

2008 Joint Annual Meeting

Florida State Horticulture Society

Abstracts

Sections

[Professional Improvement Seminar](#)

[Citrus Section](#)

[Handling and Processing Section](#)

[Krome Memorial Institute](#)

[Ornamental, Garden and Landscape Section](#)

[Vegetable Section](#)

Professional Improvement Seminar

Monday June 2

7:00 Digital Imaging and Photoshop for Agricultural Scientists

Steven Rogers, Ecostat, Inc., PO Box 237, Highland City, FL. [C0]

Images are one of the most important means of scientific communication. The onset of catastrophic citrus diseases (e.g., canker (*Xanthomonas axonopodis*), greening (*Liberibacter asiaticus*) and CVC (*Xyella fastidiosa*)) requires accurate visual communication of colors found in mottles, mosaics and even soil profiles. This is especially true when showing symptom images to audiences outside the citrus industry who may not have intuition for soil and foliar coloration. Release of the new Adobe Photoshop CS3 Extended for Science and Medicine brings important advances and tools for improving scientific images that were not possible in prior software. This session describes new Adobe imaging technologies and how they are applied specifically in horticulture and plant pathology. Five image management best practices that all agricultural professionals should know will be demonstrated, including 1) embedding keywords and copyright information in images to protect your ownership; 2) using Photoshop's powerful history log to record all image modifications; 3) camera raw, 8-bit, 16-bit and 32-bit imagery and when to use them; 4) color management and accuracy using the RGB and LAB color spaces; and, 5) adding document security to PDF output to prevent unauthorized changes to your content. The last 5 minutes of this session will be a special Q&A about anything Photoshop-related.

Citrus Section

Monday June 2

10:00 Scheduling the Harvest of Florida Oranges to Maximize Juice Production.

Jacob Searcy, Fritz Roka, Thomas Spreen, University of Florida, IFAS, Food Resource Economics Department, Gainesville, FL. and Southwest Florida Research and Education Center, Immokalee, FL. [C1]

Successful adoption of mechanical harvesters by the Florida citrus industry will require changes to the current operational systems of fruit production, harvesting, and juice processing. These structural changes have the potential to impact financial returns throughout the market. Clearly defining and understanding the correlation between the biological changes of the fruit, industry operational decisions, and economic returns from operation will contribute to improving the future of citrus harvesting in Florida. The objective of this research is to first develop an unconstrained harvesting schedule for the Florida orange juice production industry that attempts to maximize total pound-solid production. Scheduling of harvest will be determined by optimizing a biological model of expected fruit maturity and yield based on fruit variety, tree age, and geographic location. Then, the model is constrained by harvesting and processing limitations to estimate impacts of these restrictions on production and economic returns. Quantifying the costs and benefits expected from changes to the harvesting system will allow for a more thorough understanding of which industry players will be affected and the expected magnitude of those impacts.

10:15 The Economic Value of Abscission for Mechanically Harvest Late-season 'Valencia' Oranges.

German Blanco, Fritz Roka and Jackie Burns, University of Florida, IFAS, Food Resource Economics Department, Gainesville, FL. and Southwest Florida Research and Education Center, Immokalee, FL and Citrus Research and Education Center, Lake Alfred, FL. [C2]

More than 95% Florida's citrus crop is hand harvested. Hand harvesting costs continue to rise steadily and the industry needs to become more cost efficient to remain globally competitive. Brazil, the leading world citrus producer, enjoys at least a 2-fold cost advantage within harvesting. Since 1995, the Florida citrus industry has been investing in a mechanical harvesting program. While mechanically harvested acreage increased to 35,000 during the 2006-07 season, only a small percentage of growers are adopting mechanical harvesting equipment. The most significant impediment against mechanical equipment is harvesting 'Valencias' late in the season. The presence of young fruit in the tree compromises next year's yield when trees are mechanically harvested. Burns (2006) reported that the abscission agent CMNP selectively loosens mature fruit, thus potentially allowing this year's crop to be mechanically harvested without adversely affecting next year's fruit yield. CMNP will require more than \$10 million to become registered and allowed for commercial use. The purpose of this research are to compare estimated economic values of mechanically harvesting 'Valencia' through out the season without adverse yield impacts against the estimated cost of development and registration of CMNP. The basis of this analysis will be to develop a "cost-benefit" scenario for the use of abscission in

mechanical harvesting, the economic success of this investment will be determined by positive net present values in different scenarios.

10:30 Interaction of Drought Stress and CMNP on Abscission of Oranges.

Robert C. Ebel, Kelly Morgan, Peter Newman, Jacqueline K. Burns, Jim Syvertsen, University of Florida, IFAS, Southwest Florida Research and Education Center, Immokalee, FL and Citrus Research and Education Center, Lake Alfred, FL. [C3]

CMNP is being developed as a loosening agent for oranges in Florida to aid mechanical harvesting. Florida receives insufficient precipitation during winter for crop growth, thus citrus trees requires irrigation to minimize drought stress. This study was conducted to determine if mild drought stress promotes abscission of orange fruit treated with CMNP. This study was conducted as a randomized complete block, split plot design. Irrigation was withheld for 19, 12 or 5 days before harvest with half of the trees either irrigated or not irrigated the day before harvest. Half the trees were treated or not treated with 200 CMNP 4 days before harvest. All treatments had 6 adjacent trees as subplots. Leaf conductance, transpiration and stem water potential were lower with increasing drought stress the day before harvest. There was no interaction between drought stress and CMNP on fruit detachment force or preharvest fruit drop. Fruit detachment force was reduced by 12% for trees with irrigation withheld 19 days before harvest, but were similar for the other two irrigation treatments. Preharvest fruit drop was not affected by drought stress. CMNP caused significant loosening. Fruit detachment force averaged 12 N for CMNP treated fruit compared to 51 N for untreated fruit. Preharvest fruit drop was 12.8 kg/tree for CMNP treated fruit and 1.1 kg/tree for untreated fruit. These results indicate that at current irrigation practices in Florida, drought stress between irrigations should not pose significant stress that enhances loosening of CMNP.

10:45 The Florida Automated Weather Network: Ten Years of Providing of Weather Information to Florida Growers.

William R. Lusher, John L. Jackson, Larry S. Treadaway, Louis A. King, and Kelly T. Morgan, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, FL. [C4]

Southwest Florida Research and Education Center, University of Florida, Immokalee, FL
The National Weather Service's agricultural weather service program was discontinued in 1998. In response to the discontinuation of this vital source of weather data for Florida's agricultural industry, the Florida Agricultural Weather Task Force, along with the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) appropriated funds from the Florida legislature to establish a network of automated weather stations. The goal of the Florida Automated Weather Network (FAWN) is to provide real-time weather data and weather-related tools to Florida growers. FAWN began as a network of 16 automated weather observing sites located primarily in central Florida. With recurring support from UF/IFAS, the South and Southwest Florida Water Management Districts, and the Florida Department of Agriculture and Consumer Services, FAWN enters its tenth year of operation, providing real-time weather data every 15 minutes from 35 sites located from Jay, near Pensacola, to Homestead. FAWN's weather related services have also expanded to include a number of web-based tools for crop cold-protection, irrigation scheduling, and disease control. FAWN is managed by a staff of eight that provides weather station maintenance, data management and quality control, user tool

development, and website maintenance and development. The number and locations of weather stations in FAWN is constantly evaluated with stations added or relocated in response to grower needs. In addition, new grower tools are constantly under development in cooperation with UF/IFAS scientists.

11:00 El Niño-Southern Oscillation effects on freeze probabilities in Florida.

Clyde Fraisse, Howard Hu, and Guillermo Baigoria, University of Florida, IFAS, Agricultural and Biological Sciences Department, Gainesville, FL. [C5]

In spite of the mild winters, severe cold weather can take place in Florida when the polar jet stream moves further in the southern region of the US. The main objective of this study was to understand the spatial distribution of freezes probabilities that can severely affected the citrus and winter vegetable industry. Minimum temperature data collected at individual weather stations during the last century were analyzed and interpolated using geostatistics. Mean average temperatures during Florida's coldest month (January) range from the lower 50s in the north to the high 60s in the south. However, extreme cold weather can bring chaos to the state's citrus and winter vegetable industries. Probabilities for 5 temperature thresholds: 32, 28, 25, 22 and 20 degrees Fahrenheit were calculated for different El Niño Southern Oscillation (ENSO) phases. Previous research has demonstrated that ENSO exerts a substantial influence on the climate of the southeastern USA. El Niño years tend to be cool and La Niña years tend to be warm between October and April. The ENSO signal in the region is strongest in the fall and winter months. The resulting probability maps were analyzed in conjunction with land use maps to estimate the area of citrus production impacted by different probability ranges. Depending on the month, temperature threshold, and location being considered, probabilities ranged from 0% for low temperatures such as 20°F in the southern tip of the state to 100% for 32°F in the northern part of the state. Maps of site specific freeze probabilities generated by the study can be used by citrus and winter vegetables producers to evaluate freeze risk probabilities during different ENSO phases.

11:45 Citrus Cold Weather Protection and Irrigation Scheduling Tool Using Florida Automated Weather Network Data. John L. Jackson, Kelly T. Morgan, and William R. Lusher, University of Florida, IFAS, Gainesville, FL and Southwest Florida Research and Education Center, Immokalee, FL. [C6]

Weather-related information is essential to Florida's agricultural producers for making important decisions. Citrus growers, in particular, routinely monitor current weather conditions to make informed decisions regarding the use water for irrigation and cold protection as well as the application of chemicals. Real-time monitoring of air and wet bulb temperatures is critical in cold protection and determining daily evapotranspiration rates can significantly impact irrigation scheduling. The Florida Automated Weather Network (FAWN), a program of the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS), provides growers with a variety of weather-related tools that can aid them in making these decisions. The FAWN Cold Protection Toolkit assists growers in estimating minimum overnight temperatures, tracking of forecasts, estimating evaporative cooling potential, and determining the temperature at which to shut down frost-protecting irrigation; all based on real-time weather data. The FAWN Citrus Microsprinkler Irrigation Scheduler can assist growers in determining the appropriate number of

days between irrigation, irrigation run-time based on evapotranspiration rates and specific grove spacing data, irrigation system design, and soil type. These tools can be found at <http://fawn.ifas.ufl.edu/tools>.

11:30 Glyphosate and Carfentrazone Tank-mix for Hard-to-control Weeds in Citrus.

Shiv D Sharma, M. Singh and S. H. Ftuch, University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C7]

Experiments were conducted in greenhouse and field to examine the efficiency of tank mix glyphosate and carfentrazone to control Brazil pusley (*Richardia brasilienses*) and dayflower (*Commelina bengalensis*), both difficult-to-control weeds of citrus. Glyphosate was applied at 2145 and 3220 g a.i./ha and carfentrazone at 17.7 and 35.5 g a.i./ha as sole and tank mixed applications. Percent control of Brazil pusley and dayflower was increased successively to 100% by 4th week with the application of lower rate of glyphosate examined in greenhouse study. Application of lower rate of carfentrazone at 17.7 g a.i./ha achieved 100% control of dayflower but on Brazil pusley carfentrazone had only negligible effect. Considering effective control of dayflower by sole application of glyphosate or carfentrazone and that of Brazil pusley by sole application of glyphosate, it was not possible to distinguish any synergistic effect on the phytotoxicity of their tank mixed application. In field, application of glyphosate and carfentrazone at higher rates had significantly higher control of dayflower over the lower rates. The control of Brazil pusley was significantly higher with higher rate of glyphosate only over lower rate and carfentrazone had negligible effect. Tank mix application of glyphosate and carfentrazone had synergistic effect on the control of dayflower, while tank mixed did not show any added effect on the phytotoxicity of Brazil pusley. Application of tank mix glyphosate and Landmaster II (glyphosate+2,4-D) achieved similar control in greenhouse and field as achieved by tank mix glyphosate and carfentrazone. The study indicated that the effect of carfentrazone or glyphosate varied with the weed species. However, it indicated that tank mix application of glyphosate and carfentrazone had some positive effect on the control both the plant species.

1:30 Metabolite Profiling of Healthy and Huanglongbing-infected Citrus Leaves: Work in Progress.

Juan M. Cevallos, José I. Reyes De Corcuera, University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C8]

Citrus Huanglongbing (HLB) is nowadays the largest threat to the Florida citrus industry. Many efforts have been directed towards the development of methods to detect this disease in early stages. Polyacrylamide Chain Reaction (PCR) and real time PCR are the most efficient and reliable methods. However, these techniques are expensive, require trained analysts and don't allow in-field analysis. The objective of this research is to find a target metabolite specifically produced by the HLB bacteria *Candidatus liberibacter* to develop rapid assay for in-field identification. Preliminary data obtained from Capillary Electrophoresis, and HPLC-MS show the reduction in concentration of some hydrophobic anionic compounds as well as the increase in concentration of some hydrophilic ones in diseased citrus leaves. Identification of those compounds is being carried out using HPLC-MS-MS and GC-MS. Identification of high molecular weight molecules is being done using 2-D gel electrophoresis.

1:45 How the Florida Citrus Production Research Advisory Council is Working with Other Industry Organizations for Solutions to the Greening Crisis.

Steve Rodgers, Ecostat, Inc., Highland City, FL. [C9]

The Florida Citrus Production Research Advisory Council (FCPRAC) operates under the Florida Citrus Production Research Marketing Order which was approved in a referendum in 1991 and again in 1997 and 2004. This order allows growers to tax themselves up to one cent per box of fruit and direct those funds to help solve production problems. Funds are awarded as competitive grants selected from proposals submitted each year to the 14 grower-representatives of the FCPRAC. This year, the Florida Legislature and the Department of Citrus helped raise funds to about seven million, resulting in over 100 research projects being funded. The primary focus of recent research is greening (sometimes called HLB). There is urgency in addressing HLB, so FCPRAC operations are being reorganized to make it easier to cooperate with outside organizations to manage and fund projects. One major cooperator in the future will be the National Academy Sciences, who will help ensure scientific quality in funded research. This presentation covers recent developments in the FCPRAC and how scientists can participate in its funding programs. Further, a new real-time web reporting system will be demonstrated that allows scientists to provide on-going information about their research programs.

2:00 Means and Pathways for Long-range Movement of Citrus Greening in Florida.

Susan E. Halbert, FDACS/Division of Plant Industry, Gainesville, FL, Keremane Manjunath, and Chandrika Ramadugu, NCGRCD, Riverside, CA. [C10]

Avenues for long-range movement of *Diaphorina citri* and pathogens that cause huanglongbing (citrus greening disease) in Florida are diverse. Some of these include psyllid flight, movement on plants for sale, and movement on unprocessed fruit and movement on. Florida residents also move potted citrus plants to different parts of the state. In late fall of 2005, we found many plants positive for citrus greening on the eastern edges of large groves adjacent to the Everglades. The most logical sources of inoculum were urban areas on the Atlantic coast, about 40 miles away. This suggests that *D. citri* may be able to fly or drift at least 40 miles under some circumstances. Numerous regulatory samples of psyllids from citrus and *Murraya paniculata* for sale to the public have been taken. These psyllids were tested for citrus greening pathogens. In the first half of 2007, over 13% of 154 samples that have been tested were positive for citrus greening. It is clear that citrus greening-infected citrus and *Murraya paniculata* plants sold in Florida contributed to the widespread distribution of citrus greening. We collected hundreds of *D. citri* from loads of oranges at processing plants and tested the insects for the presence of citrus greening bacteria. Four samples, representing three loads, were positive, suggesting that the insects and the disease can move with unprocessed fruit.

2:15 Real-Time PCR Increases Efficiency and Sensitivity for Testing Citrus Budwood Source Trees.

Peggy J. Sieburth, Karen Nolan, Richard Dexter and Steve Alderman, Bureau of Citrus Budwood Registration, Division of Plant Industry, Department of Agriculture and Consumer Services, 3027 Lake Alfred Road, Winter Haven, FL. [C11]

All citrus nursery trees can trace their origins to fully tested scion and foundation source trees that remain clean and disease-free in screen houses. Implementation of real-time PCR has led to a dramatic increase in both the testing efficiency and sensitivity in the Florida Bureau of Citrus Budwood Registration testing program. The vectored diseases, *Citrus tristeza virus* (CTV) and Citrus greening, are tested for annually and other graft-transmissible diseases are tested for once every six years. To test the current number of source trees (6,000) yearly, streamlining of collection and extraction of samples was necessary. Advance preparation (including computerized numbering of collection and extraction supplies) allowed greater efficiency during the late summer to early fall months that samples are collected, extracted and tested for citrus greening. A new grinding technique reduced the time needed while yielding better detection. The second yearly collection from the same trees has been carried out during the spring for traditional CTV ELISA testing. An initial investigation of testing for CTV by real-time PCR showed increased sensitivity with fewer missed CTV-infections, even when sample collection was at a non-optimal time. Testing for each additional pathogen can be completed in two weeks, which is an impossible task by conventional PCR. Citrus viroids were the first pathogens tested for using the same extraction as for citrus greening. One collection, one sample, and one extraction save money and allow for thorough, sensitive budwood testing for multiple citrus pathogens.

2:30 Greening Effects on Fruit Size Distribution in a Citrus Tree.

Tim Spann and Chris Oswalt.

University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL and Polk County Cooperative Extension Service, Bartow, FL. [C12]

Citrus greening disease or huanglongbing (HLB) is a bacterial disease caused by the phloem-limited bacteria *Candidatus Liberibacter* spp. The disease causes phloem collapse which leads to a number of unique symptoms expressed in leaves and fruit of infected trees. Fruit symptoms include small fruit size, misshapen and lopsided fruit, an inverted color change and off flavors in the fruit. Because of the off flavors, it is important to keep greening affected fruit from entering the processing plant where they could destroy large volumes of juice. We hypothesized that there is a significant difference in the fruit size distribution, more heavily weighted to smaller fruit, in greening infected trees than healthy trees. This change in size distribution caused by greening could be used to grade out affected fruit when fruit are harvested from a potentially infected area. Additionally, a load of fruit with a disproportionately high number of small fruit could be an indicator of possible greening infection, thus helping to direct scouting efforts.

2:45 Progress in Manipulating Citrus Defense Pathways in Favor of Citrus Resistance Against Greening and Canker.

Abeer Khalaf^{1,2}, Vicente J. Febres¹, Frederick G. Gmitter Jr.², and Gloria A. Moore¹, ¹ Plant Molecular and Cellular Biology Program (PMCB), Horticultural Sciences Department, University of Florida, Gainesville, FL. ² Citrus Research and Education Center, University of Florida, Lake Alfred, FL. [C13]

Florida produces 76% of the total citrus in the United States with an impact of about \$9 billion to the state's economy. The industry is threatened by the newly emerging citrus greening disease (or huanglongbin, HLB) on top of now endemic citrus canker. The ultimate solution is genetic resistance to these pathogens. This may be achieved through conventional plant breeding or, perhaps more quickly, via genetic transformation strategies. In the case of citrus canker, there are citrus relatives such as kumquat that appear to be resistant to the disease. Understanding the molecular basis of this tolerance is an important step in developing new cultivars. For instance, we have determined that a large number of genes are expressed in canker-resistant kumquat but not in susceptible grapefruit upon infection with canker. These differentially expressed genes include PR and transcription factors as well as other defense genes and may be responsible of the observed resistance in kumquat. Conversely, no citrus types or relatives have thus far been characterized as resistant to citrus greening. Therefore, we are also characterizing citrus genes that function in generalized disease defense pathways for use in genetic transformation experiments. This strategy has been successful in some plant/pathogen combinations.

3:30 Greenhouse Investigations on the Effect of Guava on Infestations of Asian Citrus Psyllid in Citrus.

D.G. Hall, T. R. Gottwald, N.M. Chau, K. Ichinose, L.Q. Dien, and G.A.C. Beattie
USDA-ARS, U.S. Horticultural Research Laboratory, Fort Pierce; Japanese International Research Center for Agricultural Sciences, Ishigaki, Okinawa-den, Japan; Southern Fruit Research Institute, Ministry of Agriculture and Rural Development, Mytho City, Viet Nam and University of Western Sydney, Centre for Plant and Food Science, University of Western Sydney, New South Wales, Australia. [C14]

Reports from Vietnam indicate interplanting guava with citrus dramatically reduces infestations of Asian citrus psyllid, *Diaphorina citri*. We therefore conducted greenhouse studies to assess the effect of different guava cultivars on adult psyllids. The effects of cotton and tomato were also evaluated in some tests as non-citrus, neutral plant species. Survival of adult psyllids confined to guava was reduced. However, survival of adults was also reduced when they were confined to cotton or tomato. Adult psyllids introduced into cages generally moved to citrus faster when citrus was alone than when citrus was with either guava or cotton, and greater numbers of adults were consistently observed on citrus over time in cages with just citrus. This may have been in part due to differences in total plant surface areas in cages with citrus alone or citrus with another plant. However, in one study significant reductions in numbers of adults on citrus caged with guava was attributed to the presence of guava because there was often no significant difference in numbers of adults settled on citrus caged alone compared to citrus caged with cotton. Mortality rates of adults was increased in cages containing both citrus and guava in one study but not another. While significant reductions in infestations of adults occurred in

cages containing both citrus and guava, the levels of reduction were less dramatic than anticipated. Verifying the Vietnamese guava effect may be dependent on field studies.

3:45 Evaluation of Low-volume Application Technologies for Asian Citrus Psyllid (*Diaphorina citri* Kuwayama) Control: Initial Results.

Ryan Atwood, Lukasz Stelinski and Masoud Salyani. University of Florida, IFAS, Lake County Cooperative Extension Service, Travares, FL. and Citrus Research and Education Center, Lake Alfred, FL. [C15]

The presence of citrus greening (huanglongbing) disease in Florida mandates effective control of Asian citrus psyllid (*Diaphorina citri* Kuwayama) populations. The psyllid vectors this potentially devastating disease and anecdotal evidence suggests that reducing the vector population via insecticide application helps reduce disease spread. Growers have attempted low volume application technology for controlling psyllids due to its speed and low cost. The goals of this study were to 1) evaluate the effectiveness of low volume applicators for psyllid control compared with standard air-blast applicators, and 2) to compare the effectiveness of several insecticidal modes of action applied with low volume applicators.

4:00 Impact of Insecticidal Control on Asian Citrus Psyllid and its Natural Enemies.

A H. Jawwad, H. Qureshi, Alejandro Arevalo, and Philip A. Stansly, University of Florida, IFAS, Southwest Florida Research and Education Center, Immokalee, FL. [C16]

The Asian citrus psyllid (ACP) *Diaphorina citri* damages new growth in citrus by feeding and vectors the bacterium *Candidatus Liberibacter asiaticus* responsible for the citrus greening or 'huanglongbing' disease. Therefore, reduction in psyllid populations is a key to reduce the spread of the disease. Several insecticides were evaluated for psyllid suppression in young and mature 'Valencia' orange trees. Drench applications of imidacloprid (Admire Pro and MANA AG 8412-094B @ 14 and 16 oz per acre, respectively) and thiamethoxam (Platinum @ 13.7 or 18.8 oz per acre) to 5 year old trees in Jun significantly reduced psyllids for three months. Platinum tended to act more quickly compared to other products and the high rate was more effective. Foliar applications of several insecticides at different rates alone or with different adjuvants were tested from Jun through Sept on 12 year old trees. Effects of these applications were variable with products and rates and lasted from 2-4 weeks. The non-ionic surfactant (Induce) or 435 Oil were more effective adjuvants for Spirotetramat (Movento) than MSO or Kinetic. When present, more ladybeetles were seen on the untreated trees compared to treated trees. Ladybeetle abundance may explain the relatively low number of psyllids seen on the untreated trees and thus the lack of significant differences with many of the treatments.

4:15 Dynamics of Mortality Factors of the Citrus Psyllid in South Florida.

Jorge E. Peña, R. E. Duncan and Josep A. Jacas, University of Florida, Tropical Research and Education Center, Homestead, FL 33031 and Universita Jaume I., Castellon, Spain. [C17]

A survey for predators and parasitoids of *Diaphorina citri* was conducted from November 2005 through May 2006 on limes, *Citrus aurantifolia* and on orange jasmine, *Murraya paniculata* in Homestead, Miami-Dade county. Percent parasitism from *Tamarixia radiata* fluctuated between 0.85 to 7.74 for 2nd to 5th instar *D. citri*. The most common predators were syrphids,

coccinellids and chrysopids. Frequency of parasitoids and predators was recorded during the morning and afternoon hours by observing activity and presence of natural enemies on an orange jasmine hedge located in Homestead. The most common natural enemies during these observations were the predators, *Zelus longipes* (Hemiptera: Reduviidae), *Cicloneda sanguinea* (Coleoptera: Coccinellidae), *Eriophora ravilla* (Aranea: Araneidae) and others.

4:30 Streptomycin Controls Citrus Canker in Brazil and Florida and Reduces Risk of Copper Phytotoxicity on Grapefruit.

J. H. Graham, CREC, University of Florida, Lake Alfred; R. P. Leite, Jr., Instituto Agronômico do Paraná, Londrina, Paraná, Brazil; H. D. Yonce, KAC Agricultural Research, Inc. Deland, FL. [C18]

Field trials in Brazil demonstrated that, even at reduced rates, copper formulations such as copper hydroxide (CH) were consistently effective for control of canker on moderately susceptible sweet orange cultivars. Copper at reduced rates could minimize risk of phytotoxicity to fruit, and environmental contamination. On oranges, applications of CH at 14-day intervals at full rate (3.8 kg/ha) and at the 0.5x, 0.25x, and 0.125x rates were effective for reducing infection on foliage and fruit as well as reducing defoliation. Agrimicina (1.5% oxytetracycline + 15% streptomycin) at 4.8 kg/ha was as effective as intermediate rates of CH, whereas Mycoshield (20% oxytetracycline) at 4.0 kg/ha was ineffective. In Florida, CH and basic copper sulphate (BCS) at 2.0 kg/ha applied at 14- and 21-day intervals controlled canker on grapefruit, but caused considerable phytotoxicity to fruit. Alternation of Firewall (17% streptomycin) at 1.3 kg/ha with BCS provided similar disease control on fruit to CH or BCS alone with less phytotoxicity.

4:45 Combating Huanglongbing and Canker via Genetic Engineering of Citrus.

M. Dutt, A. Omar, V. Orbovic, G. Barthe, J. Gmitter, M. Vasconcellos, C. Dunning and J.W. Grosser. University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C19]

Florida is the world's third largest producer of citrus, behind Brazil and China. In recent years, this 9 billion dollar industry has been affected by two important diseases – huanglongbing (HLB) and canker. Both these diseases are caused by gram negative bacterium. While canker can be managed by following a canker suppression program, HLB, affecting all cultivated citrus varieties, cannot currently be controlled. Resistance to either HLB or canker is also not present in commercial orange and grapefruit cultivars. A strategy to produce resistant citrus is genetic engineering to incorporate resistance genes not found in citrus. We have successfully cloned several natural and synthetic antibacterial genes and made significant progress introducing them into commercial sweet orange and grapefruit cultivars, using both the standard *Agrobacterium*-mediated transformation system, and the protoplast/GFP transformation system developed previously in our program. Genetic constructs containing promoters that target the gene(s) exclusively to the phloem tissue, where HLB resides, are also being utilized in efforts to minimize foreign gene expression in fruit or juice subsequently going to market. Systemic acquired resistance (SAR) against these pathogens is also being investigated by transforming citrus with genes from tobacco and *Arabidopsis*. Techniques for construction and incorporation of the genes into citrus are discussed.

Tuesday June 3

10:00 Citrus Best Management Practices: Efforts and Achievements in Florida.

Geovanne Stingham, University of Florida, IFAS, BMP project, Immokalee, FL. [C20]

Best Management Practices (BMPs) are practices determined by the coordinating agencies, based on research, field-testing, and expert review, to be the most effective and practicable on-location means, including economic and technological considerations, for improving water quality in agricultural and urban discharges. Florida citrus industry has been very receptive to the implementation of BMPs; there are four producing areas that have been implementing citrus BMPs: the Ridge, Indian River, Peace River and Gulf area. Each area has also adopted a BMP manual that reflects the major BMPs recommended for that specific region. BMP measures are not regulatory or enforcement-based, they are strictly voluntary. As part of the BMP implementation program, growers must perform an environmental assessment of their operations and sign the Notice of Intent (NOI) form. This process identifies which BMPs should be considered to achieve the greatest economic and environmental benefit. The adopted BMPs may be a single practice or grouping of practices that, when implemented, are designed to improve water quality. Once enrolled in the BMP program, landowners must maintain records and provide documentation regarding the implementation of all BMPs. One of the most innovative elements of implementing BMPs is the Presumption of Compliance with water quality standards to landowners who voluntarily implement adopted BMPs that have been verified to be effective by FDEP. This component of the provides a powerful incentive to encourage landowners to enroll in the BMP programs since landowners are protected from cost recovery by the state if water quality standards are not met. This unique approach to addressing water quality concerns has been well received by the environmental and agricultural communities alike and as a result is becoming the primary method for addressing water quality concerns. In addition, growers enrolled in the BMP program become eligible for cost-sharing funds to implement specific BMP practices.

10:15 Spectral Differentiation of Young Flush and Old Citrus Leaves.

M. Salyani, R. Ehsani, A. Mishra, and R. Sweeb, University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C21]

Since psyllids mostly feed on young leaf flushes, it seems that discharging spray droplets only on those targets could mitigate some of the problems associated with frequent spray applications pesticides for HLB management. Therefore, the main objective this research was to develop a sensing system for detecting young leaf flushes in citrus tree canopies. A portable spectroradiometer was used to collect light reflectance information from young and old leaves of several citrus varieties (Hamlin, Valencia, Orlando, Navel, Murcott, Amber Sweet and grapefruit). For each variety, measurements were made on the north and south sides of five trees and reflectance intensity was recorded at 350-2,500 nm. Reflectance plots of all citrus varieties showed distinct peaks and valleys at certain wavelengths. There were some differences between light reflectance of young and old leaves at the measured wavelength range; however, reflectance intensity varied among varieties. Using various normalized difference parameters, optimal wavelengths were identified for the desired spectrometer. This paper will present the results and discuss the potential for developing a sensing system for use on citrus sprayers.

10:30 Results of Ground and Foliar Application of Nitamin Urea Polymer to Citrus.

Gene Albrigo, University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C22]

Nitamin, a linear chain urea, and Citriblen were applied at 150 or 90 lbs N/acre, respectively, as ground applications to 8 to 12 year old 'Hamlin' orange and 'Flame' grapefruit on a Candler soil near Lake Alfred, FL for 4 years. Nitamin was also applied as a foliar spray at 30 lbs N/acre at 5-10 % petal fall and 5 weeks later for 3 years on mature Rhode Red Valencia trees near Lake Placid, FL, foliar applications substituted for 60 lbs of the normal 180 lbs N/acre. In the ground application tests, there were no significant differences in yield, but the treatments were not challenged by high yields because of the hurricanes in 2004 and subsequent recovery in the next 3 years. The foliar applications significantly increased yields of the Rhode Red Valencia trees. These trees were on a more vulnerable soil and may have benefited from part of the N being applied for leaf rather than root uptake. Fruit quality and size information also will be reported.

10:45 Microbial Soil Amendments do Little to Improve Citrus Tree Performance in Florida Soils.

AW Schumann, JP Syvertsen, and JH Graham, University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C23]

The profitability of Florida citrus groves can be limited by poor soil conditions. There are many advertised soil amendments that claim to "condition" unproductive soils by improving the balance of beneficial microbes even though there is no known research demonstrating the effectiveness and profitability of these products on citrus. We tested four commercially available microbial-based liquid soil amendment products that have been recommended by their manufacturers to be beneficial for citrus. In three repeated greenhouse studies, products were applied at recommended and higher rates to seedlings of Carrizo citrange grown in pots of native Candler sandy soil. In Experiment I, total plant growth tended to increase in response to amendments of two of the products (B,C) but growth responses to increased rates of B and C were not conclusive. Nitrogen leaching and leaf N responses were not remarkable. The other two products (A, D) had no effect on seedling growth or N budgets. Greenhouse experiments were repeated twice using B and C but seedling growth and mineral nutrient status were little affected. Nonetheless, products B and C were tested in three field-scale experiments at three locations (Southern flatwoods, Indian River and central Ridge). The two products were applied at recommended rates with or without biosolids (sludge) to provide additional microbial substrate. During three years of repeated applications and monitoring, the microbial products did not consistently or significantly affect any measured parameter in the soil or citrus crop. Soil measurements included SOM, pH, CEC, P, K, Ca, Mg, Fe, Cu, microbial respiration, PWP, and *Phytophthora* counts. Leaf analyses included color (SPAD), N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, B. Tree canopy heights and volumes were measured, and fruit quality was expressed as fruit size, percentage juice, brix, acid, and ratio. Fruit yield could not be rigorously assessed because in two years the harvest was damaged by hurricanes, and one experiment was destroyed due to the canker eradication rule in Florida. The additional cost and labor of incorporating these microbial products into a Florida citrus production program could not be justified.

11:00 Rootstocks Affect the Yield and 16-Year Survival of ‘Valencia’ Trees Grown in Immokalee.

Bill Castle, University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C24]

An unreplicated planting of ‘Valencia’ orange trees on 19 rootstocks was established near Immokalee in 1991 to evaluate tree performance on a scale approximating commercial conditions. Trees on various standard or new rootstocks ranging from citranges and citrumelos to Cleopatra and Sun Chu Sha mandarins were grown in a commercial nursery. Individual beds of 98 trees on one rootstock were planted at 14 x 22 ft (141 trees/acre) in a commercial grove. The soil is mainly Malabar fine sand. Soil pH values were above 8 in places near the edges of the site where calcareous spoil from nearby ditches was used to form beds; elsewhere in the site, soil pH averaged 7.8. Tree survival was above 90% except for rough lemon and Cleopatra mandarin which lost 20 to 30% of the trees to blight and for the complete loss of trees on sour orange to tristeza virus. Trees on most rootstocks were about 12 to 13 ft tall at age 9 years; those on Cleopatra mandarin and F80-5 citrumelo were the tallest at 14.5 ft. Those on Swingle citrumelo were 10.7 ft. The highest cum. yields across six seasons were among the trees on rough lemon (17.4 boxes), Carrizo and Benton citranges (14 to 15 boxes); the lowest yield was for trees on Cleopatra mandarin (9.5 boxes). From juice data obtained in five seasons, the highest pound-solids/box values were from trees on Carrizo, Benton and Rusk citranges.

11:15 Growth, Tree Survival, and Juice Quality of Early-Season Sweet Oranges Grown on Seven Rootstocks in Immokalee.

Bill Castle, University of Florida, IFAS, Citrus Research and Education Center, Lake Alfred, FL. [C25]

Eight early-maturing sweet orange selections, including a blood orange, ‘Earlygold’ and ‘Itaborai,’ that had been previously evaluated in a formal trial were planted in a commercial grove in 1995 south of Immokalee. The unreplicated planting was designed to observe performance on a commercial scale. It consisted of typical double-row beds planted at 10 x 24 ft with trees of one scion/bed divided among eight rootstocks. There were about 80 to 120 trees/bed. The trees were raised in a commercial nursery. After 9 years, the order of tree height across all scions was Smooth Flat Seville (14.5 ft)> Goutou>Kinkoji>Benton citrange>Kuharske citrange>Carrizo citrange>Swingle citrumelo>C-35 citrange (11 ft). Yield was not measured in the planting, but occasional observation suggested that the trees on each rootstock were cropping at commercially acceptable levels. Using trees on Swingle citrumelo, juice quality was tracked seasonally for ‘Earlygold,’ ‘Itaborai,’ and ‘Ruby,’ and compared with ‘Hamlin’ fruit collected from a nearby grove. Brix-acid ratios in four seasons were generally about 20 by December. Juice color numbers of the three new selections usually exceeded that of ‘Hamlin’ by 1.5 to 2.0 points by mid-November. Pounds-solids/box were low by industry standards, about 5 lbs/box between mid-November and mid-December, with little difference among all scions.

11:30 In Vitro Germination of Citrus Seed to Produce Seedlings for Genetic Transformation.

R.P. Niedz, U.S. Horticultural Research Laboratory, ARS-USDA, Ft. Pierce, FL. [C26]

Seedlings germinated *in vitro* are commonly used as a source of explants for *Agrobacterium*-mediated transformation of citrus. Seed and seed treatments that result in rapid, uniform, and high percentage germination are preferred. A number of seed treatments including peeling, aeration, presoaking procedures, prehumidification, and sterilization procedures were used on *Citrus sinensis* 'Hamlin' seed. Germination curves were produced and percentage, rate, and uniformity for each treatment combination were estimated. Seed of additional citrus types including grapefruit, 'Carrizo' citrange, and H897 were tested using combinations of treatments that had the highest positive effect on germination. The importance of seed germination in the genetic transformation of citrus will be discussed. The likelihood and consequences of introduction of the spherical mealybug, *Nipaecoccus viridis*, into Florida, and its effects on citrus production, D.D. Thomas, Plant Medicine Program, Dept. Plant Pathology, University of Florida, Gainesville, FL. Scale insects are among the most commonly introduced insects in Florida, and many have become significant pests. Although it is not in the continental U.S., the spherical mealybug, *Nipaecoccus viridis*, is a serious threat to agriculture. Like many mealybugs, it is a polyphagous pest that attacks economically important crops including citrus. It reduces plant vigor, deforms fruit, induces leaf chlorosis, and promotes the growth of sooty molds. This pest builds large populations quickly due to its high fecundity along with multiple and overlapping generations. *N. viridis* is also easily disseminated naturally or on plants or plant products. The spherical mealybug has been intercepted 31 times at U.S. ports, but not yet in Florida. Since Florida's climate is conducive to their development, it could ultimately become established and adversely impact citrus production. The likelihood of introduction depends on the plant/produce being imported and the actions taken once imported. If this pest becomes established in Florida, it could have economic and environmental impacts. It has the potential of significant crop loss. In addition, its establishment in Florida could lead to loss of foreign markets since *N. viridis* is a quarantine pest in several countries. The use of chemical and biological control programs could also have indirect environmental impacts. Although no phytosanitary options have been developed specifically for *N. viridis*, postharvest treatments and quarantine treatments show some promise. If the spherical mealybug did establish in Florida, then biological control holds the greatest possibility of mitigation due to its success in other countries

11:45 The Likelihood and Consequences of Introduction of the Spherical Mealybug, *Nipaecoccus viridis*, into Florida, and its Effects on Citrus Production.

D.D. Thomas, Plant Medicine Program, Dept. Plant Pathology, University of Florida, Gainesville, FL. [C27]

Scale insects are among the most commonly introduced insects in Florida, and many have become significant pests. Although it is not in the continental U.S., the spherical mealybug, *Nipaecoccus viridis*, is a serious threat to agriculture. Like many mealybugs, it is a polyphagous pest that attacks economically important crops including citrus. It reduces plant vigor, deforms fruit, induces leaf chlorosis, and promotes the growth of sooty molds. This pest builds large populations quickly due to its high fecundity along with multiple and overlapping generations.

N. viridis is also easily disseminated naturally or on plants or plant products. The spherical mealybug has been intercepted 31 times at U.S. ports, but not yet in Florida. Since Florida's climate is conducive to their development, it could ultimately become established and adversely impact citrus production. The likelihood of introduction depends on the plant/produce being imported and the actions taken once imported. If this pest becomes established in Florida, it could have economic and environmental impacts. It has the potential of significant crop loss. In addition, its establishment in Florida could lead to loss of foreign markets since *N. viridis* is a quarantine pest in several countries. The use of chemical and biological control programs could also have indirect environmental impacts. Although no phytosanitary options have been developed specifically for *N. viridis*, postharvest treatments and quarantine treatments show some promise. If the spherical mealybug did establish in Florida, then biological control holds the greatest possibility of mitigation due to its success in other countries.

12:00 Considering the Citrus Grove of the Future

Ed. Stover and William S. Castle, USDA/ARS, USHRL, 2001 S. Rock Rd., Ft. Pierce, FL and University of Florida., IFAS, Citrus Research and Education Center, Lake Alfred, FL [C28]

Revolutionary changes now face the Florida citrus industry as producers grapple with economically profitable production using greening susceptible material. Changing economic realities have encouraged many tree fruit industries to modify planting density, tree architecture, and training/production systems. More trees / acre translate into earlier bearing and less yield disruption as trees are lost, but with greater establishment costs. High density orchards usually favor dwarfing rootstocks which reduce vegetative growth and ease inter-tree canopy competition. Dwarf trees are also more amenable to thorough spray coverage to manage psyllid and provide nutritional or other therapeutic materials to slow greening symptom development. Practices which facilitate early cropping and fruit quality are critical to the Open Hydroponic System, and will continue to evolve as tree physiology is actively managed to maximize returns. What other components merit evaluation? Use of larger planting stock, ready to crop and grown in isolation from greening, may be advantageous. Similarly, judicious pulsing with GA-biosynthesis inhibitors may maximize early yields and help contain canopy volume. Use of tree supports, to limit diversion of tree resources into reaction wood, has proven useful in pome fruits, and may enhance light interception by permitting pyramidal citrus. If GMO solutions are accepted, this may encourage further transgenic modification such as earlier cropping, dwarf stature, and high proportions of leafy inflorescences, perhaps even using own-rooted planting stock grown from seed to reduce planting costs. The purpose of this talk is to stimulate discussion and facilitate assembly of diverse useful ideas in facing this challenge.

12:15 Incorporation of Air Temperature into a Model That Predicts Loosening of Oranges by CMNP.

Robert C. Ebel and Jacqueline K. Burns. University of Florida, IFAS, Southwest Florida Research and Education Center, Immokalee, FL and Citrus Research and Education Center, Lake Alfred, FL. [C29]

CMNP (5-chloro-3-methyl-4-nitro-1H-pyrazole) is an abscission agent that is in the process of being labeled as an aid for mechanical harvesting. A mathematical model that would incorporate the most important factors, including environmental and plant, may be a useful tool

for mechanical harvesting companies and growers to schedule abscission sprays and harvest. A considerable amount of research has been conducted for several decades, the results of which have identified many factors that affect abscission agent efficacy. Two of the most important factors include concentration and temperature. We have developed a preliminary model using CMNP concentration and air temperature from previous and current studies. Other factors that may affect loosening include time of day, decay rate of CMNP in the fruit, and rootstock. We are currently evaluating empirical adjustments to the model for these factors to improve model predictability. Development and validation of the model using published and unpublished data as well as factors that will be considered for the model in the future, will be discussed.

Handling and Processing Section

Monday June 2

10: Optimization of Strawberry Volatile Sampling by Odor Representativeness.

Celine Jouquand, Craig Chandler, Gulf Coast Research and Education Center, UF, Wimauma, FL and Anne Plotto, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven, FL. [HP1]

The aim of this work was to choose a suitable sampling headspace technique to study 'Festival' aroma, the main strawberry cultivar grown in Florida. For that, the aromatic quality of extracts from different headspace techniques was evaluated using direct gas chromatography-olfactometry (D-GC-O), a special tool which is dedicated to assessing global odor from solvent-free extracts. A gas chromatography equipped with a sniffing port was equipped with a 15-cm deactivated silica column, thus allowing evaluation of global odor of headspace extracts without chromatographic separation. Two SPME extracts, with different types of fiber (PDMS/DVB fiber and DVD/Car/PDMS fiber), and two static headspace extracts, with different phase ratios (ratio of gas and sample phase volumes), from 'Festival' puree were evaluated using D-GC-O. A similarity test with three panelists allowed comparison of the odor of these extracts to that of 'Festival' puree. The results indicated that SPME extracts with a DVD/Car/PDMS fiber generated the most representative odor with a "green" impression and a strong "fruity" note. A fruity note was also obtained with static headspace extracts which exhibited the highest volatile concentration in headspace, i.e the lowest phase ratio. When comparing the aroma profile of each extract, the "DVD/Car/PDMS" extract showed the highest concentration of methyl butanoate and ethyl butanoate, two key compounds in strawberry aroma.

10:15 Effect of Early Detection of Greening on Juice Flavor and Chemistry.

Anne Plotto and Elizabeth Baldwin, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven, FL, Greg McCollum, USDA/ARS, USHRL Fort Pierce, FL and Mike Irey, United States Sugar Corporation, Clewiston, FL. [HP2]

When Huanglongbing (HLB) was first discovered in Florida, trees with early symptoms of disease were harvested to determine whether there was any flavor difference between juice made from infected trees but with asymptomatic fruit, and fruit harvested from healthy trees. It is of interest to the processing industry to determine what affect fruit from trees of various stages of infection would have on processed orange juice quality. Valencia oranges were harvested in

2006 from HLB-positive trees in the early stages of disease development (HLB fruit), and compared to fruit from healthy trees. A consumer panel did not perceive differences for juice taste or smell between healthy and HLB fruit in a triangle test. An experienced panel, however, did perceive that juice from HLB fruit was sweeter than juice from non-HLB fruit. Further tests were performed by using the “difference-from-control” test with filtered or unfiltered juice, to determine the effect of pulp on difference perception. When juice was filtered, panelists could perceive a difference by smell and by taste; when juice was served unfiltered they could only perceive a difference by taste. One of the descriptors that came up frequently for the HLB filtered juice for taste difference was again “sweeter”. Chemical analyses showed that the juice from HLB fruit was higher in Brix/acid ratio than from juice from non-HLB fruit which is in agreement with the “sweeter” perception. No consistent differences in aroma volatiles between juice of HLB and non-HLB fruit were observed.

10:30 Consumer Evaluation of New Tangerine Hybrids from the UF-CREC Citrus Breeding Program.

M. Filomena Valim, Florida Dept. of Citrus, Lake Alfred, FL, Fred G. Gmitter Jr., Citrus Research and Education Center, UF, Lake Alfred, FL, Anne Plotto and Elizabeth Baldwin, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven, FL. [HP3]

The objective of this study was to conduct a consumer evaluation of new tangerine hybrids from the UF-CREC citrus breeding program, together with some commercial varieties. A total of 153 mall intercept interviews were conducted with a random sample of fresh citrus fruit consumers in three markets: Baltimore, MD, Chicago, IL and Tampa, FL. Consumer acceptance was determined based on the following attributes: overall appearance, flavor, and specific product characteristics that included color, sweetness, acidity, juiciness, ease of peeling, amount of seeds, size and shape. Degree of liking/disliking and consumer expected consumption and purchase intent were also evaluated. Six samples were tested in each location: three new unreleased tangerine hybrids plus Dancy, Minneola and Spanish Clementine commercial varieties. One of the new unreleased hybrids scored overall ahead of all other samples, including the three commercial varieties. The test also provided useful information regarding consumer eating and purchasing habits concerning fresh citrus.

10:45 Improving Tomato Flavor.

Elizabeth A. Baldwin, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven, FL, John W. Scott, Gulf Coast Research and Education Center, UF, Wimauma, FL and Charles Sims, Food Science & Human Nutrition Dept, UF. [HP4]

Tomato (*Solanum lycopersicum* L.) lines from the University of Florida Gulf Coast Research and Education Center breeding program have been evaluated over the years for flavor, among other necessary horticultural characteristics. Both consumer and experienced or trained sensory panels have been conducted as well as analyses of chemical flavor components including total soluble solids, individual sugars, titratable acidity, individual acids, solids acids ratio and individual volatiles. The goal was to select for superior flavor in general, for a specific fruity floral note and for a preferred sugar/acid balance. This work resulted in the development of a medium sized round hybrid for the premium tomato market, released as ‘Fla. 8153’Tasti-Lee™ and small round and plum tomatoes with a fruity floral note.

11:00 Effect of Controlled Atmosphere on In Vivo Oxygen Levels of Tomato Fruit.

Adrian D. Berry and Steven A. Sargent, Horticultural Sciences Dept. UF. [HP5]

The oxymicro, a pc-controlled fiber optic oxygen meter, was used to measure in vivo oxygen levels of tomato fruit under various conditions. Tomato 'FL 47' initially at maturity stages pink and light red were sampled for internal oxygen in a locule and the blossom end (10mm depth). The fruit were stored at room temperature for 3d then sampled again in the same locations. The internal oxygen level was 65-75% at the blossom end and 20-40% in the locule. There was no difference in oxygen level between fruit maturity stage. Tomato fruit (BHN640) were either left untreated or treated with lanolin, at the stem and blossom end. Fruit were sampled immediately after lanolin application at the blossom end (10mm depth) and then 3 times during a 4 day period. The oxygen level inside the control fruit remained consistent during the 4d evaluation period (80%), while the oxygen level of lanolin treated fruit decreased from 70% to 2%. Tomato 'FL 47' fruit at light red stage were placed in a flow through container with a controlled atmosphere (CA) of 4% O₂ and 5% CO₂ or air (21% O₂ and 0% CO₂). Container atmosphere for CA and air treatments was verified with a 9900 checkmate O₂ / CO₂ gas analyzer (PBI Dansensor America). Internal oxygen was sampled at the blossom end (10mm depth). The internal oxygen level of CA treated fruit was initially 70% then decreased to 4% after 1hr and after 3hr was 1%. The air treated fruit had consistent internal oxygen levels of 75% throughout the sampling period.

11:15 Characterization of Citrus Flower Headspace Volatiles Using SPME and GC-MS.

Fatima Jabalpurwala*, Russell Rouseff and Jack Smoot, Citrus Research and Education Center, UF, Lake Alfred, FL. [HP6]

Citrus blossoms are known for their pleasant, highly desirable aroma. However, few studies have analyzed the volatiles in intact citrus blossoms. The object of this study was to identify the major volatiles and relative concentrations in intact grapefruit, sweet orange, sour orange, mandarin, lime and pummelo blossoms. Volatiles from freshly picked blossoms were collected and concentrated using a Carboxen/PDMS SPME fiber and separated on a high resolution capillary carbowax column. Identifications were based on linear retention index values and MS fragmentation patterns. The major citrus blossom volatiles consisted primarily of myrcene, limonene, ocimene, methyl anthranilate and surprisingly indole. Multidimensional statistics such Principal component analysis, has demonstrated that the blossom volatile patterns cluster within about four groups.

11:30 Fruit Quality and Aroma Characteristics of 'Red Moon' Specialty Red-fleshed Cantaloupe (*Cucumis melo* L.).

Jeanmarie M. Mitchell*, Daniel J. Cantliffe, Steven A. Sargent, Denise Tieman, Horticultural Sciences Dept. UF, Harry J. Klee, Institute of Food and Agricultural Sciences UF and Peter J. Stoffella, Indian River Research and Education Center (IFAS), UF, Fort Pierce, FL. [HP7]

The 'Red Moon' cantaloupe is a red-fleshed melon sold with highest quality as it is trademarked the 'Perfect Melon'. The purpose of this research was to evaluate 'Red Moon' cantaloupe fruit quality and aroma volatiles at three stages: 1.) a fully mature stage, but prior to

abscission layer development, or no-slip stage (NS); 2.) at the onset of the abscission layer (AL) development at the stem, ranging from ¼ to ¾ slip; and 3.) at full-slip (FS). Melons from each stage were evaluated on day 0 (following harvest) and after 5 and 10 days storage at 20 °C. Data was recorded for days to harvest, weight, fruit size, flesh thickness, flesh firmness, soluble solids content (SSC), ethylene and respiration rates, and aroma volatiles. Of the quality variables measured on day 0, stage NS was firmest (46 N). All other fruit quality variables and ethylene and respiration rates were similar for all stages. Average SSC was 11.7 °Brix for all stages. After 5 days of storage, overall firmness decreased from day 0, however stage NS was firmest (17 N). SSC was higher than day 0 for all stages, with stages AL and FS (13 and 12 °Brix) the highest. There were no differences among stages in other fruit quality variables or ethylene and respiration rates. Following 10 days storage, quality variables were decreased from storage days 0 and 5 and there were no differences between stages. Average SSC and firmness of the 3 stages were 10.5 °Brix and 5.4 N. There were 15 volatile compounds that were found to be significant contributors to the aroma of ‘Red Moon’ at all stages. Volatiles were greatest on day 0 at stages AL and FS. After storage 5 days, volatiles were greatest at stage NS. Following 10 days storage, most volatiles were similar at each stage. Overall, aroma decreased over storage. ‘Red Moon’ melons, maintained an average SSC of 11 °Brix at all stages and after storage. It is recommended that this cultivar be harvested at stages NS or AL for best firmness and eaten within one week of purchase if stored at room temperature

11:45 Are Fruit Firmness and Calcium Content Associated in Strawberry?

Camille E. Esmel, John R. Duval, Bielinski Santos, Gulf Coast Research and Education Center, UF, and Eric H. Simonne, Steve A. Sargent, Horticultural Sciences Department, UF. [HP8]

The objective of this study was to determine if Ca concentration is a reliable predictor of fruit firmness. Leaf and fruit samples for Ca concentration and firmness measurements were collected in February and March 2004. Correlations were conducted using Pearson’s correlation coefficient r-values. Ca concentration and fruit firmness was significantly different among cultivars. Leaf Ca concentrations ranged between 8,390 and 11,986 mg·kg⁻¹ with ‘Winter Dawn’ having the highest leaf Ca and ‘Camarosa’ the least. Fruit Ca concentrations ranged between 1,572 and 2,550 mg·kg⁻¹; ‘Sweet Charlie’ having the highest fruit Ca and ‘Winter Dawn’ the least. ‘Treasure’ had the firmest fruits with 1.23N and ‘Sweet Charlie’ the least with 0.72N. ‘Camarosa’ and ‘Winter Dawn’ were not significantly different from each other in fruit firmness. With an average range of r values from +0.67 to -0.51 for leaves and +0.54 to -0.48 for fruit, Ca concentration and fruit firmness were weakly associated ($r < +0.70$). ‘Camarosa’ had the highest positive correlation for fruit Ca and firmness ($r = +0.67$) and ‘Camino Real’ for leaf Ca and fruit firmness ($r = +0.54$). Therefore, applying supplemental Ca to strawberry plants during their normal growing season may not be beneficial to increasing fruit firmness. In Florida, strawberry production practices and land are considered high in Ca ($\text{Ca}(\text{NO}_3)_2$ is often used as a nitrogen source; soil tests often indicate that soil is high in Ca; and irrigation water generally has at least 53 ppm Ca). Moreover, Ca concentration within strawberry plants should not be used as a predictor of fruit firmness.

1:30 Weight Loss During Simulated Retail Display Affects Color and Chlorophyll Content of Cucumber.

Cecilia N. Nunes, Food Science and Human Nutrition Dept., UF, Sharon Dea, Department of Horticultural Sciences, UF and Jean-Pierre Emond, Department of Agricultural and Biological Engineering, UF. [HP9]

During retail display, fruits and vegetables are often exposed to undesirable temperature and humidity conditions which often result in increased waste due to weight loss and objectionable appearance. 'Patio Pickles' cucumbers were harvested from a commercial operation in Florida and shipped to a distribution center (DC) in Florida two days after harvest. At the DC, cucumbers were sorted and machine packed in expanded polystyrene trays covered with a polyvinylchloride film or non-packed for bulk display. Cucumbers were transported the next day by truck to a retail store in Gainesville, collected from the store, and stored under optimum (10°C and 90% RH) or simulated retail display conditions (4°C or 14°C and 90-92% RH). Weight loss, visual and instrumental color, pH, soluble solids, acidity and chlorophyll contents were measured at the DC and after a 4-day storage period. Overall, bulk cucumbers appeared less bright green and more yellowish than packed fruit, but no significant differences were observed in the L*, hue and chroma values between bulk and packed cucumbers. Weight loss was significantly higher in bulk cucumbers compared to packed fruit; was lowest in packed fruit stored at 10°C and highest in bulk fruit stored at 14°C. Packed cucumbers had higher acidity, soluble solids and chlorophyll contents than bulk fruit. In general, the display method (packed or bulk) had a more significant effect on color, composition and chlorophyll content than temperature. Results from this study demonstrate the importance of using a protective package in addition to optimum temperature during retail display.

1:45 Force Distribution Along a Tree Branch During Harvesting of Citrus by a Canopy Shaker.

Sajith Kumar Udumala Savary * and Reza Ehsani, Citrus Research and Education Center, UF, Lake Alfred, FL. [HP10]

Significant reductions in harvesting costs will be necessary in coming years for Florida to continue to compete in the international citrus industry. Two steps are involved in the mechanical harvesting (MH) of citrus fruit: removal of fruit from the tree and collection of fruit (by a catch-frame device or retrieval of fruit from the ground). The objective of this study was to evaluate the microbiological aspects of mechanically-handled fruit with respect to fruit surface and juice microflora. Three treatments were evaluated: hand-harvested fruit (control), mechanically-harvested fruit (picked up directly from ground) (MH fruit), and mechanically-harvested fruit in combination with the OXBO pick-up machine (MH/PU fruit). Microbial analysis included a total plate count (TPC), an acidophilic organisms count (OSA), and generic *Escherichia coli* and *Salmonella* testing on pooled samples of 5 oranges. Juice samples, from each fruit, were subjected to the same tests. The amount of sand found on the surface of fruit was measured. Hand-harvest control fruit had fewer microbes on the surface of the fruit than either MH or MH/PU fruit on both TPC and OSA. Juice corresponding to the control fruit also had fewer microbes on both TPC and OSA than the juice corresponding to MH or MH/PU fruit. Generic *E. coli* and *Salmonella* spp. were not detected in any of the pooled fruit or juice samples. Sand levels on MH/PU samples were significantly higher than those found on MH or control

fruit. Substantial and significant differences exist between harvesting runs, most likely due to factors including weather, equipment sanitation, grove location/management and tree/fruit treatments during production.

2:00 Effect of Citrus Tree Canopy on the Signal Strength of a ZigBee-Based Multi-Node Wireless Sensor Network.

Raghav Panchapakesan*, Reza Ehsani and M. Hebel, Citrus Research and Education Center, UF, Lake Alfred, FL. [HP11]

Information technology is playing an increasingly important role in today's agricultural production systems, regardless of operation size, type of commodity and management approach. Currently, wireless technology is one of the fastest growing technologies and its advancement has many implications in agriculture. Wireless sensor networks will enhance the monitoring of environmental factors by allowing sensing nodes to be located in precise locations, reducing installation costs, and allowing for rapid adjustment of sensor location to adapt to changes in the measured environment. Although the wireless instrument networks have many advantages and opportunities, they also have a number of technical challenges. The effective use of wireless mesh sensors in orchards will require better understanding of the effect of tree canopy and outdoor agricultural environment on radio frequency propagation. Reliable communication is crucial for successful deployment of wireless sensor networks. The goal of this study was to understand the impact of tree canopies and environmental conditions on the performance of the radios used in the network. ZigBee-based multi-node wireless sensor networks were evaluated for their potential to act as the data communication network within a citrus grove. For such wireless applications, a ZigBee network (IEEE 802.15.4 standard) was used. Field experiments were conducted to study the effect of radio antenna height, distance between two nodes along tree rows, and the distance across the tree rows on the signal strength and data transmission quality. The experimental results would not only provide a strong foundation in theoretical and experimental performance evaluation, but also give insight into wireless performance in external environments such as citrus orchards.

2:15 The Use of 1-Methylcyclopropene (1-MCP) on Fresh-cut Fruits and Vegetables.

Jinhe Bai and Elizabeth Baldwin, USDA/ARS Citrus & Subtropical Products Lab, Winter Haven, FL. [HP12]

1-Methylcyclopropene (1-MCP) is an analogue of ethylene, which occupies ethylene receptors such that ethylene cannot bind and elicit action. Currently, 1-MCP has been applied either before or after cutting by fumigation in a sealed room or container. Response of fresh-cut products to 1-MCP treatment depends on type of crop, maturity or ripening stage and 1-MCP dose, exposure time, temperature and duration. Generally, 1-MCP treatment reduces ethylene production and respiration rate, delays senescence of produce, shown as reduced softening, discoloration, and electrolyte leakage if 1-MCP was applied properly. A drawback caused by 1-MCP application is loss of aromatic flavor. Influence of 1-MCP on microbial growth and decay has not been consistent; it may negatively influence plant defense systems to increase decay, on the other hand, may decrease decay by slowing ripening. Plants which produce ethylene when ripening or wounding and are sensitive to ethylene have a better response to 1-MCP exposure. Most crops respond to 1 $\mu\text{L L}^{-1}$ or lower dosage of 1-MCP, a registered safe level in the United

State. However, some crops may need higher dosage. Application before the climacteric stage is critical for some climacteric crops, such as honeydew. For some fruit, pre-cutting application had a better effect, but others prefer post-cutting application. Non-target materials, such as packaging box and polyliner may absorb 1-MCP which influences the amount of 1-MCP delivered to produce target. New approaches such as 1-MCP release film and 1-MCP-modified atmosphere packaging systems have been developed.

2:30 Spectral Discrimination of Healthy vs. HLB-Infected Citrus Trees in the VIS-NIR Range.

Ashish R. Mishra*, Reza Ehsani, D. Lee and Gene Albrigo, Citrus Research and Education Center, UF, Lake Alfred, FL [HP13]

Huanglongbing (HLB) or greening is one of the most serious citrus diseases threatening Florida's multi-billion dollar citrus industry. It affects all citrus cultivars and causes rapid deterioration of trees. Other than tree removal, there is no effective control available when trees are affected by this disease there is no known cure for the HLB. Currently, visual inspection followed by PCR testing (Polymer Chain Reaction) is the only method of detecting HLB infected trees. This method is tedious, time consuming and costly. There is no real-time technique available for detecting HLB at an early stage in the grove. The goal of this study was to investigate the potential of VIS-NIR spectroscopy in detecting a unique spectral signature for HLB infected trees. An ASD (Analytical Spectral Devices) spectroradiometer was used to collect reflectance data from the HLB infected trees and healthy trees under field conditions. Spectral characteristics of the samples, in the 300 to 2500 nm range, were investigated for detecting infected trees. The Partial Least Squares (PLS) method and cluster analysis were used to identify and discriminate spectral characteristics of HLB infected trees, healthy trees, and nutrient deficient trees. Preliminary results support that spectroscopy has the potential to detect HLB infected trees from healthy trees; however, discrimination between nutrient deficient trees and HLB infected trees is challenging.

2:45 Differences in Secondary Metabolites in Leaves from Trees Affected with the Greening (HLB) Disease.

John A. Manthey, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven, FL. [HP14]

Preliminary analyses by HPLC-MS of methanolic extracts of two sets of orange leaves that are symptomatic of the Greening Disease (HLB) have shown several consistent differences. The main flavonoids in symptomatic and nonsymptomatic leaves were monitored in the HPLC chromatograms at 330 nm, and significant differences were detected in certain hydroxycinnamates and flavone glycosides between the symptomatic and undiseased leaves. Other differences were detected in the Total-Ion-Currents (TICs) of the mass spectral analyses of the leaf extracts. One main difference was the elevated concentration of a compound with a m/z of 187 amu, which was also visualized as an Ehrlich reagent positive band in normal phase TLC of symptomatic leaf extracts. Ehrlich reagent is useful for the detection of limonoids, as well as secondary amines, including alkaloids. Work is in progress to identify this compound.

3:30 Impact of Environmental Conditions During Distribution on Tomato Fruit Quality and Decay.

Sharon Dea*, Jeffrey K. Brecht, Horticultural Sciences Dept., UF, Cecilia M. N. Nunes, Food Science and Human Nutrition Dept., UF, Jean-Pierre Emond, and Khe V. Chau, Agricultural and Biological Engineering Dept., UF. [HP15]

Data from two commercial shipments of tomatoes by sea from Puerto Rico to Florida were used to evaluate the consequences of deviations from ideal environmental conditions on fruit quality. Temperature and relative humidity (RH) measured at different locations within containers of tomatoes varied from 11.2 to 30.3°C and from 55.4 to 98.5%, respectively. Laboratory simulations were conducted during two Florida tomato seasons using the 10% most developmentally advanced fruit from lots of commercially packed mature-green tomatoes, which were considered to be the most likely to show effects of non-ideal conditions. Control, bruised, and inoculated (*Erwinia carotovora*) tomatoes were stored at the best and the worst temperature and RH combinations recorded during the shipping trials, as well as at 12°C and 90% RH. Following the simulated shipping period, all fruit were evaluated for subjective visual and aroma quality, bruised and inoculated fruit for incidence and severity of bruising and decay, and control fruit for color, titratable acidity (TA), pH, soluble solids, and ascorbic acid. The simulated worst shipping conditions significantly increased shriveling, softening, and decay incidence, and negatively affected aroma. Virtually all of the inoculated tomatoes held in the simulated worst conditions developed severe decay; however, visual quality was otherwise not affected by shipping conditions. Other than no effect of simulated shipping conditions on TA and pH, no conclusions could be drawn regarding fruit composition since the results varied between the experiments. No significant differences in external color were found between the simulated shipping conditions.

3:45 Detection of Microbial Populations on Freshly Packed Florida Valencia Oranges.

John Zhang, Florida Department of Citrus, Lake Alfred, FL. [HP16]

Commercial fresh citrus fruit generally receive appropriate postharvest handling and treatments to ensure their safety and high fruit quality. Surface microbial populations of freshly packed Valencia oranges obtained from six packinghouses, representing different citrus growing regions in Florida, were studied using 3M Petrifilm™ microbial count plates. Freshly packed Valencia oranges were also stored at 40°F for up to 3 months to observe postharvest disease development. The experimental results showed that yeast and mold, aerobic and coliform bacteria were detected on the surfaces of tested Valencia oranges. Freshly packed Valencia oranges from two packinghouses had significantly higher levels (148.2 to 233.4 CFU/cm²) of yeast and mold counts than those (0.83 to 7.03 CFU/cm²) of the other four packinghouses. Aerobic bacterial levels on freshly packed Valencia oranges ranged from 1.54 to 3.01 log CFU/cm². A low level of coliform bacteria (0 to 1.98 CFU/cm²) was observed from all tested fruit. No *E. coli* was detected for any fruit tested. When fruit were stored at 40°F for 3 months, a significantly higher level of green mold decay was observed on the fruit from the two packinghouses having the higher levels of yeast and mold plate counts, while lower levels of decay were found on the fruit from the other four packinghouses.

4:00 Effects of Hydroxyl Ion Fumigation on Postharvest Pathogens.

Greg McCollum, Ric Stange and Darel Resch, USDA/ARS U.S. Horticultural Research Laboratory, Fort Pierce, FL. [HP17]

We initiated studies on the use of a novel technology referred to as hydroxyl ion fumigation (HIF) for its effects on *Xanthomonas axonopodis* *pv.* *citri* (Xac), the causal agent of citrus bacterial canker. This technology employs the use of very fine reactive particles introduced into air spaces to create a reactive fog with antimicrobial activity. Reactivity of the fog is measured as oxidation reduction potential (ORP). The method is simple to deploy, environmentally friendly, and leaves no residue on the product. In our first experiment we determined the effects of HIF on Xac in vitro. We found that mortality of Xac was directly proportional to exposure time and ORP of the fog. Exposure of Xac for 60 min. in fog with ORP of equivalent to 3 ppm ozone eliminated 97% of the viable Xac colonies. In a second experiment we tested the effects of HIF on strawberries. Deleterious effects of the treatment on visual quality of the strawberries were not detected; however, the effects on decay were not significant. We are in the process of conducting additional tests with a variety of postharvest pathogens and results of these experiments will be presented.

4:15 Microbiological Evaluation of Mechanically-harvested Citrus Fruit.

Michelle D. Danyluk, Lori M. Friedrich and Reza Ehsani, Citrus Research and Education Center, UF, Lake Alfred, FL. [HP18]

Significant reductions in harvesting costs will be necessary in coming years for Florida to continue to compete in the international citrus industry. Two steps are involved in the mechanical harvesting (MH) of citrus fruit: removal of fruit from the tree and collection of fruit (by a catch-frame device or retrieval of fruit from the ground). The objective of this study was to evaluate the microbiological aspects of mechanically-handled fruit with respect to fruit surface and juice microflora. Three treatments were evaluated: hand-harvested fruit (control), mechanically-harvested fruit (picked up directly from ground) (MH fruit), and mechanically-harvested fruit in combination with the OXBO pick-up machine (MH/PU fruit). Microbial analysis included a total plate count (TPC), an acidophilic organisms count (OSA), and generic *Escherichia coli* and *Salmonella* testing on pooled samples of 5 oranges. Juice samples, from each fruit, were subjected to the same tests. The amount of sand found on the surface of fruit was measured. Hand-harvest control fruit had fewer microbes on the surface of the fruit than either MH or MH/PU fruit on both TPC and OSA. Juice corresponding to the control fruit also had fewer microbes on both TPC and OSA than the juice corresponding to MH or MH/PU fruit. Generic *E. coli* and *Salmonella* spp. were not detected in any of the pooled fruit or juice samples. Sand levels on MH/PU samples were significantly higher than those found on MH or control fruit. Substantial and significant differences exist between harvesting runs, most likely due to factors including weather, equipment sanitation, grove location/management and tree/fruit treatments during production.

4:30 Temperature Mapping of a Pineapple Supply Chain.

Cecillia Amador, Jean-Pierre Emond, Agricultural and Biological Engineering Dept., UF and Cecilia N. Nunes, Food Science and Human Nutrition Dept., UF. [HP19]

Poor temperature management during pineapple shipments results in postharvest losses and in poor product quality; which generates lower customer satisfaction and impacts the produce companies with economic losses and lack of public credibility. In order to minimize poor temperature management, the risk for chilling injury (CI) and high temperature abuse during the pineapple supply chain and the temperature distribution according to the location of the fruits in the pallets and the cargo areas need to be studied. Therefore, the temperature mapping of a shipping trial comprising pallets of pineapples packed in corrugated boxes instrumented using temperature sensors and initially transported in different positions of a refrigerated truck and, later on, inside three decks of two holds of a cargo ship traveling from Costa Rica to the US was performed. The results indicate that within a pallet, the top layer is the area most prone to high temperature abuse while the bottom layer presents the highest risk for CI. During land transportation the back pallet in the truck was subjected to the highest temperatures while the frontal and middle pallets had colder recordings. At sea, within a cargo hold, the deck near the surface of the ship provided less opportunity for high temperature abuse than its correspondent lower deck; and, when comparing holds, the one closer to the bow presented lower temperatures than the one at the center of the ship. Finally, recommendations are given in order to reduce the risk of temperature abuse during the pineapple supply chain.

4:45 Effect of Wax Coating, Fungicide Treatment and Storage on Antioxidant Content and Associated Physiological Changes in Satsuma Mandarin.

Floyd M. Woods, Julie H. Campbell, W.A. Dozier, Jr., Junbae Jee, Robert C. Ebel, Dept. of Horticulture, Auburn U, AL, Chang Y. Lee, Dept. of Food Science and Technology, Cornell University, Geneva, NY, Monte Nesbitt and Randy McDaniel, Alabama Agricultural Experiment Station, Gulf Coast Research and Extension Center, Fairhope, AL. [HP20]

Over the past 10 years there has been considerable interest in Satsuma mandarin (*Citrus unshiu* Marc. cv. Owari) production in the northern coast of the Gulf of Mexico and central Alabama. Consumers are increasingly aware of the health benefits attributed to the consumption of mandarin fruit. Due to increased consumer demand there is a need to extend the postharvest shelf life and market period for this fruit. This study was conducted for two growing seasons to investigate the effect of wax coating (Sta-Fresh 4201, FMC Technologies; Riverside, California) in combination with either fungicide treatment Imazalil (Freshgard 700, FMC Technologies; Riverside, California) or without wax or IMZ application during storage at 5°C and 95% RH and 7 days room temperature to simulate consumer retail environment. Changes in antioxidant status (Vit C, reduced ascorbic acid, oxidized and total, antioxidant capacity as determined by vitamin C equivalent antioxidant capacity, VCEAC and 2,2-diphenyl-1-picrylhydrazyl, DPPH; and total phenolic and flavonoid content) and associated fruit quality parameters (soluble carbohydrate and proline content). The results show that antioxidant status and fruit quality parameters (soluble carbohydrate content) varied greatly dependent on season, wax coating, fungicide application and duration in storage. In contrast, proline content an indicator of water stress of Satsuma mandarin fruit during storage was relatively unaffected by treatments. These

findings show that postharvest application wax coating and fungicide treatment is essential to extension of shelf life of Satsuma mandarin fruit and thus market period.

Tuesday June 3

10:00 Effects of Laser Labeling on the Quality of Citrus Fruit During Storage.

Preeti Sood, Ed Etxeberria, Citrus Research and Education Center, UF, Lake Alfred, FL, Chris Ference and Jan Narciso USDA/ARS, Citrus & Subtropical Products Lab, Winter Haven, FL. [HP21]

Etching the required information on fruit is an alternative means to label produce. Low energy CO₂ laser beams puncture holes on the surface showing the contrasting underlying layer and seemingly create wounds. These opened wounds can promote water loss and pathogen entry. Study was conducted on water loss and decay in citrus fruit during storage due to laser labeling. Laser labeled and no laser labeled fruit was stored at 50°F and 95% RH for 5 weeks and was examined weekly for decay and peel appearance. It was observed that laser labeled fruit does not facilitate decay and the amount of water loss from the fruit surface is negligible and comparable to non laser labeled fruit.

10:15 Technical and Economic Assessments of Ethanol Production from Citrus Peel Waste.

Weiyang Zhou, Wilbur Widmer and Karel Grohmann, USDA/ARS Citrus & Subtropical Products Lab, Winter Haven, FL. [HP22]

Each year, the Florida citrus juice industry produces about 3.5~5.0 million tons of wet peel waste, which are currently dried and sold as cattle feed, often at a loss, to dispose of the waste residual. Profitability would be greatly improved if the peel waste could be used to produce higher value products. In this paper, a new process for making ethanol and limonene co-product from citrus peel waste is described. The process consists of three parts: pretreatment, simultaneous saccharification and fermentation (SSF), and distillation. Our pilot plant study has demonstrated that citrus peels can be fermented to produce ethanol with limonene and citrus pectin fragments obtained as co-products. The sensitivity study shows that citrus ethanol is economically competitive to citrus pulp pellets, depending on the prices of citrus pulp pellet, energy, ethanol and limonene. This new technology provides an alternative disposal of citrus peel waste in the citrus industry.

10:30 Biosorption Properties of Citrus Peel Derived Oligogalacturonides, Enzyme-modified Pectin and Peel Hydrolysis Residues.

Randall G. Cameron, Gary A. Luzio and Wilbur W. Widmer, USDA/ARS Citrus & Subtropical Products Lab, Winter Haven, FL and M. Iqbal, Biotechnology and Food Research Centre, PCSIR Laboratories Complex, Ferozepur Road, Lahore-54600, Pakistan. [HP23]

A citrus processing industry priority is obtaining added value from fruit peel. Approximately one-half of each processed fruit is added to the waste stream. Peel residue mainly is composed of water (~80%), the remaining 20% (solid fraction) consists of pectin, soluble sugars, cellulose, proteins, phenolics, etc. Viewing these constituents in light of exploiting potential functionality and creating added value at the same time as diverting material

away from the feed mill or land fill, pectin provides enormous opportunity. To create a new technology centered on pectin structure and concomitant functionality, we have begun exploring methods to precisely engineer pectin structure and correlate it to function. A valuable pectin functionality, resulting from its polyanionic character, is its biosorption capabilities. In the past several years we have developed techniques and methods to enzymatically modify pectin structure, characterize these structural alterations and determine their effect on rheology and calcium sensitivity. Here we present data on the biosorption properties of modified pectins and pectin fragments using lead as model cation. The greatest biosorption capacity (Mean = 373.3 mg • g⁻¹; S.E. = 1.595; p > 0.001) was observed in the Medium DP size-class of galacturonic acid oligomers. A comparison of enzymatically demethylated (blockwise) homogalacturonans indicated that the 60% and 50% DE pectins treated at pH 4.5 had a significantly greater sorption capacity than higher DE or pH 7.5 treated samples. Calcium-sensitive pectin released from peel fragments had higher sorption capacity than non-calcium-sensitive pectin or peel hydrolysate.

10:45 Microwave Extraction of Citrus Peel to Release Pectin Using a Closed Vessel Reactor.

Gary Luzio, USDA/ARS Citrus & Subtropical Products Lab, Winter Haven, FL. [HP24]

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 components, pectin is relatively easy to modify using enzymes and has great utility in the food industry and other applications. Thus it appears reasonable to focus on the use of pectin for the maximum utilization of fruit peel for new products from peel. Modified 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. Yield stress behavior can be important for pulp stabilization in citrus drinks while providing low viscosity for acceptable mouth feel. Modification of pectin requires the pectin to be a soluble form. Pectin is typically extracted using heat and strong acid conditions at 70°C. New microwave technology is available which allows for rapid heating and cooling of the extract to temperatures in excess of 100°C. Data will be presented showing the quantity and quality of pectin which can be extracted at elevated temperatures using mild acid conditions.

11:00 Removal of Furanocoumarins in Grapefruit Juice by Four Edible Fungi.

Kyung Myung, Jan A. Narciso and John A. Manthey, USDA/ARS Citrus & Subtropical Products Lab, Winter Haven, FL. [HP25]

Furanocoumarins in grapefruit juice are known to inhibit human cytochrome P450 3A4 (CYP 3A4) activity responsible for metabolism of certain medications. This inhibition increases the oral bioavailability of these medications in blood, leading to potential toxic effects. Despite the health benefits of grapefruit, these interactions have adversely affected the grapefruit industry, and have led to a need to remove the FCs from GFJ. Previously, we reported that autoclaved *Aspergillus niger* adsorbs FCs in GFJ, and the fungus-treated GFJ showed a reduced inhibitory activity of CYP 3A4. However, *A. niger* is not an edible fungus, and so we have extended our research to edible fungi. In this study, the binding capacity of two edible

ascomycetes (*Morchella esculenta* and *Monascus purpureus*) and two edible basidiomycetes (*Pleurotus sapidus*, and *Agaricus bisporus*) to three major grapefruit furanocoumarins, 6',7'-dihydroxybergamottin (DHB), 6',7'-epoxybergamottin (EB), and bergamottin (BM) was investigated. When GFJ was incubated with autoclaved the edible fungi for 4 h, the FCs were removed, indicating that this removal results from a general passive interaction between FCs and fungal hyphae.

11:15 Effect of Pre- and Postharvest Factors on Fresh Citrus Peel Breakdown

Mark A. Ritenour, Brian J. Boman, Cuifeng Hu, Indian River Research and Education Center, UF/IFAS, Fort Pierce, FL, Jacqueline K. Burns, Citrus Research and Education Center, UF/IFAS, Lake Alfred, FL, and Jean Bertrand Contina, Pan-American Agricultural School, Zamorano, Honduras. [H26]

During the 2006-07 and 2007-08 fresh citrus seasons, reports of peel breakdown problems were more frequent and severe than usual. Plots were established during the 2007-08 season in commercial groves using standard fresh fruit growing practices to evaluate pre- and postharvest factors influencing peel breakdown. Preharvest treatments included up to three foliar potassium (K) sprays (March, October, and January) or withholding irrigation for up to two months before harvest. In one commercial block, foliar mono-potassium phosphate (MKP) was used at 23.5 lb MKP per acre (0-52-34; 8 lb K₂O per acre) with 4 lb per acre low-biuret urea (46-0-0) applied at 125 gal per acre. In another block, the grower applied a commercial 3-18-18 formulation at 3 gal per acre. Postharvest treatments included holding fruit for three days at 30%, 60%, or 100% (including wetting the fruit) relative humidity (RH) before washing and storing at 70°F under ambient RH. Fruit were subsequently evaluated weekly for peel breakdown. Preharvest foliar K treatments did not significantly affect K content of the fruit peel at harvest. In one block, preharvest foliar K treatments did not significantly reduce peel breakdown. However, the other block with foliar 3-18-18 applied within a month of harvest did significantly reduce stem-end rind breakdown. Preventing preharvest tree irrigation for almost two months before harvest increased peel breakdown, whereas wetting the fruit after harvest and maintaining high postharvest RH reduced peel breakdown.

Krome Memorial Institute

Monday June 2

10:00 Effect of Pesticides on Pests Affecting Tropical Fruit.

Jorge E. Peña, and R. E. Duncan, Tropical Research and Education Center, UF, and J. Jacas, Universita Jaume I, Castellon, Spain. [K1]

Selected pesticides were evaluated for control of the spider mites (*Tetranychus* spp.) infesting bananas, sri-lankan weevil (*Myloccerus undecimpustulatus*) infesting mangoes, armored scales (*Andaspis punicae* and *C. dyctiospermi*) infesting mangoes, and Persea mite (*Oligonychus perseae*) infesting avocados. *A. punicae* has an armor usually covered with the outer layers of the bark and regularly is located near lenticels. *C. dyctiospermi* is an economic pest in Florida to fruit and ornamentals. *Myloccerus undecimpustulatus* is a weevil introduced

into the USA during 2000 and it has since spread to different counties in the state, causing damage to fruit crops and ornamentals. The Persea mite, *Oligonychus perseae*, is native to Mexico. It was discovered in Miami Dade county during June, 2007. Spider mites, Tetranychus spp., cause damage to the foliage of bananas. All trials were conducted at the Tropical Research and Education Center. We discuss the effectiveness and shortcomings of the tested products.

Biology, Parasitoids and Damage of *Leptoglossus zonatus* and *Leptoglossus gonagra* (Heteroptera: Coreidae) on Citrus in Colombia, S.A.

Irwin Duarte S. Facultad de Ciencias, Escuela de Biología, Universidad Industrial de Santander, Bucaramanga-Colombia, Ligia Nuñez B. Fundación para el Desarrollo Integrado del Campo (FUNDIC), Bucaramanga-Colombia, Jorge E. Peña, Tropical Research and Education Center, UF, and Libardo Pinto, Grupo de Prevención y Erradicación de Riesgos Fitosanitarios, Instituto Colombiano Agropecuario, Bucaramanga-Colombia. [K2]

The appearance of watery lesions on citrus fruits in Santander-Colombia, coincided with high densities of *Leptoglossus zonatus* (Dallas) and *L. gonagra* (F.) (Heteroptera: Coreidae) adults present on citrus groves in the same area. We report the life cycle of both species, the role of parasitoids of both pests, and their alternative host plants. The first instar nymph of both species, survived on *C. tangelo* fruits, but the 2nd instar failed to survive on these hosts. The life cycle of *L. zonatus* and *L. gonagra* using *Phaseolus vulgaris* as a substrate for the 1st and 2nd instar and *C. tangelo* Ingram & Moore (Sapindales: Rutaceae) for the 3rd to 5th instar resulted on the development of *L. zonatus* in 69.11 ± 3.4 d and the development of *L. gonagra*, on 69.7 ± 3.6 d. Several parasitoids were observed: the encyrtid *Hexacladia* sp was found parasitizing 1,6% adults of *L. gonagra*; the syrphid *Eristalis* sp was observed laying-eggs in a male of the same coreid and the tachinid fly, *Trichopoda* sp parasited 11% adults of *L. zonatus*. The alternant host plants were, *Solanum americanum* Mill. (Solanales: Solanaceae), *Melothria guadalupensis* (Spreng.) Cogn, *Momordica charantia* (L.) (Cucurbitales: Cucurbitaceae), *Zea mayz* (L.) (Poales: Poaceae), *Psidium guajava* (L.) (Myrtales: Myrtaceae), *C. reticulata* and *C. tangelo*. Statistical analysis of induced lesions to *C. tangelo* fruits, suggests that the presence of *L. zonatus* and *L. gonagra* is related to the presence of watery lesions to citrus in the study area.

Microlepidoptera Complex Affecting Sapodilla, (*Manilkara zapota* van Royen) in Florida.

Lisa Myers Ministry of Agriculture and Lands, Jamaica, J. E. Peña and R. Duncan Tropical Research and Education Center, UF, and J. B. Heppner, Department of Plant Industry, FDACS. [K3]

The sapodilla, (*Manilkara zapota* van Royen), also known as naseberry, nispero, zapote, zapotillo, chicozapote native to Mexico and Central America is currently grown in south Florida. Pests and diseases are not usually considered a major problem on sapodilla, however, the larva of a small moth *Banisia myrsusalis* has been reported as an occasional pest that causes extensive damage to sapodilla blooms in Florida. Damage to buds, flower drop, and damage to 70% of fruits have been observed (Peña, unpubl. data). A preliminary survey of sapodilla groves was conducted during May to July 2002, since very little was known about this moth. The survey indicated the presence of lepidopterous pests, feeding on the young leaves, flowers or young fruits. Three Lepidoptera species were frequently encountered, *Banisia myrsusalis* (Lepidoptera: Thyrididae), *Dichrorampha sapodilla* (Lepidoptera: Tortricidae) and a *Zamagiria*

sp (Lepidoptera: Pyralidae). A test was conducted on 2006 to determine the efficacy of Fury, Novaluron, Venom, Danitol, Thiamethoxan, and Alverde for control of the sapodilla moths.

The IFAS Center for Tropical Agriculture.

Richard E. Litz, Director, Center for Tropical Agriculture, Tropical Research and Education Center, UF. [K4]

The IFAS Center for Tropical Agriculture aspires to be the premier center for tropical agriculture with expertise in capacity building, technical assistance, and research related to agriculture and agro-ecosystems in the tropics and subtropics. The Center provides students and non-degree seeking trainees with the capacity to hold professional, leadership, and executive positions in tropical agriculture. A postgraduate minor in Tropical Agriculture is conferred at the Masters and Doctoral level. The Center addresses issues that impact tropical agriculture and agro ecosystems of international significance while enhancing Florida's agriculture. The major focus areas include: 1) production agriculture for crops and livestock; 2) invasive species; 3) conservation and utilization of genetic resources and biodiversity; 4) effects of climate change on tropical agriculture; 5) environmental and economic sustainability of tropical agriculture; 6) food security and nutrition; and 7) food technology and safety.

Response of Mamey Sapote (*Pouteria sapota*) Trees to Flooding in a Very Gravelly Loam Soil in the Field

Mark Nickum*, Jonathan Crane, Bruce Schaffer, Tropical Research and Education Center, UF, and Fred Davies, Horticultural Sciences Department, UF. [K5]

Mamey sapote cv. Magaña were planted on 11 May 2006 in the field in mounds of Krome very gravelly loam soil at the Tropical Research and Education Center in Homestead, Florida. Before planting, the soil was scraped down to bedrock, and a water resistant tarp and plastic sheet (barrier) was placed on the bedrock and the native soil was mounded on each barrier for each tree. The barrier edges were raised above the soil surface to form a pool so that trees could be individually flooded. The response of trees to flooding was tested in two separate trials 6 Nov. 2006– 9 Jan. 2007 and 23 April 2007–11 June 2007. Trees were divided into control (nonflooded) and flooded treatments. In trial 1, flooding resulted in leaf epinasty after 2 weeks and reductions in net CO₂ assimilation after 3 weeks. However, all trees survived flooding and there was no increase in leaf abscission for flooded trees. In trial 2, net CO₂ assimilation was significantly lower for flooded plants by the beginning of week two. By the end of week four, 4 out of 8 flooded plants had no leaves and one was wilted, while 3 were still in good condition. Six of the flooded plants were infected with *Pythium infestans* root rot, likely the cause of death. Results indicate that mamey sapote is moderately tolerant to flooding in a very gravelly loam soil. However more work is needed to separate tree decline due to flooding from that due to *P. infestans* infection in this soil.

Breeding and Selection of Mangos for Florida.

RJ Campbell, N. Ledesma, Fairchild Tropical Botanic Garden, Homestead, G. Zill, Zill High Performance Plants, Boynton. [K6]

Opportunities exist for mango growing in Florida to supply local demand of Florida residents. These local markets can be substantial in size and potentially lucrative if mangos can be produced and supplied that can successfully compete with imported fruit. Over the last 17 years, Fairchild Tropical Botanic Garden in collaboration with Zill High Performance Plants has been involved in the breeding and selection of mangos for this market. Appropriate varieties must meet a minimum standard of quality, productivity, disease resistance and horticultural management. All selections must have exceptional flavors and have sufficient disease tolerance to provide for consistent, heavy fruiting under South Florida conditions with a reasonable care program. Additionally, selections have focused on small, manageable tree size to provide for opportunities for high density production and production in unconventional systems (i.e. hoop houses). Advanced selections are under field evaluation in 3 locations in Florida and in Costa Rica. Evaluations continue, and we are beginning the process of release within the next 2 years.

Effect of Foliar-applied Acids and FeSO₄ on Iron Content and Greenness of Lychee Leaves

J.H. Crane, B. Schaffer, Y. C. Li, E.A. Evans, W. Montas and C. Li, Tropical Research and Education Center, UF. [K7]

Iron deficiency is a major nutritional problem of lychee trees (*Litchi chinensis* Sonn.) grown in calcareous soils. Applications of chelated iron to calcareous soil are efficacious but very expensive. The effects of foliarly applied organic acids, organic acids plus ferrous sulphate (FS) or chelated iron (EDDHA) soil drench on iron nutrition of 18-month-old 'Mauritius' lychee trees in containers and 8-year-old 'Kaimana' lychee trees in an orchard in calcareous soil were investigated. Treatments included an organosilicone adjuvant (Freeway[®]). Trees in containers were sprayed six times at 2-week intervals with either ascorbic acid alone (AA), citric acid (CA), sulphuric acid (SA), ascorbic acid plus FS (AA+Fe), citric acid plus FS (CA+Fe), or sulphuric acid plus FS (SA+Fe). Additional treatments were: chelated iron (EDDHA) applied as a soil drench once at the beginning of the treatment period and no iron applied (Control). Trees in the orchard received four foliar applications of AA, AA+Fe, CA+Fe or SA+Fe at 14-19 day intervals, or EDDHA applied once to the soil or no iron (Control). For trees in containers, leaf chlorophyll indices (SPAD meter values) and leaf total and ferrous iron contents were significantly higher for all foliar acid+iron and EDDHA treatments than for trees in the acid alone or Control treatments. Similarly, SPAD values and total and ferrous leaf iron content in orchard trees were significantly higher for all foliar acid+iron treatments than for the EDDHA, acid alone or Control treatments. Economic analysis indicated that foliar applications of acid+iron were 25 to 63% less costly than soil applications of EDDHA.

Challenges for high tunnel production of white guava in Southern Virginia

A. R. Rafie and C. D. Mullins, Virginia State University, Petersburg, Virginia. [K8]

Guava, *Psidium guajava* L. is a tropical and subtropical fruit with many varieties grown in different countries. The traditional pink-color flesh guava is mainly consumed by Hispanic and Caribbean populations and has not crossed-over to American consumers. One particular type

of guava, a mildly sweet fruit with crunchy texture that is eaten immature, has attracted attention in recent years. According to some growers in South Florida, the white guava variety is appreciated among non-Hispanic American consumers. In Virginia, farmers who sell at their local farmer's markets are always looking for exotic items to produce and sell. In response to this, an observational trial was conducted to study the feasibility of high tunnel production of white guava under South Virginia conditions. Two sets of seven guava plants, Asian White variety, were planted in November 2007 and January 2008 in a high tunnel. A second polyethylene cover inside the high tunnel was used to protect the plants when the outside temperature dropped below 50 F°. If the outside temperature reached below 26 F°, a small heating unit was used to protect the plants. Even after several < 26 F° events, the plants are currently thriving. Detailed results from this study will be reported.

Control of Caribbean fruit fly on three peach cultivars in Adjuntas, Puerto Rico.

Sara Ramos, María Librán and José Morales, Department of Horticulture, University of Puerto Rico, PR, Ángel González, Crop Protection, University of Puerto Rico, PR, Robert Rouse and Phil Stansley, Southwest Florida Research and Education Center, UF, Annette Wszelaki, University of Tennessee, Knoxville, TN, and Evelio Hernández, UPR-Research Center, Adjuntas, PR. [K9]

Low-chill peach cultivars (Flordaprince, TropicBeauty, Flordaglo) were evaluated in two sites (Beneficiado and Montaña) in Adjuntas, P.R. Fruit yield and quality were severely reduced by Caribbean fruit fly (*Anastrepha suspensa* Loew), which had not been previously reported in peaches in Puerto Rico. The objective of this study was to evaluate a control method for this species. To evaluate fruit fly control, a paired design was used. To evaluate fruit fly control, three pairs of trees per cultivar (similar yield) were chosen in the two peach sites. One of the two sites was sprayed weekly with GF-120NF Naturalyte® (Dow AgroSciences). Mature fruits were harvested randomly from each tree on four sampling dates. A lower number of larvae were observed in fruits from treated trees. Differences in the number of fruit fly larvae between pairs within each cultivar were evaluated by a paired t-test. Statistical analysis results demonstrated the efficiency of the treatment to control *A. suspensa* in the evaluated peach cultivars. By increasing the treated area, efficacy should improve.

Thrips Monitoring in Florida Blueberries.

G. K. England, Sumter County Extension, UF, E. M. Rhodes and O. L. Liburd, Entomology and Nematology Department, UF. [K10]

Flower Thrips belonging to the genus *Franklinella* affect both rabbiteye and southern highbush blueberries (Liburd and Arevalo 2005). *Frankliniella bispinosa* is the key pest of Florida blueberries (Arevalo et al. 2006). These tiny insects with yellowish to orange coloration and fringed wings progress through two actively feeding larval instars and two inactive instars (often called pupae) during their short life cycle of 18 to 22 days (Lewis 1997). These tiny insects damage blueberry flowers and developing fruit by the feeding activities of larvae and adults. Oviposition by female adults and the eventual emergence of larvae can also result in significant damage. Monitoring flower thrips populations in commercial blueberry fields can be a tactic to determine if insecticide applications are necessary. One method of monitoring is to

place white sticky traps within the canopy of commercial blueberries during the flowering period. It is recommended that four traps per acre with two in the interior and two in border portions of the planting. Check traps once per week to determine if the population is approaching the treatment threshold. A more labor intensive method is to collect 20 blueberry flowers per acre and count the thrips present. Studies sponsored by IPM Florida were conducted in commercial blueberry fields in spring 2006 and 2007 to evaluate monitoring methods. The data indicated differences in thrips counts in various commercial blueberry cultivars evaluated in the trial, with Emerald having highest counts on sticky traps.

Monitoring and Phenology of Thrips in Southern Highbush Blueberries

Oscar E. Liburd, Teresia Nyoike and Alejandro Arevalo, Department of Entomology and Nematology, UF. [K11]

Blueberries have several insect pests that damage foliage and fruit. In Florida, there are two key pests of southern highbush blueberries, flower thrips *Frankliniella spp.* and blueberry gall midge *Dasineura oxycoccana* (Johnson). *Frankliniella bispinosa* is the most important species in southern highbush. Flower thrips feed on the floral parts of the plant and high populations damages the young fruit. Several experiments were conducted to refine thrips monitoring techniques, identify key thrips species and examine thrips phenology. In experiments to compare various colors of sticky cards, blue, white and yellow performed better than green. Further studies indicate that white traps were better than alcohol dip, floral tap, and floral dissection techniques. Flower thrips were more likely to be found within the canopy of blueberries as opposed to above or below the blueberry bushes. An Economic Injury Level (EIL) experiment indicated that 50 thrips per white sticky trap when using Malathion (standard) and 73 thrips per card using SpinTor was sufficient to cause economic losses. In our phenology experiment, thrips were more likely to feed on tissues from petals and ovaries compared with styles and fruits. The highest thrips population was recorded when 80-90% of the flowers were opened and thrips population disappeared when fruit initiation begins.

Florida's Commercial Blueberry Industry: Past, Present and Future.

Ken Patterson, general manager and southeastern representative for the United States Highbush Blueberry Council, Island Grove Ag Products, Island Grove, FL. [K12]

Florida currently produces the earliest commercial blueberry crop in North America. While Florida's volume is small compared to other blueberry-producing states, the fresh fruit grown and harvested in April and May are in high demand and berry prices have been significantly higher in Florida than in other US production areas during the past decade. Currently the industry is experiencing rapid growth. The future of Florida's blueberry industry will be discussed in the context of increasing acreage and production in Florida and the impacts of national and international competition for Florida's market.

Performance of Highbush Blueberries in North Florida.

Peter C. Andersen University of Florida North Florida Research and Education Center-Quincy, UF, Jeffrey G. Williamson, E. Paul Miller and Paul M. Lyrene Department of Horticultural Sciences, UF. [K13]

A southern highbush blueberry planting was initiated at the NFREC-Quincy during spring 2003. The experimental planting consisted of 'Blue Crisp', 'Emerald', 'Jewel', 'Millennia', 'Misty', 'O'Neal', 'Sharpblue' and 'Star'. Plants were mulched with a 3 to 4 inch layer of pine bark and were supplied with drip irrigation. Overhead freeze protection was not applied. Yield per bush, berry weight, and soluble solids was measured in 2004; however, because of herbivory by crows in 2005 yields were not determined and only samples of berries were evaluated for berry weight and soluble solids. During 2004 yields per bush varied between 19 g for 'Misty' and 1250 g for 'Star'. Berry weights averaged 1.64 and 1.78 g, respectively for 2004 and 2005. Soluble solids ranged from 9.8 and 8.9 °Brix for 2004 and 2005, respectively. During 2006 and 2007 yields were rated before berry ripening and before crow herbivory. 'Emerald' and 'Star' produced a consistent crop (62-63 % of a crop in 2006 and 49-50 % of a crop in 2007). 'Jewel' and 'Sharpblue' had low yield ratings during both years. Crop loads were higher in 2006 and 2007 than in 2004 and 2005, and consequently, average berry weights were reduced (1.46 g in 2006 and 0.86 g in 2007). However, average soluble solids were higher in both years (13.2 °Brix in 2006 and 12.0 °Brix in 2007) compared to 2004 and 2005. 'Blue Crisp' had the highest soluble solids in 2006 (15.2 °Brix), whereas 'Emerald' had the highest soluble solids in 2007 (13.9 °Brix).

Commercial Blueberry Production Methods in Hillsborough County.

Alicia Whidden, Hillsborough County Extension Service, UF. [K14]

More inquiries are received on starting up a commercial blueberry operation than is received for any other commodity in Hillsborough County- vegetable or fruit. Hillsborough County is located along the west central part of the state and is a climate zone 9. Florida Ag Statistics records show there were around 1,500 acres in the entire state in 2000-01. The 2004-05 Florida Ag Statistics reported 2,500 acres in the state. In 2006, Hillsborough County had 325 acres with approximately half of the acreage established in the last 10 years or less. The size of the farms in the county are from ¼ acre to slightly more than 20 acres with most being 5 acres or less. The south central part of the state has a unique market window from mid-March to early May. This is the only place in the world with fresh blueberry production at that time of year. This has allowed growers to sell at a high price. Many new growers who may or may not have growing experience are attracted to the hopes of continued high returns and the ability to be competitive in the market even though they may only be a small farm. Growers in this area are using three cultural management systems. The three systems are: mulched rows, broadcast mulch high intensity plantings and container production. Container production has been very popular in this area. Reasons for using each system and pros and cons of each will be discussed.

Effect of Fertilizer Rate and Composition on Growth and Yield of Container-grown Southern Highbush Blueberry.

Wendy L. Wilber and Jeffrey G. Williamson, Horticultural Sciences Department, UF. [K15]

Research was conducted to determine the effects of different fertilizer rates and analyses on vegetative and reproductive growth of southern highbush blueberries (SHB) grown in containers. 'Star and 'Misty' SHB were grown in a containerized pine bark media production system. Two fertilizer analyses (12N-1.8P- 6.6K and 12N-5.2P-9.9K) and three fertilizer rates were used. Fertilizer analysis did not effect plant growth or fruiting of either cultivar. Fertilizer rate effected plant growth and yield of each cultivar differently. For 'Star', growth and fruit yield increased linearly with increasing fertilizer rate. However, reduced growth and yield were seen at the highest fertilizer rate for 'Misty'. This appeared to be related to a high prevalence of blueberry stem blight that occurred at the highest fertilizer rate. 'Misty' plants fertilized at the highest rate showed very high flower bud density and this may have caused excessive fruit set leading to the stress induced blueberry stem blight. Fertilizer requirements for young, containerized, SHB plants appear to be similar to that of plants grown in soil systems but vary with cultivar.

Application of Embryo Rescue in Grape (*Vitis*) Cultivar Development.

Xia Xu, Jiang Lu, Danae Dalling, Huang Hong, Clifford Louime, Zhongbo Ren, Fitz Bradley, and Rashad Reed, Center for Viticulture and Small Fruit Research, Florida Agriculture and Mechanical University, Tallahassee. [K16]

Interspecific hybridization and stenospermocarpic seedless grape cultivars (*V. vinifera* L.) have been widely used in Florida grape cultivar development. Unfortunately, interspecific and/or stenospermocarpic hybrid embryos aborted prematurely and failed to develop into plants. Immature ovule cultures were conducted to rescue such embryos and recover the hybrid plants for improving grape breeding efficiency. Immature ovules were harvested and excised from berries of three cross combinations including seedless x seedless, seedless x muscadine, and seedless hybrid x muscadine 6th to 8th weeks after pollination, then cultured on Emershad and Ramming (ER) medium supplemented with 0.05 g/l casein hydrolysate, 0.05 g/l inositol, 1.21 g/l cysteine, 0.98 g/l MES, and 0.2 g/l BAP for direct germination. Ovules cultured on above ER medium without plant growth regulator were dissected two months after cultivation and cultured on Lloyd and McCown woody plant (WP) medium for comparison. Direct germination was also tested on Nitch and Nitch medium plus 0.2 mg/l NAA and 0.5 mg/l GA. The results indicated that Embryos dissected from ovules two months after culture on ER medium followed by embryo culture on WP medium recovered about 60% of seedless x seedless hybrids, 23% seedless muscadine hybrids, and 8% hybrid x muscadine in 2007. Direct germination rarely produced plantlets even prolonged extensive culture on ER and NN, which was similar to previous results. Embryo rescue on ER medium followed by dissection of *in vitro* embryo culture on WP medium was the best method for rescuing interspecific and/or stenospermocarpic hybrids.

Chestnut (*Castanea* sp.) Cultivar Evaluations for North Florida

R. C. Hochmuth, L. L. Davis, W. L. Laughlin, A. L. Warner, North Florida Research and Education Center – Suwannee Valley, UF. [K17]

The chestnut (*Castanea* sp.) is a unique tree crop with potential as an alternative crop for small farmers in North Florida. Few tree crops have had more historical significance than the chestnut. The American chestnut was one of the common trees in eastern United States forests until the early to mid 1900s. Chestnut blight (*Cryphonectria parasitica*) was accidentally introduced to the US from the Orient in 1904 and killed nearly every American chestnut (*C. dentate*) in the US by the 1940s. Less than 1% of the world production of this nut now occurs in the United States. Chestnuts are gaining popularity in response to its attributes of a high quality, nutritious, fresh, local product, low in fat. Chinese Chestnut (*C. mollissima*) and Japanese Chestnut (*C. crenata*) are resistant to blight. In Florida, varieties of Chinese and American chestnut crosses are being successfully grown, as well as Chinese chestnut cultivar. A chestnut cultivar trial was established at the North Florida Research and Education Center – Suwannee Valley near Live Oak, Florida in 1989. The planting included seven cultivars planted in a 30 x 30 ft arrangement. The chestnut crop in this trial was harvested in 2006 and 2007 and nuts were counted and weighed to obtain total yield and nut size for each cultivar.

Preliminary Results on the Performance of Low-chill Peach and Plum Cultivars in North-central Florida.

E. Paul Miller and Jeffrey G. Williamson, Horticultural Sciences Department, UF. [K18]

Yields of commercially mature fruit were determined for three-year-old trees of ‘TropicBeauty’, and two-year-old trees of ‘Flordaprince’, ‘UFSun’, ‘Gulfking’, ‘UF2000’, ‘UFGold’, ‘Earlygrande’, ‘FlordaGlo’, ‘TropicSnow’, ‘Flordastar’, ‘Flordaking’, ‘Rayon’, ‘Flordabelle’ and ‘Flordacrest’ peaches. Yields were also taken from two-year-old trees of ‘Sunraycer’ nectarine, and ‘Gulfbeauty’, ‘Gulfblaze’ and ‘Gulfrose’ plums. Fruit were harvested during the 2007 season and sized according to California Tree Fruit standards. Picking dates, total pounds, pounds per size category, and Los Angeles terminal market prices are given. The seasonal best, mean, and break even prices for Georgia peach growers are also presented.

Incidence of Blind Node Development of Four Low-chill Peach Cultivars in Three Locations in Florida.

T. W. Wert, J. G. Williamson, J. X. Chaparro, and E. P. Miller, Horticultural Sciences Department, UF and R. E. Rouse, Southwest Florida Research and Education Center, UF. [K19]

The effect of climate on the occurrence of vegetative and floral buds in four low-chill peach cultivars (‘Flordaprince’, ‘Flordaglo’, ‘UFGold’, and ‘TropicBeauty’) was observed at three locations in Florida. Trees were planted in north-central, central, and southwest Florida. The relative number of blind nodes, nodes with vegetative and floral buds, and nodes with only vegetative buds were determined from three representative shoots per tree at each location. Generally, higher percentages of blind nodes were observed in central and southwest Florida and a higher percentage of nodes containing both vegetative and floral buds were observed in north-central Florida. ‘TropicBeauty’ tended to have a higher incidence of blind nodes than the other cultivars. Defoliation from bacterial spot and high winds from multiple hurricanes during 2004,

along with higher temperatures during bud formation, may have contributed to the higher percentages of blind nodes observed in the central and southwest locations, and to the lower incidence of mixed nodes (nodes with both vegetative and floral buds). The results obtained in this study indicate that certain peach genotypes have a predisposition for the formation of blind nodes. The results also suggest that high temperatures in combination with environmental stresses during bud formation can contribute to increased amounts of blind nodes. It is suggested that advanced selections with low chilling requirements and the potential for adaptation to a wide diversity of tropical or subtropical climates should be tested in multiple locations to evaluate blind node formation.

Climate influences fruit shape of peach in Florida

T. W. Wert, J. G. Williamson, J. X. Chaparro, and E. P. Miller, Horticultural Sciences Department, UF, and R. E. Rouse, Southwest Florida Research and Education Center, UF. [K20]

Fruit tip and suture development of four low-chill peach [*Prunus persica* (L.) Batsch] cultivars were evaluated in north-central, central, and southwest Florida. Measurements were taken at each location for cheek diameter, suture diameter, and tip protrusion. Suture deformation was determined by using a suture:cheek diameter ratio. Fruit had more pronounced tips and suture deformation was more pronounced at the southwest location than at the north-central or central locations. Overall, 'TropicBeauty' had more pronounced tips than the other cultivars. Warmer temperatures at the southwest location during fruit development appeared to affect fruit shape by increasing the incidence of protruding tips and pronounced sutures.

Ornamental, Garden and Landscape Section

Monday June 2

10:00 Use of Manure to Grow Impatiens (*Impatiens wallerana* Hook.f.).

Kimberly K. Moore, Fort Lauderdale Research and Education Center, UF. [GL1]

Two experiments were conducted to investigate the growth of impatiens plants (*Impatiens wallerana* Hook.f.) in substrates amended with swine manure or dairy manure. In experiment 1, impatiens plants were fertilized with 0.88, 1.77, 3.54, or 5.30 g of N per pot incorporated into 60% Sphagnum peat:25%vermiculite:15% perlite (v/v) substrate (peat substrate) as Nutricote 13N-5.7P-10.8K plus minors type 100, swine manure, or dairy manure. Impatiens plants fertilized with Nutricote had greater shoot dry weights and final plant quality ratings than plants fertilized with equivalent N rates of swine or dairy manure. Impatiens plants fertilized with 3.54 g and 5.30 g of N from swine manure were considered saleable but none of the plants fertilized with dairy manure were considered saleable. In experiment 2, impatiens plants were transplanted into peat substrate, peat substrate with 10% swine manure, or peat substrate with 10% dairy manure. All plants were top-dressed with 0.33, 0.65, or 1.30 g of N from Nutricote13N-5.7P-10.8K plus minors type 100. Highest impatiens quality and greatest shoot dry weights were observed for plants grown in peat substrate with 0.65 and 1.30 g of N from Nutricote. The combination of 10% swine manure with 0.33 and 0.65 g of N and 10% dairy manure with 0.33 g of N also produced saleable quality plants. It appears from this work that a

combination of swine or dairy manure with commercial control-release products will produce saleable quality impatiens plants.

10:15 Trees, Urban Environments and Soil Volumes. Jimmy Socash, JFS Design Inc., and Henrique Mayer, Miami Dade Cooperative Extension Office, UF. [GL2]

Endless expansion of urban areas throughout Florida has caused rampant destruction of forested lands resulting in exaggerated increases in temperature and the creation of new urban spaces devoid of natural live able conditions. Fortunately, this problem has not gone unrecognized and many governmental and municipal agencies have been pro-active in requiring extensive new plantings as part of “development”. However, due to the precious value of urban real estate, open spaces and tree planting opportunities are small and more often than not, the urban tree plantings are left to the marginal corners and most undevelopable places on a typical site. This presentation will attempt to demonstrate that development regulations requiring tree plantings for urban environments is vital to these areas. However, without adequate soil volume for urban tree plantings, these tree requirements are doomed to fail. We will show approximate minimal requirements for tree growth in the urban environments and use of new technologies such as “CU-Structural Soils, “Deep Root Silva Cells” and use of permeable pavements to add to root volume growing areas for urban tree plantings. Incorporation and use of these and other similar measures may help provide better growing environments for urban trees.

10:30 Irrigation Scheduling Using Evapotranspiration-based Irrigation Controllers in Florida. Stacia L. Davis*, Michael D. Dukes, Agricultural and Biological Engineering, UF, Grady L. Miller, Turfgrass Science, North Carolina State University, Raleigh, NC. [GL3]

Despite limited water resources, typical homes in Florida have in-ground irrigation systems utilizing automated timers that have been shown to increase outdoor water use. The need for landscape irrigation will continually grow with increased population and home construction in Florida if there is no change in the demand for aesthetically pleasing urban landscapes. Evapotranspiration-based controllers, or ET controllers, are irrigation controllers that use an estimation of evapotranspiration (ET) to schedule irrigation. Three controllers were selected to evaluate their ability to schedule irrigation efficiently and adequately compared to a theoretically derived soil water balance model using site conditions. Five treatments were replicated four times to total twenty plots measuring 7.62 m x 12.2 m. The plots were constructed at the UF Gulf Coast Research and Education Center and partitioned into 65% St. Augustinegrass (*Stenotaphrum secundatum*) and 35% mixed-ornamentals to represent a typical Florida landscape. The irrigation treatments were as follows: Smart Line Series controller (Weathermatic, Inc., Dallas, TX), Intelli-sense (Toro Company, Inc., Riverside, CA), Smart Controller 100 (ETwater Systems LCC, Corte Madera, CA), a time-based treatment determined by UF-IFAS recommendations, and a time-based treatment that is sixty percent of the previous time-based treatment. Results were quantified using similar criteria to the SWAT testing protocol developed by the Irrigation Association.

10:45 Growing Medium Effects On The Establishment Of *Muhlenbergia capillaris*.

J. J. Muchovej¹, O.U. Onokpise¹, M.J. Williams², and K. Livingston¹. ¹Florida A&M University, Tallahassee, FL, 32307. ²USDA-ARS, Gainesville, FL. [GL4]

The establishment and survival of *Muhlenbergia capillaris* was determined by planting greenhouse grown rametes in 4 different potting media. The rametes were removed from the planting medium, and the roots trimmed at a length of 3 cm. The treatments, in 4 replicates consisted of planting densities of 1, 2, 4, 8, or 16 rametes planted in each of 4 different potting media. The potting media were i) a mixture of 80:10:10 bark:sand:peat (v:v); ii) 80:20 peat:perlite (v:v); iii) 60% composted pine bark; and peat, perlite, vermiculite, horticultural grade charcoal, and lime (v:v); and iv) 1:1:1 peat:sand:perlite (v:v). Data collected every 30 days included number of rametes surviving, and plant height. After 9 months, the plants were harvested and dry weights of tops and roots determined. In general higher planting densities gave greater survivability. Also, the mixtures i and ii provided greater rates of survival.

11:00 Evaluation of Irrigation Control on Turfgrass Quality and Root Growth.

Mary Shedd, Michael D. Dukes, Agricultural and Biological Eng. Dept., UF, and Grady L. Miller, Turfgrass Science, North Carolina St. Univ., Raleigh, NC. [GL5]

Landscape irrigation is regulated in many areas of Florida due to water shortages. Restrictions in some of these areas include a maximum of either one or two days per week available for irrigation scheduling. The objectives of this experiment were to evaluate the differences in root growth and turf quality in St. Augustinegrass (*Secundatum Stenotaphrum*) comparing frequency and depth of irrigation events using three types of control technologies. This study was performed at the Plant Science Research Extension Unit in Citra, Florida on 'Floritam' St. Augustinegrass during 2006 and 2007. Testing was performed on plots with dimensions of 4.27m by 4.27m. Technologies studied were ET controllers, rain sensors, and soil moisture sensors. Irrigation schedules were limited to two day per week except for four rain sensor treatments which were allowed one or seven days of irrigation per week. The total possible depth applied each week was the same for all treatments, but the number of possible irrigation events during the week was different. There were two comparison treatments, which also had a two day per week irrigation schedule and one control treatment. A reduced irrigation treatment with a rain sensor (DWRS) was set to apply 60% of the irrigation amount applied by other treatments. There was a time based treatment with no sensor (WOS) used for comparisons in water applied and there was a non-irrigated treatment (NON) used as the control. Quality ratings of the turfgrass were taken based on NTEP procedures and root samples were taken once during both years of testing at depths of 7.6 cm, 15.2 cm and 30.5 cm. Results show that the majority of root mass was in the top 15.2 cm of the soil profile with between 61% and 100% for 2006 and between 47% and 100% for 2007. In 2006, turf quality was low for plots receiving low levels of irrigation and also for one out of the two one day per week with rain sensor irrigation treatments. Analysis showed that frequency of irrigation scheduling and total water applied did not have a significant impact on depth of root growth.

11:15 Evaluations of New Controlled-release Fertilizers for Use in Production of Interiorscape and Landscape Plants.

R.H. Stamps, J. Chen, S. Natarajan, Department of Environmental Horticulture, Mid-Florida Research and Education Center, UF; J. Popenoe, Lake County Cooperative Extension Service. [GL6]

Controlled-release fertilizers (CRFs) are commonly used in the production of ornamental plants. They are often used to reduce labor costs, provide consistent nutrient availability over time, and potentially reduce nutrient losses due to leaching. Studies were initiated in Apopka, Florida in May 2007 to compare two 16-8-12 experimental CRFs, one with a 6-month (ECRF6) and one with a 9-month release term (ECRF9), to a commonly used commercial CRF with a similar release term (Osmocote[®] Plus 15-9-12 or Nutricote[®] Total 17-7-8 type 270/70, respectively). Tissue-cultured liners of interiorscape cultivars *Dieffenbachia* 'Camille' and *Spathiphyllum* 'Ty's Pride' were potted into a Sphagnum peat-based container medium and grown in a shaded greenhouse using one of the two 6-month release materials. Cutting-derived liners of landscape shrubs *Loropetalum chinense* 'Burgundy' and *Viburnum odoratissimum* were transplanted into containers filled with a pine bark-based mix and grown in full sun using one of the two 9-month release products. The interiorscape plants grew equally well using ECRF6 as with the Osmocote[®] Plus. *Loropetalum* growth and grades were similar using both 9-month release fertilizers; however, growth of viburnums fertilized with ECRF9 was somewhat greater after four months than those fertilized with Nutricote[®]. Initially, nitrate-nitrogen (NO₃-N) leaching, determined using the pour-through method, was greater for ECRF9 than for Nutricote[®]. Subsequent leachate concentrations were mostly similar for the two products and ranged from four to 21 mg · L⁻¹.

11:30 Update on Fertilizer Ordinances and BMP Education for the Green Industries.

Laurie E. Trenholm, UF/IFAS. [GL7]

The increasing number of fertilizer regulations at the local government level makes it difficult for Extension agents as well as for the lawn care industry to keep current. Add to that potential statewide regulations for fertilizer application to begin within the next year and it becomes more confusing. This talk will provide updates on the current status of both local and state regulations and will have specifics on providing BMP Education.

1:30 Cercospora Leaf Spot Caused by *Cercospora Dendrobii* on Dendrobium and its Control

Robert T. McMillan, Jr, Kerry's Nursery, Inc., Homestead, Florida, Aaron J. Palmateer and Wagner A. Vendrame, Tropical Research and Education Center, UF. [GL8]

Cercospora leaf spot of *Dendrobium* spp. has been reported in Florida, Thailand and most of the tropical areas of the world where *Dendrobiums* are grown. It most commonly occurs in South Florida and has been significant in *Dendrobium* production. Other *Cercospora* leaf spots are occasionally found on other orchids, including *Angraceum* spp., *Cattleya* spp., *Odontoglossum* spp., *Brasavola*, *Broughtonia*, *Epidendrum*, *Schomburgkia*. Leaf lesions on the *Dendrobium* are at first noted on the under surface of the leaf as pale yellow sunken spots, 1-3 mm in diameter. With time, the spots continue to enlarge in a circular or irregular pattern and

eventually may cover the whole under side of the leaf. Later the spots become slightly sunken and purple-black with the developing margin remaining yellow. Following the appearance of the spots on the lower leaf surface a corresponding yellow-pale green area can be seen on the upper leaf surface. Eventually the spots turn purplish black or black. Heavily infected leaves abscise. Prolonged periods of leaf wetness should be avoided. Chlorothalonil and thiophanate-methyl are labeled for control of *Cercospora* leaf spot on orchid in the United States. *Cercospora* efficacy studies conducted in 2006-2007 showed that the new BASF azoxystrobin compounds are significantly effective.

1:45 Designing an Integrated Pest Management Program for Hispanic Landscapers.

H. Mayer, Miami Dade Cooperative Extension Office, UF, E.A. Skvarch St. Lucie County Cooperative Extension Office, UF, P. R. Mattis, Duval Cooperative Extension Office, UF and R. Jordi, Nassau Cooperative Extension Office, UF. [GL9]

According to a 2005 University of Florida Nursery and Landscape Industry Economic analysis report Florida's landscape sector accounts for 5.255 billion dollar sales a year. Almost 30% is related to landscape maintenance business. In Florida we have 6 million acres of land. The use of IPM principles to minimize pests and apply chemicals only when appropriate is a key concept if we want to live in a sustainable environment. Traditionally the majority of Extension landscape management programming and educational publications available on Integrated Pest Management (IPM) topics have been produced and directed towards an English speaking audience. However in Florida a demographic change is rapidly happening where the number of Hispanic speaking landscape management companies is increasing in the last few years. In Miami-Dade approximately sixty percent of the landscape work force speaks Spanish. The purpose of this project is to develop a basic IPM Scouting Kit to educate the growing number of urban Hispanic landscape personnel. The Spanish IPM Scouting Kit is a multi-county effort between Duval, St. Lucie and Miami-Dade County Commercial Extension agents.

2:00 Developing a Bilingual Video / Video Podcast to Teach Clients How to Control a New Pest, The Fig Whitefly.

Mary Lamberts, Henrique Mayer, Ruben Regalado, Adrian Hunsberger and Catharine Mannion, Miami-Dade County Extension Office, Homestead, FL. [GL10]

In September 2007, the Miami-Dade County Extension office began receiving numerous phone calls about a new problem with *Ficus* hedges. This was identified as the fig whitefly *Singhiella simplex* (Singh) in October 2007. By November 2007, a management protocol was developed, which included the use of a soil drench with a neo-nicotinoid insecticide to help preserve natural enemies. As the result of many questions about application techniques from industry professionals, reports of misapplications and concerns about environmental impacts, the Miami-Dade County Extension horticultural staff decided that the best way to educate all possible clients was through a bilingual video demonstration of proper application techniques. The video was produced in-house using Extension agents and a member of an Extension Advisory Committee who is an industry professional as the "talent." It includes information for both homeowners and professionals on the methods that should be used to apply a soil drench. This has been converted into segments and adapted for downloading via either a dial-up or a

DSL connection and is posted on the Miami-Dade County Extension website. It has also been used in several workshops.

2:15 The Truth about Staining and Black Olive Trees, *Bucida buceras*: (Combretaceae).
Douglas L. Caldwell, Collier County Extension, UF/IFAS. [GL11]

Black olive, also known as ox-horn bucida, is used as a shade tree in south Florida landscapes and street plantings. It is a fairly wind and salt tolerant, low maintenance tree from the Greater Antilles and Leeward Islands. One drawback is that the tree is associated with a rusty staining of driveways, cars, etc. due to fruit drop. This report documents that the staining is not due to the normal fruit, a dry capsule, but rather a series of arthropod infestations. Observations reveal that the staining is associated with the long, “ox-horn” shaped fruit galls which are caused by eriophyid mites and not the normal seed capsules. Not only that, but the galls have caterpillar borers that produce frass which is the source of the staining, not just the galls themselves. Proposed management of the eriophyid mites will be discussed. If the galls can be prevented, staining problems may be eliminated in situations where the trees should not have been planted.

2:30 Observations on the Erythrina gall wasp, *Quadrastichus erythrinae* (Hymenoptera: Eulophidae), an adventive insect pests in Florida.
FW Howard, UF/IFAS. [GL12]

The Erythrina gall wasp, *Quadrastichus erythrinae*, has been known to science only since 2004 at which time it was described from specimens collected in Singapore, Mauritius and Reunion. It was first found in the Continental US in Miami-Dade County, Florida, on October 15, 2006. Five months later, we observed galls induced by this wasp on a coral tree, *Erythrina variegata*, on the grounds of the Fort Lauderdale Research & Education Center, and thus we initiated field observations on this gall wasp. Exotic and native *Erythrina* spp., the only known hosts of *Q. erythrinae*, are uncommon in urban landscapes in southern Florida, nevertheless this gall wasp was observed to be highly effective in finding its highly dispersed hosts. The gall wasp appeared to have pronounced differences in host preference among *Erythrina* spp., with *E. variegata* (of Asian origin) being highly galled, *E. herbacea* (native to Florida) slightly to moderately galled, and *E. humeana* (native to Africa) remaining free of galls. Massive galling of individual Erythrina trees caused extensive defoliation and branch die-back, often resulting in the death of the tree. For unknown reasons, the numbers of wasps caught in traps in *Erythrina* trees and the incidence of galling on hosts has diminished in recent months. Some trees that survived severe galling and resulting defoliation have recovered and are currently only slightly galled. Results of initial research on chemical control and potential management methods for this pest in Florida will be discussed.

2:45 Response of Cut Flowers and Bedding Plants to Root-knot Nematodes.
Namgay Om, Robert McSorley, and John J. Frederick, Department of Entomology and Nematology, UF. [GL13]

Seven cultivars of cut flowers and bedding plants were grown under greenhouse conditions to test their susceptibility to root-knot nematodes, *Meloidogyne incognita* race 2 and *M. javanica*. Cultivars examined included ‘Thumbelina’ and ‘Envy’ zinnia (*Zinnia elegans*); ‘Petite’ and ‘Jaguar’ marigold (*Tagetes patula*), and ‘Snowdrift’ marigold (*T. erecta*.); ‘Dwarf

Jewel Blend' nasturtium (*Tropaeolum minus*); and 'Potomac Pink' snapdragon (*Antirrhinum majus*). In a separate experiment, snapdragon plants were tested to determine their response to *M. arenaria* and varying concentrations of *M. incognita* race 2 inoculum. Both nasturtium and snapdragon had heavy galling from *M. incognita* compared to the other cultivars. Based on numbers of nematodes recovered from the root system, nasturtium was more susceptible to *M. incognita* than marigold or zinnia ($P \leq 0.05$). Snapdragon had heaviest galling by *M. javanica* compared to all other cultivars. However, high numbers of nematodes were obtained from both snapdragon and nasturtium, indicating that they are better hosts to *M. javanica* than any of the marigold or zinnia cultivars. Snapdragon responses to *M. arenaria* and different concentrations of *M. incognita* were not different ($P \leq 0.05$). Snapdragon and nasturtium were susceptible to the root-knot nematodes evaluated while marigold and zinnia cultivars were resistant.

3:30 TAME Invasives Portal: A Solution for Your Life.

K.T. Gioeli, St Lucie County Extension, UF. [GL14]

The State of Florida spends an estimated \$120,000,000 annually to manage invasive plants. Often times these invasives can not be adequately managed utilizing traditional mechanical, chemical and cultural practices. Biological control is another proven, yet under utilized, strategy that can be used to manage invasive plants. Unfortunately, there is a lack of understanding of the role of biological control as an effective tool in our efforts to control invasive plants. A web portal entitled "TAME Invasives: A Solution for Your Life" is currently under development by the University of Florida at <http://pesticide.ifas.ufl.edu>. This portal features research-based information, multimedia products and online coursework that focuses on the management of four high priority invasive pest plants in South Florida including Old World Climbing Fern (*Lygodium microphyllum*), Tropical Soda Apple (*Solanum viarum* Dunal), Brazilian Pepper-tree (*Schinus terebinthifolius*), and Melaleuca (*Melaleuca quinquenervia*). Online courses have been developed to teach course participants how to 1) manage these high priority invasive plants; 2) use herbicides in the most effective manner that is safe for people and the environment; and 3) understand the role of biological control as an essential Integrated Pest Management (IPM) tool for the management of these invasive plant species. The purpose of this presentation is to inform Conference participants about the University of Florida's research and extension biological control programs for four high-priority South Florida invasive plant species and how the TAME Invasives web portal is being utilized.

3:45 Trap Cropping: A Farm Scale and Philosophy Neutral Suppression Tactic for the Major Pestiferous Genera of Stink and Leaf-footed Bugs in the Southern U.S.

R. F. Mizell, III and T. C. Riddle. North Florida Research and Education Center-Quincy, UF. [GL15]

Stink and leaf-footed bugs in the genera *Euschistus*, *Acrosternum*, *Nezara* and *Leptoglossus* are ubiquitous pests of fruit, seed, grain, nut, vegetable and other crops. Many other genera and species are major and minor pests in specific commodities. A trap cropping system was developed that is applicable for all types of agricultural enterprises from homeowners, organic to conventional producers. It is applicable from early spring to late fall to suppress these overarching agricultural pests. The system relies on triticale, buckwheat,

sunflower, grain sorghum and millet depending on time of year. Details surrounding implementation and use of the trap crops will be discussed.

4:00 Comparison of Ramete and Genete Establishment for *Imperata cylindrica*.

J.J. Muchovej, O.U. Onokpise, and S. Bambo, Florida A&M University, Tallahassee, FL. [GL16]

The establishment of *Imperata cylindrica* was compared by planting greenhouse grown genetes and field collected rametes. The genetes were collected taking rhizomes from a single plant; cutting them in pieces that contained 2 nodes and then planting these in a composted pine bark potting mix. The rametes were produced by harvesting field grown cogon grass, trimming the roots to 2 cm, and planting in the same potting mix. All plants were then placed under mist until they had become established. The genetes and rametes were then potted in a mixture of 80:10:10 bark:sand:peat (v:v); in 40 cm diameter pots. The pots were then placed on greenhouse benches. Data collected every 2 weeks included number of tillers per plant. Pots were harvested at 6, 12, 18 or 24 weeks and the length of tillers; and dry weights of tops, rhizomes and roots.

4:15 Using Banker Plants as a Biocontrol System for Spidermites and Whiteflies.

Lelan Parker and Juanita Popenoe, UF/IFAS. [GL17]

Biological control is the most environmentally friendly control measure for pests, but the most difficult to learn. Greenhouse and nursery growers have been slow to adopt biocontrol partly because of the difficulty in identifying, purchasing and monitoring biocontrol agents. Two banker plant systems to control the two most common greenhouse pests – whiteflies and spidermites – have been used in a grower demonstration project. The pests and the biological control agents through their life cycles were illustrated for easy identification and how to purchase and use them was explained with the objective to get more growers to try, and then adopt some biocontrol agents. The educational information used and the results of the demonstration will be presented.

4:30 Natural Solutions for Your Gardening Life.

G. K. England, Sumter County Extension, UF. [GL18]

There are a number of tactics available to enable homeowners to manage pests in the landscape with minimal use of synthetic pesticides. Utilization of this concept can result in a healthy landscape while reducing the potential to harm oneself and the environment that is associated with some synthetic pesticides available to homeowners. Taking all the measures possible to grow healthy landscape plants is the first step to take. Putting the right plant in the right place plus following good horticultural practices help to achieve this goal. Taking steps to identify and eliminate pests will help keep populations low. To do this it is necessary to learn the key pests to expect with the plants you are growing. If pest populations begin to expand in the landscape, there is an array of tactics that may be employed. Pests can be managed by mechanical means such as picking, washing and trapping. Enhancing and augmenting natural pest managing organisms, such as insect predators and parasites, help to maintain pest populations within an acceptable range. There are some non-synthetic products available to homeowners that may assist in managing damaging pests of the landscape.

4:45 Evaluation of Biofungicides for Control of Powdery Mildew of Gerbera Daisy.

Catalina Moyer and Natalia A. Peres, UF. [GL19]

Gerbera daisy (*Gerbera jamesonii*) is highly susceptible to powdery mildew caused by the fungus *Erysiphe cichoracearum* or *Podosphaera* (Syn. *Sphaerotheca*) *fusca*. This disease affects all plant parts and reductions in yield and in quality are the main components of economic loss. Repeated applications of fungicides are the main method for powdery mildew control. However, pathogens may develop resistance to some fungicides after consecutive applications. The objective of this study was to evaluate the efficacy of silicon and other biofungicides for suppressing powdery mildew in gerbera daisy. Silicon as calcium silicate or potassium silicate was evaluated in the highly susceptible cultivar 'Snow white'. The effect of spray applications of the biofungicides Actigard, Agsil, K-phite, MilStop, TriCon, and Cease was evaluated in highly susceptible ('Snow White' and 'Orange') and moderately susceptible ('Hot Pink' and 'Fuchsia') cultivars. Disease severity was assessed and neither calcium silicate nor potassium silicate were effective in suppressing powdery mildew. The biofungicide products Actigard, Agsil, K-phite, MilStop, TriCon, and Cease suppressed powdery mildew severity compared with untreated plants; however, these products were not as effective as a fungicide program of Heritage alternated with Eagle. Among the biofungicides tested, Actigard and Agsil were the least effective treatments. Cease provided moderate disease control and K-phite, MilStop and TriCon were the most effective in reducing disease severity. The level of disease reduction obtained with TriCon in cultivars Fuchsia, Hot pink and Orange compared to that attained with the systemic fungicides.

Tuesday June 3

10:00 An Ecological Assessment of the Urban and Urbanizing Forests of the Tampa Bay Watershed.

Andreu, M.G. and Friedman, M.H. University of Florida, School of Forest Resources and Conservation; Landry, S., University of South Florida; and R.J. Northrop, University of Florida IFAS - Hillsborough County Extension. [GL20]

Two hundred (200) permanent plots were randomly established within the City of Tampa, with another 300 plots established in adjacent subwatersheds. Data collected include: trees (species, crown diameter, total height, DBH, proximity to buildings), shrubs and ground cover (e.g. impermeable, herbaceous). The data were entered into the USDA Forest Service Urban Forest Effects model (UFORE) to quantify values for forest functions such as air quality, carbon sequestration/storage, mitigation of urban energy consumption and economic value. Plot data were used to establish baseline information concerning the composition, structure, and condition urban vegetation and built environment. Plot data and remote sensing were used jointly to characterize the vegetation coverage. Existence of these geo-referenced permanent plots has already provided the impetus for aligned research including: social values of urban forests (UF IFAS – Hillsborough County Extension), calculation of post-hurricane forest waste expectations for FEMA projects (UF IFAS), estimation of biomass yields from urban forests for bio-fuel production (UF IFAS), and effects of forest cover on soil and water quality across the urban to rural continuum (UF IFAS – Hillsborough County Extension). This inventory and assessment is

seen as a first step in planning for sustainable urban forest management within the Tampa Bay metropolitan region.

10:15 Caladium Breeding: Progress in Developing Lance-leaved Cultivars.

Zhanao Deng and Brent K. Harbaugh, University of Florida, IFAS, Environmental Horticulture, Gulf Coast Research and Education Center, Wimauma, FL. [GL21]

Caladiums are commonly grown as container or landscape plants in Florida. Historically, fancy-leaved cultivars have dominated the market. During the past two or three decades, the demand for lance leaf cultivars has increased due to their inherent characteristics including short plants, resilience to environmental stresses, and ease of forcing in containers. However, the number of lance-leaved cultivars has been limited with few choices available for leaf color or color pattern, and many of the available lance-leaved cultivars have poor tuber yields. Consequently, tuber production for these cultivars is difficult and less profitable compared to production of fancy-leaved cultivars and this has led to a short supply and higher price for tubers of lance-leaved cultivars. Since its beginning in 1976, developing new lance-leaved cultivars with improved or novel foliar characteristics and good tuber yield has been a major breeding objective of the University of Florida's Institute of Food and Agricultural Science's caladium breeding program. 'Florida Sweetheart' was released from these breeding efforts in 1991, followed by 'Florida Red Ruffles' and 'Florida Irish Lace' in 1996, and 'Florida White Ruffles' and 'Florida Whitewater' in 2002. Some of them have become very popular in the Florida caladium industry. In more recent years, efforts have been made to improve disease resistance, sun tolerance and cold tolerance in lance-leaved cultivars. Dozens of elite lines have been developed and are being evaluated for their tuber production, landscape performance in the sun as well as in the shade, and container performance. A number of these lines have performed outstandingly and are scheduled to be released as new cultivars.

10:30 Fort Lauderdale Trial Garden – Year 6 (2007-2008).

Kimberly K. Moore and Luci Fisher, Fort Lauderdale Research and Education Center, UF. [GL22]

Rooted cuttings of vegetatively propagated annuals from Danziger "Dan" Flower Farms were planted on August 20, 2007, while rooted cuttings from Proven Winners were planted in November 2007. All cultivars were planted as three groups of six plants with the groups being randomly placed in the garden. Danziger plants were planted under 30% shade while half of the Proven Winners plants were planted in full sun, and the remainder under 30% shade. Monthly evaluations were conducted to record plant height, plant width, flower number, number of plants with flowers, insect and disease damage, and quality rating. Quality was rated on a scale of 0 to 5 with 5 = top performance, 3=plants of interest, 1=poor performance, and 0=dead. One consumer preference survey was conducted on March 20, 2008. Quality and consumer preference results will be presented.

10:45 Providing Core Continuing Education Units in Partnership with a Regional Commercial Nursery Horticulture Magazine.

Edward A. Skvarch, St. Lucie County Cooperative Extension Office, UF/IFAS. [GL23]

Traditional Extension programs in the past have been delivered in face-to-face classroom settings. Even though research has shown that the value of classroom delivery is still important, some of Extension clients in the production field have become concerned with the cost of face-to-face classroom education. However, Extension clients also indicated that to remain competitive in a changing industry, producers still needed educational resources. In an effort to help curtail costs associated with face-to-face workshops, while still delivering desired educational resources, a statewide team of University of Florida / IFAS Commercial Horticulture Extension educators began authoring a series of monthly articles in a regional commercial nursery industry magazine.

11:00 Shade Tolerance in St. Augustinegrass Cultivars.

Laurie E. Trenholm, UF. [GL24]

Five St. Augustinegrass cultivars were evaluated for shade tolerance in a greenhouse study at the University of Florida. Cultivars ‘Amerishade’, ‘Delmar’, ‘DeltaShade’, ‘Floratam’, and ‘Palmetto’ were placed in full sun or under shade structures that provided 30, 50, or 70% shade in a glasshouse at the Turfgrass Research Envirotron in Gainesville. Evaluations were taken for visual quality, color, and density, leaf clipping weights, leaf length and width, and multispectral reflectance. For the majority of measurements, the cultivars Amerishade and Delmar were the best performers. They maintained acceptable quality levels up to 62 and 55% shade, respectively. Worst performance in shade or sun was seen in Floratam. Clipping weight declined in all cultivars as shade increased, in spite of increasing leaf length in shade. Reflectance scores showed that there are significant differences in light attenuation between cultivars.

11:15 Identification of the Four Forms of *Plumeria Rubra*.

Stephen H. Brown, Lee County Extension, UF. [GL25]

Plumeria rubra is a small ornamental tree from Central Mexico to Columbia. It is the most commonly grown *Plumeria* species in Florida. This tree becomes 15 to 25 feet tall, with a very open crown of a few thick spreading branches. March to July is the main flowering period of *P. rubra*. The species is apparently the source of many plumeria hybrid cultivars. In the past, the flower colors were associated with distinct species but are now regarded as different forms of the same species. All forms have twisted overlapping corollas, much like the blades of a propeller. Forma *acutifolia* has white flowers and yellow centers. Forma *lutea* has yellow flowers. Forma *rubra* has deep pink flowers with a yellow center and Forma *tricolor* has pale yellow white flowers with yellow centers and red or pink rim. *P. rubra* has the longest flowering days and is the tallest of the four forms. Flowers of *P. acutifolia* and *P. lutea* appear earlier in the year than *P. rubra* but their flowering days are generally shorter.

Vegetable Section

Monday June 2

10:00 Evaluation of Nitrogen Rates and Irrigation Programs for Tomato Production in West Central Florida.

Bielinski M. Santos, Gulf Coast Research and Education Center, UF. [V1]

Three field trials were conducted in 2006 and 2007 to compare current nitrogen (N) recommendations with grower-standard N rates under various irrigation programs. Irrigation programs were seepage (14.7 acre-inch/acre/season; 1 acre-inch/acre = 27,154 gal/acre), seepage + drip (14.7 + 13.6 acre-inch/acre/season), and drip (13.6 acre-inch/acre/season). Total N rates were 200, 250, and 300 lb/acre and were supplied in different combinations of preplant and drip-applied. Drip fertilization occurred three times per week. The results indicated that: a) after plant establishment with seepage and drip irrigation, drip irrigation alone can be used to produce the crop, b) when seepage alone is used the crop increased yields as the N rate increased to 250 lb/acre and no further yield increase occurred afterwards, and c) when drip irrigation alone or seepage + drip irrigation are used there were no differences among 200, 250 and 300 lb/acre of total N during the season, regardless of the partitioning (e.g. 50 lb/acre preplant + 150, 200 or 250 lb/acre through drip). A possible field recommendation would be using up 250 lb N/acre with seepage irrigation and between 200 and 250 lb N/acre for seepage + drip irrigation.

10:15 Plant Tumor Development on Tomatoes Derived from *Lycopersicon hirsutum*.

Xin Zhao, Eric H. Simonne, Karen E. Koch, Horticultural Sciences Department, UF, Jeremy D. Edwards, J. W. Scott, Gulf Coast Research and Education Center, UF, Byung-Ho Kang, Microbiology and Cell Science Department, UF, Robert Hochmuth, North Florida Research and Education Center – Suwannee Valley, UF and Stephen M. Olson, North Florida Research and Education Center – Quincy, UF. [V2]

Nonpathogenic tumor can develop on the leaves of tomato plants. This intumescence injury, often called “oedema”, is a physiological disorder that occurs under certain environmental conditions. Besides genotype, water congestion resulting from the imbalance between plant water use and uptake has been considered as the primary cause of the blister-like symptoms. However, the initiation and process of the tumorous growth remains unclear. It is suggested that the regulation of tumor development in plants may also involve phytochrome and phytohormones. A wild tomato species *Lycopersicon hirsutum* is known for its susceptibility to intumescence formation, particularly in the greenhouse environment. In a recently conducted greenhouse study of grafted tomatoes, the rootstock ‘Maxifort’, a hybrid derived from *Lycopersicon hirsutum* showed marked symptom of oedema on the leaves, indicating the possibility of genetic inheritance of intumescences. Tomato variety ‘Florida-47’ did not exhibit any tumorous growth in either non-grafted treatment or grafted treatment with ‘Maxifort’ as rootstock. A follow-up greenhouse experiment further evaluated the effect of grafting on oedema development in ‘Maxifort’. The results demonstrated that grafting did not affect the susceptibility of ‘Maxifort’ to intumescences as self-grafted ‘Maxifort’ plants and ‘Maxifort’ grafted onto ‘Florida-47’ both had the similar injury in comparison with the non-grafted control.

Internal morphology of oedema-afflicted leaves of ‘Maxifort’ implied that cell division, in addition to cell enlargement, may also play a role in the development of intumescences.

10:30 Yield, Chemical Composition and Eating Quality of Heirloom Tomatoes Grown in the Subtropical Climate of Florida.

Danielle D. Treadwell, Horticultural Sciences Department, UF, Amy H. Simonne, Thabile P. Nkambule, Kim Evans, Department of Family, Youth and Community Sciences, UF, Robert C. Hochmuth, Wanda L. Laughlin, North Florida Research and Education Center – Suwannee Valley, UF, Corstiana Peavy, Columbia County Extension, UF, Catherine J. Rogers, Suwannee County Extension, UF and Teresa Olczyk, Miami-Dade County Extension, UF. [V3]

Florida small farm growers and producers are interested in strategies that can differentiate their operation and products from the competition, and heirloom tomato varieties have potential for adoption by small farm producers in Florida. We evaluated chemical compositions (vitamin C, pH, total soluble solid (TSS), titratable acidity (TTA) and eating quality (semi-trained panelist, n = 38) of six cultivars (‘Arkansas Traveler’; ‘Brown Berry’; ‘Cream Sausage’; ‘Juanne Flame’; ‘Nyagous’; ‘Mortgage Lifter’) of field and shade-grown heirloom tomatoes during the 2007 spring growing season at the North Florida Research and Education Center – Suwannee Valley, Live Oak, FL. Although tomato yields were highly variable among varieties, they were not statistically different. Marketable yields ranged from 0.86 to 1.8 kg/plant and were generally higher than culls. Vitamin C, pH, TSS and TTA were different among cultivars. ‘Brown Berry’ (26.18 mg/100g) yielded the highest vitamin C while ‘Nyagous’ yielded the lowest vitamin C (13.40 mg/100g). While the vitamin C content and pH of field produced tomato appeared higher than the shaded production, statistical analyses did not yield significant differences ($P = 0.0876$). The sensory evaluation was conducted only on varieties with high marketable yield (‘Brown Berry’; ‘Cream Sausage’, and ‘Juanne Flame’). Age and gender did not significantly affect rating score of the sample ($P > 0.05$) while difference among the samples are significantly different ($P < 0.0008$). There was no specific trend that indicated a flavor preference for shade-grown tomato. Based on the marketable yield, chemical composition, and eating quality, none of the varieties tested was exceptional.

10:45 Response of ‘Tasti-Lee’ Tomato to Nitrogen Fertilization Programs and In-row Distances.

Bielinski M. Santos and John W. Scott, Gulf Coast Research and Education Center, UF. [V4]

‘Tasti-Lee’ is a recently released fresh-market tomato hybrid of determinate vines, high lycopene content, attractive deep red interior color and superior flavor. Two field studies were conducted in Fall 2006 and Spring 2007 to determine the effect of in-row distances and nitrogen (N) fertilization programs on the marketable yields of ‘Tasti-Lee’ tomato. In-row distances were 18 and 24 inches. N fertilization programs consisted of: a) 1.5, 1.5, and 2.0 lb/acre/day during weeks 1 to 2, 3 to 4, and 5 to 11 after transplanting, respectively; b) 1.5, 2.0, and 2.5 lb/acre/day during weeks 1 to 2, 3 to 4, and 5 to 11 after transplanting, respectively (IFAS recommendation); and c) 1.5, 2.5, and 3.0 lb/acre/day during weeks 1 to 2, 3 to 4, and 5 to 11 after transplanting, respectively. There was no significant interaction between in-row spacing and N fertilization programs on tomato yields, whereas each factor individually had a significant effect on this variable. An in-row distance of 18 inches produced the largest marketable yields per area. The N

fertilization program consisting of 1.5, 2.5, and 3.0 lb/acre/day during weeks 1 to 2, 3 to 4, and 5 to 11 after transplanting increased the proportion of large and total fruit in comparison with the other two fertilization programs.

11:00 Sensory Evaluation of Red and Yellow Grape Tomato Varieties.

Eric Simonne, Reva Datar, Amy Simonne and Robert Hochmuth, Horticultural Sciences Department, FL. [V5]

Grape tomatoes (*Solanum lycopersicon* L. var. *cerasiform*) have recently gained in popularity because they are convenient to eat, sweet and flavorful, and are recognized as a good source of vitamins C and A, and lycopene. Because of the limited seed availability of the standard variety 'Santa', the objective of this study was to identify suitable replacement varieties for three segments of the grape tomato industry. The first taste test included commercial red varieties ('Sugary', 'Red Grape', 'St. Nick', 'Santa', 'Sweet Olive', and 'Tami G'), the second one included red varieties suitable for small farm production ('Cupid', 'Sugary', 'Sweet Hearts', 'Jelly Bean', 'Jolly Elf', and 'Santa'), and the third one included yellow varieties ('Gold Nugget', 'Golden Sweet', 'Honey Bunch', and 'Sun Gold'). All varieties but 'Santa' were grown at the North Florida Research and Education Center – Suwannee Valley. A 33-member panel rated the varieties for sweetness, acidity, flavor, and overall preference on a 90-mm unstructured line. Significant differences were found for most attributes, but variability was high (CV ranging from 47 to 61%). Based on an overall rank sum index, 'Red Grape', 'Sugary' and 'Cupid', and 'Sun Gold' were rated highest varieties in each category. Surprisingly, the store-bought 'Santa' was among the least preferred red varieties. Together with consumer preference, factors such as market needs, seed availability, growth habit, and disease resistance/tolerance should also be considered when selecting a grape tomato variety.

11:15 Fate and Movement of Nitrogen and Phosphorus in Deep Creek in the Lower St Johns River Basin of Northeast Florida.

Christine M. Worthington and Chad M. Hutchinson, Horticultural Sciences Department, UF. [V6]

The St. Johns River Water Management District estimates 36% of the pollutant load entering the lower St Johns River basin (LSJR) is related to human activities including agriculture. Deep Creek, a tributary in the LSJR basin, drains agricultural land in and around Hastings. Approximately 1,600 hectares of irrigated cropland drain through a system of tail water canals into Deep Creek. Objectives of this project are to measure water quality and aquatic plant density effects in the tributary. Water samples collected in Deep Creek to the St. Johns River were analyzed for NO₃-N, NH₄-N, K and Total P (TP). Blue green algae (cells/ml), chlorophyll (RFU), dissolved oxygen, (mg L⁻¹), pH, specific conductivity (μS cm⁻¹) and water temperature (C) were measured at each of the eleven sample sites on a weekly schedule in October 2007. Mean TP (1, 150 μg L⁻¹) and blue green algae concentrations (2,125 cells ml⁻¹) increased 60 and 31%, respectively on the 4 and 11 October sample date following a storm event on 3 October compared with the 31 October sample date. Mean TP and blue green algae concentrations for the 31 October sample date were 468 μg L⁻¹ and 1,458 cells mL⁻¹, respectively. Mean NO₃-N concentration remained below 0.32 mg L⁻¹ during all sample dates in October. Mean specific conductivity for the 4 and 11 October sample dates were approximately

17% lower compared with 31 October sample date. Data collected from this project will further support BMP strategies for the Tri-County Agricultural Area of Northeast Florida.

11:30 Adapting the CROPGRO Model to Simulate Fresh Market Production and Quality of Snap Bean as Affected by N fertilization and Irrigation.

Desire Djidonou, Eric Simonne, Horticultural Sciences Department, UF, Kenneth Boote, Jerry Bennett, Jon Lizaso, Agronomy Department, UF and Jim Jones, Agricultural and Biological Engineering Department, UF. [V7]

With the increasing issues related to groundwater contamination by nitrate, Florida vegetable production faces serious challenge of maintaining high crop productivity while concurrently reducing the environmental consequences of intensive management practices. Computer simulation models have become a valuable management tools for assessing crop growth, yield and nutrient movement in plant and soil in relation to the weather, soil and management practices. In this study nitrogen uptake, nitrate leaching and fresh market yield of snap bean (*Phaseolus vulgaris* L.) response to fertilizer N rates and irrigation regimes was studied in field experiments and by evaluation with the CROPGRO model. In a two-season field study carried out in Gainesville, FL, snap bean was grown under three irrigation regimes (main factor) described as low, optimum and over-irrigated, and four nitrogen rates (37, 64, 111 and 149 kg ha⁻¹) as split-plot treatments within the irrigation regimes. During the experiment, data were collected on crop growth, yield, and plant nitrogen uptake. Simulated growth, yield, pod quality, N uptake, will be compared to observed growth, yield, pod quality, N uptake, as they are impacted by N fertilization amounts and differential irrigation. Upon completion of data analysis and model adaptation, the results of this study will provide valuable insight into the optimization of crop management (irrigation and fertilization), assist the development of Best Management Practices for snap bean in particular and for Florida vegetable crops in general.

11:45 Evaluation of Alternative Fertilizer Programs in Seepage Irrigated Potato Production.

Zhiwei Chen and Chad M. Hutchinson, Horticultural Sciences Department, UF. [V8]

This study evaluated the influence of controlled release fertilizer (CRF) programs and application timing on 'Atlantic' tuber production, tuber quality, and water quality. The experiment was arranged in a randomized complete block with four replications. Application timing was at fumigation (21 days prior to planting), planting, and at hilling (30 days after planting) or a combination of timings. Fertilizer treatments were no nitrogen, ammonium nitrate (AN, 224 and 280 kg N ha⁻¹), polymer sulfur coated urea (PSCU), polymer coated urea (PCU), and three liquid urea formaldehyde formulations (UF). CRF nitrogen rate was 196 kg N ha⁻¹. Total and marketable tuber yield from plants in the no nitrogen control were 15.7 and 11.5 MT ha⁻¹, respectively. Plants in the AN (224 kg N ha⁻¹) treatment produced the highest total and marketable tuber yield among fertilized treatments (39.3 and 34.1 MT ha⁻¹) significantly higher than the UF treatments. Total and marketable yield in the PSCU and PCU treatments were similar to the AN treatments when the majority of nitrogen fertilizer was applied at or before planting. There was no significant difference in tuber specific gravity, percent hollow heart, or percent internal heat necrosis from plants in fertilized plots. There was no significant difference between fertilizer treatments for nitrate concentration in the root zone or perched water table

over the season. The 2007 season was relatively dry with limited nitrogen leaching pressure resulting in few observed differences between treatments.

12:00 Effect of Controlled-release Nitrogen Fertilizers on Potato Yield and Nitrate Leaching in Northeast Florida

Y. Fan, R.S. Mylavarapu, Soil and Water Science Department, UF/IFAS and C.M. Hutchinson Horticultural Sciences Department, UF/IFAS, Gainesville, FL.[V9]

Water availability and quality in the Tri-county Agricultural Area in the lower St. Johns River basin are two critical concerns in northeast Florida. A three-year study was undertaken to evaluate the impact of an alternate seepage irrigation method and fertilization management on potato yield and water use efficiency. The field trial consisted of two levels of seepage irrigation systems (regular and reduced) in combination with two N sources- urea and controlled-release fertilizer (CRF) at 168 and 224 kg N ha⁻¹. In 2006, a significant difference was observed in marketable yields, 27.6 and 22.5 MT ha⁻¹ with CRF224 and Urea224, respectively. No significant difference in yields was observed between CRF168 and Urea168. In 2007, marketable yield with the CRF168 treatment (34.9 MT ha⁻¹) was significantly higher than that with Urea168 (29.4 MT ha⁻¹). Treatments CRF224 and CRF168 recorded the highest yields in 2006 and 2007, respectively. In 2006, the lowest mean NO₃-N concentration (0.51 mg L⁻¹) in the water table was observed under treatment CRF224. In 2007, treatment Urea224 recorded significantly higher mean NO₃-N concentration of 3.32 mg L⁻¹ in the water table than treatment Urea168 (1.85 mg L⁻¹). CRF treatments produced better yields in both years, and reduced nitrate leaching into the water table in 2006, compared to urea treatments. No evidence, however, was found that CRF treatments helped reduce leaching compared to urea treatments in 2007.

1:30 Is it profitable to produce greenhouse bitter melon in Southern Virginia?

A. R. Rafie and C. D. Mullins, Virginia State University, Petersburg, Virginia. [V10]

Bitter melon (*Momordica charantia*) is a member of the Cucurbitaceae (gourd) family, a relative of squash, watermelon and cucumber. It is considered an important vegetable for the Asian and Indian population living in the United States. Bitter melon is usually grown in the field during the summer months; however, the price of bitter melon is considerably higher during the December-May when it is usually imported from other countries. No information is available about bitter melon production in a greenhouse setting and whether higher market prices justify the higher production cost. An observational trial was planted in December 2007 at the Virginia State University greenhouse facility to study this possibility, currently data are being collected and the results will be presented at the Florida State Horticulture Society meeting in June.

1:45 Increased Net Profits Result from Greenhouse-grown Colored Pepper Compared to Field Production in Florida

James E. Webb, Daniel J. Cantliffe, Nicole L. Shaw, Horticultural Sciences Department, UF and John J. VanSickle, Food and Resource Economics Department, UF. [V11]

The U.S. is one of the few countries where the majority of bell peppers produced are green colored and grown on raised beds with mulch and drip irrigation. Outside the U.S., peppers are grown in greenhouses and harvested as mature, colored peppers which in turn receive a

premium value at market. Florida bell pepper producers are in direct competition with Mexico, Israel, and Spain due to overlapping seasons in the winter months, while greenhouse producers in Canada and Holland are able to enter the U.S. market during the spring, summer and early fall. Greenhouse vegetable production could be one alternative to field production of bell peppers for Florida fresh market vegetable growers. The objective of this study was to determine the costs and benefits associated with greenhouse pepper production. Through the use of SIMETAR and Excel software, a budget analysis model was created for greenhouse bell pepper production. Variable cost from a greenhouse bell pepper venture was \$128,362/acre (\$2.92/ft²) compared to \$2,772/acre for field production. Fixed costs were \$39,659/acre annually for greenhouse production and \$5,695/acre for field production. Although greenhouse production requires a significantly larger capital investment compared to field production, potential profits from growing colored peppers have been determined to be as much as four times greater in greenhouse production than from field production(\$15,166/acre compared to \$3,289/acre, respectively). Greenhouse production may allow Florida growers searching for alternatives to field production a viable alternative to stay competitive in the U.S. fresh vegetable market.

2:00 Horticultural and Postharvest Potential of Producing Florida Strawberry Cultivars under High Tunnels

Teresa P. Salame, Bielinski M. Santos, Craig K. Chandler, Gulf Coast Research and Education Center, UF, Steve A. Sargent, Horticultural Sciences Department, UF and Alicia J. Whidden, Hillsborough County Extension, UF. [V12]

Protected strawberry production is widely used in Europe and other parts of the world. However, in California and Florida open-field production remains as the main production system. Strawberry production in high tunnels could potentially increase yield, improve fruit quality, promote early ripening, reduce pest incidence as well as rain damage. If adopted in Florida, this technology would open new doors for long-term changes on strawberry production practices and an eventual increase in grower profits. The objectives of this study were a) to compare the growth, fruit earliness and yield of strawberry cultivars, and b) to examine the difference in postharvest quality of strawberries grown under tunnels and open fields. The cultivars Strawberry Festival, Winter Dawn, Ruby Gem and 00-51 were tested inside of 16-ft high tunnels and in open fields during the 2006-07 and 2007-08 seasons. Resulting data showed that the total yields of Strawberry Festival, Winter Dawn, Ruby Gem and 00-51 increased by 36, 70, 66 and 87% in the tunnels in comparison with the open fields in the 2007-08 season, when early freeze or nearly-freezing temperatures occurred. Postharvest quality followed similar trends.

2:15 Growing and Marketing Basil at Local Green Markets in Southeast Florida

Kenneth D. Shuler, Stephen J. Nie, Deanna V. Shuler, and Pei-Ann N. Shuler. [V13]

Stephen's Produce began growing and marketing basil in 2002 from a 0.38 acre backyard market garden to help supply local green markets with a weekend supply of garden fresh produce. Planting schedules, growing and harvesting methods, yields, and sales figures will be discussed. For the 2003-2004 season, 18 plantings of basil were made. Basil was sold at all of the 32 weekends for the sales season which began 19 Oct and concluded 22 May. Stems were cut, bunched, and banded the day before sales. Bunches were either stored in a cooler with ice or

stood upright in a bucket with water. Bunches of 6-8 stems were generally sold for \$1.00 to \$2.00 each. Plants were allowed to regrow for multiple harvests at three to four week intervals. In 2003-2004, an average of 50 bunches of basil were sold each week.

2:30 Potential Profits from Greenhouse-grown Organic Strawberries are Greater than Conventional Greenhouse or Field-grown Strawberries in Florida.

James E. Webb, Daniel J. Cantliffe, Nicole L. Shaw, Horticultural Sciences Department, UF and John J. VanSickle, Food and Resource Economics Department, UF. [V14]

In Florida, 7,100 acres of fresh strawberries were planted in fields during 2003-2004 growing season using plastic mulch raised beds and irrigated using drip irrigation. Florida is the second largest fresh market strawberry producing state behind California. Because Florida enters the market prior to California during the winter months, Florida strawberry value per pound exceeds that of California (\$1.10/lb compared to \$0.62/lb, respectively). Florida strawberry growers are faced with many challenging obstacles such as the loss of methyl bromide, urbanization, weather, water restrictions, pests, and foreign competition. Many of these challenges are removed with the use of a protected structure such as a greenhouse. The objective of this research was to create a model determining the feasibility of greenhouse production of strawberries, grown both conventionally and organically, as an economical alternative for Florida strawberry growers competing in a global market. Although greenhouse production requires a significantly larger capital investment (total costs organic: \$158,076/acre; non-organic: \$168,951/acre) compared to field production (\$25,602/acre), potential profits of greenhouse-grown organic strawberries were as much as 9.5 times greater than field production (\$22,316/acre compared to \$2,419/acre, respectively). Conventionally-grown greenhouse strawberries profits (\$3,855/acre) were 1.5 times greater than field production. These findings are significant for Florida growers searching for alternatives to field production.

2:45 Growing and Marketing Collards and Kale at Local Green Markets in Southeast Florida.

Kenneth D. Shuler, Stephen J. Nie, Deanna V. Shuler, and Pei-Ann N. Shuler. [V15]

Stephen's Produce began growing and marketing collards in 2002 and kale in 2004 from a 0.38 acre backyard market garden to help supply local green markets with a weekend supply of garden fresh produce. Planting schedules, growing and harvesting methods, yields, and sales figures will be discussed. For the 2007-2008 season, five plantings of collards and eight plantings of kale were made. Collards and kale were sold at all but one of the 28 weekends for the sales season which began 20 Oct and concluded 27 April. Young collard and kale leaves were broken off plants, bundled, banded, and stored in a cooler with ice the day before sales. Bunches of 18-30 collard leaves were generally sold for \$2.50 to \$3.00 each. Bunches of 16-20 kale leaves were generally sold for \$2.00 each. In 2002-2003, an average of 15 bunches of collard greens were sold each week. In 2004-2005, an average of 21 bunches of kale were sold each week.

3:30 Ethnic Crop Opportunities for Growers on the East Coast: A Demand Assessment

Ramu Govindasamy, Venkata S. Puduri, Food and Resource Economics Department, Rutgers University, New Brunswick, NJ, Richard Van Vranken, William Sciarappa, Cooperative Extension Service, New Jersey Agriculture Experiment Station, Cook College, New Brunswick, NJ, Albert Ayeni, International Programs, Rutgers University, New Brunswick, NJ, , James E. Simon, Center for New Use Agriculture and Natural Plant Products, Rutgers University, New Brunswick, NJ, Frank Mangan, Department of Plant, Soil, and Insect Sciences, University of Massachusetts, Amherst, MA, Mary Lamberts, Miami-Dade County Extension, UF, Gene McAvoy, Hendry County Extension, UF, and Kim Pappas, Marquis Who's Who, New Providence, NJ. [V16]

The rapid change in the ethnic population in the Eastern Coastal USA has consequences in the food and vegetable markets. As demographic profiles change, growers may wish to change their focus of food and vegetable production to capture the changes in demand. This paper examines the scope of an expansion of ethnic crops in the Eastern Coastal USA by the growers from an economic perspective based on demand revealed by a survey. It gives us an idea and understanding of the demand for ethnic crops by four ethnic groups: Chinese, Asian Indians, Mexicans and Hispanic. The report summarizes the differences and similarities with respect to crop selection, spending patterns. Results of the study have important implications for the development of ethnic crop production locally.

3:45 The Production of European-type Cucumber in a Passively Ventilated Greenhouse is 1200 Times more Profitable than the Production of Field-grown Slicing Cucumber in Florida.

James E. Webb, Daniel J. Cantliffe, Nicole L. Shaw, Horticultural Sciences Department, UF and John J. VanSickle, Food and Resource Economics Department, UF. [V17]

Florida is the leading producer of fresh-market cucumbers in the United States and accounts for 24% of the total value of the U.S. fresh-market industry. Florida cucumbers are generally produced on raised beds covered with polyethylene mulch and fumigated. With the loss of methyl bromide, Florida cucumber producers as with other vegetable growers in Florida, are searching for alternatives. The objective of this research was to gather pertinent information from public, private, and research sources to create an economic feasibility model that compares the costs and benefits associated with field-grown slicing cucumbers and the production of European-type greenhouse cucumber in Florida. Though greenhouse production requires a significantly larger capital investment (total cost: \$391,922/acre) compared to field production (total costs: \$5,620/acre), potential profits have been determined to be as much as 1,206 times greater for greenhouse produced cucumbers than in the field (profits: \$72,775 compared to \$60/acre, respectively). Greenhouses provide opportunities for Florida growers faced with urbanization, water restrictions and the loss of methyl bromide, as well as minimize risks associated with weather, and pests and disease pressures. This study will demonstrate that it is not only economically feasible to produce cucumbers in a greenhouse setting, but the potential profits are significantly greater for greenhouse-grown cucumbers compared to field-grown cucumbers in Florida.

4:00 The South West Florida Small Farmer Network - a Participatory and Regional Approach to Diversified Horticultural Production Extension.

Robert Kluson, Sarasota County Extension, UF, Roy Beckford, Lee County Extension, UF and Robert Halman, Collier County Extension, UF. [V18]

The successful models across the nation for sustainable, small farmers include highly diversified horticultural production systems. These agroecosystems require increased knowledge of different crops, enterprises and marketing compared to past limited commodity-based operations. To address the needs of these farmers, networks have been formed to provide information, research and support that are farmer-driven and locally-based. In May 2007 some of these models were visited and evaluated by UF/IFAS and FAMU extension faculty on the Small Farms Study Tour in GA, SC, and NC. The subsequent report identified strengths and weaknesses that could be addressed by extension facilitation of a growers' network. To this end, the South West FL Small Farmers Network was formed in July 2007, drawing upon the attendance lists of the 2006-07 South Central FL Small Farm Workshops and the 2005-07 SSAWG Conferences. To date, there have been 4 meetings with increasing attendance at each event. The format of these meetings is designed to achieve the following objectives:

- 1) a regional network of beginning and experienced small farmers interested in diversification
- 2) meetings at local small farms with farmer-led tours for sharing of information on production/marketing
- 3) discussion of events/organizations/issues on small farming and local food systems
- 4) promotion of UF/IFAS/FAMU Small Farm & Alternative Enterprise Program resources
- 5) extension presentations on farmer-identified topics

4:15 Greenhouse Production of the Famous St. Augustine Hot Pepper, the Datil (*Capsicum chinense*).

Nicole L. Shaw, Daniel J. Cantliffe, Chad M. Hutchinson, Steven A. Sargent, Horticultural Sciences Department, UF and David Dinkins, St. Johns County Extension, UF. [V19]

Datil pepper (*Capsicum chinense* var.) is well known throughout St. Augustine, FL where it has been cultivated since the 1700s. Liked for their unique sweet-hot flavor, Datils are used for cooking, hot sauces, relishes and other condiments. Mainly grown in backyard gardens, numbers of plants grown for commercial purposes are unknown. Seeds are not commercially available, but found via the internet, festivals, Master Gardeners, or as family heirlooms. Four selections were cultivated under passively-ventilated greenhouse conditions in Citra, FL. Seeds were sown 26 Jan. 2006 and transplanted into 11-L pots filled with pine bark on 15 March. Plants were grown at 2.2 plants/m² until 2 Aug. when plants were cut back to 30-cm height and re-spaced at 0.5 plants/m². Plants were harvested 6 times from 8 June to 31 July at 2.2 plants/m² and 4 times at 0.5 plants/m² from 26 Oct. 2006 to 3 Jan. 2007. Marketable fruit number/m² was similar between densities, but significantly different between selections and ranged from 234 to 392 fruit/m². Interactions between plant density and selection for marketable fruit weight/m² and cull number/m² were significant. "Datil Dew" produced nearly twice the fruit weight at 0.5 than at 2.2 plants/m²; other selections were not affected by plant density (yields ranged from 0.8 to 1.4 kg/m²). A selection named "Norm" (handed down through 10 generations), was included on 17 May 2006 and harvested three times (4, 26 Oct., and 13 Nov. 2006). "Norm" produced nearly three times greater yield than the other four selections in the trial at 998 fruit/m² and 2.7 kg/m².

4:30 *Jatropha curcas* (Physic Nut) as a Potential Biodiesel Feedstock Crop in Florida.

Fitzroy B. Beckford Agriculture/Natural Resources Agent, IFAS, Lee County Extension. [V20]

Jatropha curcas (Family: Euphorbiaceae) is a tropical plant widely distributed in arid areas. Different parts of the plant are used in the ethnomedicine of many countries such as India, Mexico and Nicaragua and various indications on the anti-inflammatory effect of extracts of the leaves have been described in literature. Due to toxic principles including a lectin (curcin), neither the seeds, press cake or oil of *Jatropha curcas* can be used for human or animal nutrition, but this characteristic supports the use of *Jatropha curcas* as a desirable biodiesel feedstock having no food conflicts such as those posed by crops such as soy and corn. The seeds contain about 55 % oil, which after trans-esterification produces biodiesel. The crop significantly out yields soy and corn on a per acreage basis and has comparative advantage in Florida as a biodiesel feedstock. The Lee County *Jatropha* Project currently conducts trials on small plots of *Jatropha curcas* to identify the basic agronomic factors favoring the development of a viable *Jatropha curcas* industry in South Florida. Initial data collection have revealed impacts by drought conditions, flooding, frost, diseases and pests; and supporting secondary data has identified a long existing Florida variety of *Jatropha curcas* with frost tolerance advantages as well as the absence of the toxic principle curcin.

4:45 Artificial and Natural Pollination of Sunn Hemp in Florida.

Romy Krueger, Plant Medicine Program, UF, Koon-Hui Wang, University of Hawaii, Honolulu, HI, Robert McSorley, Department of Entomology and Nematology, UF, and Raymond N. Gallaher, Agronomy Department, UF. [V21]

Sunn hemp (*Crotalaria juncea*) is considered an important cover crop, providing benefits in weed, disease, and pest suppression and supplying nitrogen to the soil. Sunn hemp requires high temperatures, moderate humidity, and frost-free conditions, which define the geographical regions where sunn hemp can be grown and seed produced. Even if frost onset is late, sufficient seed production may not occur if compatible pollinators are absent. Therefore seed production in the US has been limited. To increase seed set natural pollination could be aided by employing alternative pollination techniques. Over the duration of two seasons (2005-2006), various treatments for enhancing pod and seed set were tested in three experiments in north Florida. The main objective was to determine if the plant growth regulator ethephon could substantially improve pod and seed set. Other methods tested were manual removal of the carpel and beating of the stem leading to the targeted inflorescence. In most instances all treatments produced similar amounts of pods and seeds compared to an untreated control. In a few cases, significant ($P < 0.05$) differences among treatments occurred in pod and seed production, but these were very limited. In one trial in 2005, a higher ethephon concentration ($16.7 \mu\text{l ai/m}^2$) performed better than a lower concentration ($8.3 \mu\text{l ai/m}^2$), but did not achieve better results than the control. Results suggest that native pollinators, even if few in number and not as well adapted as their relatives in tropical areas, were competitive with the artificial pollination methods examined in this experiment.

5:00 Effects Of Shade On Growth & Fruit Yield Of Scotch Bonnet Hot Peppers (*Capsicum chinense* Jacq.)

Gardner, S. Cassel, Gilbert L. Queeley, Trevor Hylton, Bravo Brown and Kennard Grant, College of Engineering Sciences, Technology and Agriculture. Florida A&M University, Tallahassee, Florida, 32307. [V22]

Producing Scotch Bonnet hot pepper under shade may enhance fruit quality and increase marketable yield. However, information on this production method is limited. This study was carried out in 2006 and 2007 to determine the optimum level of shade which the crop would tolerate and still give profitable yields. The experiment was a randomized complete block design with treatments (shade houses) providing 0%, 27%, 53% and 92% shade constructed from sarong cloth. The study was conducted at the FAMU Research and Extension Center in Quincy, FL. Data were collected on growth and yield parameters and analyzed using regression and ANOVA. In all except one of the regression models, shading explained more than 70% of the variability in growth parameters with R^2 values ranging from 0.70 to 0.96. However, the explanatory power of shade on yield parameters was less pronounced with R^2 values ranging from 0.45 to 0.72. All yield parameters were inversely related to shade. Post hoc tests following ANOVA revealed no significant difference in time to flowering between the 0%, 27% and 53% shade treatments. However, plants grown under 92% shade were significantly taller, had fewer branches and significantly larger leaves. Fruits harvested from the 0% and 27% treatments were significantly larger ($p < 0.05$) compared to the 53% treatment. Fruit numbers were similar for the 0% and 27% shade treatments but these two treatments produced significantly ($P < 0.05$) more fruits than the 53% treatment. The 92% shade did not produce any fruits and was determined to be unsuitable for growing the crop.

Tuesday June 3

10:00 Estimating Strawberry Yield Using Counts of Plant Sizes and Fruit Stems.

J.W. Noling, Citrus Research and Education Center, UF. [V23]

The objectives of the studies reported herein were to 1) evaluate plant size distributions (canopy diameter) in the field as meaningful indicators of strawberry yield; and 2) to evaluate the temporal relationship between strawberry plant size and average fruit weight and numbers of fruit stems (pedicel) per plant for plants exhibiting different levels of plant stunting due to the sting nematode, *Belonolaimus longicaudatus*. The intent was to establish a chronological record of total fruit picked from the plant during the season and for assessing differences in fruit yield among classes of nematode stunted plants. The relationships between fruit weight or relative numbers of fruit stems per plant with average canopy diameter were always well described by quadratic, polynomial functions for all years and farm locations. In general, 70 to 75% of the variability in fruit stem counts per plant was explained by changes in canopy diameter. However, even when the same strawberry variety was used, different functional relationships between canopy diameter and counts of fruit stems were observed between years and farm locations. This suggests that in addition to cultivar differences, differences in environment and cultural practices also significantly influence crop productivity and potential response to the sting nematode. Overall, field scale changes in strawberry crop productivity due to sting nematode can be

meaningfully determined, on a farm by farm basis, from post harvest assessments of plant sizes and counts of fruit stems per plant.

10:15 Tolerance of Fresh Market Dill, Parsley, and Cilantro to Potential Herbicides in Florida.

W. M. Stall and E. J. McAvoy; University of Florida, Gainesville and LaBelle, FL. [V24]

Trials were established in Hendry County, Florida on an Immokalee fine sand soil in December, 2006 and February, 2007 to evaluate several herbicides on dill (*Anethum graveolens*), parsley (*Petroselinum crispum*) and cilantro (*Coriandrum sativum*). Treatments consisted of pre emergence (PRE) applications of s-metolachlor (Dual Magnum at 0.66 and 1 pt/A), dimethenamid-p (Outlook at 6,12, and 14 fl oz/A) and pendimethalin (Prowl H2O at 1 and 1.5 pt/A). In 2006, prometryn (Caparol) was applied at 1, 2, and 3 pt/A PRE. In 2007, Caparol was applied at 2 and 4 pt/A PRE and 2 and 4 pt/A post emergence (POST). Linuron (Lorox) was applied at 1 lb/A PRE, 1 lb/A POST and 1 plus 0.5 lb/A PRE plus POST in 2006 but the 1 plus 0.5 was changed to 1 plus 1 lb/A PRE + POST in 2007. The crops were least tolerant to Outlook applied PRE. Germination and emergence of parsley was reduced 10 to 30% in 2006 and 0 to 17% in 2007. Later in the season, stunting ranged from 36 to 93% in 2006 and 40 to 98% in 2007. There was no reduction in emergence in cilantro, but the highest applied rates had 10 to 33% stunting. Emergence of dill was reduced in the 12 and 14 fl oz/A rates by 25% in 2006 and 54 to 60% in 2007. No stand reduction or stunting was seen in any of the Dual Magnum or Prowl H2O treated plots. There were also no stand reductions in any of the Caparol or Lorox plots, but some stunting or leaf burn did occur on one or more of the crops with PRE and POST applications of these herbicides.

10:30 Comparative Activity of Registered and Experimental Miticides to Control Twospotted Spider Mite (*Tetranychus urticae* Koch (Acari: Tetranychidae)) in Plant City Area Strawberry Culture.

James F. Price, Curtis A. Nagle, Gulf Coast Research and Education Center, UF. [V25]

Strawberries valued at \$210 million were produced on 7,900 acres in Florida, USA in 2006-2007. Among arthropod pests, the twospotted spider mite (*Tetranychus urticae*) represents the greatest concern and must be managed in most fields and years. This pest is managed by the predatory mite, *Phytoseiulus persimilis*, on about 25 - 30% of the production area. The technique involves scouting the crop until about 5% - 8% of the leaflets possess one or more spider mites then releasing predators one time per season at about one per plant. Additionally, miticides are used to control spider mites on the remaining production area. Programs of spider mite management were evaluated in two field experiments during 2007 that measured effectiveness of various miticides, a non-ionic surfactant, and their frequency of application. Miticides evaluated included two formulations of abamectin and single formulations of bifenthrin, hexythiazox, spiromesifen, and essential oil of *Chenopodium ambrosioides*. All of the miticides provided significant reductions in spider mites. Three weeks after initial application of treatments the most effective reductions occurred when abamectin, bifenthrin, hexythiazox, spiromesifen were used. The effective miticides are derived from numerous modes of action groups and can be rotated in programs of control that provide high quality fruit and can reduce the likelihood of spider mite resistance to the chemicals. With the biological control

method available and sound miticides possessing qualities to delay resistance also available, strawberry farmers should expect mites not to limit production in the foreseeable future.

10:45 Tomato, Pepper, and Watermelon Tolerance to EPTC Applied under Mulch in Florida.

E. J. McAvoy, Hendry County Extension, UF and W. M. Stall, Horticultural Sciences Department, UF. [V26]

As the phase out of the soil fumigant methyl bromide proceeds, research indicates that Florida growers will have to increasingly rely on a combination of a chemical and non chemical pest and weed management strategies which will likely involve the use of cocktails of alternate fumigants such as 1,3 dichloropropene, metam sodium and chloropicrin in combination with an herbicide. Nutsedge (yellow and purple) are among the major weed control challenges in many tomato production systems. Since the leading alternative fumigants provide less than satisfactory control of nutsedge, Florida growers may have to consider the use of a preplant herbicide for control. EPTC is an old but effective material that provides selective pre-emergent control of grasses, sedges and many broadleaf weeds and is labeled for various crops including tomatoes in California. Three years of small plot trials in Florida has shown that application of EPTC to the bed surface just prior to mulch application with a 14 day pre transplant waiting period delivered excellent crop safety with very good nutsedge control. Also, on-farm demonstration trials in Southwest Florida on tomato using EPTC applied to the bed and immediately covered with polyethylene film demonstrated excellent nutsedge control and had no apparent effect on the crop. Early indications are that EPTC may be an important tool in tomato weed management in the development of methyl bromide alternative strategies. A 24c state label has been issued in Florida. Small plot trial results warrant further study of this compound for use also in pepper and watermelon.

11:00 Resistance of Strawberry Cultivars and Advanced Selections to Anthracnose, Botrytis Fruit Rot and Angular Leaf Spot.

Natalia A. Peres, Craig K. Chandler, James C. Mertely, Teresa Seijo, and Catalina Moyer, Gulf Coast Research and Education Center, UF. [V27]

Strawberry cultivars and advanced selections were evaluated for resistance to anthracnose fruit rot (caused by *Colletotrichum acutatum*), Botrytis fruit rot (caused by *Botrytis cinerea*), and angular leaf spot (caused by *Xanthomonas fragariae*) in field trials at Wimauma during the 2004-05, 2006-07 and 2007-08 seasons. Fruit were harvested twice weekly and evaluated for anthracnose and Botrytis fruit rot incidence from January to March of each season. Angular leaf spot incidence was evaluated on the leaves twice during the 2006-07 and 2007-08 seasons. The incidence of anthracnose fruit rot ranged from 1 to 10% in 2004-05, 1 to 9% in 2006-07, and 1 to 54% in 2007-08. 'Sweet Charlie', 'Carmine', and 'Rubygem' were the most resistant cultivars and FL 00-51 and FL 01-116 were the most resistant advanced selections tested; 'Strawberry Festival' was intermediate in susceptibility, and 'Camarosa', 'Treasure', and 'Albion' were the most susceptible. The incidence of Botrytis fruit rot ranged from 5 to 37% in 2004-05, 1 to 8% in 2006-07, and 1 to 6% in 2007-08. Separation among cultivars for resistance to Botrytis fruit rot was more difficult. Advanced selections FL 99-117 and FL 01-116 showed good levels of resistance. 'Sweet Charlie', 'Camino Real', and 'Ventana' were the most susceptible. Angular

leaf spot incidence ranged from 21 to 75% in 2006-07 and 47 to 73% in 2007-08. 'Treasure' and 'Rubygem' showed consistently the lowest incidence.

11:15 Fungicidal Management of Downy Mildew on Cole Crops

R. N. Raid, Everglades Research and Education Center, UF. [V28]

A series of field studies were conducted on a commercial farm in Loxahatchee, FL from 2004-2007 to evaluate fungicidal efficacy against *Peronospora parasitica*, the causal agent of downy mildew on cole crops. Chinese broccoli was selected for testing due to its high susceptibility to this disease. All trials were directed seeded in four rows with a 25-cm row spacing on top of 20-cm raised beds. Experiments consisted of randomized complete blocks with four replications of 7-10 treatments. Experimental units were 4-row 10-m bed sections separated by 1.5-m alleys. Downy mildew arose from natural inocula and disease severity in all trials was severe. A nonionic adjuvant was used as a spreader/sticker and all tests were considered definitive. All fungicide treatments provided significant levels of downy mildew control, including the broad spectrum protectants, Manex (maneb) and Bravo (chlorothalonil). Other fungicides evaluated in these trials included the phosphonic compounds ProPhyt (potassium phosphite) and Aliette (fosetyl-Al), Tanos (famoxadone/cymoxanil), Forum (dimethomorph), Amistar (azoxystrobin), Previcur (propamocarb), Reason (fenamidone), Revus (mandipropamid), and Ranman (cyazofamid). In general, translaminar and systemic fungicides provided for control significantly superior to that afforded by the protectants. Of all the fungicides tested, Revus, Reason, and Forum provided the most efficacious, consistent control. Results indicate that downy mildew management programs using these and other fungicides, tank-mixed or alternated with a broad spectrum protectant or a phosphonic fungicide, gave excellent control without risking phytotoxicity. Such programs are recommended to avoid or slow the risk of developing fungicide insensitivity.

11:30 Application of Imidacloprid and Cultural Techniques for Management of Whiteflies in Cucurbits.

Teresia Nyoike and Oscar E. Liburd, Department of Entomology and Nematology, UF. [V29]

Living mulch, buckwheat *Fagopyrum esculentum* Moench, and UV reflective mulch in combination with (Imidacloprid [Admire 2F]) significantly reduced *Cucurbit Leaf Crumple Virus*, a whitefly-borne virus and its vector (B biotype of *Bemisia tabaci* Gennadius) in zucchini squash. Treatments evaluated included living mulch with and without Admire® 2F and UV reflective mulch with and without Admire® 2F. The mulches were compared with standard white mulch (control) in fall 2005 and 2006 in Florida. In 2005, there were no incidences of insect-transmitted viruses where as in 2006 *Cucurbit leaf crumple virus* (CuLCrV), a virus new to Florida was found. Plants growing within white mulch had the highest incidence of CuLCrV while the lowest incidence was observed in mulches with Admire® 2F. Similarly, mulches with Admire® 2F were more effective in reducing whitefly populations than mulches without the insecticide. The highest numbers of natural enemies were recorded in living mulch treatments, which differed significantly in 2005. Yield results were consistent between the two years of the study. Reflective mulch with Admire® 2F had significantly higher yields than the living mulch treatments and the control. Living mulch treatments had consistently lower yields than all the other treatments. Addition of Admire® 2F enhanced yield only in the living mulch treatment in

2005. Overall, reflective and living mulch with Admire® 2F reduced whitefly densities and hence the virus incidence.

11:45 Evaluation of U.S. Plant Introductions of *Cucurbita pepo* for resistance to *Phytophthora capsici*.

Eileen Kabelka, Horticultural Sciences Department, UF. [V30]

Phytophthora capsici causes several disease syndromes in *Cucurbita pepo* L. (squash, pumpkins, and gourds), including crown rot, foliar blight, and fruit rot, which can lead up to 100% crop loss. Currently, there are no *C. pepo* cultivars resistant or tolerant to this pathogen. The objective of this study was to evaluate a select group of *C. pepo* plant introductions (PIs) for resistance to crown rot symptoms caused by *P. capsici*. One hundred fifteen *C. pepo* PIs, representing 24 countries, were evaluated for response to a cocktail suspension of Floridian *P. capsici* isolates. Replicates of each PI, including susceptible controls, were planted in the greenhouse using a randomized complete block design. At the second to third true-leaf-stage, each seedling was inoculated at their stem base with a 5 mL *P. capsici* cocktail suspension of 2×10^4 zoospores/mL. Fourteen days after inoculation, the plants were rated for their response based on a disease rating scale ranging from 0 (no symptoms) to 5 (plant death). A mean disease rating score (DRS) classified the PI as resistant (mean DRS ≤ 1.9) or susceptible (mean DRS ≥ 2.0). Eight PIs were identified as potential sources of resistance to crown rot symptoms caused by *P. capsici*.

12:00 Control of Diamondback Moth, *Plutella Xylostella* (L.) Using Various Formulations of *Bacillus thuringiensis* and Azadirachtin in Cabbage

D. R. Seal, Tropical Research and Education Center, UF. [V31]

Various studies were conducted in 2007 and 2008 to control diamondback moth (DBM), *Plutella xylostella* (L.) using *Bacillus thuringiensis* and azadirachtin. *B. thuringiensis* significantly reduced diamondback moth in all studies. Application of *Bacillus thuringiensis* at weekly intervals provided better control of DBM than the application of same products at two week intervals. Azadirachtin based products were also effective in reducing DBM. This information will be important in developing an IPM against diamondback moth.