for these citrus rootstock seedlings.

Rootstocks for 'Parson Brown' Sweet Orange. William S. Castle and J.C. Baldwin, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. [C11]

'Parson Brown' sweet orange is a well-known early-maturing seedy variety whose importance has slowly declined over time. Its usefulness as a commercial variety has been based on its superior juice color and soluble solids content compared to 'Hamlin.' The juice traits of 'Parson Brown' have fit into the production and marketing profile of various companies, thus, a trial was initiated in 1988 to determine how rootstock influences yield and fruit quality. The trial was located near Basinger, FL, on the property of a grower-cooperator. Citrus tristeza infected bud sources of PB-S-F-56-2-XE were used to propagate trees on 18 rootstocks. A single double-row bed (ca. 100 trees) was planted with trees of each rootstock in a site consisting mostly of Myakka fine sand soil. The trees were spaced 10 x 25 sq-ft. Yield was measured annually along with juice quality for 9 years between the 1992-93 and 2000-01 harvest seasons. Yield and juice quality was also measured among trees on five additional rootstocks in adjacent blocks. Tree survival was >80% except for those trees on 'Rusk' citrange (73%) and 'Changsha' mandarin (72%). Tree height after 13 years ranged from 7.3 ft ('Flying Dragon' trifoliolate orange) to 14.9 ft ('Vangasay' lemon). Cumulative yield ranged from 9.6 (hybrid 1573-26) to 29.0 boxes/tree ('Changsha' mandarin). Tree height was significantly correlated with cumulative yield ($r=0.72$) and cumulative pounds-solids/acre ($r=0.69$). Cumulative pounds-solids/acre (PS/acre) was highly correlated with cumulative yield ($r=0.96$). These relationships show that PS/acre, which determines grower income, was largely determined by the effect of tree height on yield. Thus, the high-yielding, tall trees on 'Changsha' mandarin rootstock produced the largest cumulative PS/acre (26,073); however, high-yielding smaller trees on other rootstocks with high quality juice such as 'Rusk' citrange (22,493 PS/acre) and the 'Rangpur' x 'Troyer' hybrid (20,155) were also among the most productive trees.

Impact of Inflation on the U.S. Orange Juice Tariff and the Competitiveness of Florida Growers and Processors. R.A. Morris, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. [C12]

Juice orange production costs have almost tripled since 1982-83, going from \$548 per acre to \$1,599 per acre by 2008-09, including costs to manage citrus greening. Even when greening management costs are not included, production costs have increased by 114%. However, the U.S. orange juice tariff is \$0.29 per pound solids for bulk concentrate and \$0.18 for not-from concentrate (NFC). If the tariff had been adjusted for inflation, it would currently be \$0.46 per pound solids for concentrate and \$0.29 for NFC. This paper reviews the history of the U.S. orange juice tariff and U.S. orange juice dumping suits against Brazilian exporters. An analysis of the economic impact of inflation's reduction of the protection of the tariff was undertaken, with projections of the impact this has had on Florida processed orange plantings and production. Finally, duty-drawback was analyzed as a provision that enables U.S. orange juice exporters to be competitive in international markets, and the reason why this trade provision doesn't make U.S. orange juice 100% competitive in international markets is explained.

Effect of Salicylic Acid on Oxidative Metabolism During Xac Infection of Grapefruit. N. Kumar, R.C. Ebel, and P.D. Roberts, UF/IFAS South West Florida Research and Education Center, Immokalee, FL. [C13]

Bacterial canker is one of the most devastating diseases of citrus in Florida, especially for grapefruit which is highly susceptible to the disease. There has been much interest in chemicals that induce systemic acquired resistance (SAR) in citrus, mainly against HLB. Salicylic acid is an endogenous compound known to be part of the SAR mechanism. A strain of bacterial canker was injected into leaves of grapefruit either alone or with salicylic acid (SA) and oxidative metabolism was evaluated over time. Activities of important enzymes involved in oxidative metabolism, including superoxide dismutase, catalase, peroxidase, and ascorbate peroxidase, were affected over the course of disease development by SA. The changes in enzyme activities corresponded to changes in hydrogen peroxide production.

Copper Formulations and Duration of Activity for Control of Citrus Canker on Grapefruit. J. Graham, M. Dewdney, and M. Myers, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. [C14]

Citrus canker (*Xanthomonas citri* subsp. *citri*) control on grapefruit is required to reduce fresh fruit blemishes. The objective of this study was to evaluate formulations, rates, duration of copper residues and application timing of the antibiotic streptomycin (Firewall, Agrosource, Inc.) for effective control on young, fruiting grapefruit trees. Copper applications were made at 21-day intervals starting at spring flush until fruit were fully expanded. The period of fruit susceptibility to canker was established by applying an increasing number of 21-day interval sprays through each growth stage. The risk and predisposing factors for fruit phytotoxicity were also assessed. In addition, the residual activity of Kocide (copper hydroxide, Dupont) on fruit, as affected by the adjuvant polymer delivery system (PDS), was measured at 7, 14 and 21-days after application. Copper formulations containing copper hydroxide or copper sulfate (metallic rates of 0.6 to 1.0lb/acre), varied from low to moderately effective for canker control depending on late season wind-blown rains. Copper pentahydrate, at a lower percent copper/application, provided equivalent control to other copper formulations. Streptomycin, alone or with a reduced rate of Kocide, in July and early August gave equivalent control to Kocide alone. Copper phytotoxicity risk coincided with accelerated fruit growth after summer rains. Greater canker susceptibility of fruit in later season is likely because of increased stomatal openings for bacterial infection coincident with greater windblown rain events. The only factor that led to significant reductions ($P < 0.01$) in copper residue/fruit surface area over time was Kocide 3000 concentration. PDS had no effect on the residue.

Screening Program for Products that are Reported to Stimulate Systemic Acquired Resistance Against Bacterial Canker. R.C. Ebel, N. Kumar, and P. Roberts, UF/IFAS South West Florida Research and Education Center, Immokalee, FL. [C15]

Greening and canker have become significant challenges to the citrus industry in Florida. Managing these diseases has included prevention, detection, vector control, disease control, and tree removal. Although innoculum removal through tree roguing has been the preferred method for managing diseases in general, the rapid development of greening, especially in the flatwoods

region, has compelled some grove managers to seek alternative approaches that include retaining infected trees in their groves. Mixes of nutrient application plus chemicals that have been reported to promote systemic acquired resistance have been applied to greening infected trees with some apparent reversal of greening symptoms. However it is not known if the SAR chemicals are at least partly responsible for suppressed symptoms independent of improved nutrition, and it is not known if SAR chemicals will suppress HLB titer. We have implanted a program to screen commercial products that are reported or believed to promote SAR in citrus. This program includes an initial greenhouse screening by spraying trees infected with greening or canker with chemicals that are believed to promote SAR, evaluating symptom development/suppression over time, bacterial titer, and some aspects of the SAR pathways. Chemicals that hold promise will be evaluated in the field. Preliminary experiments will be discussed.

Broad Spectrum Insect Control with MOVENTO® (Spirotetramat) in Florida Citrus. M. Edenfield, R. Morris, and J. Bell, Bayer CropScience, RTP, North Carolina. [C16]

MOVENTO® (spirotetramat) is a novel active ingredient from the new chemical class of tetramic acids. The product's new mode of action, known as a lipid biosynthesis inhibitor, shows no cross-resistance to currently available chemical classes in the market. When applied to the foliage, this highly systemic insecticide is translocated in an acropetal and basipetal manner within the plant, resulting in effective pest control on roots and developing flush. MOVENTO provides excellent initial and long-lasting residual control of a broad range of economically important pests infesting citrus. Studies have shown minimal risk to both predators and parasitoids, making MOVENTO an excellent fit in IPM programs. Several insect efficacy studies in citrus were initiated with MOVENTO to develop grower spray recommendations. MOVENTO at 10 oz /A in mature citrus controlled Asian Citrus Psyllid, Citrus Mealybug, Florida Snowscale, and Citrus Rust Mite. MOVENTO at 20 oz per 100 gallons of water was an effective treatment for Citrus Leafminer in immature citrus. Due to the new mode of action that shows no cross-resistance to currently available chemical classes, as well as the product's excellent performance against target pests with minimal risk to beneficial arthropods, MOVENTO will serve as a powerful tool in both resistance management and IPM programs.

Effect of Stimplex® Crop Biostimulant on Drought Tolerance of Container-grown 'Hamlin' Sweet Orange Trees. Timothy M. Spann, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL and Holly A. Little, Acadian Agritech, Sacramento, CA. [C17]

One-year-old container grown 'Hamlin' sweet orange trees on 'Carrizo' citrange and 'Swingle' citrumelo rootstocks were treated weekly with Stimplex Crop Biostimulant (5ml/L) as either a soil drench or foliar spray; untreated trees served as controls. All trees were fully irrigated during the first four weeks of treatment. Beginning on week five, half of the trees in each treatment were subjected to drought stress (irrigated at 50% of evapotranspiration) while the other half remained fully irrigated (100% ET). Stimplex treatments continued to be applied weekly to all trees during the drought stress period (eight weeks). The total shoot length was recorded weekly for all trees. Photosynthesis, instantaneous leaf water use efficiency and stomatal conductance were measured at weeks 4, 8 and 12. Stem water potential (Ψ_{stem}) was measured on all trees in each treatment immediately prior to and 24 hrs after irrigation during weeks 8 and 12 using a Shoelander-type pressure chamber. At the end of the study, all trees

were destructively harvested and stem, leaf, root and whole plant dry weight determined. Prior to drying, total root length per tree was estimated using a line-intercept method. Results showed that Stimplex-treated drought stressed trees on both rootstocks had more total growth than untreated drought stressed trees, but did not achieve the same total growth as well irrigated trees. Additionally, root-to-shoot ratio was unaffected by drought stress in the Stimplex treated trees, but was significantly increased (i.e. more root growth) in untreated drought stressed trees. Furthermore, the maintenance of growth by Stimplex under drought stress conditions was found to be independent of carbon fixation as photosynthesis was depressed in all drought stressed trees regardless of treatment. However, the Stimplex effect may have been related to an improvement in plant water relations since soil drench treated trees had significantly better (less negative) and foliar treated trees had numerically better Ystem after eight weeks of drought stress compared to untreated drought stressed trees.

B - Huanglongbing

A Comparison of Common and Different Volatiles in 'White' Guava and 'Hamlin' Orange Leaves. E. Onagbola, J. Smoot, L. Stelinski and R. Rouseff, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL. [C18]

Interplanting guava (*Psidium guajava* L.) with citrus in Vietnam has been reported to reduce populations of the Asian Citrus Psyllid (*Diaphorina citri* Kuwayama) and the incidence of HLB. This has been attributed to a repellent effect of guava volatiles. Because of the apparent protective effect of guava, a comparison study of 'Hamlin' orange and guava volatiles was undertaken. Although dimethyl disulfide has been identified as a key biologically active volatile produced by guava but not citrus, there could be other guava volatiles which might contribute to this protective effect. In order to be protective, these additional volatiles had to be found only in guava or primarily in guava and not 'Hamlin' orange. Therefore, static head-space volatile analyses were conducted to compare volatile profiles of 'Hamlin' orange and guava using gas chromatography- spectrometry, GC-MS, techniques. Six guava-only, 14 'Hamlin' orange -only, and 11 shared compounds were initially identified using library GC-MS fragmentation patterns and data base standardized retention index values. Identifications were confirmed by matching observed fragmentation patterns and retention values with those of known standards.

Ground Application of Foliar Sprays of Insecticides on 'Valencia' Oranges to Control *Diaphorina citri* Kuwayama. J.A. Qureshi, J.A., B. C. Kostyk, and P. A. Stansly, UF/IFAS South West Florida Research and Education Center, Immokalee, FL. [C19]

The Asian citrus psyllid (ACP; *Diaphorina citri*) is an economically important insect pest of citrus because it vectors *Candidatus Liberibacter asiaticus*, a bacterium that causes the devastating disease huanglongbing (HLB) or greening. Using insecticides is critical to reduce vector populations to manage HLB. Therefore, foliar sprays of broad spectrum and selective insecticides with or without adjuvants were evaluated against ACP in 14-year-old 'Valencia' orange trees. Delegate WG, Requiem 25 EC, Micromite 80 WGS, Movento 240 SC, and Portal 0.4 EC applied with 435 oil, Movento 240 SC with Induce and 435 oil applied alone during bloom in March were all effective in reducing psyllid populations for up to two months compared to the untreated control. Orocit was less effective than 435 oil in enhancing the effectiveness of Micromite 80 WGS. The addition of 435 oil enhanced the effectiveness of

Actara 25 WG in June and Movento 240 SC + 435 oil was not different from 435 oil alone. Treatments of Actara 25 WG + 435 oil, Agriflex + 435 oil, and Warrior 1SC + Actara 25 WG were all equally effective and reduced psyllid populations for up to five weeks. In an August experiment, Delegate WG + 435 oil or Induce and Kocide, Movento 240 SC + 435 oil, Requiem 25 EC + 435 oil or alone, Sil-Matrix and 435 oil alone all reduced psyllid adults for two to three weeks compared to the untreated control. Requiem 25 EC with 435 oil or alone, 435 oil alone, Sil-Matrix and Delegate WG + Induce were less effective than other treatments against nymphs. Danitol 2.4 EC, Warrior 1SC, Dimethoate 4 EC, Lorsban 4 E, and Imidan 70 W all applied alone in Sept. provided effective control of psyllid for up to five weeks. Treatment effects on adults were more pronounced and longer lasting than those seen on immature.

Possible Resistance to Huanglongbing in Sweet Orange. R.H. Brlansky. and W.S. Castle, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL; S. B. Garrett Citrus Grower, Haines City, FL. [C20]

Sweet orange cultivars account for approximately 80% of the total acreage of citrus in Florida. With the spread of huanglongbing (HLB) throughout the Florida citrus industry, yields of sweet orange have been affected. Research was initiated to examine the susceptibility of various commercial sweet orange cultivars to HLB. In greenhouse tests, most commercial sweet orange cultivars tested were found susceptible to graft inoculation with HLB-affected budwood. However, a high percentage of seedlings of a midseason cultivar continued to test PCR negative for *Candidatus Liberibacter asiaticus* even after one year after inoculation. The inoculum in all test plants sprouted, grew and tested PCR positive for the bacterium assuring that the test plants were inoculated with infected bud wood. Psyllid transmission tests to a limited number of the seedlings again produced results that numerous seedlings of the cultivar were not infected. This sweet orange cultivar appears be resistant to *Ca. L. asiaticus* infection. Work is continuing on this cultivar grafted on various rootstocks.

HLB/ACP Resistance or Tolerance in Non-transgenic Citrus Scion Varieties: Potential Commercial Significance? E. Stover, G. McCollum, B. Shatters, D. Hall, and Y. Duan, USDA/ARS USHRL, Ft. Pierce, FL. [C21]

While all tested commercial citrus scion cultivars are reported to be susceptible to huanglongbing (HLB), evidence suggests some cultivars are slower to develop severe symptoms. In recent grove surveys where most sweet orange and ‘Minneola’ trees have HLB symptoms and high *Liberibacter* (Las) titers, few trees of ‘Temple’, ‘Sunburst’, and ‘Fallglo’ display HLB symptoms or Las indicative of disease. These observations precipitated numerous experiments at the USHRL, including broader surveys of groves with diverse cultivars, replicated trials of cultivars with high exposure to Las, assessment of Las/HLB in breeding populations exposed to high disease pressure, and controlled psyllid challenges. Since ‘Temple’, ‘Sunburst’, and ‘Fallglo’ and/or their parents are used frequently within our breeding program, we hope to identify many citrus scion types with greater HLB tolerance for near-term deployment. Continued observation that *Poncirus trifoliata* is among the most resistant material to HLB and Asian citrus psyllid (ACP) offers the more distant promise of identifying advanced intergeneric hybrids with even greater resistance, and suitable fruit quality. Theoretically, slower development of HLB/Las could be due to alteration in a number of components: attractiveness of

trees to ACP, Las establishment at ACP feeding, Las proliferation following ACP inoculation, systemic movement of Las with subsequent further proliferation, and development of plant responses observed as HLB symptoms. Reduction or slowing of any of these steps may slow disease development and spread, but have different implications in overall management and commercial significance. Careful consideration needs to be given to the value and implications of such tolerance.

Managing Huanglongbing (Citrus Greening) with Foliar-applied Nutrient Sprays and SAR Inducers: Guiding Principles. T.M. Spann and A.W. Schumann, UF/IFAS Citrus Research and Education Center, Lake Alfred, FL.; K.T. Morgan and R.E. Rouse, UF/IFAS South West Florida Research and Education Center, Immokalee, FL. [C22]

An alternative HLB management strategy being adopted by many Florida citrus growers uses various foliar nutritional products, primarily micronutrients, alone or in combination with various SAR inducers to maintain tree health and productivity. There is substantial scientific evidence about the positive effects of improved, balanced mineral nutrition on plant disease, particularly with annual crops and foliar fungal and bacterial diseases. However, data on the interaction of plant nutrition and systemic vascular diseases, like HLB, are less conclusive. The beneficial effects of nutrition do not extend to situations of excessive or luxuriant fertilization, which can in fact increase disease severity. Currently no data exist to support the use of SAR-inducing products in the fight against HLB. However, studies currently conducted at several locations in Florida aim at determining the SAR affects, if any, of selected compounds (e.g. salicylic acid, Serenade) against HLB. Additionally, data in the literature indicate that SAR is effective against systemic bacterial wilt diseases in both woody perennials as well as herbaceous crops. Here we discuss several guiding principles for managing HLB with foliar applied nutrients and/or SAR inducers, namely: 1) emphasizing frequent, light applications over few heavy applications, 2) maintaining the balance of nutrients relative to one another, and 3) removing quantities of foliar applied nutrients from ground applications. In addition, preliminary data from two years of field trials are discussed.

Monitoring Trees in a Commercial Grove with HLB in Southwest Florida Receiving a Nutritional/SAR Cocktail. R.E. Rouse, UF/IFAS South West Florida Research and Education Center, Immokalee, FL; M. Irey, U.S. Sugar Corporation, Southern Gardens Citrus Corp., FL; P.D. Roberts, UF/IFAS, SWFREC, Immokalee, FL, M.M. Boyd and T.D. Willis, McKinnon Corporation, Immokalee, FL. [C23]

Citrus grower Maury Boyd has had success in maintaining his HLB infected trees using a cocktail mix of nutrients and SAR (Systemic Acquired Resistance) inducing chemicals. The Orange Hammock grove in Felida, FL, was first confirmed to have HLB in 2006. Since 2006, he has maintained his trees and kept them productive, setting his fifth crop of fruit. Two plots of 'Valencia' on 'Swingle' rootstock containing 100 trees (10 rows of 10 trees per row) each were PCR tested in 2008 and in 2010 and visually rated in 2010. One plot contained mature trees planted in 1992 and the other was a plot of younger trees planted in 2002. All trees in both plots were rated in 2010 for symptoms of HLB using a 0 to 5 scale where 0= tree vigorous, no symptoms of HLB to 5= tree in permanent decline. For PCR testing, leaf samples were collected from each tree and assayed by real-time PCR for detection of the HLB bacteria at the US Sugar

(both years) and HLB Diagnostic lab at SWFREC (2010 only). Results indicated that the percentage of HLB positive trees in the young trees increased from 81% in 2008 to 100% in 2010. The mature trees tested 40% positive in 2008, and were 90% positive in 2010. In 2010, the disease severity in the young trees using the 0 to 5 scale rated 50% of the trees as 3 or greater (3=moderate decline; symptoms of HLB). The disease rating on mature trees was less severe by comparison with less than 20% rated 3 or above.

Observations Gleaned from the Testing at the Southern Gardens HLB Diagnostic Laboratory: Three Years and 150,000 Samples Later. Irey, M.S., J. Johnson, P. Gadea, and T. Gast, United States Sugar Corporation, Southern Gardens Citrus Corporation, FL, and J. H. Graham and O. Cutino, UF/IFAS, CREC, Lake Alfred, FL. [C24]

The Southern Gardens Diagnostic Laboratory (SGDL) is a cooperative effort between Southern Gardens Citrus Corporation, the University of Florida/IFAS and the Florida Citrus Production Research Advisory Council to provide the industry with laboratory testing services to detect citrus Huanglongbing (HLB). The laboratory receives samples from growers, citrus nurseries, door yard citrus owners, researchers, and from Southern Gardens Citrus Corporation. Since the first grower sample was received on October 31, 2006, the SGDL has assayed 127,615 grower/nursery/dooryard samples, 16,841 samples from Southern Gardens Citrus, 4,170 psyllid samples, and approximately 5,000 research samples through February 11, 2010. When samples are submitted to the lab, SGDL requires basic information such as grove name, block, county of origin, date of sample collection as well as some other basic information to be submitted with each sample. In addition to the required information, SGDL requests optional information including row and tree, scion and rootstock, tree age and size, symptom description, etc. When provided, these data, coupled with assay results have proven to be a valuable data resource to elucidate some of the manifestations of HLB as it occurs in Florida. Data will be presented on the periodicity of samples, periodicity of symptom types, periodicity of infection in plant and psyllid samples, inferred bacterial populations over time, infection levels in scion varieties, possible rootstock effects, and infection levels by tree age and size.

Optical Methods for Huanglongbing (HLB) Detection in Citrus Orchards. S. Sankaran and R. Ehsani, UF/IFAS Citrus Research and Extension Center, Lake Alfred, FL. [C25]

Huanglongbing (HLB) is a devastating citrus disease that threatens the citrus industry in Florida. Several efforts are ongoing to control and contain this disease to protect the citrus industry. Among different approaches, detection of Huanglongbing (HLB) disease in citrus trees is one of the critical steps in HLB management and control. At the Citrus Research and Education Center, in Lake Alfred, we are working on multiple approaches to develop an effective and accurate mobile sensor system that can be used to detect HLB under field condition. This research presents some of our ongoing work on HLB detection. A SVC HR-1024 spectroradiometer (350-2,500 nm) and a portable InfraSpec VFA-IR spectrometer (5,150-10,720 nm) were used to collect data from the healthy and HLB-infected citrus trees to evaluate the applicability of the optical sensors. The reflectance data were collected in the visible, near-infrared, and mid-infrared regions of the electromagnetic spectra. The reflectance data were analyzed using statistical methods to classify HLB-infected citrus leaves from that of healthy ones. Preliminary

results showed the potential of these methods in detecting HLB-infected citrus leaves with good accuracy.

Assay of Citrus Seed for Viable *Xanthomonas citri* pv. *citri* (Xcc) after Extraction from Fruit Affected by Citrus Canker. Jim Graham, University Florida, CREC, Lake Alfred, FL; Mike Irey, US Sugar Corp., Clewiston; and Chuck Reed, Reed Brothers Citrus, Dundee, FL.(jhgraham@ufl.edu) [C26]

Trees for production of seed of rootstocks for citrus nursery propagations are typically located in blocks planted outdoors and are unprotected from pathogen and pest infestations. A seed-tree block in Dundee, FL experienced an initial incursion of citrus canker in July 2009. By September 2009, canker had spread in the block from south to north in the tops of Swingle citrumelo and Carrizo citrange trees. The disease distribution suggested that the Xcc inoculum was introduced in a single windblown rain event. This case illustrates the high risk for outdoor seed-tree blocks in Florida nurseries to become infected with canker. The purpose of this study was to provide evidence that the seed extraction and disinfection process for treating against fungi utilizing hot water, fungicide and bleach treatments is effective for eliminating Xcc from seed harvested from canker-infected fruit. The Carrizo citrange fruit used for seed extraction in this experiment exhibited moderate to severe canker symptoms. Seed extracted from the fruit were subjected to the standard hot water/fungicide treatment and then were assayed for the presence of Xcc. To validate the assay process, seed were soaked in Xcc inoculum at 10^4 colony forming units per ml, then they were washed, and the wash solution infiltrated into grapefruit leaves for detection of viable bacteria. The presence of canker lesions in the grapefruit confirmed that the recovery and bioassay methods were effective for detection of viable Xcc in seed washes. Treatments of seed extracted from canker-infected fruit with hot water at 125°F for 10 minutes and 8-hydroxyquinoline sulfate, with or without 10% bleach in the wash step nullified recovery of viable Xcc. This was expected since each of the disinfectants has bactericidal activity. In conclusion, the protocol for extracting and disinfecting citrus seed was effective for Xcc disinfection of seed from canker-infected fruit.