

**Abstracts for the
2007 Joint Annual Meeting of the
Florida State Horticulture Society
and the
Soil and Crop Science Society of Florida
June 3 to 5**

*PGA National Resort & Spa
Palm Beach, FL*

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Citrus Section

Monday June 4

10:00 In-situ Measurement of the Actual Detachment Force of Oranges Harvested by a Canopy Shaker Harvesting Machine.

R. Ehsani, M. Hebel, G. Bora, K. Lee, CREC, SIU. [C1]

Canopy-shaking mechanical harvesters are increasingly being used in Florida to harvest process oranges. Current canopy shaker machines use a series of six- to seven-foot long tines to shake the tree canopy at a relatively constant shaking stroke and frequency. The goal of this study was to evaluate the actual detachment force exerted on oranges at different locations in the tree canopy while harvested by a tractor-driven canopy-shaking harvesting machine. A multi-node, ZigBee-based wireless mesh-network sensor was developed for this study. Each sensor node was equipped with a 3-D accelerometer sensor. Sensors were placed at various locations in the tree canopy. The field experiment was conducted in different groves with a tractor-drawn canopy shaker. The maximum vibration force and detachment of the fruits were measured at different locations and the pattern of force distribution throughout tree canopy were studied.

10:15 Daily fluctuations in fruit detachment force of Valencia orange are related to temperature and relative humidity.

L. Pozo, A. Malladi, F. Alferez, Y. Lluch, and J.K. Burns, CREC, UF/IFAS [C2]

The force required to remove orange fruit from their stems (fruit detachment force, FDF) is closely related to fruit development. FDF increases from fruit set through peel color break. Thereafter, FDF remains relatively stable throughout the maturation stage, but then declines as fruit senescence proceeds. Throughout the course of

our research addressing topics related to abscission, we noted differences in FDF that were dependent upon the time of day measurements were taken. We hypothesized that these daily fluctuations in FDF were correlated with environmental conditions such as temperature and relative humidity. To test this, FDF was measured at 8 am, 11 am, 2 pm and 5 pm for five consecutive days each month, starting in January 2007. FDF readings were taken using five, 10-fruit-replicates harvested from five 6-tree plots. The plots were located within a 17-year-old Valencia grove (*Citrus sinensis* grafted on Swingle) at the Citrus Research and Education Center/UF, Lake Alfred, Florida. Fruit weight, juice content and soluble solids/acids ratio were determined for samples harvested at 8 am and 2 pm. Hourly averages for temperature, relative humidity, solar radiation and wind speed were provided by University of Florida's Florida Automated Weather Network (FAWN) for the Lake Alfred location. The results indicate that daily fluctuation in FDF changed 1 to 1.5 kg-force in a period from 8 am to 5 pm daily. The fluctuations were correlated with temperature and relative humidity in that order, and to a lesser extent with solar radiation and wind speed. Furthermore, FDF fluctuations were correlated with fruit weight and juice content, perhaps due to changes in diurnal variations in fruit water content. These results demonstrate that FDF throughout a given day are not static, and that daily changes in FDF are associated with temperature, relative humidity and fruit weight.

10:30 Reconciling grower and processor objectives when deciding to harvest juice oranges.

Jake Searcy, Fritz Roka, and Thomas Spreen, Food and Resource Economics, UF/IFAS. [C3] (Student Competition)

Growers of processed oranges are paid on the total amount of pound-solids they produce. Hence, a grower's preference of when to harvest would be when pound-solids per acre reach their maximum. The actual harvest date for a specific block, however, is set in conjunction with processor objectives as well. Ratio and color are other quality parameters that need to be considered. Operational capacity at a plant and inventory management decisions within the processing firm are other factors that govern harvest schedules. Overlaying both grower and processor objectives are the availability and cost of harvest crews. This paper develops an optimal harvest-timing model that maximizes combined returns of both growers and processors. One outcome of this model will be to analyze the effect of mechanical harvesting systems on harvesting logistics between growers and processors. Current harvesting logistic is based, in part, on hand-harvest labor. A mechanical system improves harvest labor productivity by 10-fold, hence forcing an increase in the daily trailer allocation to a given harvest site.

10:45 Optimum Nitrogen Rate for Fertigated Young Navel Orange Trees in Arizona.

Ayako Kusakabe, Scott A. White, James L. Walworth, Glenn C. Wright, and Thomas L. Thompson, Soil, Water and Environmental Sci., Univ. of Arizona, Tucson, AZ. [C4] (Student Competition)

A field experiment was conducted during 1999-2002 in central Arizona (AZ) to evaluate effects of N rate and frequency on leaf N concentration and residual soil N of 3-6 yr-old 'Newhall' navel oranges (*Citrus sinensis*) on 'Carrizo' citrange (*Porcirus trifoliata* × *Citrus sinensis*) rootstock. Trees were grown in a calcareous Gilman fine sandy loam and were well-watered with a small positive leaching fraction. The experiment included non-fertilized control plots, and factorial combinations of three fertigation frequencies (27, 9, and 3 applications year⁻¹) and three N rates (0.15, 0.30, 0.45 lb N tree⁻¹ yr⁻¹) from urea ammonium nitrate (32-0-0) applied through microsprinklers. Maximum yields occurred at N rates of 0.23 to 0.34 lb N tree⁻¹ yr⁻¹. These rates were equivalent to only 17 to 34 % of currently recommended N rates for flood irrigated citrus grown in AZ. Fruit size and juice quality were not affected by N rate or fertigation frequency. Leaf N concentrations at yield-maximizing N rates were above 2.7 %. During all three seasons, higher concentrations of residual soil NO₃ resulted from the highest N rate. Our results suggest that optimum N rates for microsprinkler-irrigated 'Newhall' navel orange trees in AZ are much lower than currently recommended N rates.

11:00 Georeferenced ground photography of citrus orchards for canopy research and variable rate technology.

AW Schumann, JP Syvertsen, and KH Hostler, CREC, UF/IFAS. [C5]

Citrus canopy measurements with ultrasonic and optical sensors are being used in Florida to control the placement and rate of fertilizers and pesticides with variable rate application (VRA) spreaders. Additional refinement of agrochemical VRA may also be possible if fruit load, leaf nutrient stress or water stress could be measured on the tree canopies. Detection of early (mild) water stress before it becomes visible and reduces yield, could be used to schedule irrigation, manipulate flower and leaf flushes, or improve fruit quality. In this study we developed ground-based digital photography systems to study the characteristics of citrus tree canopies over large areas. A color digital camera mounted on a moving vehicle was used to capture georeferenced overlapping images of tree canopy in entire orchards. Images were stored on a laptop PC and were processed using red-green-blue (RGB) pixel ratios and thresholds to identify and quantify ripe fruit and green leaf pixels in order to estimate yield and canopy health. A monochrome digital camera with visible and infrared bandpass filters was used to develop a multispectral imaging system capable of rapidly detecting early water stress on tree canopies. Significant correlations were achieved between the camera system and the stem water potential measurements used for quantifying water stress in citrus trees. Additional applications such as detecting pest or disease damage, hurricane wind damage, or flooding / salinity stress are discussed.

11:15 Effect of winter and spring foliar urea, NPK or K-phosphite sprays on productivity of citrus in Central Florida.

L.G. Albrigo, CREC, UF/IFAS. [C6]

Abstract: Previous work in South Florida indicated that winter bloom and post-bloom nutritional sprays of urea, K-phosphite or NPK mixes resulted in increased yields of citrus on poorer flatwood soils. The issue of whether these sprays could enhance yields of better performing Central Florida groves is addressed by these tests for up to 4 consecutive years on the same trees. In NPK tests, winter urea, and bloom and/or post-bloom NPK mixes in all combinations were applied to navel, Hamlin or Valencia oranges or Flame grapefruit. For P tests, K-phosphite or urea were sprayed during the winter and NK with or without PO₄ or PO₃ were sprayed at bloom and/or post-bloom on Hamlin and Valencia trees in several locations in Central Florida. In the NPK tests, rates ranged from 8 to 16 lbs of urea N/ac/spray with either 4 or 8 lbs of P and K. In the P tests, 0, 2.4 or 8 lbs of P (8 lb rate for PO₄ only) were used with 16 lbs N as urea and 8 or 10 lbs of K. In the NPK tests, no significant differences were found in 8 or 17 comparisons (years times sites). In 9 tests (years time sites), NPK applications at bloom or post-bloom had significantly higher or near the highest yields. In 7 cases, treatments that included winter urea were near the lowest yields. For the P tests, 10 of 14 sites had no significant differences in yield. In one test, the control was highest and in another test it was significantly lower than any other treatment. Although there were significant differences in some tests in some years, no consistent pattern was discerned to suggest that foliar sprays of NPK solutions increase yields on blocks that are producing well on standard ground applied fertilizer programs.

11:30 Citrus Water Requirements: Linking Irrigation Scheduling and Fertilizer Strategies.

K.T. Morgan, SWFREC, UF/IFAS. [C7]

Florida citrus trees must be irrigated to reach maximum production due to the low soil water-holding capacity of our sandy soils. Nutrients, especially nitrate-N, move rapidly through these sandy soils with drainage of excess water. In a highly urbanizing state with limited water resources, improved understanding of soil water uptake and movement is needed to optimize irrigation without leaching nutrients and impacting water quality. In a 25-month field study using mature 'Hamlin' orange (*Citrus sinensis* L.) trees, ET_c averaged 1137 mm yr⁻¹, and estimated K_c ranged between 0.7 and 1.1. Day of year explained more than 88% of the variation in K_c when soil

water content (θ) was near field capacity. The value of K_s decreased steadily from 1.0 at field capacity ($\theta = 0.072 \text{ cm}^3 \text{ cm}^{-3}$) to approximately 0.5 at 50% available soil water depletion ($\theta = 0.045 \text{ cm}^3 \text{ cm}^{-3}$). Roots were concentrated in the top 30 cm of soil under the tree canopy (0.71 to 1.16 cm roots cm^{-3} soil), where maximum soil water uptake decreased as soil water content decreased. Estimating daily plant water uptake and resulting soil water depletion based on root length density distribution under a citrus tree would provide a reasonable basis for a citrus soil water balance. It has been demonstrated that nutrient uptake is relatively rapid in citrus. However, leaching of nutrients by over irrigation must be avoided for several days after fertilizer application. Using a water balance, irrigation amounts can be estimated that would provide adequate water for nutrient uptake and reduce leaching from over-irrigation.

11:45 Effect of Water Management and Soil Application of Nitrogen Fertilizers, Petroleum Oils, and Lime on Inoculum Production by *Mycosphaerella citri*, the Cause of Citrus Greasy Spot.

S.N. Mondal, K.T. Morgan, and L.W. Timmer, CREC, UF/IFAS and SWFREC, UF/IFAS. [C8]

Greasy spot, caused by *Mycosphaerella citri*, produces leaf spots and defoliation of citrus trees reducing tree vigor and yield. The fungus produces air-borne ascospores from pseudothecia in decomposing leaf litter on the grove floor. Factors affecting production of inoculum on decomposing leaves were evaluated. Pseudothecial formation and ascospore production increased as greasy spot severity on the leaves increased. Applications of urea, dolomite, or increased irrigation on frequency to leaf litter all reduced inoculum production by 70 to 90 %. Of the N fertilizer materials evaluated, urea and ammonium sulfate were very effective in reducing inoculum, ammonium nitrate less so, and potassium and calcium nitrate were ineffective. Effects of ammonium fertilizers are thought to be due to the toxicity of ammonia gas to the fungus. Soil surface applications of petroleum oils were also reduced inoculum, but had to be applied in large volumes of water for maximum effectiveness. These measures may provide a practical method of reducing inoculum levels and controlling greasy spot and reducing fungicide applications to foliage, but inoculum levels must be reduced greatly to delay symptom development and reduce disease severity.

1:30 The Relative Salt Tolerance Of 'Rangpur Lime' Seedlings And 'Arbequina' Olive Cuttings.

J. C. Melgar, J. P. Syvertsen, CREC, UF/IFAS, V. Martinez and F. Garcia-Sanchez, CEBAS-CSIC, Murcia, Spain. [C9]

The salinity tolerance of citrus rootstocks varies but citrus trees are generally considered to be more sensitive to salinity stress than olive trees that are usually grown from cuttings. We compared the salt tolerance of six-month-old seedlings of the relatively salt tolerant citrus rootstock, Rangpur lime (*Citrus limonia* Osbeck) with similar sized rooted cuttings of olive (*Olea europaea* L. cv. Arbequina). Well fertilized plants were grown in native Candler sand in a greenhouse and watered with either no salt (0 mM NaCl) or 50 mM NaCl for citrus, or with 0 or 100 mM NaCl for olive. Salinity increased Cl^- and Na^+ content in leaves and roots in both species and reduced total plant growth, net photosynthetic rate and stomatal conductance. High concentrations of Cl^- and Na^+ caused a decrease in leaf chlorophyll *a* in citrus but not in olives. Decreased growth and gas exchange was apparently due to a toxic effect of Cl^- and/or Na^+ and not due to osmotic stress since both species were able to osmotically adjust to maintain higher leaf turgor than the non-salinized control plants. The lower osmotic potential values in salinized olive (100 mM NaCl) than in citrus (50 mM NaCl) imply that osmoregulation was more efficient in olive than in citrus.

1:45 Shade effects on salinity tolerance of 'Valencia' orange trees on contrasting rootstocks.

J. P. Syvertsen and F. García-Sánchez, CREC UF/IFAS, V. Martínez, CEBAS, CSIC Universitario de Espinardo, Murcia, Spain and J. C. Melgar, Universidad de Córdoba, Spain. [C10]

We studied the effects of shading and salinity stress on two-year-old potted 'Valencia' orange trees on either Cleopatra mandarin (Cleo, relatively salt tolerant) or Carrizo citrange (Carr, relatively salt sensitive) rootstocks to determine if shading could reduce the negative effects of salinity stress. Trees were grown either under 50% shade cloth or left unshaded in full sun light and half the trees were salinized with 50 mM Cl during two 9 wk salinity periods in the spring and fall interrupted by our normal 11 wk rainy period while the other half received no salinity treatment. As expected, the shade treatment generally reduced midday leaf temperature and evaporative demand while the salinity treatment reduced growth. In non-salinized trees, the shade effect increased midday photosynthesis and stomatal conductance but not leaf transpiration. Shade also increased leaf chlorophyll and water use efficiency of trees on both rootstocks and increased tree growth in Cleo trees. Shade decreased Cl⁻ concentrations in leaves of salinized Carr trees but had no effect on leaf or root Cl⁻ of trees on Cleo. The growth reduction from salinity stress was actually greater for shaded than for unshaded trees. Shaded trees on both rootstocks had higher leaf Na⁺ than unshaded trees after the first salinity period and this shade-induced elevated leaf Na⁺ persisted after the second salinity period in trees on Carr. Although shading reduced Cl⁻ accumulation in 'Valencia' on Carr, shading did not alleviate the negative effects of salinity on growth and Na⁺ accumulation in trees on either rootstock.

2:00 Performance of 'Hamlin' Orange Trees on Flying Dragon Trifoliolate Orange, Changsha Mandarin, and Koethen Sweet Orange x Rubidoux Citrange Rootstocks at Three In-Row Spacings in a Flatwoods Site.
W.S. Castle, J.C. Baldwin, and R.P. Muraro, CREC, UF/IFAS. [C11]

'Hamlin' orange trees on Flying Dragon trifoliolate orange (FDT), Changsha mandarin, or a citrange (Koethen sweet orange x Rubidoux trifoliolate orange [KxR]) rootstock were planted in a commercial site of Riviera series soil near Indiantown in April 1982. The split plot trial was planted on double-row beds with 21 ft between rows and in-row spacings of 7.5, 10, and 12.5 feet. In-row spacing did not affect tree survival which was ca. 85 % after 21 years. Tree losses were mostly from citrus blight. The trees on FDT were smaller (< 7 ft) at age 10 years than those on the other rootstocks which were 8.5 to 9.0 ft tall. Plant height increased as the distance among trees in the row increased, but the differences were small. The trees on FDT had 8.3 boxes/tree at age 10 years in cumulative yield regardless of spacing over 5 seasons between 1986 and 1994. The FDT cumulative yield extrapolates to 67% higher productivity for a hypothetical acre of trees at 7.5 ft in-row spacing versus 12.5 ft. The cumulative yields/tree for those on the other rootstocks at the closest and intermediate row spacings were ca. 10 boxes for Changsha and 8.5 boxes for KxR; however, with both rootstocks, yields increased to 12.8 and 11.2 boxes, respectively, at the 12.5 spacing. Mean juice quality measured in 4 seasons was ca. 6 pounds-solids/box. There were no treatment differences. Overall, the results indicated that medium- to small-sized trees were most productive at 7.5 ft in-row spacing. An economic interpretation will be provided.

2:15 Field Performance of 'Hamlin' Orange on 27 Rootstocks in Lake County.
K.D. Bowman, G. McCollum, and U. Albrecht, USDA-ARS-USHRL, Ft. Pierce. [C12]

Twenty-seven rootstock selections consisting of 25 new numbered hybrids, and two named cultivars were tested as rootstocks for 'Hamlin' orange, *Citrus sinensis* L. Osbeck. The test included six single-tree replications in randomized complete blocks on sandy soil typical of the center of Florida. Four-year cumulative fruit production, fruit quality, tree growth, and tree health were measured and compared among the rootstocks. In cumulative fruit production, the standard rootstock Carrizo citrange was significantly more productive than Swingle citrumelo, while both rootstocks were intermediate in their effect on tree productivity as compared with the new numbered hybrids. The hybrid selections US-1242, US-1235, and US-1239 were significantly more productive than Swingle citrumelo, while the hybrid selections US-1221, US-1223, and US-1224 were significantly less productive than either Swingle or Carrizo. The rootstocks also differed significantly in their effect on fruit brix and soluble solids production. Some of the new hybrid rootstocks appeared promising

for more widespread commercial trials.

2:30 Creating an Improved Sour Orange Rootstock.

K.D. Bowman, U. Albrecht, USDA-ARS-USHRL, Ft. Pierce. [C13]

Sour orange is widely regarded in Florida and other parts of the world as the standard for ideal rootstock performance, except for the major fault of susceptibility to a tristeza virus-induced decline. Although the origin of sour orange was formerly unknown, recent molecular studies have made it clear that it is derived from a cross of pummelo (*Citrus grandis*) with mandarin (*C. reticulata*). Over the past several years the USDA rootstock program has focused on developing an improved sour orange-type rootstock, by making crosses between pummelo and mandarin. The objective is to produce a better rootstock with the broad soil adaptation and all the other good attributes of sour orange, but without the sensitivity to tristeza-induced decline. Thousands of candidate Supersour hybrids have been produced and about 200 of the most promising of these hybrids have been selected for more careful testing. The use of molecular markers and several types of specialized testing for disease and soil factors are keys to finding the handful of Supersour candidates with the best characteristics. The final selection of the few Supersours for industry release will be based on performance in field trials. Some preliminary information will be presented on approach and progress in the generation of a Supersour rootstock.

2:45 Screening citrus rootstock genotypes for tolerance to *Phytophthora-Diaprepes* under field conditions.

J. H. Graham, K. D. Bowman, D. B. Bright and R. C. Adair, Jr., CREC, UF/IFAS, USDA-ARS-USHRL, Ft. Pierce and FLARES, Vero Beach. [C14]

Rootstock germplasm from USHRL breeding program was evaluated in each of three growing seasons at the FLARES. The screening site is located on Winder and Manatee fine sand soil naturally infested with *Diaprepes abbreviatus*, and *Phytophthora nicotianae* and *P. palmivora*. Seedlings grown in containers were planted into a mixture of rhizosphere soil with fibrous roots from beneath Sunburst trees on Swingle rootstock supporting both *Phytophthora* spp. adjacent to the test block. The established trees also served as a source of egg laying adults of *D. abbreviatus*. Seedlings were planted in May 2002 and 2003 and in January 2005 and harvested after 6, 7 and 10 months, respectively. At harvest, soil samples were taken from each tree for enumeration and identification of *Phytophthora* spp. Root systems were visually rated for root rot by the fungi and feeding damage by the weevil on a scale from 1-5 (1=no damage, 5=no undamaged roots). When 2002 and 2004 data were combined, there was a significant positive correlation between whole root system damage and total *Phytophthora* populations. Among the genotypes, mandarins and pummelo hybrids showed greater tolerance to PD complex than trifoliolate and some of its hybrids. In 2005, screening focused on hybrids of pummelo and sour orange. The tolerance of genotypes in the third year was greater than for those tested in the first two years of screening. These findings confirm the promise of certain pummelo and mandarins as parents for hybrids with requisite *Phytophthora* resistance to develop rootstocks tolerant to the PD complex.

3:30 Progress in the Development of New Rootstocks Tolerant of the *Diaprepes/Phytophthora* Complex.

J.W. Grosser, J.H. Graham, D. Bright, A. Hoyte, and H.M. Rubio, CREC, UF/IFAS. [C15]

Our primary strategy for dealing with the *Diaprepes/Phytophthora* problem has been to develop complex rootstock hybrids that have the capacity to tolerate mechanical damage caused by weevil feeding and then recovery by exhibiting vigorous root growth in challenging soils inoculated with both *Phytophthora nicotianae* and *P. palmivora*. We have continued with annual crosses of superior allotetraploid somatic hybrid rootstocks and screening of resulting seed in high pH calcareous 'Winder' soil inoculated with both *Phytophthora* spp. in greenhouse flats. Vigorous healthy "tetrazyg" seedlings are selected and propagated by grafting to vigorous rootstocks and subsequently rooted cuttings. Replicated *Diaprepes* force-feeding assays are conducted in containers, and hybrids selected for reduced mechanical damage are replanted in a 'Winder'/*Phytophthora* mix

to assess recovery potential. During the past year, 3 large sets of new hybrids from 2004 crosses were screened, and several promising hybrids were identified that show excellent capacity for complete root system recovery in this greenhouse test. These are now being propagated for more extensive field evaluation. Data from these assays will be presented. Citrus rootstock breeding and selection at the tetraploid level maximizes genetic diversity and selection efficiency, and shows great promise for generating new rootstocks that can tolerate the *Diaprepes/Phytophthora* complex.

3:45 Use of landscape cloth to manage *Diaprepes Root Weevil* in citrus groves.

L.W. Duncan, S.L. Lapointe and R.J. Stuart, CREC, UF/IFAS and USDA-ARS, Ft. Pierce. [C16]

Significantly fewer *Diaprepes abbreviatus* and *Artipus floridanus* weevils were recovered from ground traps adjacent to young trees growing in soil covered by woven landscape fabric compared to trees growing in bare soil. After four years of growth, the mean cross sectional trunk area of trees growing in fabric-covered soil was 36% greater ($P < 0.02$) than that of trees growing in bare soil. The trees are growing on the central ridge at a site with low prevalence of *D. abbreviatus* and the effects of herbivory and other factors such as soil temperature on tree growth are unknown. A second trial at a flatwoods site with high prevalence of *D. abbreviatus* was initiated using mature trees in March 2007. The effect of landscape fabric on weevil emergence from soil during the annual peak emergence period (Spring 2007) will be presented.

4:00 Integrated approaches for managing the Asian citrus psyllid (Homoptera: Psyllidae) in Florida.

Jawwad A. Qureshi and Philip A. Stansly, SWFREC, UF/IFAS. [C17]

The Asian citrus psyllid (ACP), *Diaphorina citri* Kuwayama, is an invasive insect pest of citrus in Florida. It is an efficient vector of the bacterium, *Liberobacter asiaticum*, causal organism of citrus greening disease or "Huanglongbing" (HLB). The pest was first detected in Florida in 1998 and now occurs on all citrus throughout the state. HLB was first detected in Florida 2005 and is spreading rapidly. Effective means of control are required to manage pest and disease while maintaining ecological and economic sustainability.

Generalist predators such as the ladybeetles, *Curinus coeruleus*, *Olla v-nigrum*, *Harmonia axyridis*, and *Cycloneda sanguinea*, and lacewings such as *Ceraeochrysa* spp. and *Chrysoperla* spp. were observed to make significant contribution to the mortality of ACP resulting in 80-100% reduction in psyllid populations.

In contrast, parasitism by *Tamarixia radiata*, a species specific parasitoid of ACP, was variable and generally low in southwest Florida, averaging less than 12% during May through September and 50% in November.

Foliar applications of insecticides reduced psyllid populations for a short time at best, but also suppressed the populations of predatory ladybeetles. Soil application of aldicarb provided limited control of ACP while drenches of imidacloprid to young trees were effective for two months or more. Our results suggest that the contributions of biological control agents to mortality of ACP need to be conserved and enhanced for successful long term management of pest and disease. Conservation of the natural enemies will require insecticides to be used selectively and at times relatively safe to key predators and parasitoids. The contribution of parasitism should be enhanced by mass release and/or introduction of additional parasitoid species.

4:15 Effectiveness of several soil-applied systemic insecticides for managing the Asian citrus psyllid, *Diaphorina citri* Kuwayama (Homoptera: Psyllidae).

Michael E. Rogers, CREC, UF/IFAS. [C18]

The Asian citrus psyllid [*Diaphorina citri* Kuwayama (Homoptera: Psyllidae)] is the insect responsible for transmission of the Asian strain of the citrus greening pathogen (*Candidatus Liberibacter asiaticus*) in Florida. In citrus producing countries where both citrus psyllids and greening disease occur, insecticide use to reduce psyllid populations is an important component of greening management programs. Foliar insecticide

applications, along with the soil application of aldicarb, are currently the most widely utilized methods of controlling psyllids on large bearing citrus trees in Florida. Under typical growing conditions in Florida, these large trees produce 3-4 major flushes during a year. Insecticide applications for psyllid control are thus timed to reduce psyllid populations during these major flushing periods. Blocks of young non-bearing citrus trees and resets within mature groves present a different management problem. These young trees produce many additional flushes throughout the year which often occur at times when mature trees are not producing new leaf flushes. Thus, these trees will likely attract psyllids and facilitate the increase of psyllid populations within a grove if additional protection is not provided. These trees may also have the potential to become infected by the greening pathogen at a much higher rate than mature trees within the same grove. The most reliable method of protecting non-bearing trees from pests such as psyllids is the use of the soil-applied systemic insecticide imidacloprid. However, due to the potential for insecticide resistance to develop due to widespread use of imidacloprid, additional soil-applied systemic insecticides are needed. Presented are the results of a study to evaluate the effectiveness of other soil-applied systemic insecticides for controlling psyllids on non-bearing citrus.

4:30 Defoliation of Canker Infected Citrus Trees by Diquat.

Shiv D Sharma, M Singh, CREC, UF/IFAS; Eric K. Rawls and John B. Taylor, Jr., Syngenta Crop Protection, North Palm Beach. [C19]

Studies were conducted in winter, spring and fall of 2006 on mature trees to evaluate the potential of diquat (Reglone) as a defoliant in case of canker outbreak. All the leaves were dead after Reglone application. Leaf defoliation gradually increased from 0% at 1 DAT to 90% (grapefruit) in winter; to 79%, 84% (grapefruit), 83%, 85% (oranges) in spring; and 83%, 74% (grapefruit), 90%, 73% (oranges) in fall season, with 1, 2 pt/A Reglone, respectively 14 DAT. Further shaking of trees achieved 100% defoliation. Similarly fruits defoliation successively increased with time until 14 DAT in spring and fall seasons. The values of fruit defoliation at 14 DAT were 94% (grapefruit) in spring and 95% (grapefruit), 100% (oranges) in fall with 2 pt/A Reglone. Shoot desiccation was also successively increased and recorded highest at 14 DAT. Regrowth of new leaves and shoots was recorded in winter season only which started from the end of desiccated shoot in grapefruit 14 DAT. Regrowth increased with the time and >95% of the branches bloomed with new flush in grapefruits and 15 to 20% branches in oranges under both Reglone rates at 28 DAT. Application of Reglone 1 pt/A may be enough to defoliate leaves or fruits with in 14 DAT. Canker inoculums remain viable on green leaves and fruits and due to application of Reglone, the leaves and fruits are dead, became bronze colored and fallen on the earth. Thus defoliation of leaves and fruits may prevent the potential spread of citrus canker disease.

4:45 Severe pruning for control of citrus canker in São Paulo State Brazil.

J. Belasque Jr., Luciane M. Ribeiro, Antonio J. Ayres, and Nelson Gimenes-Fernandes. Fundo de Defesa da Citricultura, Araraquara, São Paulo, Brazil. [C20]

In São Paulo state Brazil, where citrus canker was first detected in 1957, the law related to disease eradication does not allow for the use of severe pruning as an alternative method to tree removal. To evaluate the efficacy of severe pruning for citrus canker control, 20,255 trees of sweet orange (*Citrus sinensis*) in 31 orchard blocks on 9 farms were pruned in three different experiments. Prior to pruning, the incidence of diseased trees per block varied from 0.09 to 100%. Up to two years after pruning, periodic inspections detected diseased trees in 13 orchards (42% of the cases) and the diseased trees detected were not necessarily those that were diseased before pruning. Pruned trees started to produce fruits after two years, and averaged 1 to 2 boxes (40.8 kg) per tree. In São Paulo state, the removal of diseased trees and those suspected of being infected is the most effective method to achieve eradication of the pathogen, whereas severe pruning may be considered a strategy for reducing the inoculum to prevent further spread of the disease.

Tuesday June 5

10:00 Citrus leafminer control and copper fungicide sprays for management of citrus canker on lemon in Tucumán, Argentina.

B. Stein, J. Ramallo, L. Foguet, J. H. Graham, Estación Experimental Agroindustrial O. Colombres, and CREC, UF/IFAS. [C21]

Abamectin and copper bactericides applied alone or in combination with other products for Citrus leafminer (*Phyllosnictis citrella*) and citrus canker (*Xanthomonas axonopodis* pv *citri*) control, respectively, in lemons were evaluated for three seasons in a commercial lemon orchard in Tucuman, Argentina. Treatments were applied on six dates from petal fall to February each year at 28-day intervals with a high volume air blast sprayer. Citrus canker incidence on fruits was reduced significantly by all spray treatments compared with the nonsprayed control. Canker control achieved with copper oxychloride and copper hydroxide was not significantly different. High application rates of copper hydroxide (0.20%) were more effective in controlling the disease than low rates (0.15%). The combination of copper oxychloride with spray oil as an adherent or quaternary ammonium and disinfectants did not improve disease control on fruit. Disease incidence on fruit was reduced 19%, average two years, by abamectin treatment for citrus leafminer (CLM) control applied every 15 days during the period of high CLM pressure. Disease incidence on fruits was not improved by CLM control, when abamectin was combined with 6 copper sprays during the growing season.

10:15 The Impact of Citrus Greening and Canker on Florida Grove Care Management Practices and Costs.

Ronald P. Muraro, CREC, UF/IFAS, Thomas H. Spreen and Jordan C. Malugen, Food and Resource Economics, UF/IFAS. [C22]

With the 2005 finding of citrus greening disease (Huanglongbing or HLB) in Florida citrus along with the discontinuation of the federal-state mandated citrus canker eradication program, Florida citrus growers have initiated new grove care practices to manage these diseases. The new citrus grove practices include the additional sprays for controlling the Asian citrus psyllid insect vector that transmits the HLB bacteria, the copper sprays to control the spread of citrus canker in the grove and the field inspections for identifying trees infected with citrus greening and for certification of a fresh fruit block free of citrus canker. This paper will explore the costs of the additional grove care practices being used to manage citrus greening and canker. The impact that these additional costs will have on replanting of citrus will also be discussed.

10:30 The Projected Impact of Citrus Greening in Sao Paulo and Florida on Processed Orange Production and Price.

Thomas H. Spreen, Food and Resource Economics, UF/IFAS, Mark G. Brown, FDOC Economic-Market Research Department, and Ronald P. Muraro, CREC, UF/IFAS. [C23]

Citrus greening is a highly destructive disease that attacks a number of plant and tree crops including citrus. The only known control for greening is eradication. Therefore, the presence of greening will affect fruit production and tree mortality. Currently, greening is present in both Sao Paulo, Brazil and Florida, who collectively account for 80 percent of world processed orange production. In this paper, projections of future orange production and prices are provided in which the likely effects of greening are incorporated.

10:45 Culturing Fastidious Prokaryotes - Points to Consider When Working with Citrus Greening.

M. J. Davis and R. H. Brlansky, CREC, UF/IFAS [C24]

The first of the fastidious prokaryotic plant pathogens to be grown in axenic culture was the phloem-limited *Spiroplasma citri* which causes stubborn disease of citrus. Others followed and include *Spiroplasma kunkelii* (Corn stunt) and *Spiroplasma phoeniceum* (Periwinkle yellows). The vast majority of spiroplasmas

are associated with arthropods and don't cause plant diseases. The axenic culture of fastidious xylem-limited bacteria followed the work on these phloem-limited fastidious bacteria. The Gram-negative bacterium causing Pierce's disease of grapevines and now known as a pathogenic variant of *Xylella fastidiosa* was the first isolated in culture in 1978. The Gram-positive coryneform bacterium causing ratoon stunting disease of sugarcane and known as *Clavibacter xyli* subsp. *xyli* (*Liefsonia xyli* subsp. *Xyli*) was the second. Media formulations for culturing these bacteria have served as models for the development of other media for the culture of fastidious plant-associated microbes. Knowledge gained in such efforts may lead to the culture of the citrus greening bacterium. The importance of culturing the causal agent as a tool for the management of citrus greening is discussed.

11:00 Characterization of recently introduced HLB and CTV isolates.

W. Dawson, S. Garnsey, C. Robertson, S. Gowda, S. Tatineni, M. Irej, P. Sieburth, and M. Hilf, CREC, UF/IFAS, and USDA Horticultural Research Laboratory, Ft. Pierce. [C25]

Severe stem-pitting isolates of *Citrus tristeza virus* (CTV) were found in Florida citrus 5 years ago, followed by the discovery two years later of the citrus greening disease (Huanglongbing: HLB) caused by the bacterium *Candidatus Liberibacter asiaticus*. The new CTV isolates are members of the VT group, which contains isolates more severe than the mild and decline isolates now common in Florida. These new isolates are apparently moving rapidly into commercial citrus. Individual VT isolates from the same field vary considerably in severity, suggesting that the virus population may be still evolving. Grapefruit seedlings inoculated with some of the VT isolates have shown severe reactions, but effects on larger trees remain unknown. Additionally, severe CTV-like symptoms were observed in some of the trees initially discovered with HLB infections, suggesting that additional severe isolates of CTV may have been co-imported with the citrus greening pathogen. The similarity of these isolates is under investigation. The establishment of greening in Florida poses a major threat to future production, so development of effective management strategies is urgently needed. Using information and techniques developed for studying CTV, we are examining the movement and distribution of *Liberibacter* to optimize sampling times and patterns for better detection, especially in trees without definite visual symptoms. We also are examining the relationship between symptom expression and *Liberibacter* titers in infected trees.

11:15 Update on the Southern Gardens Diagnostic Laboratory and the procedure for submitting diagnostic samples for Huanglongbing.

M. S. Irej, P. Z. Mai, US Sugar Corp., and T. Gast, Southern Gardens Citrus Corp., and J.H. Graham, CREC, UF/IFAS. [C26]

Citrus Huanglongbing (HLB, syn=citrus greening) is considered to be the most severe of all citrus diseases worldwide. The disease greatly debilitates trees and results in losses in crop production. HLB was reported for the first time in Florida in late August, 2005. Since the initial discovery in Dade County, the disease has been found in at least 15 counties, primarily in southern Florida and the number of known infected properties increases almost daily. As the number of infected groves continues to increase, grower awareness and concern has also increased. This has resulted in an increased need to have laboratory testing available to growers and homeowners to verify and confirm the presence of HLB on their properties so that control measures can be implemented. In late October, 2006, Southern Gardens Citrus Corporation in cooperation with the IFAS, University of Florida, opened up a testing facility available to all growers to test samples for the presence of the *Candidatus Liberibacter asiaticus*, the causal organism of HLB in Florida. In the first 16 weeks of operation, the facility has tested 8,213 samples with an average throughput of 483 samples per week. The average turn around time from receipt of the sample to the reporting of results during this period was 16 days. Results are reported directly back to the grove owners and summary reports are turned in to the Florida Department of Agriculture and Consumer Services and USDA-APHIS to be incorporated into databases maintained by both agencies. Any findings of regulatory significance are resampled and retested by both agencies before

being released as official findings. Detailed sampling procedures and the process for sample submission can be obtained from the Highlands County Citrus Growers Association website at: <http://www.hccga.com/posgreen/061221mikeirey.pdf> or by contacting Mike Irely directly.

11:30 Seasonal and spatial variability in the titer of *Candidatus Liberibacter asiaticus* in sweet orange and the Asian citrus psyllid as it relates to sampling.

M. S. Irely, US Sugar Corp., D. G. Hall and T. R. Gottwald, USDA-ARS, and T. Gast, Southern Gardens Citrus Corp. [C27]

Citrus Huanglongbing (HLB, syn=citrus greening) is considered to be one of the most severe diseases of citrus worldwide. Among the control measures recommended to manage HLB is the early identification and removal of infected trees, i.e. roguing. Since its discovery in Florida in late August, 2005, the initial identification and verification of HLB has been problematic due to the similarity of some HLB symptoms to symptoms of nutritional, physiological, and other disease problems. Therefore the initial confirmation of the disease is usually based on laboratory testing employing one of several polymerase chain reaction (PCR) assays that are available to screen for the presence of *Candidatus Liberibacter asiaticus* (CLA), the causal agent of HLB in Florida. Although the tests are well documented in the literature, it is also well documented that testing for the presence of CLA can be problematic, presumably due to the low titer and incomplete distribution of CLA in the plant. However, reliability could be related in part to seasonal and spatial variability of the titer and distribution of CLA in the trees. The present study was conducted to determine if the titer of CLA in infected trees and psyllids varies over time and location sampled within the tree. Tissue samples were taken from multiple locations on naturally HLB-infected Valencia trees from a commercial grove in south Florida and tested on a monthly basis for the presence of CLA using a real-time PCR assay. Psyllids were also collected and tested on a monthly basis using yellow sticky traps hung in HLB-infected trees. Over the 10 month period studied, CLA titer from the plant samples, as measured by CT values, was highest in the months preceding the spring flush (January and February), then declined during the spring flush and succeeding months (March, April, May), and then gradually increased from June to October. The effectiveness of testing based on % PCR-positive results from known HLB-infected trees was highest in January, February, March, September, and October. HLB was seldom detected in May, June, and July. Titer also differed by tissue type. CLA was detected in psyllids only during January, February, and April, however these data were affected by the low numbers of psyllids that were trapped late in the year after an intensive psyllid control program was implemented in the commercial grove.

Handling & Processing Section

Monday June 4

10:00 BASF FreshSeal® CHC Helps Keep Packed Tomatoes Firmer and Fresher Longer.

Mark P. Kohout, BASF Corporation, Sarasota; Mark A. Ritenour and James J. Salvatore, IRREC, UF/IFAS. [HP1]

FreshSeal® CHC is a naturally occurring, polymer-based edible coating marketed to improve the postharvest quality of fresh horticultural products such as tomatoes and peppers. A series of packinghouse experiments in Florida evaluated the effects of FreshSeal® application on tomato (*Lycopersicon esculentum* Mill) fruit ripening and quality retention under commercial and simulated commercial conditions. These experiments were designed to compare non-treated fruit, FreshSeal® CHC-treated fruit, and fruit coated with a commercial wax using commercial varieties of round and Roma tomatoes treated on the day of packing. Fruit were harvested at either the vine ripe or mature green stage and consisted of five replicates of approximately 50 or 100 fruits for round and Roma, respectively; all fruit were exposed to ethylene. In addition to total unmarketable fruit including soft and decayed fruit, individual fruit firmness, skin peel puncture resistance, external color, and water loss

were quantified. In general, FreshSeal® treated tomato samples were significantly firmer than the control at both one and two week(s) after packing and contained less decay. In addition, coating mature green tomatoes with FreshSeal® CHC resulted not only in more rapid and uniform color development but also produced a unique color.

10:15 Effect of Edible Coatings and Other Surface Treatments on Pericarp Color of Thai Lychee Cultivars.

Nithiya Rattanapanone, Chiang Mai University, Chiang Mai, Thailand; Anne Plotto, and [Elizabeth Baldwin](#), USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven. [HP2]

Lychee fruit have a brilliant red pericarp upon harvest that turns brown during shipping and storage. 'Hong Huay' and 'Jugkat' lychee fruit (*Litchi chinensis* Sonn.) were harvested at the commercial stage (90-100% red pericarp) in Thailand. In four separate experiments, fruit with pedicels were dipped for 30 s in various treatment solutions including: no dip and water as controls, ascorbic acid (AA), citric acid, acetic acid, chitosan, HCl, and two Semperfresh products, in an effort to retard browning of the pericarp. Fruit were air-dried, and stored at 2 or 10 °C with 90% relative humidity for 1-3 weeks. Total soluble solids (TSS), titratable acidity (TA), weight loss, total ascorbic acid (TAA) and color (hue angle and chroma) were measured every day or once a week. During storage, TSS and pH generally increased while TA and TAA generally decreased (except for those treatments that included AA). Most treatments reduced weight loss compared to untreated fruit. Treatment of lychee fruit with acidified coatings including Semperfresh, acidified Semperfresh (with 2% citric acid), Semperfresh Lychee Treatment Power (LTP) ± citric acid and chitosan + HCl sometimes resulted in brighter, redder color than control fruit, as evidenced by lower hue angle or higher chroma values.

10:30 Optimization of a HPMC, Bee's Wax and Shellac Edible Coating for 'Valencia' Oranges and 'Marisol' Tangerines.

Maria-Llanos Navarro-Tarazaga and M.-Bernadita Pérez-Gago, Instituto Valenciano de Investigaciones Agrarias, Valencia, Spain; [Anne Plotto](#) and Kevin L. Goodner, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven. [HP3]

Commercial coatings used for citrus fruit include carnauba- and shellac-based waxes or resins, which provide an attractive shine to the fruit, but are not necessarily made of 100% food grade ingredients. A new food grade formulation based on bee's wax, shellac resin and hydroxypropylmethylcellulose (HPMC) was tested, along with an experimental polyethylene-candellila (PE) wax emulsion, and two commercial citrus coatings (shellac and carnauba based). 'Valencia' oranges from a local grove were washed, hand-coated, dried, and stored 2 weeks at 23-25 °C. The PE and carnauba coatings provided the best weight loss control, and were preferred for appearance by a taste panel. The HPMC coating provided the least shininess, and rated similarly to control for appearance. On the contrary, shellac coated fruit were the shiniest, but had intermediate appearance preference ratings. Shellac coated fruit had high levels of ethanol and CO₂, followed by HPMC-coated fruit.

These indicators of anaerobiosis are known to produce off aromas. The HPMC formulation was modified to increase permeability to O₂ and CO₂ and were tested on 'Marisol' tangerines from Spain, and stored at 23 °C for 3 weeks. A reduction of the HPMC:glycerol ratio from 2:1 to 1:2 improved gas permeability and sensory quality of tangerines stored 1 and 2 weeks at room temperature. Increasing solid content (SC) from 5% to 8% reduced weight loss. Therefore, HPMC formulation with HPMC:glycerol ratio of 1:2 and at 8% SC was retained for further applications with tangerines.

10:45 Relationship between Weight Loss and Visual Quality of Fruits and Vegetables.

[Cecilia N. Nunes](#), Food Science and Human Nutrition, UF/IFAS, and Jean-Pierre Emond, Agricultural and Biological Engineering, UF/IFAS. [HP4]

Loss of water from harvested fruits and vegetables is a major cause of deterioration during the postharvest period. Loss of substantial amounts of water may result in important quality and economic losses, and even when weight losses are subtle the visual, compositional and eating quality of produce may be impaired. Fourteen freshly harvested fruits and vegetables were stored at 20°C and 85 to 95% relative humidity, and weight loss and visual quality attributes (firmness, wilting, shriveling or/and browning) were evaluated every day or every other day until each individual fruit or vegetable was considered unacceptable for sale. A highly significant correlation was found between weight loss and visual quality attributes for each fruit and vegetable evaluated. As weight loss increased, firmness decreased, and wilting, shriveling and browning increased. A maximum acceptable weight loss before each selected fruit or vegetable became unacceptable for sale is suggested.

11:00 Changes in the Postharvest Quality of a Datil Selection and 'Datil Dew' Hot Peppers as Affected by Storage Temperature.

Elena E. Lon Kan, Steven A. Sargent, Nicole L. Shaw, and Daniel J. Cantliffe, Horticultural Sciences, UF/IFAS, and Amy Simonne, Family, Youth and Community Sciences, UF/IFAS. [HP5]

Two yellow hot peppers (*Capsicum chinense*), a local selection named Datil selection and a commercial variety with Datil background, 'Datil Dew', were studied. Both peppers were grown hydroponically in greenhouses. Ripe peppers were packed in vented clamshells and stored the day of harvest at 5, 10 or 20°C. After 14 days containers were transferred to 20°C for 4 days. General appearance, weight loss, respiration rate, pH, acidity, total soluble solids, and carotenoids (HPLC) were evaluated. Average of Datil selection and 'Datil Dew' peppers were: Respiration rate (ml CO₂/kg-hr) at: 5°C = 11.10 and 16.49; 10°C = 15.10 and 18.39; 20°C = 41.95 and 52.58. The weight loss for 6, 14 and 18 days for Datil selection at 5°C = 2.74%, 4.65% and 15.05%; 10°C = 5.03%, 9.25% and 18.02%; 20°C = 16.82%, 33.59% and 40.16%; 'Datil Dew' was at 5°C = 1.52%, 2.52% and 7.81%; 10°C = 2.36%, 4.16% and 8.47%; 20°C = 8.54%, 16.47% and 20.09%; Datil selection and 'Datil Dew' lutein contents (µg/g) were: at 5°C = 68.70 and 52.44; 10°C = 94.49 and 49.75; 20°C = 100.57 and 48.14; beta-carotene content (µg/g) were: at 5°C = 31.51 and 6.37; 10°C = 43.86 and 6.74; 20°C = 15.65 and 6.48. Both peppers did not show chilling injury after 14 days storage at 5°C; those stored at 10°C had slight signs of shriveling; however at 20°C the peppers became unmarketable by 11 days due to shriveling and mold decay.

11:15 A High Sensitivity Continuous Ethylene Monitoring Device for Postharvest Applications.

Reza Shekarriz, Fluid Analytics, Inc., Portland, Oregon. [HP6]

As a fruit ripening hormone, ethylene gas is effective at greater than 0.1 ppm. Constant ethylene monitoring is essential because automotive emissions, plastics, and fluorescent lights all increase ethylene gas levels. Ignoring the ethylene gas produced by or surrounding fruit, at various stages postharvest could be costly. Here, a new approach for post-harvest ethylene sensing is presented. It is based on electrochemical oxidation of the ethylene molecules flowing past the sensor. The signal generated from the oxidation of ethylene on a nanoporous gold catalyst provides a direct measure of the gas concentration. The overall system for electrochemical sensing is relatively simple and requires few components, thus providing a very cost effective gas monitoring system. Furthermore, the direct contact between the molecules in air and electrocatalytic surface renders this process more sensitive than conventional diffusion-type electrochemical cells. The electrochemical sensor developed by Fluid Analytics, ETH-1010, has been packaged into a complete field portable unit. It continuously samples and monitors the ethylene in air at a specified flow rate, commonly between 100 ml/min and 1000 ml/min. The sensor detection thresholds are less than 100-ppb although detection thresholds of 10-ppb and better have been tested. Bundled with CO₂, oxygen, temperature, and humidity sensors, one is able to use this system to monitor the ethylene production and respiration rates for a single apple, or the real-time

concentrations in a warehouse full of apples. This system is currently being deployed for fruit maturity monitoring, CA room ethylene monitoring, and general scientific use in the laboratory.

1:30 Harvesting Carambola at Different Ripeness Stages Affects Postharvest Quality.

Oren Warren, Marcio E. Pereira, Adrian D. Berry, and Steven A. Sargent, Horticultural Sciences, UF/IFAS.
[HP7] (Student Competition)

Carambola (*Averrhoa carambola*) fruit grow well in south Florida. The fruit is usually harvested commercially at the color break stage, while the fruit is still firm, to minimize mechanical injury. A study was conducted to determine the effect of carambola harvested at three ripeness stages (color break, half yellow, and full yellow) on postharvest quality. Treatments were +/- a commercial carnauba-based wax, three ripeness stages, and either holding for 7 d at 5 °C before transferring to 20 °C or holding constantly at 20 °C in four replications. At full-ripe stage (orange) the non-waxed fruit typically showed more shriveling at the stem end, had rib softening, and lost about twice as much weight as the waxed fruit; however, the waxed fruit held initially at 5 °C then at 20 °C displayed non-uniform color development and internal tissue browning. Those fruit that were held constantly at 20 °C had non-uniform color and fermented flavor. Fruit harvested at the yellow color stage had a higher initial soluble solids content (7.9 °Brix) and lower total titratable acidity (0.25%) than the fruit harvested at the color break (6.7 °Brix, 0.28% acid) and half yellow stages (7.1 °Brix, 0.31% acid). Sugar-acid ratios for these respective harvest stages were: color break 23.3, half yellow 22.6, and full yellow 31.9.

1:45 Ripening of 'Tainung 1' Papaya Fruit Delayed by 1-Methylcyclopropene.

Marcio Eduardo Canto Pereira, Horticultural Sciences, UF/IFAS; Djalma Barbosa dos Santos, Aline Simoes da Rocha Bispo, Silvia Barbosa dos Santos, Embrapa Cassava & Tropical Fruits, Cruz das Almas, BA, Brazil.
[HP8] (Student Competition)

The ethylene inhibitor 1-methylcyclopropene (1-MCP) has proven that this compound is highly effective in delaying ripening and/or extending shelf-life of many horticultural products. In order to investigate the effects of postharvest application of 1-MCP on papaya ripening, an experiment was carried out at the Embrapa Cassava & Tropical Fruits Research Center in Cruz das Almas, Bahia State, Brazil. Fruits of 'Tainung 1' papaya were harvested at the color break stage, washed and immersed in water with 100 ppm free chlorine for three min and air dried. Fruit was treated with gaseous 1-MCP (100 or 300 nL.L⁻¹), obtained by dilution of the commercial powder (SmartFresh®) in water in hermetically sealed chambers (186 L) during 12 h. Control fruits were held in air. Subsequently fruits were allowed to ripen at 27 °C and 80% relative humidity. Quality evaluations were assessed on four fruit replicates the day of harvest and each 3 d during 12 d for epidermal color, pulp firmness, soluble solids content and total titratable acidity. 1-MCP effectively delayed epidermal color development and strongly affected pulp firmness. Treated fruits reached >75% yellow 6 d later than the control for both concentrations. Control fruit lost firmness rapidly (3 d), while fruit treated with 100 nL.L⁻¹ 1-MCP did not soften significantly until after 12 d storage; those treated with 300 nL.L⁻¹ showed the first sign of softening after 12 d. The results showed that 1-MCP is highly effective in delaying ripening of 'Tainung 1' papayas. The effects were stronger with 300 nL.L⁻¹.

2:00 Temperature Tracking Using RFID in the Pineapple Supply Chain.

C. Amador and J.P. Emond, Agricultural and Biological Engineering, UF/IFAS; C. N. Nunes, Food Science and Human Nutrition, UF/IFAS, and K. V. Chau, Center for Food Distribution and Retailing, UF/IFAS.
[HP9] (Student Competition)

The global pineapple market requires highly effective temperature controlled supply chains that will prolong

the product's shelf life while avoiding its chilling injury. Current temperature tracking systems lack the accuracy and simplicity demanded by the real conditions of a fast-paced produce supply chain. In recent years RFID technology has been suggested to be an enhanced method for temperature tracking because of its many benefits, such as using very little instrumentation, offering the quick readings necessary for real-time decision making, and allowing the capture of long-duration temperature profiles. Still, its limitation lies on its failure to provide accurate temperature readings on the critical points of the pallet. Our research presents a solution to this problem by developing and applying heat transfer software able to predict temperatures at different locations in the pallet based on RFID temperature readings obtained on the exterior of it. In order to do so, the creation of a Customized Temperature Tracking System is proposed. This involves three steps: a cold chain analysis, the creation of the software and the model validation. It is expected that once applied, this RFID Temperature Tracking System will be a powerful decision-making tool for both suppliers and retailers, and that their economic returns and the satisfaction of their customers will increase. In addition, it is also anticipated that, when joining forces with shelf-life prediction models, this technology will be able to offer in situ real-time shelf-life estimates for produce loads during each step of the supply chain.

2:15 Visualization of Polyphenol Oxidase and Phenolics Distribution in Mesocarp of Fresh-Cut Mango (cv. Kent) During Storage.

Sharon Dea and Jeffrey K. Brecht, Horticultural Sciences, UF/IFAS and Cecilia do Nascimento Nunes, Food Science and Human Nutrition, UF/IFAS. [HP10] (Student Competition)

Sensory quality attributes such as flavor, aroma, texture and visual appearance are important considerations in the commercialization of fresh-cut fruits. When fruits are processed (peeling, cutting and slicing), enzymatic browning significantly increases due to the release and interaction between polyphenol oxidase (PPO) and phenolic compounds. In this study, enzymatic browning activity of mango (cv. Kent) mesocarp tissue was correlated with the incidence of browning during storage. PPO activity was tested by applying a catechol solution to different sections of the mesocarp, and color development was evaluated every minute during a 10-minute period. Total phenolic content was evaluated similarly using a Nitroso test, which results in dark red color formation in the presence of phenolic compounds. PPO activity was found to be moderately uniform through the mesocarp tissue, but was more intense close to the endocarp. Phenolic compounds in the mesocarp tissue were present in higher concentrations near the endocarp and subtending the peel. Overall, the incidence of browning on the fruit cut surface was not considered to be a limiting visual quality factor for fresh-cut mango (cv. Kent) during storage.

2:30 Aroma Volatiles in Tangerine Hybrids.

Pauline Kerbiriou, Kevin Goodner, Anne Plotto, and Elizabeth Baldwin, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven, and Fred Gmitter, CREC, UF/IFAS. [HP11] (Student Competition)

Volatile compounds are well known to contribute to food flavor. In a breeding program, the knowledge of the identity and quantity of volatile compounds may help selecting fruit with desirable eating quality. Many studies report which compounds are responsible for orange juice flavour and aroma, but the flavour of tangerines has been less investigated. This study was undertaken to give a precise description of the most common compounds present in a wide range of tangerine hybrids. Fruit were harvested biweekly, washed, and manually squeezed. Then 2.5 mL of saturated sodium chloride were added to 2.5 g of juice in 20 mL vials and stored at -20 °C until analysis. Headspace was sampled by SPME and analyzed by gas chromatography and mass spectrometry. Early maturing tangerine hybrids were rich in alcohols (ethanol, pentanol, linalool, α -terpineol, 4-terpineol), hydrocarbons (limonene, α -pinene and β -pinene), and aldehydes (acetaldehyde, perillaldehyde, pentanal, octanal, 2-E-octenal, 2-E-nonanal), all of which were found in previous studies. Moreover, several acids (mainly hexanoic acid, benzoic acid, and nonanoic acid) were detected by mass spectrometry, which could contribute to the taste of

the fruits. In addition, other aromatic compounds were found in the juices (α -cubebene, β -ionone), and may also contribute in the aroma of the fruits.

2:45 Kinetics of Dissolved Oxygen and Vitamin C Consumption in Fresh Orange and Pineapple Juice.

Rosalía García-Torres, Jose I. Reyes-De-Corcuera, Russell Rouseff, CREC, UF/IFAS. [HP12] (Student Competition)

Orange juice is the most consumed fruit juice in the world. Pineapple juice consumption has been continuously increasing over the last 10 years. Pineapple juice is often mixed with orange and other tropical fruit juices to add flavor. Orange and pineapple juices are an important source of vitamin C with content of about 45 mg/100g and 36.2 mg/100g respectively. The kinetics of degradation of vitamin C in orange juice is available but information is incomplete. For pineapple that information is not available. Dissolved oxygen (DO) is associated to vitamin C degradation in fruit juices but there is little information about the kinetics of DO consumption. This study presents the kinetics of DO and Vitamin C degradation in fresh orange and pineapple juices at 5 – 45 °C. Order of reaction, rate constant and activation energy are determined.

3:30 Advances in Commercial Applications of the AgroFresh Technology (1-MCP) on Fruits and Vegetables.

Alvaro Ureña-Padilla, AgroFresh, Inc., San Pedro Montes Oca, Costa Rica. [HP13]

1-Methylcyclopropene (1-MCP), an ethylene antagonist that inhibits ethylene signal transduction by preventing ethylene from binding to its receptors is a useful tool to further identify ways to affect the physiological changes associated with ethylene. Since the commercial launch of the SmartFreshSM Quality Systems (AgroFresh, Inc.) in 2001 to enhance fruit quality in apples, ethylene management in such diverse crops as tomato, corn, kiwifruit, bananas, and ornamentals is being studied through collaborative research between universities and Agrofresh, Inc to extend shelf-life. The work in laboratories and fields has facilitated novel ideas for the commercial application of (1-MCP). Data on the effect of SmartFreshSM technology on melons and tomatoes out of fields from Central America and the US are backing up the potential of 1-MCP to change our concepts about how to best preserve fruit quality. The commercial release of InvinsaTM technology in agronomic crops and HarvistaTM in tree crops, both based on 1-MCP field applications for reducing the negative effects of ethylene, is a signal of the potential of this technology in many innovative concepts. The potential for using AgroFresh technology in dipping or spray treatments opens new possibilities for more friendly applications in packinghouses.

This paper provides a review of our current experience in experimental and commercial applications for the AgroFresh Technology on fruits and vegetables. Most of the information is based on work done by researchers based at the University of Florida, Universidad de Costa Rica, and University of California Davis on bananas and tomatoes.

4:00 A Simple Method to Test the Efficiencies of Postharvest Decay Control Treatments.

Jan A. Narciso, Anne Plotto and Elizabeth A. Baldwin, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven. [HP14]

It is often difficult to extrapolate information obtained under laboratory conditions to field conditions. This is especially true in the case of translating reactions between microorganisms grown in a Petri dish with experimental antimicrobials, and using these experimental compounds in commercial applications. Often large volumes of fruit are used for a virtually untested protocol and results in wasted fruit and a large expenditure of time and materials. An intermediate method where experimental compounds could be tested on produce without expending large quantities of either fruit or experimental compound would be practical and economical. An intermediate method developed at the CSPL employs the use of a small experimental

chamber with pieces of fruit to be tested with experimental compounds that would result in effects that more closely reflect commercial application than the laboratory dish. This method is easily scaled up to commercial application with similar results to chamber data.

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

R. Goodrich-Schneider, Food Science and Human Nutrition, UF/IFAS and M. D. Danyluk, L.M. Friedrich and R. Ehsani, CREC, UF/IFAS. [HP15]

For Florida to effectively compete in the world citrus industry, significant reductions in harvesting costs will be necessary. Mechanical harvesting (MH) can be thought of a two-step process: (i) removal of fruit from the tree and (ii) collection of fruit (immediately, by a catch-frame device or during retrieval of fruit from the ground). This study evaluates the microbiological aspects of mechanically-handled fruit with respect to fruit surface 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). If the pickup machine was not utilized, fruit was retrieved from the collection bin (MH/C), and compared to a hand-harvest control. Microbial analysis included total plate count (TPC), acidophilic organisms (OSA), and generic *Escherichia coli* (as an indicator of potential contamination) and *Salmonella* testing on pooled samples of 5 oranges. In general, 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. *E. coli* was detected in three of 10 pooled samples in both MH and MH/PU fruit. *Salmonella* was detected in one of 10 pooled samples from MH/PU fruit. There is no correlation between presence of *E. coli* and presence of *Salmonella*. Substantial and significant differences exist between the two runs conducted to date, possibly due to factors including weather, equipment sanitation, grove location and tree/fruit treatments during production.

4:30 Effectiveness of Different Preharvest Fungicide Applications at Controlling Postharvest Diseases of Florida Citrus.

James J Salvatore and Mark A. Ritenour, IRREC, UF/IFAS, Ft. Pierce. [HP16]

Annual studies have been conducted since 1999 evaluating the effectiveness of compounds applied preharvest for reducing postharvest decay on many types of fresh citrus fruit (*Citrus* spp.). Commercially mature fruit were harvested two different times after the compounds were applied, degreened when necessary, washed, waxed (without fungicide), and then stored at 50 °F (10.0 °C) with about 90% relative humidity. Compared to control (unsprayed) fruit, preharvest application of benomyl (Benlate) or thiophanate-methyl (Topsin) resulted in significantly ($P < 0.05$) less decay of citrus fruit after storage in most of the trials, often reducing decay by about half. In two experiments, pyraclostrobin (Headline) significantly decreased total decay by between 29% and 47% compared to the control. Phosphorous acid significantly decreased total decay by 36% in one experiment compared to the control. Only benomyl and thiophanate-methyl significantly reduced stem-end rot (SER; primarily *Diplodia natalensis* or *Phomopsis citri*) after storage, with an average of about 65% less decay compared to the control. Benomyl, thiophanate-methyl, and pyraclostrobin significantly reduced the incidence of Anthracnose in 2004 and 2005.

4:45 Update on the USDA, ARS Citrus Scion Improvement Project.

T.G. McCollum, USDA, ARS, USHRL, Ft. Pierce. [HP17]

Citrus breeding has been conducted by the USDA in Florida since 1893 when W.T. Swingle made his first crosses at the USDA Subtropical Laboratory in Eustis, FL. The initial emphasis was to develop disease resistant cultivars. A second objective was to develop citrus fruit that were easy to peel; ease of peeling is still an important objective

of the program. Swingle hybridized 'Duncan' grapefruit (*Citrus paradisi*) with pollen from 'Dancy' tangerine (*Citrus reticulata*) which resulted in the new citrus type known as tangelos of which 'Orlando' and 'Minneola' are most important in commerce. Frank Gardner used 'Orlando' tangelo pollen in crosses with 'Clementine' mandarin and created the hybrids 'Osceola', 'Lee', 'Nova' and 'Robinson'. Gardner pollinated 'Minneola' tangelo with 'Clementine' pollen which led to 'Page'. Jack Hearn began making citrus hybrids in the early 1960s and created 'Sunburst' ('Robinson' x 'Osceola') and 'Fallglo' ('Bower' x 'Temple'). Several hybrids generated by Hearn have been identified as candidates for release and numerous additional hybrids are in the early stages of evaluation. Many seedy but otherwise high quality hybrids have been irradiated in an effort to reduce seed production and thereby increase consumer demand. Recently research on understanding the components of fruit quality important to consumers as well as how new cultivars hold up in marketing channels has been incorporated into the USDA scion improvement program. Continued development of new attractive, flavorful and convenient citrus cultivars available over a wide season will enable the US citrus industry to remain competitive in the global marketplace.

Tuesday June 5

10:00 Flavonoids in Grapefruit and Commercial Grapefruit juice: Concentration, Distribution and Potential Health Benefits.

Jiuxu Zhang, Florida Department of Citrus, Lake Alfred. [HP18]

Florida is the main producer of grapefruit (*Citrus paradisi* Macf.) in the world. Grapefruit provide not only the traditional nutrients (carbohydrate, protein, vitamin, mineral), but also phytochemicals such as flavonoids, which may provide many health benefits. Flavanones are the dominant flavonoids, and account for about 98% of the total flavonoids in grapefruit. Major flavanones in grapefruit are present as glycosides. In grapefruit, identified flavanone glycosides include didymin, dihydrokaempferol glucoside, eriocitrin, naringin, poncirin, hesperidin, neohesperidin, neoeriocitrin, narirutin, narirutin-4'-glucoside, naringin-6"-malonate (open form) and naringin-6"-malonate (closed form). Flavones and flavonols found in grapefruit include: apigenin 6,8-di-C-glucoside, apigenin 7-(malonylapiosy)-glucoside, kaempferol glycoside, myricetin, neodiosimin, quercetin, rutin and rhoifolin. Reported polymethoxylated flavones in grapefruit include heptamethoxyflavone, nobiletin and tangeretin. The presence of naringenin (an aglycone form of naringin and narirutin) in grapefruit remains controversial. Naringin is present at the highest concentration followed by narirutin, hesperidin, poncirin, neohesperidin, didymin and quercetin. The presence and their concentrations of individual flavonoids vary with grapefruit variety, fruit tissue, juice extraction method and geographic location. Flavonoids have been linked to many health benefits including antioxidant, anti-inflammatory and anti-tumor activity. Grapefruit and grapefruit juice are rich sources of flavonoids, especially naringin. By consuming grapefruit and grapefruit juice, individuals will not only obtain essential nutrients but also gain health beneficial flavonoids.

10:15 Spectral Characteristics of Unknown Furanocoumarins and Coumarins from Grapefruit Oil Wax (GFW).

Thais Cesar and John Manthey, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven. [HP19]

Previous reports have shown that furanocoumarins and coumarins from grapefruit juice (GFJ) are primarily responsible for the inhibition of intestinal cytochrome P450 3A4 (CYP3A4). This enzyme is responsible for the metabolism of some widely prescribed drugs, and its inhibition by these GFJ compounds can cause unexpected physiological responses. Due to the potential pharmacological actions of such (furan)coumarins in humans, an effort is underway to characterize their structure/function relationships, relative to protein binding and enzyme inhibition. Grapefruit oil wax (GFW) is a sub product of grapefruit peel oil (GFO) and contains a complex concentrated mixture of compounds, some of them found in GFJ. In this study we isolated new components – furanocoumarins and coumarins – from GFW and described their spectral characteristics. These compounds were also tested for their inhibition of CYP3A4 relative to known standards such as bergamottin and 6',7' dihydroxybergamottin.

10:30 Preliminary Investigation of Furanocoumarin Metabolism by *Aspergillus niger*.

Kyung Myung, Jan Narciso, and John Manthey, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven. [HP20]

Fungi metabolize polycyclic aromatic hydrocarbons by a number of detoxification processes. Prevalent fungal detoxification pathways for aromatic compounds include the formation of sulfate and glycosidated conjugates. Such fungal metabolism has been extensively studied as models of mammalian metabolism. Furanocoumarins, a class of aromatic compounds, are important due to their biological activities and clinical applications. The 6',7'-epoxybergamottin (EB), 6',7'-dihydroxybergamottin (DHB), and bergamottin (BM) are three major furanocoumarins found in grapefruit and their metabolism in humans is involved in the "grapefruit/drug interactions". Thus far, the metabolism by fungi of these furanocoumarins has received little attention. In our study, the metabolism by *Aspergillus niger* of EB, DHB, and BM and other furanocoumarins, such as bergaptol (BT), xanthoxol (XT), 5-methoxypsoralen, and 8-methoxypsoralen, has been investigated. *Aspergillus niger* was observed to metabolize EB, DHB, BM, BT, and XT into a water-soluble conjugate using hydrocarbon cleavage enzyme- and arylsulfotransferase-like activities. The enzymes involved in these metabolisms are under investigation, as well as the structural identifications of these metabolites.

10:45 Functional Analysis of Block Deesterified Citrus Pectins.

Gary Luzio and Randall Cameron, USDA/ARS Citrus & Subtropical Products Laboratory, Winter Haven. [HP21]

After removal of soluble sugars and other compounds by washing, citrus peel is largely composed of pectin, cellulose and hemicellulose. One of the components, pectin is relatively easy to modify using enzymes and has great utility in the food industry and other applications. It appears reasonable to focus on the use of pectin for the maximum utilization of fruit peel for new products from peel. During deesterification, the ester groups on the pectin can be removed in a random or blockwise manner with enzymes. The unesterified galacturonic acid units formed by blockwise deesterification are highly reactive to divalent cations such as calcium. Pectins having such blocks of unesterified galacturonic acid are said to be "calcium sensitive." Calcium sensitivity affects rheology, such as yield stress, and is an important functional property of pectins for use in applications which require suspension, metal ion binding or water absorption. Pectins, with a high degree of esterification (DE) were demethylated with a purified pectin methyltransferase PME isolated from citrus fruit tissue and with an unpurified fraction of PME from papaya to a DE of 55%. Rheology and calcium sensitivity measurements were performed on these pectins. The calcium sensitive properties of pectins are typically measured by calcium sensitive pectin ratio (CSPR) assay and a new improved assay was developed to facilitate this analysis. Comparisons are made for properties of rheology and CSPR for pectins which have been deesterified with different enzyme preparations.

11:00 Economic Analysis of Ethanol Production from Citrus Peel Waste.

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

The Florida citrus juice industry produces about 3-4 million tons of wet peel waste per year. In current industrial practices, waste peels are dried and sold as cattle feed to offset the waste disposal cost. Profitability could be greatly improved if this amount of peel can be used to produce high value co-products. Recent advances by the USDA/ARS scientists have given rise to the potential of a new process for making fuel ethanol from citrus peel waste. The production of citrus ethanol has advanced from a bench scale to a pilot plant scale (10,000 gallons/batch). Nevertheless, the development of an economically viable process could be a challenge. Although

the starch-to-ethanol process and the peel-to-ethanol process consist of similar unit operations; the economics of the former has been studied extensively, whereas the economics of the latter has not been fully investigated. In this paper, the economics of these two processes are compared and analyzed. The economic model for the starch-to-ethanol process was used as a benchmark to estimate the project cost and the fixed operating cost for the peel-to-ethanol process. The breakeven cost of citrus ethanol is estimated to be approximately \$ 1.00 /gallon, equal to the breakeven cost of corn ethanol, but lower than the breakeven cost of cellulose ethanol (\$1.35/gallon). This study allows us to pinpoint the economics of the process for making fuel ethanol from citrus peel waste, and is useful for predicting the cost benefit of proposed research and its economic impact on the juice industry.

Krome Section

Monday June 4

10:15 Performance of 5 Plantain Accessions at the National Germplasm Repository Under Limestone Soil Conditions.

Tomas Ayala-Silva, Raymond Schnell, Alan W. Meerow, and Garry Gordon, USDA/ARS, National Germplasm Repository, Subtropical Horticulture Research Station, Miami. [K1]

Five cultivars of plantains (*Musa x paradisiaca*.) from the National Germplasm Repository in Miami were used for evaluation under local edaphic and environmental conditions. The number of pseudostems per mat, height at fruiting, and cycling time were determined during the first fruiting cycle, and bunch number and bunch weight were recorded. A productivity index (PIX), calculated as $100 \times \text{mean bunch weight in kg} / \text{cycling time in days}$, was used to determine the productivity of the clones over time. In addition, the susceptibility of the clones to black Sigatoka, caused by *Mycosphaerella fijiensis*, was evaluated. Preliminary results demonstrated that all the clones have resistant to black Sigatoka and should be recommended for production in areas that have problems with this disease. The clones 'Gypungusi', 'Bom', and 'Cacambou', produced moderate to high yields of good to excellent fruit, and are recommended for use in all areas with a tropical/subtropical climate with dry areas and limestone soils.

10:30 – Assessment of Mango Diversity in Oman

Rashid Al-Yahyai, Zaher Al-Farei, Sulaiman Al-Khanjary, and Michael Deadman, Department of Crop Sciences, and Harith Al-Nabhani, Agricultural Experiment Station, College of Agricultural and Marine Sciences, Sultan Qaboos University, Sultanate of Oman. [K2]

Oman is the second largest producer of mangoes in the Arabian Peninsula with 11,000 tons from 1500 ha in 2005. Mango (*Mangifera indica*) is the second most important fruit crop in the country after date palm (*Phoenix dactylifera*). A new disease, Ceratocystis wilt of mango, caused by *Ceratocystis fimbriata sensu late* emerged in 1998. Within 6 years, the disease devastated 60% of seedling and grafted mango trees in parts of northern Oman. Many trees survived the epidemic, showing tolerance to the disease. However, information about mango cultivars and rootstocks and their biodiversity in Oman is lacking. This study was conducted to assess the diversity of mango based on quantitative and qualitative phenotypic characteristics of the vegetative and reproductive structures. Three sites with variable levels of Ceratocystis wilt infection were selected for the study. Biodiversity index and cluster analysis showed a close relationship among the surveyed trees. All trees were monoembryonic with variable fruit physical quality attributes.

10:45 Florida Avocado Heritage Collection for South Florida.

Carlos Balerdi, Richard J. Campbell, Miami-Dade County Extension, UF, and Noris Ledesma, Fairchild Tropical Botanic Garden, Miami. [K3]

The avocado (*Persea americana* Miller) has been an important fruit crop throughout South Florida for subsistence farmers, small- and large-scale producers. Commercial and hobbyists selections have resulted in an improved pool of cultivars of superior quality. For decades, Miami-Dade County has experienced dramatic population growth and continues with increased urbanization, potentially eroding the genetic resources for West Indian avocados. For the past two years there has been a joint project with the University of Florida Tropical Research and Education Center, Miami-Dade Cooperative Extension Service and (FTBG) Fairchild Tropical Botanic Garden to safeguard the genetic resources of South Florida, with the collection and maintenance of these resources. The living collection is planted and curated at FTBG Williams Grove Genetic Facility in Homestead. There are currently 25 accessions, which have been screened for sunblotch disease. The collection will be expanded in the coming years and be a resource available to local and international avocado growers.

11:00 Performance of 'Gulf Beauty' and 'Gulf Blaze' Plum on *Prunus persica*, *P. salicina* and *P. umbulata*.
Paul Miller, Horticultural Sciences, UF/IFAS. [K4]

Two low chill plum cultivars, 'Gulf Beauty' and 'Gulf Blaze', were released from the University of Florida breeding program in 1998 for commercial trial. These cultivars were grafted onto two rootstocks, peach (*Prunus persica*) and native plum (*Prunus umblata*), and own-rooted (*P salicina*). Trees on their own roots were the most vigorous and required the most winter pruning. Trees on peach rootstock were not quite as vigorous as own rooted trees, and those on native plum were dwarfing and required support. Fruit size and crop load were compared and evaluated.

11:15 Plant Exploration in Tropical Forests of Puerto Rico to Collect Ornamental Germplasm.
Tomas Ayala-Silva, USDA, ARS, National Germplasm Repository, Subtropical Horticulture Research Station, Miami, and Alan W. Meerow, Ricardo Goenaga and Brian Iris, USDA, ARS, Tropical Agriculture Research Station, Mayaguez, PR. [K5]

The main focus of this collection was *Tabebuia haemantha*, a rare Puerto Rican endemic that has many features of interest to horticulture. It is a small-statured tree, evergreen, red-flowered and is largely unknown in cultivation. We are also interested in looking for improved forms of *Tabebuia heterophylla*, the common pink tabebuia. These species, widely produced and planted in south Florida, has suffered from a great deal of inbreeding, as local seed sources are continuously used for the production of this staple of horticulture. The species is currently negatively impacted by a new thrips. Introduction of new genetic diversity from offshore populations of this species may help alleviate this problem. We also collected seeds and cuttings of other selected species (*Coccoloba*, *Sabinea*, *Hillia*, *Turnera*, *Polygala cowellii*) for evaluation as tropical and subtropical ornamentals, improvement of currently cultivated species or preservation of species in danger of disappearing.

11:30 Quality Characteristics of Selected Muscadine Grape (*Vitis rotundifolia* Michx.) Cultivars Grown in North Florida.

J. W. Breman, Union County Extension, UF; A. H. Simonne, Family, Youth and Community Sciences, UF/IFAS; R. C. Hochmuth, L. Landrum, M. Taylor, K. Evans, NFREC-SV, UF/IFAS; C. Heykoop, and D. Goode, Columbia County Extension, UF. [K6]

Muscadine grapes are a popular fruit, but choosing cultivars that perform well and have good eating quality can be

a challenge for homeowners. This study evaluated quality characteristics and eating quality of eleven muscadine grape cultivars grown in north Florida. Fully ripe fruits were evaluated for quality characteristics, including pH, titratable acidity, brix, and water activity (Aw). Sensory evaluation using a consumer panel was conducted on five cultivars, four of which are currently recommended cultivars for fresh market and one of which is a cultivar recommended for trial for fresh market. Consumers evaluated the cultivars based on color, taste (sweetness and sourness), muscadine flavor, firmness, and overall preference on a line scale (0-9 centimeters, where 0 represents a low rating and 9 represents a high rating). PH (3.0-3.5), titratable acidity (0.16-0.59%), Brix (12.6-21.45), and Brix/acid ratio (21.35-100) were significantly different among different cultivars ($p < 0.0001$). Among the cultivars used in the sensory evaluation study, the consumer panel consistently rated "Fry," "Ison," and "Nesbitt" higher than "Doreen" and "Southern Home," but all of them were rated as more than acceptable by a consumer panel. This study revealed that quality characteristics were different among the eleven cultivars.

11:45 The Potential of New *Mangifera* Species in Florida.

Richard J. Campbell, Fairchild Tropical Botanic Garden, Coral Gables. [K7]

There are more than 60 *Mangifera* species native to Southeast Asia with horticultural potential as fruit and ornamentals for South Florida. *Mangifera* species are poorly characterized in terms of horticultural potential. Following over a decade of investigation into a number of *Mangifera* species there are some recommendations possible for South Florida. *M. odorata*, *M. casturi*, *M. lalijiwa*, *M. laurina* and a putative *M. odorata*/*M. foetida* hybrid have been grafted successfully on 'Turpentine' rootstock. Resulting trees have been grown in the field at Fairchild Tropical Botanic Garden for a decade. All of these species have bloomed and fruited with reasonable reliability over this time. In addition, many of the *Mangifera* species have shown potential as ornamentals due to their profuse, showy bloom panicles. These species have withstood temperatures as low as 29F for more than 5 hours with only minimal damage. Additional investigation is necessary, but *Mangifera* species also have shown a high degree of anthracnose tolerance under Florida conditions. The fruit of each species is unique in terms of color, appearance and eating quality, and all have potential as fresh fruit given proper selection of clones with superior fruit quality.

1:30 The Inverted Root Graft: Applications for the Home Garden in Florida.

Noris Ledesma and Richard J. Campbell, Fairchild Tropical Botanic Garden, Coral Gables. [K8]

Experimentation began over 15 years ago with a grafting technique with potential for size control and precocity of fruiting in tropical fruit. This technique, termed the inverted root graft, was inspired by a similar technique used for lucuma (*Pouteria obovata*) in a large commercial nursery in Chile. The inverted root graft, which is detailed within this paper, reverses the polarity of the rootstock, yielding a rootstock without a defined tap root and an enhanced feeder root system. The technique has been used in Florida on canistel, mamey sapote, sapodilla, jackfruit, mango and avocado with varying success. Thus far the results have been best with canistel and mamey sapote. The resultant trees are anchored well in the ground, have profuse branching that lends well to size management, and begin to bear at an earlier age than conventionally propagated trees of the same species. The commercial viability of this technique will depend on the species used, due to survival rates of grafts and ease of management of the technique. Also, there is clear evidence of clonal specificity within species that will require further study. However, given the superior horticultural traits of these trees there is significant potential for home garden usage in Florida.

1:45 Graft Interstocks for Wild Mangos.

Richard J. Campbell, Fairchild Tropical Botanic Garden, Coral Gables. [K9]

Following a decade of research into *Mangifera* species, some conclusions can now be drawn about suitable interstocks for use with the propagation of *Mangifera* species. Over 15 *Mangifera* species have been grafted onto *Mangifera indica* rootstock at the Tropical Fruit Program of FTBG. With these trials there have been successful grafts as well as partial and complete incompatibility. These results led us to identify *Mangifera* species that could serve a role as interstocks with *Mangifera indica* 'Turpentine'. *Mangifera casturi*, which is commonly cultivated in Kalimantan under the name of kastooree has been used as a highly successful interstock for *M. griffithii*. Interstock grafts above *M. indica* have high percentage success, and subsequent grafts of *M. griffithii* have a high percentage take and develop quickly into healthy trees. *M. casturi* has also been successful as an interstock for *M. lalijiwa* and *M. merillii*. An undetermined *Mangifera* species collected near Kuching, Sarawak on the island of Borneo has also shown potential as an interstock for *M. pajang*. Trials continue for suitable interstocks for *M. foetida*, which has been completely unsuccessful as a scion on *Mangifera indica*.

2:00 Pruning Systems for Tropical Fruits in Florida.

Carlos Balerdi, Miami-Dade County Extension, UF, and Jonathan Crane, TREC, UF/IFAS. [K10]

Pruning has been practiced on deciduous fruit trees for hundreds of years. Florida citrus growers began to prune citrus in the late fifties after the development of hedging and topping machines. Mechanical pruning was adopted in the sixties by growers of limes, avocados and mangos. In the early years of the Florida tropical fruit industry groves were planted at wide spacings and little to no pruning was practiced. With the advent of high density plantings and the loss in fruit production and quality and expensive picking costs growers realized tree size management was necessary. This paper reports on some pruning systems used by growers of tropical fruits in south Florida.

2:15 Carbon Sequestration in Oil Palm Crop System (*Elaeis guineensis*) in the caribbean lowlands of costa rica.

Humberto A. Leblanc and Ricardo O. Russo, Universidad Earth, Las Mercedes de Guacimo, Limon, Costa Rica. [K11]

Oil palm is currently the most valuable cash crop in the tropical world (Hartemink, 2005; Henderson and Osborne, 2000). Large plantation areas are located in Malaysia where the area of oil palm has increased from about 150,000 ha in the early 1970s to 3.88 million ha in 2006. Worldwide, oil palm plantations cover more than 12 million hectares in Africa, Asia and America. In consequence, this agroecosystem seems to be a good candidate to sequester carbon (C) in tropical countries. Although, crop plantations are not yet considered a clean development mechanism (CDM) under the Kyoto Protocol; in the future, these systems could be selectable for CDM accepted projects (Lamade *et al.*, 2005). Oil palm crop systems have large areas and economic importance in Latin America. Although, there is a huge amount of knowledge on the agronomic management of the crop, there is not enough information on the C sequestration potential of this agroecosystem. The objective of this study was to quantify the amount of C stored in the crop biomass and soils of oil palm crop system (*Elaeis guineensis* Jacq.). The C stored in the soil was calculated from the soil %C, bulk density, and sample depth. The C stored in the biomass was calculated from the biomass %C and the dry weight. The average of total carbon sequestration of an oil palm agroecosystem (aboveground carbon biomass + soil carbon), reached 96.02 Mg C ha⁻¹ (soil depth 0-30 cm) and 126.03 Mg C ha⁻¹ (0-50 cm), of which 22.68 Mg C ha⁻¹ were found in the oil palm aboveground biomass, and the remaining part in the soil. Soil was the system component that stored the highest amount of C, ca. 76.4 % (0-30 cm) and 82.1 % (0-50cm).

2:30 Hydrogen Cyanamide: A Potential Tool for Advancing Fruit Harvest of Blueberry in Florida.

Jeffrey G. Williamson and E.P. Miller, Horticultural Sciences, UF/IFAS. [K12]

Hydrogen cyanamide has been used for several years on blueberries in Florida to advance fruit ripening and

has resulted in earlier fruit sales that are more profitable to growers. The degree of advanced fruit ripening varies depending on cultivar, year, and application rate and timing. In some cases, ripening has been advanced by approximately 10 days or more. Research and field observations indicate that hydrogen cyanamide may also increase mean berry weight and thereby increase total fruit yield. The effects of hydrogen cyanamide appear to be related to early leaf canopy establishment in the spring and increased leaf to fruit ratios during fruit development. If misapplied, hydrogen cyanamide may be ineffective or detrimental to blueberry cropping. Spray concentration and volume, and stage of flower development at time of application, appear to be critical factors affecting efficacy of hydrogen cyanamide sprays for blueberry.

2:45 Effect of Foliarly Applied Ascorbic Acid Plus Ferrous Sulfate on Carambola Leaf Greenness.

J.H. Crane, B. Schaffer, Y. Li, and G. Evans, TREC, UF/IFAS. [K13]

The effects of foliar- or soil-applied iron on leaf greenness of 8-year-old 'Arkin' carambola trees was tested in a 2.9-acre orchard at the Tropical Research and Education Center in Homestead, FL. Trees received either a monthly foliar application of ascorbic acid plus an organosilicone adjuvant (Freeway®) and ferrous sulfate (FOLIAR-Fe), a single soil application of EDDHA-Fe (SOIL-Fe), or no iron as a control (CNT). FOLIAR-Fe was applied monthly from 18 October 2006 to 22 March 2007 (6 applications) and the chelated iron soil drench was applied on 31 Oct., 2006. Treatments were arranged in a randomized complete block design with 3 replications per treatment (35 trees per row per replication). Leaf greenness was assessed on 3 recently mature (young) and 3 older leaves per tree from 2 trees per replication with a SPAD meter just prior to each FOLIAR-Fe application. There were no effects of treatment on SPAD values of young leaves. However, for older leaves, there was a consistent trend for FOLIAR-Fe treated trees to have higher SPAD values than EDDHA-Fe treated and CNT trees, although differences were generally not statistically significant due to the large variability within treatments. Several days after the first and third FOLIAR-Fe applications, flowers abscised and the oldest mature leaves (closest to the base of stem) became chlorotic and abscised and immature fruit turned yellow and abscised. However, young leaves generally remained green and intact. In addition to within treatment variability, the lack significant differences in SPAD values among treatments may have been due to reduced tree growth and nutrient uptake in fall and winter when temperatures are relatively low, since carambola trees become quiescent below 20°C.

3:30 Effect of Low Temperature Storage on Mamey Sapote (*Pouteria sapota*) Fruit Quality.

J.H. Crane, TREC, UF/IFAS, and S.A. Sargent, Horticultural Sciences, UF/IFAS. [K14]

Florida currently has about 485 acres of mamey sapote worth an estimated \$6.5 million annually. The recommended storage temperature for mamey sapote is 13°C and the scurfy fruit surface of mamey sapote is sometimes infested with mining scale (*Howardia biclavis*). However, for some market areas of the U.S. (e. g., California) the scurfy surface of fruit must be free of scale. The scale may be removed from the scurfy fruit surface by scrubbing with a paint-stripping pad. The effect of removal of the scurfy surface and temperatures below 13°C have on postharvest handling of mamey sapote is not known. Thirty-six 'Pantin' mamey sapote was harvested off-season (11-Nov., 2006) and stored at 10°C for 4 days. One half the fruit sampled had their scurfy fruit surface removed, the other half did not, fruit were then either placed at room temperature to ripen (22-26°C) or re-stored at 10°C for 3 more days then placed at room temperature to ripen. In general, stored fruit at 10°C for 4 days with or without the scurfy fruit surface or stored at 10°C for 7 days without the scurfy surface ripened normally. Fruit with the scurfy surface and stored for 7 days at 10°C showed symptoms of chilling injury. The mean number of days to ripen at room temperature was not significantly affected by treatment and ranged from 3.5 to 4.3 days.

3:45 Developing a Linkage Mapping Population for Avocado.

Cecile Olano, James Borrone, David Kuhn, J. Steven Brown, and Raymond Schnell, USDA/ARS, National Germplasm Repository, Subtropical Horticultural Research Station; Helen Violi, and Randy Ploetz, Plant Pathology, TREC, UF/IFAS. [K15]

A saturated genetic linkage map can aid greatly in efforts to improve avocado (*Persea americana* Mill.) via breeding. A genetic linkage map for avocado can be generated using molecular genetic markers and a known family structure. Currently over 250 microsatellite markers have been developed for avocado. This number of microsatellite markers will give suitable coverage for the avocado genome. Two experimental families have been identified: A Florida mapping population [West Indian x (Guatemalan x West Indian)] of approximately 1600 seeds harvested from a commercial grove in South Miami-Dade County, Florida, and a California mapping population [Mexican x (Guatemalan x Mexican)] of approximately 2000 seed harvested from a commercial grove in Ventura County, California. Phenotypic evaluation of the mapping population will allow the identification of Quantitative Trait Loci (QTL) that are associated with important horticultural traits such as host-plant resistance to *Phytophthora* root rot (PRR), productivity, fruit quality and cold tolerance. The production of a saturated linkage map will lead to a better understanding of the avocado genome. New sources of resistance to PRR and cold tolerance will be identified and a Marker Assisted Selection (MAS) program established.

4:00 Phylogenetic Analysis of Aestivales, Planchon American Native Grapes by Nuclear Microsatellite Profiling as a Valuable Germplasm for Grape Improvement.

Walters, Tresia, Parker, Lelan, Bordallo, Patricia and Violeta Colova (Tsolova), Center for Viticulture and Small Fruit Research, CESTA, Florida A & M University. [K16]

The native grapes of Americas have provided valuable germplasm for improvement and development of cultivated commercial grape genotypes (for fresh fruit, wine and processing and rootstocks) all over United States and Canada, where *Vitis vinifera* or “old world grape” can not grow. Cultivated varieties developed based on *Vitis aestivalis* are the only American native grapes with remarkable color stability of the juice and wine and with qualities for longevity of the wines, and very pleasant “mouth feel” which makes them comparable with the so called “noble grape wine varieties” which belongs to the European grape *Vitis vinifera*. *Vitis aestivalis* Michaux is found in the eastern and central USA, from New England to Florida and from Wisconsin to Texas (Galet, 1998). The close proximity of related species and many variants to *Vitis aestivalis* has created confusion among taxonomists trying to classify grape species. Lately, DNA fingerprinting methods are broadly used for identification of various genotypes across the organism’s population. We are aiming to define the phylogenetic relations between the grape species and subspecies listed under *Aestivales* Planchon group (Munson, 1909) via data mining in the existing North American grape germplasm collections, ampelographic analyses and specifically expressed in the members of the group DNA microsatellites. DNA isolation and quantification of 9 *Aestivales* accession evenly distributed through the area of natural habitat is completed. DNA amplification and fragment analysis with the set of 10 pairs of SSR markers from *V. riparia*, previously successfully used for grape species identification and two specific markers from Cynthiana/Norton var. developed in our lab are under way.

4:15 Self-incompatibility of ‘Julie’ Mango.

Gary Zill, Zill High Performance Plants, Inc., Boyton Beach. [K17]

Mangos are known to be insect pollinated, and in general flies, wasps and other non-honeybee Hymenoptera are the most prevalent pollinating insects in Florida. However, there are significant differences among mango cultivars in terms of self-compatibility. A simple experiment was conducted to determine if ‘Julie’ mango is self-compatible under South Florida conditions. Mature ‘Julie’ mango trees were enclosed by an insect proof tent. A large population of flies were reared in the tent insuring good pollination. Because of the large number of

pollinators, there was a very heavy initial fruit set. However, all of the fruit aborted, most before reaching 1/2 inch diameter. The self-incompatibility of 'Julie' has impact for home garden production of this cultivar and also the commercial production of 'Julie' in other locations.

4:30 Why aren't Tropical Fruits as Popular as Temperate Fruits? An Industry Perspective.

A. R. Rafie, Carlos Balerdi, and Jonathan Crane, TREC, UF/IFAS. [K18]

Tropical fruits are important crops for south Florida's agricultural industry. It is generally believed that the market demand for tropical fruits is not as high as those for traditional temperate fruits grown in other parts of the country. Many private and public agricultural sectors in south Florida have attempted to promote the tropical fruits among wholesaler, brokers, retailers and consumers. Although these efforts have generated some positive results, many of the tropical fruits are still unknown in the market place and the overall demand for them is low. To understand and identify strategies needed to effectively promote the tropical fruits of south Florida, a survey was developed and sent to shippers, brokers, wholesalers doing business with tropical fruits. The list of potential respondents for this survey was obtained from the Produce Blue Book. The results of this survey will be presented the Krome Section of the Florida State Horticulture Society.

4:45 Development and Evaluation of Subtropical Stone Fruit Cultivars in Florida.

J. J. Ferguson, J. G. Williamson, J. Chaparro, Horticultural Sciences, UF/IFAS, R. E. Rouse, SWFREC, B. T. Scully, C. A. Powell, IRREC, UF/IFAS. [K19]

Florida's subtropical, low-chill stone fruit breeding program, initiated in the 1950s in cooperation with the University of Georgia and the USDA, has released over 30 peach, nectarine, and plum cultivars that can be grown from north to south central Florida. Since the 1990s development of non-melting stone fruit that resist bruising and can be harvested at physiological maturity for longer shelf life has been emphasized. Stages in development of these new cultivars include involve inheritance studies, molecular characterization, adaptation to biotic and abiotic conditions, selection of elite lines, fruit quality and market potential, patenting, cultivar release and foundation seed deposits. Although a range of parameters like fruit yield, weight, size, color, shape and other factor are used to describe new releases, uniform harvest and post-harvest evaluation methods and procedures have not been standardized for Florida stone fruit and will be proposed.

5:00 Internet-based Audio & Video (IAV): A new resource for Extension, Teaching, and Research.

Ian Maguire, TREC, UF/IFAS. [K20]

The use of internet-based audio and video (IAV) is a powerful tool for mass and specialized communication. In recent years with the improvement of data streaming technology, availability of high-speed internet connections, development of user-friendly equipment and software for production and editing, and free IAV hosting websites has offered a new resource for extension, teaching, and research. A common device such as a cell phone has the capability to record, send, and receive IAV clips and for an extension agent in the field this tool is valuable for recording and communication of findings. The use of IAV for the enhancement of course material, lectures, and archiving of classroom activities and field trips can have long term benefits for future offerings of a particular course, especially if there is a possibility for conversion to a distance education format. A particular protocol for a research experiment can benefit from IAV as specialized technique can be document and readily shared and/or published to a scientific website for others to review. The future of mass and specialized communication using IAV for extension, teaching, and research will rely on how users are able to incorporate IAV technologies into there everyday lives.

Ornamental, Garden and Landscape Section

Monday June 4

10:00 The Effect of Quality of Parks on Neighboring Property Values.

Christopher Rubottom, R. Gomez, F. Cosby, and A.B. Lorenzo, Landscape Design and Management Program, College of Engineering Sciences, Technology, and Agriculture, Florida A&M University, Tallahassee. [GL1] (Student Competition)

Cities across the United States have lost farmlands, wetlands, wildlife habitat and other valuable natural open spaces to urban sprawl. Like other cities, the City of Tallahassee has increased its efforts to protecting remaining open spaces. One way the City has done to benefit its residents is develop and manage a network of award winning parks and recreation areas. While the parks provide recreational opportunities and attractive views for nearby residents, they might also lead to increased traffic and noise. A potential but least understood benefit of parks and recreation areas is their impact on housing prices. Using a data set of single family homes recently sold in the City of Tallahassee, this paper will discuss the significant positive and negative effects on surrounding property values, of park proximity, park type, park size, and park quality based on landscaping, cleanliness, availability of gathering spaces, and other amenities.

10:15 Tree Damage and Restoration Following Hurricanes Katrina and Wilma at Miami Metrozoo.

H. Mayer, UF / IFAS Miami-Dade County Extension., UF/IFAS, T. Trump, Supervisor-Horticulture, Miami Metrozoo, F. Escobedo, UF School of Forest Resources and Conservation, UF. [GL2]

The Miami Metrozoo ground maintenance personnel assessed tree and palm damage after Hurricanes Katrina and Wilma during August and October 2005 respectively. They also estimated the costs associated with the removals, resetting, and clean up of the debris. After Katrina, 546 trees and 7 palms were reset and 142 trees and 7 palms were removed. Following Wilma 345 trees and 26 palms were reset and 380 trees and 53 palms were removed. The total damage and clean up costs after Katrina and Wilma were \$69,660 and \$181,860. The 5 species that suffered the most damage after Katrina were: *Tabebuia caraiba*, Yellow tab (134 trees), *Peltophorum pterocarpum*, Copperpod (96), *Bucida buceras*, Black olive (45 trees), *Bauhinia variegata*, Orchid tree (35 trees) and *Syagrus romanzoffiana*, Queen palm (5). The top 6 species that suffered the most damage after Hurricane Wilma were: *Peltophorum pterocarpum*, Copperpod (111 trees), *Bucida buceras*, Black olive (77 trees), *Tabebuia caraiba*, Yellow tab (63 trees), *Tabebuia heterophylla*, Pink tab (31 trees), *Washingtonia robusta*, Washington palm (26 palms) and *Syagrus romanzoffiana*, Queen palm (17 palms). These findings confirm recent research that indicates that the species most damaged after these two hurricanes correspond to species with a low to medium-low wind resistance rating. In August 2006 the list of existing plants in the Metrozoo was updated to include a total of: 207 tree species, 175 shrubs, 200 groundcovers and wild flowers, 15 vines and 172 palms.

10:30 Fort Lauderdale Trial Garden – Year 5(2006-2007).

Kimberly K. Moore and Luci Fisher, FLREC, UF/IFAS. [GL3]

Rooted cuttings of vegetatively propagated annuals from Danziger were planted on August 21, 2006) while rooted cuttings from Proven Winners were planted on November 3, 2006. All cultivars were planted with 3 groups of 6 plants that were randomly placed in the garden. Plants were watered 3 times a week for 30 minutes using overhead irrigation. Monthly evaluations were conducted to measure and record plant height and width (size), flower number, and quality rating. Quality was rated on a scale of 1 to 5 with 5 = excellent and 1 = poor.

One consumer preference survey was conducted in March. Quality and consumer preference results will be presented.

10:45 Landscape Valuation of the Effect of Canopy Roads on Property Values in Tallahassee-Leon County, Florida.

Alfredo B. Lorenzo, Florida A&M University, Tallahassee, Y. Cao, Planning and Landscaping Division, PBS&J, T. Zhang, Department of Geography, Florida State University, Tallahassee, and L. Yu, Florida A&M University, Tallahassee. [GL4]

The City of Tallahassee-Leon County, FL is known for its canopy roads. The 76-mile canopy road system serves as a peaceful alternative to the typical city/county roads of asphalt, cement, signage and visual chaos. The moss-draped trees and vegetation within the tree protection zone add to the City's southern charm while providing shade and aesthetics enhancing landscape visual quality. A landscape evaluation model which relies on landscape quality was developed in ArcGIS version 9. Landscape quality includes a wide range of environmental/ecological, social, cultural and psychological factors. The land cover and viewshed as seen from the ground are analyzed from satellite images and from a digital terrain model. The landscape quality and house attributes are then used in an economic model based on the values of single family homes along canopy roads. The results show that seeing canopy roads from houses nearby is an amenity and the landscape quality in the immediate proximity of houses has positive impact on house values. The potential role of this model in landscape analysis, planning and management and for environmental/ecological, socio-cultural, and economic impact assessments will also be discussed.

11:00 Experiencing Sense of Place of Cultural Landscapes: A Suburban-Strip Chinatown Case Study.

Yun Cao, Planning and Landscaping Division, PBS&J, A. B. Lorenzo, R. Rome and M. Powers, Florida A&M University, Tallahassee. [GL5]

Cultural landscape studies examine the influences of culture and history on landscapes. These studies generally focus on the history of the ordinary spaces people use everyday. Since built landscapes oftentimes relate to human experience and history, almost every landscape has cultural associations. One important cross-cultural landscape in the U.S. is Chinatown. There are three types of Chinatowns. The large-scale, urban Chinatown and the suburban Chinatown have been both widely studied. The third type which has emerged more recently is the suburban-strip Chinatown. The suburban-strip Chinatown is normally the smallest and least recognized of the three types of Chinatowns. To date, very few studies on the value of suburban-strip Chinatowns as cultural landscape exist. Using the case of suburban-strip Chinatown, this paper will show that the inclusion of cultural motifs, artifacts, landscaping, and provision of spaces and facilities for social interaction and education, enhance the identity and sense of place of built landscapes. The role these landscape elements play in making such strip centers analogous to older Chinatowns and adding to their cultural value to the community will also be discussed.

11:15 Concordance Among Landscape Design Professionals on Ecological Design.

Cheryl Callender, Keith & Schnars, Fort Lauderdale, A. B. Lorenzo, R. Rome, and M. Powers, Florida A&M University, Tallahassee. [GL6]

Landscape is being transformed at an accelerated rate in developed countries due both to urban growth and an intense exploitation of natural resources. Lands adjacent to natural protected areas tend to be more affected as land use change processes are more dynamic as a consequence of urban expansion. Ecological design is increasingly becoming an important part of the solution to the challenges of urban expansion and environmental / ecological quality. Ecological design is interdisciplinary, requires a deep understanding of the issues, and promotes the use of innovative techniques to protect the environment. A major challenge for

ecological design is the need to reconcile and integrate individual strongly held opinions and knowledge. This paper will present and describe an objective method for evaluating and resolving conflicts and differences among design and environmental professionals involved in ecological design. The results of a case study dealing with Natural Protected Areas along both sides of the Panama Canal in Panama are presented.

11:30 Construction of a Pergola in a Demonstration Garden.

D. B. Shibles, A.E. Yasalonis, Polk County Extension, UF/IFAS. [GL7]

The Polk County Residential Horticulturist and the Florida Yards and Neighborhood's program assistant have been working for several years on various demonstration gardens at the Extension office in Bartow. There currently are butterfly, turf, wildflower, palm, rose and native plant demonstration gardens. Master Gardener volunteers suggested that the construction of a pergola would enhance and tie together several of the gardens, and could be used as an outside teaching classroom as well a structure to display native vines. The first step was to make a basic design and model from which a list of necessary materials could be developed. Funding was the next serious consideration, as it was quickly realized that the pergola would cost well over \$2000. Lowes, Inc. in Bartow offered to supply, at no cost, a large portion of the materials. The Master Gardeners contributed the remainder of the necessary construction funds. The basic above ground structure was made of an assortment of pressure treated wood and the floor was made of flagstone laid in sand. The basic structure was completed in the fall of 2006. During the construction phase numerous drainage problems had to be addressed and solved. Plants, consisting of vines and shrubs, were selected and planted in the spring of 2007. All of the labor for this project was donated by Master Gardener volunteers.

11:45 Challenges of Fertilizer Ordinances – Planning for an Ordinance.

D.P. Rainey, Sarasota County, UF/IFAS. [GL8]

The State of Florida is experiencing a population trend that will continue to grow for years to come. This population growth brings more impervious surfaces, paved roads roof tops, and manicured landscapes. Water quality will also suffer as unbridled population increases. The State and local governments must learn how to cope with maintaining high water quality standards under the stress of increased growth and development. Public outcry from annual outbreaks of Red Tide has motivated many of the communities to address nutrient loading in coastal waterfronts communities. The Sarasota County Commissioners, in response to public concern, recognized water quality as an important and critical component to the public safety as well as the environment. Stormwater runoff is the largest source of nutrient pollution to our bays and estuaries. This concern has led to a signed resolution establishing the local government's role and options in managing fertilizer use. It is at this juncture that careful review and research must be made in order to establish fair and reasonable actions outlining the intent of a possible ordinance. In 2006, five counties and two cities have either enacted, or are presently reviewing the language intended for a local fertilizer/nutrient management ordinance. Many of these ordinances have resulted in complications or at worst lawsuits. There are many pros and cons to ordinances in general, but the language, intent, scope, enforcement, collective support of a fertilizer ordinance are challenging.

1:30 Effects of modified Hoagland's solution nitrogen concentration and aeration on *Pteris vittata* production.

R.H. Stamps, MFREC, UF/IFAS. [GL9]

Pteris vittata L. (Chinese ladder brake fern) has potential for use as a biofilter for arsenic-contaminated groundwater. However, little research has been done on growing ferns hydroponically. The purpose of this experiment was to determine the effects of hydroponic solution aeration and nitrogen (N) concentration on plant growth. Individual *Pteris vittata* plugs in net pots were suspended in water from polystyrene sheets floating in 11-liter tanks. The water contained modified Hoagland's solution with one of three nitrogen concentrations—10,

20 or 30 mg · L⁻¹. Half the tanks were aerated and half were not. Solution electrical conductivity increased with increasing N concentration and pHs were higher in the aerated than in the nonaerated tanks. Root dry masses were not affected by N concentration, but frond and rhizome dry masses increased linearly with increasing N concentration. Dry masses of all three plant parts were generally greater in the aerated tanks. Frond water use (mL · cm⁻²) was reduced by aeration while water use efficiency (g dry wt · L⁻¹) was increased. N concentration had no effect on these latter two parameters.

1:45 Monitoring Nitrate Nitrogen and Phosphorus in Porous Nursery Containers and Adjacent Native Soil.

L. M. Miller, Hillsborough County Extension, UF/IFAS; T.H. Yeager and C.A. Larsen, Environmental Horticulture, UF/IFAS. [GL10]

Nitrate nitrogen and phosphorus concentrations in the substrate of above ground soft-sided porous nursery containers amended with controlled-release fertilizer and in adjacent native soil were monitored for 5 months in 2003 and for 7 months in 2004 using suction lysimeters. In both 2003 and 2004, phosphorus concentrations were higher in container substrate than in native soil throughout the monitoring period. In 2003, nitrate nitrogen concentrations were higher in container substrate than in adjacent native soil for the first 6 weeks of monitoring. For three of the four monitoring dates during the first 6 weeks, nitrate nitrogen concentrations in the container substrate were above 15 ppm, the lower limit for production. Nitrate nitrogen concentrations in the native soil on these same dates were below 10 ppm, the maximum allowable concentration in drinking water. Thereafter, nitrate concentrations in the container substrate decreased and were similar to concentrations in native soil, ranging from 2.8-3.2 ppm for the last 4 weeks. In 2004, the lysimeters used for monitoring native soil were 48" longer than the 24" lysimeters used in 2003. Nitrate nitrogen concentrations in the container substrate were consistently below 15 ppm, the lower limit for production, possibly due to excessive rain. Nitrate nitrogen concentrations in the native soil exceeded 10 ppm, the maximum allowable concentration in drinking water, at four sampling events.

2:00 Camellias: New Scents and Seasons.

J. Popenoe, Lake County Extension Tavares, UF, J. Conrad, Erinon Camellias, Plymouth. [GL11]

New Camellia species and cultivars collected from China, Japan and Korea offer a range of scents and flowering seasons unknown in Camellia before. 'Cinnamon Cindy,' 'High Fragrance,' 'Sweet Emily Kate,' 'Fragrant Pink,' 'Scentuous,' and 'Scented Son' are scented hybrid cultivars that grow well in Central Florida and north. There are several new early-season flowering *Camellia japonicas*, 'Early Autumn,' 'Autumn Twilight' and 'Mark Chason,' which do not bullnose, a common problem with early japonicas, and bloom as early as September. A new species *C. cuspidata* has small sasanqua-type leaves and blooms, but blooms in February in full sun and is often called spring-blooming sasanqua. Erinon Camellias, which grows over 700 varieties of camellia, has several tricks to growing a good camellia including the soil mix, fertilizer, type of shade and irrigation.

2:15 Identification of the Four Forms of Plumeria Rubra.

Stephen H. Brown, Lee County Extension, UF/IFAS. [GL12]

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. F. rubra has the longest flowering days and is the tallest of the four forms. Flowers of F. acutifolia and F. lutea appear earlier in the year than F. rubra but their flowering days are generally shorter.

2:30 “Compost Happens” Workshop Results.

P. W. Brown, Pinellas County, UF/IFAS. [GL13]

Pinellas County has primarily sandy soil with an inherent lack of nutrients and water holding capacity. Adding compost that is created using landscape and kitchen organic waste to landscape beds incorporates valuable organic matter and associated nutrients into the soil. Compost stimulates the proliferation of healthy soil organisms and improves the water holding capacity of the amended soil. This coupled with the fact that landfill space is limited led to collaboration between Pinellas County Utilities and our Extension Horticulture Department. The Recycling Department at Pinellas County Utilities purchases compost bins to provide free to participants of “Compost Happens” workshops. These workshops are presented at various locations around the county by a trained Extension Master Gardener. Participants are introduced to the process of composting, what items should be composted, along with the pitfalls associated with composting. Utilizing a compost bin reduces the amount of organic waste going to the landfill. A survey to assess the usage of the compost bins and to get an idea of the amount of refuse being composted and diverted from the landfill was sent in September of 2005 and September of 2006 to those attendees who received the free compost bins. These surveys show that a significant amount of organic refuse can be diverted from landfills by citizens who embrace composting.

2:45 Saint Lucie County Pond Appeal Series: Turning Your Pond Into An Oasis.

R.L. Creswell, J.P. Gellermann, K.T. Gioeli, E.A. Skvarch, St. Lucie County Extension, UF/IFAS. [GL14]

Approximately 70% of the population of Saint Lucie County, Florida relocated to the county from areas where environmental conditions are significantly different. Pond Appeal is a three-session program designed to educate new and long-term residents how to maintain their ponds using best management practices. These practices include proper landscape fertilization and maintenance, tackling insect issues, aquascaping, managing aquatic plants, stocking fish, and attracting wildlife. In 2006, one hundred and fifty people participated in the Pond Appeal Program in St Lucie County. 100% of the surveyed participants indicated that they adopted a practice change that enabled them to better manage their Florida ponds. In addition, the St Lucie County Pond Appeal Series website was developed and features presentations and links to relevant publications.

3:30 Rain Garden Installation: Site and Soil Conditions.

A. Bolques, Gadsden County Extension, UF/IFAS, S. Valentine, J. Cherrier, and M. Abazinge, Environmental Sciences Institute, Florida A&M University. [GL15]

Rain gardens have the potential to lower the impact of stormwater coming from impervious surfaces in urban landscapes and mitigate non-point source polluted runoff. They are easy to install, inexpensive, sustainable and are esthetically pleasing. The site and soil conditions of a rain garden installed in the spring of 2006 on the campus of Florida A&M University, Tallahassee, Leon County, Florida is described. The site encompasses three types of soils: Orangeburg, Plummer, and Urban land. Soil leaching and runoff potential for pesticides indicates that these soils have a medium soil leaching potential to leach to groundwater with Plummer and Urban soils having a higher runoff potential. Soil fertility testing of the rain garden site for phosphorus, potassium, magnesium, and calcium indicates that the site is high in phosphorus, medium-high in potassium and very high in magnesium.

3:45 Horticultural Therapy: How can it make a difference in your everyday life?

P. Porchey, Sarasota County Extension, UF/IFAS. [GL16]

Horticultural Therapy is the practice of engaging people in horticultural activities to improve their bodies, minds, and spirit. It is a time-tested therapeutic treatment modality for rehabilitation. There are many venues for Horticultural Therapy including hospitals and Hospice, assisted-living facilities, schools, community gardens, etc. The benefits of Horticultural Therapy include reducing physical and emotional pain, improving memory, and reducing stress and anger. At home and at work, Horticultural Therapy can improve your or your loved ones quality of life.

4:00 Effect of Roguing on Erwinia Soft Rot In Commercial Production with Two Phalaenopsis Plants per Pot.

R. T. McMillan, Jr., Kerry's Bromeliad Nursery, Inc., A. Palmateer, and W. Vendrame, TREC, UF/IFAS. [GL17]

The major bacterial disease of Phalaenopsis orchids in Florida is the bacterium *Erwinia carotovora* (L.R. Jones) Bergey et al. subsp. *carotovora* (L.R. Jones) Bergey et al. Major economic damage occurs during environmental conditions that favor *E. carotovora* soft rot disease, such as warm to hot temperature combined with high moisture. This bacterium spreads through rain or overhead irrigation splash, which allows plant to plant movement. Phalaenopsis are generally planted with two plants per 6 inch pot. When plants infected with *Erwinia* are found in the nursery, the diseased plant is rouged out. A study was initiated in Homestead, Florida in 2006 to determine if rouging of diseased plants was effective in reducing plant losses. The study was repeated 5 times and in all cases rouging of a single diseased plant from the pot was not effective, with losses ranging from 80 to 100 percent.

4:15 Chemical Control of the Palm Leaf Skeletonizer, *Homaledra sabalella* (Lepidoptera: Coleophoridae).

F. W. Howard and Bryan Steinberg, FLREC, UF/IFAS. [GL18]

Studies were conducted to develop chemical control treatments for the palm leaf skeletonizer, *Homaledra sabalella* (Lepidoptera: Coleophoridae). Bifenthrin applied as a foliar insecticide to cabbage palmetto, *Sabal palmetto*, and to red latan palm, *Latania lontaroides*, resulted in 100% kill of larvae of this insect within 7 days. Biweekly foliar applications of azadirachtin to coconut palm, *Cocos nucifera*, prevented infestations by this caterpillar. A root drench treatment with imidacloprid was not effective in controlling this pest on coconut palms. The practical implications of each of the two effective treatment methods and their potential integration with control of the pest by natural enemies will be discussed.

4:30 Biohistory Updates and Defoliation by a Climbing Cutworm, the Royal Poinciana Caterpillar (*Melipotis acontioides*) and an Inchworm, the Snowbush Spanworm (*Melanchroia chephise*) in Naples, Florida.

Douglas L. Caldwell, Collier County Extension, UF/IFAS. [GL19]

Insect populations ebb and wane to the point that certain species are difficult to find some years. Outbreaks of the royal poinciana caterpillar and the snowbush spanworm provided opportunities to gather more information on these two Lepidoptera. The royal poinciana caterpillar (host is, *Delonix regia*) in particular appears to have long periods, 10 years or so, between outbreaks. The Naples area experienced localized defoliation of very large trees in 2006. The snowbush spanworm (host is, *Breynia disticha*) occurred in outbreak numbers in 2005 and in low numbers prior to that. Information and photos are provided on various aspects of their biology and host

damage and responses.

4:45 Bees And Trees: Problems Of Honeybee Nesting In Landscapes.

Adrian G. B. Hunsberger, UF/IFAS Miami-Dade County Extension, UF/IFAS, and Jude Plummer, Miami-Dade County General Services Administration, Miami. [GL20]

Feral European honey bees (EHB), *Apis mellifera*, commonly nest in tree hollows. In South Florida, trees with trunk rot are fairly common, especially trees that have storm damage or have been improperly pruned. In addition, feral bee colonies are increasingly found hanging from tree limbs. The more aggressive Africanized honey bee (AHB), *Apis mellifera scutellata* take over EHB nests. As the AHB spreads throughout Florida, their presence is causing increased “stinging events” to humans, animal deaths, as well increased public concern. People need to “bee” more aware when working outdoors and to monitor bee nests. To be proactive, trees with hollows should be bee-proofed in high risk areas such as school yards, playgrounds, and recreational areas. Different methods of bee-proofing trees will be discussed.

Tuesday June 5

10:00 Pathogenicity of *Pythium aphanidermatum* and *Fusarium oxysporum* on Snapdragon.

K.-H. Wang, R. McSorley, and E.R. Malek, Entomology and Nematology, UF/IFAS. [GL21]

Pythium aphanidermatum (P) and *Fusarium oxysporum* (F) were frequently isolated from a diseased snapdragon (*Antirrhinum majus*) planting near Stuart, Florida, in 2003. Plants exhibited stem rot and dieback. Several greenhouse trials were performed to determine the relative pathogenicity of P and F on snapdragon. Snapdragon seedlings were inoculated with F, P, or F+P, or were treated with culture media of each fungal treatment. A negative control treated with water was also included. In Trial 1 and Trial 2, both treatments with the presence of *Pythium* (P and P+F) reduced plant height, shoot and root weights, and numbers of flowers compared to the control. Although F slightly reduced plant growth relative to the negative control, plant growth was not different ($P < 0.05$) between F and potato dextrose broth (PDB) alone, the substrate for F. When volume of the PDB was reduced in Trial 2, F did not reduce plant growth. In Trial 3 and Trial 4, P and F from the diseased plants in Trial 1 and Trial 2 were reisolated and reinoculated, confirming the pathogenicity of P on snapdragon and fulfilling Koch’s postulates for this pathogen isolate. Young snapdragon seedlings were more susceptible to this P isolate than older plants. Infected young seedlings showed the stem rot and dieback symptoms as observed in the field where the original disease outbreak had occurred.

10:15 Integrated Pest Management of *Apis mellifera scutellata* (Africanized Honey Bee): Bee-Proofing a Home and School.

J. D. Ellis, Entomology and Nematology, UF/IFAS, A.S. Neal, E. A. Skvarch, St. Lucie County Extension, UF/IFAS. [GL22]

Africanized honey bees (AHB) first spread to the United States through the southern tip of Texas in 1990. Since then eight more states: New Mexico, Arizona, California, Nevada, Oklahoma, Louisiana, Arkansas, and Florida have identified nests of this honeybee. The AHB are believed to have entered Florida through a human-assisted transport system, ships docking our major ports. Many of our western states have learned to live with these new, more defensive bees. For most people here in Florida this means taking some extra precautions when partaking in outdoor activities. Some of these are being aware of possible nesting sites, inspecting your property during swarming season, listening for buzzing and looking for bees entering or leaving the same area. The second step is to bee-proof the home or school by sealing all gaps larger than 1/8 inch in walls and chimneys, plumbing or covering holes greater than 1/8 inch with hardware cloth. Through these steps an informed

and educated public with an action plan can make the best decisions. We can learn to live with AHB and their cousins, who are essential to Florida and U.S. agriculture.

10:30 Effects of Plant to Water Ratios and Nitrogen and Phosphorus Fertilization Levels on Arsenic Removal from Groundwater and Growth of *Pteris vittata*

R.H. Stamps, Department of Environmental Horticulture, Mid-Florida Research and Education Center, UF, J.A. G. Santos, L.Q. Ma, Department of Soil and Water Science, UF/IFAS and S. Natarajan, Mid-Florida Research and Education Center, UF/IFAS. [GL23]

Arsenic (As) pollution of groundwater arises from both natural and anthropogenic sources and can have very detrimental health effects. Chinese ladder brake fern (*Pteris vittata* L.) has been shown to be an As hyperaccumulator but plants are expensive. The purpose of this experiment was to study the effects of plant to groundwater volume ratios and nitrogen and phosphorus fertilization levels on the growth and concomitant As removal from contaminated groundwater. *Pteris vittata* plugs in net pots were suspended into the groundwater below floats made of polystyrene sheeting. Three plant:water volume ratios (1:30, 1:15, 1:7.5 liters) were used. The As-contaminated groundwater ($138 \mu\text{g}\cdot\text{L}^{-1}$) was augmented with one-quarter strength Hoagland's solution with two N (100 or 50%) and P (20 or 0%) rates. At 7 days after initiation (DAI), As concentrations decreased more rapidly with smaller water volume to plant ratios and were also more rapid in the treatments containing 0% P compared to 20% P. At 14, 21 and 28 DAI, only plant:water ratio had an effect on As depletion of the contaminated water. At 42 DAI, As concentrations ranged from 1.5 to $27.7 \mu\text{g}\cdot\text{L}^{-1}$ and there were no treatment effects. At 98 DAI, As concentrations in all tanks were below $10 \mu\text{g}\cdot\text{L}^{-1}$ and now N and P treatments were significant. Frond biomass was not affected by treatments. The fungal pathogen *Pythium* damaged some of the plants in this experiment and the damage appeared to be greatest in the 0% P plots.

Vegetable Section

Monday June 4

10:00 Soilless Media, Growing Containers, and Plug Transplants Influence on Vegetative Growth and Fruit Yield of 'Sweet Charlie' Strawberry (*Fragaria x ananassa* Duch.) Grown Under Protected Agriculture.

Daniel J. Cantliffe, Horticultural Sciences, UF/IFAS; Ashwin V. Paranjpe, Pune, India; Peter J. Stoffella, IRREC, UF/IFAS; Elizabeth M. Lamb, New York Agricultural Experiment Station, Geneva, NY; Charles A. Powell, IRREC, UF/IFAS. [V1]

'Sweet Charlie' strawberries (*Fragaria x ananassa*) were grown in a passively-ventilated greenhouse to evaluate the effects of soilless media (pine bark, peat-mix, and perlite), growing systems ('bag on gutter', 'polygal trough', and 'bag on ground'), and sources of plug transplants (greenhouse-grown and field-grown) on yield and plant growth during two production seasons. Plants grown in perlite generally produced higher early marketable yields than those grown in peat-mix or pine bark. Plants grown in 'bag on gutter' or 'bag on ground' had larger crowns and more leaves than plants grown in 'polygal troughs' during both seasons. The interaction between growing system and media for total marketable yield was significant in both seasons. The highest yield during the first season occurred from plants grown in 'bags on gutter' regardless of media, mean yield was 23.4 fruit per plant. During the second season, plants grown in 'bags on gutter' with peat-mix or perlite produced more fruit per plant than all other growing system by media combinations, mean yield was 24.6 fruit per plant. Field-grown plugs generally produced plants with larger crown diameter, more leaves, and higher total marketable yields than plants from greenhouse-grown plugs. Using pine bark as a soilless substrate in protected strawberry culture reduced media costs by 50% than for peat-mix and 42% than for perlite. 'Polygal troughs' were easy to

install, and the cost per season (\$0.43 per m) was comparable to that of polyethylene bags within a PVC gutter (\$0.39 per m). Plants grown in elevated containers were easier to harvest than plants grown in containers on the ground. Therefore, protected strawberry culture using specialized growing containers such as 'Polygal troughs', cost effective soilless media such as pine bark, and field-grown plugs, can enhance winter strawberry production in north-central Florida. Protected culture provides a practical commercial alternative to methyl-bromide dependant field production of strawberry.

10:15 Growing and Marketing Cabbage at Local Green Markets in Southeast Florida.

Kenneth D. Shuler, Stephen J. Nie, Deanna V. Shuler, and Pei-Ann N. Shuler. Stephen's Produce, Jupiter. [V2]

Stephen's Produce began growing and marketing cabbage in 2003 from a 0.35 acre backyard market garden to help supply the West Palm Beach and Stuart green markets with a weekend supply of Agarden fresh@ produce. Cabbage (Asian flat cabbage) was one of the 30 crops grown and has been included in the crop mix for the past four seasons. Planting schedules, growing and harvesting methods, yields, and sales figures will be discussed. For the 2006-2007 season, 25 plantings of cabbage were made for 25 weeks of sales which began 11Nov and concluded 29 April. Cabbage was cut, excessive leaves trimmed off, and lightly spray washed the day before sales. Heads were generally sold for \$2.50 each. For the first three seasons an average of 12 heads of cabbage were grown and sold each week.

10:30 Performance of Strawberry Cultivars in Florida.

Bielinski M. Santos, Craig K. Chandler, GCREC, UF/IFAS; Stephen M. Olson, NFREC-Quincy, UF/IFAS; and Teresa W. Olczyk. Miami-Dade County Extension, UF/IFAS. [V3]

Field trials were conducted to assess the performance of various strawberry cultivars in three locations in West Central, North, and south Florida. Tested cultivars were 'Albion', 'Camarosa', 'Camino Real', 'Carmine', 'Festival', 'Treasure', 'Winter Dawn', and '00-51'. Bare-root transplants were established on polyethylene mulched beds at an in-row spacing of 15 inches. In West Central Florida, marketable yield was collected over 22 harvests in December, January and February. December yields were the highest with '00-51' (8.4 ton/acre), 'Winter Dawn' (6.4 ton/acre), 'Carmine' (6.2 ton/acre), 'Festival' (5.4 ton/acre), and 'Albion' (5.2 ton/acre). 'Winter Dawn' had the largest cumulative fruit weight during the season (34.4 ton/acre), and the yields of '00-51', 'Albion', 'Camarosa', 'Carmine', and 'Festival' were not different from each other averaging approximately 22.2 ton/acre.

10:45 Yield and Quality of Greenhouse Grown Strawberries as Affected by Nitrogen Level in Coco Coir and Pine Bark Media.

Daniel J. Cantliffe, Horticultural Sciences, UF/IFAS; Javier Z. Castellanos, Celaya, Mexico; Ashwin V. Paranjpe, Pune, India. [V4]

Greenhouse grown strawberries are a new crop for the U.S. and Mexico. The present study was conducted to determine the nitrogen (N) requirements for strawberries produced in soilless media in a passively ventilated greenhouse. Two soilless media: a) pine bark and b) coconut coir, and 4 N levels in the nutrient solution: 40, 80, 120 and 160 mg·L⁻¹ N, were evaluated in a factorial designed experiment. Plants grown at a density of 21 plants·m⁻² received a complete nutrient solution at every irrigation, the only variation being the level of N in each treatment. Increasing N level in the nutrient solution significantly increased the number of runners. Neither early nor total marketable yields were significantly affected by N level or media. Increasing N level in the nutrient solution significantly decreased fruit soluble solids on two of the three sampling dates. Higher values of soluble solids occurred during the cooler months of the season; as the temperature increased, the soluble solids content in the fruit was reduced. Thus, N levels as low as 40 to 80 mg·L⁻¹ N can be used to produce

strawberries in either coconut coir or pine bark media in a greenhouse environment.

11:00 A case study – Diagnosis of Hydrogen Dioxide Toxicity to Greenhouse Tomatoes.

Luis Barquin, [Yuncong Li](#), Teresa Olczyk, Aaron Palmateer, TREC, UF/IFAS. [V5]

Hydrogen dioxide or similar chemicals are often used to disinfect growth media for greenhouse production. Improper use of the chemical could cause phytotoxicity of plants. We examined a real case of phytotoxicity and simulated the conditions in the greenhouse. The diagnostic procedure and possible remediation methods will be discussed during the presentation.

11:15 Evaluation of Galia-type Melons (*Cucumis melo* L. var. *Reticulatus* Ser.) for Fruit Yield, Quality and Powdery Mildew (*Podosphaera xanthii*) Susceptibility.

[Jeanmarie M. Mitchell*](#), Horticultural Sciences, UF/IFAS; Daniel J. Cantliffe, Horticultural Sciences, UF/IFAS; Steven A. Sargent, Horticultural Sciences, UF/IFAS; Lawrence E. Datnoff, Plant Pathology, UF/IFAS, Gainesville; and Peter J. Stoffella, IRREC, UF/IFAS. [V6] (Student Competition)

Galia melon (*Cucumis melo* L. var. *Reticulatus* Ser.) is an F₁ hybrid known for exceptional quality. Since introduction to the market in 1973, 'Galia' has become a trade name for look-a-like cultivars. Such 'Galia'-type cultivars are firmer, ship well and are less susceptible to powdery mildew (*Podosphaera xanthii*) than a true 'Galia,' but often lack the flavor of the original hybrid. The objective of this trial was to identify 'Galia'-type cultivars that sustain the true flavor of 'Galia' while producing excellent yield, quality (including firmness and taste) and disease resistance. During fall 2005 and spring 2006, cultivars were grown in a passively-ventilated greenhouse in Citra, FL and rated for fruit yield, quality and susceptibility to powdery mildew. Disease severity ratings (DSR) based on percentage of leaf area infected were taken once per week from first sign of disease until final harvest. Area under disease progress curve (AUDPC) values were also calculated from weekly DSR ratings. In fall 2005, cultivars 'Nestor,' 'Galileo' and 'Elario' had the lowest final DSR while 'Gala' had the highest with a final DSR of 100%. Fruit yields were low overall due to pollination problems, however 'Gala' was the lowest yielding cultivar (3.9 kg · m⁻²). The sweetest (12.4° Brix) and firmest (30 N) cultivar was 'Galileo.' In spring 2006, pollination was improved and all cultivars had marketable yields greater than 6.7 kg·m⁻² except 'Gala' (3.5 kg·m⁻²), which was, again, the only cultivar with a final DSR of 100%. 'Nestor' had the lowest final DSR (2%) and was among the firmest (27 N) and sweetest (11°Brix). Powdery mildew severity could not be correlated with yield or fruit quality for any of the cultivars in both seasons.

11:30 The Future of the Florida Strawberry Industry from a Grower and Nurseryman's Perspective.

[Allen Williford](#), Florida Strawberry Growers Association, Plant City. [V7]

An historic perspective as well as a current status of the strawberry industry in Florida will be presented and discussed. Main biological and financial issues affecting this industry and potential solutions will be presented.

1:30 Plectosporium Blight of Cucurbits.

[G. K. England](#), Sumter County Extension, UF/IFAS; J. S. Strickland, Hernando County Extension, UF/IFAS; and R. J. McGovern, Plant Medicine Program, UF/IFAS. [V8]

Plectosporium blight, caused by the fungus *Plectosporium tabacinum* (formerly known as *Microdochium tabacinum* and *Fusarium tabacinum*), is a relatively new disease of cucurbits, which was first reported in Tennessee in 1988. Henceforth, it has been observed in numerous eastern states causing significant damage in commercial plantings of summer squash, pumpkin and some gourd cultivars. Trials conducted in various

states showed a 50-85% loss of marketable fruit attributed to this disease. Symptoms of Plectosporium blight are diamond shaped white to cream colored lesions on the stems and underside of the leaves. In severe infestations, the lesions on the stem will coalesce causing the stem to become brittle and susceptible to breakage. The first reported observations of Plectosporium blight in Florida were made in the fall of 2005 on two farms producing summer squash in Sumter County. This disease was observed in both yellow squash and zucchini, with the most severe symptoms expressed in the later. Recommended tactics for the management of this disease in Sumter County included crop rotation, scouting and fungicide treatments.

1:45 Comparative Effectiveness of New Insecticides in Controlling Armyworms and Leafminers on Tomato.

D. R. Seal, TREC, UF/IFAS and D.J. Schuster, GCREC, UF/IFAS. [V9]

Spodoptera spp. armyworms and *Liriomyza spp* leafminers are important pests of tomatoes in Florida. Various studies were conducted on tomato research plots at the Gulf Coast Research and Education Center (GCREC) in Balm, FL. and the Tropical Research and Education Center (TREC) in Homestead, FL in 2005 and 2006. Metaflumizone (16.0 oz/acre, Alverde™, 240SC), chloanthraniliprole (6.7 oz/acre; DuPont Coragen™ SC), indoxacarb (3.5 oz/acre, Avaunt™ 30WG), spinetoram (7.0 oz/acre, Radiant™ 120SC), spinosad (8.0 oz/acre; Spintor™ 2SC) and novaluron (12.0 oz/acre; Rimon™ 0.83EC) provided significant reduction of armyworms on tomato. Spinetoram at 5 oz/acre in rotation with methoxyfenozide (8.0 oz/acre; Intrepid™ 2F) also provided similar level of control of armyworms. Metaflumizone at 11 and 16 oz/acre significantly reduced armyworms and did not differ from esfenvalerate (10.0 oz/acre; Asana^R) when applied alone. Metaflumizone also provided significant control of armyworm larvae when applied in combination or in rotation with esfenvalerate. All insecticides increased marketable yield of tomato at harvest. Emamectin benzoate (4.0 oz/acre; Proclaim™ 5SG) and pyridalyl (6.4 oz/acre; Tesoro™ 4EC) also increased marketable yield of tomato. Spinetoram provided significant reduction of leafminers on tomatoes and did not differ from chloanthraniliprole at 6.7 oz/acre. This information is valuable to manage armyworms and leafminers of tomato by applying above mentioned insecticides alone, in combination, or in rotation.

2:00 MOVENTO® , a New Broad-Spectrum Insecticide for Sucking Insect Pest Control.

Marco A. Toapanta, Bayer CropScience, Brandon; John Bell, Steve Krueger and Robert Steffens, Bayer CropScience, Research Triangle Park, NC. [V10]

MOVENTO® (spirotetramat) is a novel active ingredient from the new chemical class of tetramic acids. The product's new mode of action, known as a lipid biosynthesis inhibitor, shows no cross-resistance to currently available chemical classes in the market. When applied to the foliage, this highly systemic insecticide is translocated within the plant in both xylem and phloem vascular tissues, resulting in effective pest control on roots and shoots. MOVENTO provides excellent initial and long-lasting residual control of a broad range of economically important sucking pests infesting annual and perennial crops, including aphids, whiteflies, scales, mealybugs, psylla, and *Phylloxera*. Studies have shown minimal risk to both predators and parasitoids, making MOVENTO an excellent fit in IPM programs. Due to the new mode of action that shows no cross-resistance to currently available chemical classes, as well as the product's excellent performance against target pests with minimal risk to beneficial arthropods, MOVENTO will serve as a powerful tool in both resistance management and IPM programs.

2:15 Miticides and Programs of Application for Control of Twospotted Spider Mite (*Tetranychus urticae* Koch (Acari: Tetranychidae)) on Strawberry in 2007.

J. F. Price and C.N. Nagle, GCREC, UF/IFAS; and E. McCord, Jr., Natural Sciences Division, New College of Florida, Sarasota. [V11]

The twospotted spider mite is a key pest of strawberry in Florida and around the world. In Florida, growers may choose biological or chemical methods for control and achieve good results. Chemical methods require reapplications throughout the season but control costs are spread over a longer period and costs can cease if the crop becomes uneconomic early. Biological controls are applied once and can be effective as long as the crop is in the field, but the total cost of control must be borne early in the season. For these and other reasons some growers feel that they should not invest in the biological control and thus require a selection of effective miticides. Programs of abamectin, bifenthrin, spiromesifen, hexythiazox, and an essential oil alone and in combinations with other miticides were compared to an untreated check in two experiments during the 2006-2007 strawberry fruiting season. All programs provided excellent to good control. The essential oil, as with any oil, can be problematic in strawberry culture that includes the use of captan fungicide.

2:30 Alverde® (Metaflumizone) A Novel New Insecticide for Control of Key Insect Pests in Vegetables.

Larry Newsom, Venkat Pedibhotla, Dawn Calibeo-Hayes, Joseph Mitchell, Thomas Holt, BASF Corp. Research Triangle Park, NC. [V12]

Metaflumizone, representing a new class (semicarbazone) of broad-spectrum insecticide from BASF and to be sold under the trade name Alverde® 2SC, is expected to be registered in the USA for use in 2007. It controls insects primarily by ingestion and has limited contact activity. Once consumed, metaflumizone acts on the voltage dependent sodium channel by blocking the flow of sodium ions. As a result, insect pests stop feeding within hours often resulting in crops with better quality and higher yields. Recognizing this unique chemistry, IRAC recently classified metaflumizone in a new sub-group "Group 22 B" of the insecticide "*Mode of Action Classification*". Research indicates that metaflumizone controls insects that are resistant to other insecticides. Laboratory and field studies indicate that Alverde® 2SC has low toxicity to beneficial insects, honey bees (Acute Oral LD₅₀ 48-hr > 100 µg/bee, Acute Dermal LD₅₀ 48-hr 23 µg/bee), mammals (Rat, Acute Oral LD₅₀ > 2,000 mg/kg, Acute Dermal LD₅₀ > 4,000 mg/kg) and other non-target species. Greater than 500 field efficacy studies have been conducted in the U.S. with over 45 studies in the state of Florida with metaflumizone and these studies indicate that Alverde® controls insects harmful to Florida vegetable production including such species as *Plutella xylostella*, *Pieris rapae*, *Manduca spp.*, *Trichoplusia ni*, and *Spodoptera spp.*

2:45 Barriers to Local Vegetable Production and Marketing in Florida: Challenges and Opportunities for Extension, Research, and Industry.

N. Roe, Farming Systems Research, Boynton Beach; Diane Cordeau and Carl Frost, Kai-Kai Farm and Grove, Stuart. [V13]

In recent years, media has encouraged consumers to buy local food. However, in many areas of Florida, the problem is not lack of customers, but lack of locally grown produce. People who would like to farm for local Florida markets, often young people or early retirees, face several barriers in addition to those in most other areas. The initial cost of land is high. Meeting the government environmental standards for the use of the land can cost over \$2000 per acre and take years of frustrating negotiations with government agencies and private engineers. Land preparation is expensive and requires large equipment. Pest control is a year-round challenge, a major limiting factor for crop production. Smaller growers usually pay more for supplies. Crops which are adapted to sub-tropical areas may not be familiar to consumers. In addition to the traditional education of growers, Extension can maintain databases of resources for new growers and facilitate interaction between new growers for information exchange, cooperative buying and/or marketing, and perhaps equipment sharing. More research is needed to develop appropriate pest control methods for crops which may be harvested daily and used immediately. The pesticide industry can also help by developing methods for using their pesticides on small

areas. Perhaps the most critical task for all members of Extension, research, and industry (including growers!) is consumer education: teaching consumers what to expect when they buy local produce and how, what, and why we grow differently in Florida.

3:30 Nutrient Management for Greenhouse Production of Container Grown Organic Herbs.

Teresa Olczyk, Miami-Dade County Extension, UF/IFAS; Y. Qian, Y. C. Li, TREC, UF/IFAS; G. J. Hochmuth, Horticultural Sciences, UF/IFAS; R. C. Hochmuth, NFREC, UF/IFAS; E. H. Simonne, D. D. Treadwell, Horticultural Sciences, UF/IFAS; L. S. Osborne, MFREC; R. K. Sprenkel, NFREC-Quincy, UF/IFAS and K.W. Migliaccio, TREC, UF/IFAS. [V14]

Production of organic herbs, in South Florida is a challenging task due to the poor soils, high rainfall, and constant pest pressure. Producers can increase the yield and quality of organic herbs by adapting or modifying greenhouse production techniques. Four greenhouse replicated trials were conducted in 2005/2006 at the University of Florida IFAS Tropical Research and Education Center in Homestead, Florida as part of a USDA TSTAR three year grant. The objectives of the project were 1) evaluate several commercially available organic fertilizers and potting media for their suitability for organic production of container herbs; and 2) developing organic fertilization programs, including nutrient sources, fertilization rates, and timing of application for small container production systems (4" pots) for greenhouse-grown organic herbs. In the first two trials, three commercial organic fertilizers [Nature Safe (Griffin Industries) 8-5-5, Fertrell (Fertrell Company) 4-2-2 and Perdue (Perdue Agri Recycle) 4-2-3] and a control (no fertilizer application), two organic potting media Fafard organic formula and Agro-Soils commercial potting mix and two herbs: basil (*Ocimum basilicum* L.), and dill (*Anethum graveolens* L.) were evaluated. In trials three and four, three rates of Perdue fertilizers were compared with the control for basil, dill and coriander (*Coriandrum sativum*). Results will be presented and discussed.

3:45 eOrganic: A New Community of Practice in eXtension.

D. D. Treadwell, Horticultural Sciences, UF/IFAS. [V15]

eXtension is an Internet-based educational partnership of the 74 institutions that comprise the US Land Grant University System (LGUS). eXtension is an evolving, virtual, customer-centered educational environment that provides the most current, objective research-based information from the LGUS. This program will transform the way the Cooperative Extension System nationwide develops and distributes educational programs and products. Virtual teams of content specialists and support professionals (Communities of Practice or CoPs) interact with the clientele served (Communities of Interest or CoIs) to create educational materials that evolve over time based on the needs of the clientele and the latest research available. eOrganic is a new CoP created to address information gaps among many land grant universities for science-based information relevant to organic production systems. The eOrganic CoP will evolve through a participatory process involving 100 members from public and private enterprises and representing diverse organic production regions and content areas. Members include LGUS research and extension faculty, federally funded sustainable agriculture programs (National Agriculture Information Service (ATTRA), Sustainable Agriculture Research and Education Program, National Agriculture Library) as well as private organizations (Organic Farming Research Foundation, Organic Materials Review Institute, Horizon Milk, Rodale Institute's New Farm E-zine) will contribute to the development of educational materials. Two main challenges are to learn the variety of integrated software necessary to post and display the educational deliverables in multiple formats, and to motivate extension educators to work collaboratively on national issues through a shared electronic portal while maintaining access to issues of regional and local relevance.

4:00 Effect on N Rate on Yield of Tomato Grown with Seepage Irrigation and Reclaimed Water.

Monica P. Ozores-Hampton, Eric Simonne, Phyllis Gilreath, Steven Sargent, Thomas Wilkes, Daniel.C.

McClure, Eugene McAvoy, Phil Stansly, Sanjay Shukla, Pam Roberts, Fritz Roka, Tom Obreza, Kent Cushman, and Darrin Parmenter. SWFRECC, UF/IFAS. [V16]

The Florida Department of Environmental Protection (DEP) is "encouraging and promoting reuse," and has developed a comprehensive reclaimed waste reuse program, Chapter 62-610, Florida Administrative Code (FAC). Reclaimed water may contain up to 9.9 mg/L NO₃-N there by making irrigation water a hidden source of N. An average monthly reclaimed water concentration of 9.9 mg/L of NO₃-N as used in this experiment contributed approximately for 20 lb/acre/month of N to the crop assuming a daily water usage of 8,310 gal/acre/day with seepage irrigation. The objectives of this study were to evaluate the effect of multiple N fertilizer rates under the use of reclaimed waste water for seepage irrigated tomatoes on petiole N sap, fruit yield and post-harvest quality. The study was conducted in spring 2006 in Palmetto, FL. with eight N rates ranging from 20 to 420 lb/acre. Using the daily analysis report from the Manatee County waste water division a potential season-long NO₃, NH₄ and TKN contribution from reclaimed waste water were 61, 1.3 and 5.4 lb/acres, respectively. Sap NO₃-N concentrations showed that rates lower than 100 lb/acre N were below IFAS sufficiency ranges 60 days after transplant. Total tomato yield total first and second harvest and total extra-large tomato yields did not differ among N treatments except in total large (240-429 boxes/acre), medium (131-276 boxes/acre) and culls (37-103 boxes/acre) fruits categories. Values obtained among N treatments for soluble solids content (3.23-4.15), total titratable acidity (0.28-0.36) and pH (4.32-4.39) were within the range of typical values reported previously for 'FL-47' tomatoes. So, what is the "best" in-bed N rate under these conditions? With a 14-week-long spring tomato crop, up to 70 lb/acre of N can be contributed by reclaimed waste water and assuming 50% can be taken up by the plants, then a net contribution of 35 lb/acre of N. At \$0.41/ lb of N this may result in a cost savings of \$29/acre. These results suggest that (1) nitrate in reclaimed water should be accounted for in the N fertilization program, and (2) tomato yields and nutritional status were more enhanced by reclaimed water at low N rates.

4:15 Comparing Nitrogen and Sulfur Fertilizer Sources for Tomato Production.

Camille E. Esmel, Bielinski M. Santos, GCREC, UF/IFAS; Humberto Moratinos, University Central of Venezuela; and Jack E. Rechcigl, GCREC, UF/IFAS. [V17]

A field study was conducted to compare the effect of ammonium sulfate nitrate (ASN) as a N and S source with other commercially-available fertilizers in tomato. The fertilizer sources were ASN (26% N, 14% S), ammonium nitrate (AN; 34% N), ammonium sulfate (AS; 26% N, 14% S), and potassium sulfate (PS; 23% S, 55% K). Treatments were: a) non-treated soil, b) AN (200 lb/acre of N), c) AN (300 lb/acre of N), d) AS (200 and 229 lb/acre of N and S), e) AS (300 and 343 lb/acre of N and S), f) AN + PS (200 and 229 lb/acre of N and S), g) AN + PS (300 and 343 lb/acre of N and S), h) ASN + PS (200 and 229 lb/acre of N and S), g) ASN + PS (300 and 343 lb/acre of N and S). Potassium chloride was used to balance K contribution as needed. 'Florida-47' tomato was planted in 30-ft plots and fertilizers were applied 2 weeks before transplanting. There were significant treatment effects on both total marketable fruit weight and S concentration in the tissues. Adding S, either from PS alone or from ASN, increased tomato yield and S concentration in the leaf tissues. Interestingly, the same treatments (AN + PS and ASN + PS) that had higher yield than AN alone were the ones with higher tissue S increments. There were no differences on either yields or tissue S concentrations between: a) AN and AS, and b) AN + PS and ASN + PS. These preliminary results suggested that S fertilization has a significant effect on tomato yield.

4:30 Analysis and Interpretation of On-farm Fertilizer Trials with Tomato.

Eric Simonne, Monica Ozores-Hampton, Kent Cushman, Phyllis Gilreath, Ramon Littell, Eugene McAvoy, Sanjay Shukla, Thomas Obreza, Darrin Parmenter, Pamela Roberts, Fritz Roka, and Philip Stansly, Horticultural Sciences, UF/IFAS. [V18]

With the development of Best Management Practices, fertilizer recommendations have to reconcile profitability with environmental stewardship. On-farm fertilizer trials are needed to validate state-wide recommendations under different growing systems, propose adjustments where needed, and facilitate growers' adoption. ANOVA, mean separation tests, and regression analysis may not be adequate when small yield differences need to be detected based on economics and/or when experiments have low power. Using current prices, it takes approximately 4 to 10 25-lb/A boxes of tomato to offset the price of 100 lbs N/A. Power analysis showed that it would take more than 30 replications to detect these difference. Using ANOVA to analyze yield component responses to two N fertilizer rates (UF-IFAS and grower's) in 5 replicated trials conducted in 2005-2006 with seepage irrigated tomato, yield component differences were significant 11 times out of 45 times (5 trials x 3 grades x 3 harvests). When yield data were analyzed using the binomial distribution of the algebraic yield differences among yield components, the effect of using a N rate higher than the University rate was significant only at the third harvest for the medium-size category ($P \leq 0.05$). These alternate statistical techniques may be used when a compromise between type I and type II error is needed.

4:45 Financial Implications of Limiting N-fertilization on Fresh Market Tomatoes.

Fritz Roka, Monica Ozores-Hampton, Eric Simmone, Gene McAvoy, Sanjay Shukla, and Kent Cushman, SWFREC, UF/IFAS. [V19]

Growers of fresh market tomatoes are consistently applying nitrogen fertilizer at rates greater than IFAS recommendations. A multi-year economic analysis of fertilizer decisions demonstrates that excessive nitrogen applications are a sound financial strategy given the wide variability of yields and market prices. If public policies for improved water quality mandate a reduction in nitrogen fertilization, long run returns from fresh market tomato production will decrease.

Tuesday June 5

10:00 Effects of Pruning on 'Florida 47' and 'Sungard' Tomato.

Bielinski M. Santos, GCREC, UF/IFAS. [V20]

Four trials were conducted to assess the effect on tomato yield of pruning side branches at 2 weeks after transplanting (WAT). 'Florida-47' and 'Sungard' tomato were pruned allowing 1, 2, and 3 main stems to grow. A non-pruned control was also included. Plant height was measured at 3 and 4 WAT in 'Sungard' treatments and at 4 and 6 WAT. Marketable fruit weights were collected twice for each cultivar during each season and grades as extra-large, large, and medium fruits. There was significant effect of the pruning regime on the initial measurement of plant height of both tomato cultivars, but that effect disappeared on the latest observation. For tomato fruit yield, there was no effect of pruning on fruit weight per category and on total fruit weight. This indicated that growers may not require this field practice, reducing labor costs and possible transmission of diseases through mechanical removal of the side branches.

10:15 Variability in Watermelon Flower Attractiveness to Insect Pollinators.

J.H. Freeman, Horticultural Sciences, UF/IFAS and S.M. Olson, NFREC-Quincy, UF/IFAS. [V21]

In the Spring and Fall of 2006 pollinator preference of diploid watermelon pollenizers was recorded at Quincy, FL. Triploid watermelon plants [*Citrullus lanatus* (Thunb.) Matsum. & nakai.] do not produce sufficient viable pollen to pollinize themselves and a diploid cultivar must be planted in the field as a pollen source. Recent studies have illustrated differences in triploid watermelon yields as a result of the pollenizer cultivar used. Pollinator preference of watermelon pollenizers may greatly affect the amount of viable pollen that is being

moved throughout a field and thus the amount of triploid fruit that will be set. Pollinator visitations were recorded for the pollenizer cultivars Companion, Mickylee, and SP-1, and the triploid cultivar Intruder. Visitation to 'Mickylee' and 'SP-1' was greater than that of 'Companion'. Visitation of the diploid cultivars was also greater than that of the triploid cultivar. 'Companion' has recently been shown to be a less effective pollenizer than 'Mickylee' or 'SP-1' and lower visitation by pollinators may be a contributing factor. 'Companion' has a nearly entire leaf and staminate flowers that are produced on short peduncles. In many cases this may obstruct the view of the staminate flowers which may reduce the pollinator visitation as visual cues are used in long range foraging decisions. It is important that a pollenizer cultivar be more attractive to pollinators than the triploid because foraging of triploid staminate flowers can reduce the percentage of viable pollen being moved throughout a field. This study suggests that pollenizer attractiveness to pollinators may be an important factor that determines a pollenizer's performance.

10:30 Growing and Marketing Kohlrabi at Local Green Markets in Southeast Florida.

Kenneth D. Shuler, Stephen J. Nie, Deanna V. Shuler, and Pei-Ann N. Shuler. Stephen's Produce, Jupiter. [V22]

Stephen's Produce began growing and marketing kohlrabi in 2001 from a 0.15 acre backyard market garden to help supply the West Palm Beach Green Market with a Saturday supply of Agarden fresh@ produce. The garden has been expanded each year. In 2006-2007, 0.38 acres were under cultivation and clientele were being served at two weekend green markets. Kohlrabi (green and purple cultivars) were two of the 30 crops grown and have been included in the crop mix for the past five seasons. Planting schedules, growing and harvesting methods, yields, and sales figures will be discussed. For the 2006-2007 season, 28 plantings of kohlrabi were made for the 28 week sales season which began 21 Oct and concluded 29 April. Kohlrabi was cut, excessive leaves trimmed off, and lightly spray washed the day before sales. They were generally sold for \$1.00 each. In 2003-2004, an average of 32 green and 19 purple kohlrabi were grown and sold each week. In 2005-2006, an average of 14 green and 25 purple kohlrabi were grown and sold each week.

10:45 Determining Optimum Planting Dates for Inter-Cropped Cucumber, Squash, and Muskmelon with Strawberry.

Bielinski M. Santos, GCREC, UF/IFAS. [V23]

Field trials were conducted to determine the optimum planting date to intercrop cucumber, squash, and muskmelon with strawberry. Planting dates were January 24, February 7 and 21, and March 7 and 21. Seeds of 'Straight Eight' slicer cucumber, 'Crookneck' squash, and 'Athena' muskmelon were sown in between double strawberry rows. There was a freezing event on February 14, when temperature reached 29°F and plants were protected with overhead irrigation. Marketable yield of each crop were collected twice a week for cucumber and squash, and once a week for muskmelon. Preliminary results indicated that cucumber and squash yields are the highest when planted between February 23 and March 9, whereas muskmelon can be planted starting on January 25. It appears that muskmelons are more tolerant to cold temperatures than the other two crops.

11:00 Pumpkin (*Cucurbita pepo*, *C. maxima*, *C. moschata*) as an Alternative Crop in a Northeast Florida Seepage-Irrigated Production System.

C. M. Worthington, D. M. Gergela, C. M. Hutchinson, Horticultural Sciences, UF/IFAS. [V24]

Pumpkin production was evaluated as an alternative crop for northeast Florida farmers. Twenty-six varieties were evaluated at the Florida Partnership for Water, Agricultural and Community Sustainability (PWACS) at Hastings farm in Hastings, FL in 2006. Varieties were categorized into 5 classes or types (miniature, small-decorative, medium and large-sized jack-o-lantern, and specialty) pumpkins. Treatments were arranged in a randomized complete block design with three replications. Total N, P₂O₅ and K₂O was applied at rates of 258,

72, and 143 kg ha⁻¹, respectively. Pumpkins were grown on raised beds with silver reflective plastic mulch using seepage irrigation. Plant spacing for vining and bush-type varieties was 0.8 m within-row and 2.7 and 2.0 m between-rows, respectively. Seeds were planted 18 July and fruit harvested 9 October (83 days after planting). Lil' Pump-ke-mon produced the highest yields in the "miniature" category at 18.4 MT ha⁻¹ followed by Hooligan and Baby Boo at 13.4 and 12.3 MT ha⁻¹, respectively. Orange smoothie in the "small decorative" category had significantly higher marketable yields (25.8 MT ha⁻¹) compared with all others in the "small decorative" category. There were no significant differences within "medium" and "large-sized jack-o-lantern" categories. Average fruit weights for these two categories were 2.5 and 3.1 kg, respectively. Cinderella, the highest yielding "specialty" variety, produced significantly higher marketable fruit yields (46.1 MT ha⁻¹) compared with Long Island Cheese (19.0 MT ha⁻¹) and Lumina (13.2 MT ha⁻¹). Pumpkin variety evaluation should continue in northeast Florida to identify varieties with improved production characteristics in each category.

11:15 Growing Specialty Potatoes in Southeast Florida: Is it Feasible?

Darrin Parmenter, Palm Beach County Extension, UF/IFAS; Doug M. Gergela, Chad M. Hutchinson, and Russell T. Nagata, Horticultural Sciences, UF/IFAS. [V25]

Currently, potato (*Solanum tuberosum*) production is centered in the southwest (Immokalee) and northeastern (Hasting) areas of Florida. Even though Palm Beach County is traditionally one of the largest vegetable producing areas in the state, very little potato production has occurred in the area. In 2004, a study was initiated in Palm Beach County to identify if potatoes could be successfully grown, what cultivars would demonstrate consistent marketable yields, and how they could be successfully marketed. Using the small-scale, community supported agriculture (CSA) model, the three-year study indicated that compared to conventionally grown potatoes, yields of the specialty-type cultivars grown in Palm Beach County were considerably lower than state averages. However, by marketing the crop as either 'specialty' or 'new' potatoes, the CSA subscribers responded favorably and would like to see potatoes as a component of their weekly produce box.

SCSSF Program Graduate Forum I: Water, Nutrients, And Environmental Quality

Monday June 4

10:00 Sensing Accuracy of Four Commercially Available Soil Moisture Irrigation Controllers.

B. Cardenas-Lailhacar and M. D. Dukes, Agricultural and Biological Engineering, UF/IFAS. [SC1]

Over-irrigation has been reported for homeowners having automatic irrigation systems in Florida. Soil moisture sensor (SMS) irrigation control systems have recently been commercialized for single family homes. Each SMS system consists of a probe to be buried in the irrigated zone, and a controller that has an adjustable soil moisture content (θ) set point, for irrigation bypass. The objectives of this research were to: a) determine a relationship between actual θ and the soil moisture content sensed (θ_s) by four different SMS system brands (Acclima, Rain Bird, Irrrometer, and Water Watcher), and b) quantify the proportion of scheduled irrigation cycles that the different SMS systems could bypass. Three SMS probes from each brand were buried between 7 and 10 cm depth, on turfgrass plots, at the University of Florida, in Gainesville. In every plot, a calibrated ECH₂O probe was also installed, at the same depth, to continuously monitor θ . The θ records were then compared to the θ_s readings. Overall, only one Irrrometer and the three Acclima controllers resulted in a predictable relationship between actual θ and θ_s ($r^2=0.82$ for the Irrrometer, and between $r^2=0.66$ and $r^2=0.89$, for the Acclimas). Rain Bird and Water Watcher controllers did not produce θ_s readings related to θ . In spite of this, the SMS systems

were able to follow the main wet and dry weather/soil conditions. Since wet conditions prevailed during the 308-day study period, the SMS systems bypassed between 32% and 92% of the scheduled irrigation cycles.

10:15 Tomato and Pepper Yield Response to Irrigation Management and Nitrogen Rates under Plastic Mulch Conditions.

L. Zotarelli, M. D. Dukes, J. M. Scholberg, J. Icerman, K. Le Femminella, and R. Muñoz-Carpena, Agricultural and Biological Engineering, UF/IFAS. [SC2]

The objectives of this study were to evaluate the effects of different N-fertilizer rates and irrigation practices on the yield and water use efficiency (WUE) of pepper and tomato production systems during 2006. Three N-rates (166, 208, 312 kgN/ha) were evaluated across three different drip irrigation scheduling methods. A fixed time (FT) treatment was included to mimic grower practices and plants were irrigated once daily. Two treatments controlled by a soil moisture sensor (SMS) were allocated five irrigation application windows. If the volumetric water content exceeded the predefined SMS treatment threshold during a potential application event, irrigation was bypassed. The Acclima's decide to irrigate the entire event or not at the very beginning. The QIC's on the other hand can turn the system on/off in one minute increments. The programmed irrigation window was 24 min in length. For tomato, the effect of subsurface drip irrigation (SDI) coupled with a SMS was evaluated. Compared to FT, SMS treatments reduced water use by 40 to 45% and 12 to 66% for tomato and pepper, respectively. Tomato yield was higher on SMS/SDI treatments than FT, while pepper yield was not affected by irrigation. In general, SMS treatments increased irrigation WUE 2-3 times compared to FT treatments for both crops while N-rate did not affect yield. Average marketable fruit yields were 51, 15, and 39 Mg/ha for tomato, pepper, and fall-grown pepper, respectively. Use of SMS based systems appears to be promising as a management option to enhance WUE.

10:30 Evapotranspiration and Soil Moisture-based Irrigation Control on Turfgrass Compared to Theoretical Requirements.

M. L. Shedd and M. D. Dukes, Agricultural and Biological Engineering, UF/IFAS; G. L. Miller, Crop Science Dept., North Carolina State Univ. [SC3]

A variety of commercially available technologies for reducing residential irrigation water use are available to homeowners. These technologies include soil moisture sensors, rain sensors and evapotranspiration (ET) based controllers. The purpose of this research was to evaluate the effectiveness of these various technologies based on irrigation applied, turfgrass quality measurements, and compared to theoretical irrigation requirements. Testing was performed on two types of soil moisture sensors (SMS, LawnLogic® and the Acclima Digital TDT® RS500) at low, medium, and high soil moisture threshold settings. Mini-Clik® rain sensors comprised seven time-based treatments, with three treatments pre-set for 3 mm of rainfall and the remaining 4 rain sensor treatments had sensors pre-set to bypass irrigation for 6 mm of rainfall. Two ET controllers were also tested, the Toro Intelli-Sense™ controller and the Rain Bird® ET Manager™. A time-based treatment with two days of irrigation per week and no rain sensor (2-WORS) was established as a comparison. SMS-based treatments resulted in 0-63% reductions in water use compared to 2-WORS. Rain sensor treatments resulted in 7-33% reductions in water use. ET-based irrigation resulted in 36% to 59% reductions in water use compared to 2-WORS. The SMS treatments at the low threshold settings resulted in high water savings, but reduced turf quality to unacceptable levels. The medium threshold setting SMS-based, time-based and both of the ET-based treatments produced good turfgrass quality while reducing irrigation water use compared to 2-WORS. Savings for the medium SMS-based systems ranged from 11-28%.

10:45 Characterization of Sorption of Hydrophobic Organic Pesticides in Carbonatic and Non-carbonatic

Soils from Florida, Puerto Rico, and Uganda.

G. Kasozi, P. Nkedi-Kizza, Soil and Water Science, UF/IFAS; J. A. Dumas-Rodriguez, Crop Protection Dept., Agricultural Sciences College, Univ. of Puerto Rico-Mayaguez; Y. Li, TREC, UF/IFAS; D. Hodell, Geology Dept., UF; W. Harris, Soil and Water Science Dept., UF/IFAS; and D. Powell, Chemistry Dept., UF [SC4]

Sorption is a major process that influences the environmental fate of a pesticide once applied to agricultural soils. In US, there are about 500 soil series with carbonatic mineralogy and 12 of them occur in South Florida and 8 in Puerto Rico. A lot of research has been done on characterizing the sorption of organic pesticides in non-carbonatic soils but a literature search indicates lack of these data for Carbonatic soils. Eighty five percent of Florida's vegetables and tropical fruits are grown on these soils. The sub-tropical climate in South Florida and Puerto Rico, and the tropical climate in Uganda encourage proliferation of pests. As a result, a variety of pesticides are used to control these pests. Several pesticides have been reported in both surface and ground water of South Florida and Puerto Rico. Our data on some of these pesticides (Atrazine, Ametryn, Duiro and Carbaryl) indicate that these pesticides adsorb less on Carbonatic soils compared to the non-carbonatic soils. This study aims at understanding the cause for the anomalous sorption behavior of hydrophobic organic pesticides applied to carbonatic soils. For comparison, soils associated with carbonatic soils and soils that differ in type and geographic location (Spodosols and Oxisols) were included in the study. The carbonatic soils in South Florida are very shallow, underlain by porous limestone bedrock and are characterized by a high water table. Their low sorption capacities for organic pesticides may pose threats to the environment and natural resources.

11:00 Estimation of Release Properties of Slow-Release Fertilizer Materials.

L. C. Medina, J.B. Sartain, and T.A. Obreza, Soil and Water Science, UF/IFAS. [SC5]

At present there is no official laboratory method for verification of nutrient release claims for slow-release fertilizer materials. A laboratory long term incubation methodology (182 day) has been developed which produces nutrient release constants over an extended period of time. In addition, a relatively short term extraction method (74 hr) has been developed to assess nutrient release under accelerated laboratory conditions. Through regression techniques the release constants established for individual slow-release nutrient sources using the incubation methodology are used in conjunction with the laboratory extraction data to verify the release claims of the slow-release fertilizer source. For select slow-release nutrient sources we have been able to predict the nutrient release curve with greater than 90% accuracy. Mixtures of slow-release nutrient have proven more difficult to predict. It is typical for soluble and slow-release nutrient sources to be mixed in commercial products. Successes and failures in predicting nutrient release from mixtures of soluble and slow-release nutrient sources will be discussed in detail. Ultimately, it is intended that these methodologies will be accepted as an official method for verifying the nutrient release claims placed on slow-release fertilizer materials.

11:15 Determination of Soil Sorption Coefficient (Koc) of Strongly Hydrophobic Organic Chemicals (SHOCs) Using Mixed Solvents Systems and the Solvophobic Model.

Muwamba, P. Nkedi-Kizza, R. D. Rhue, Soil and Water Science, UF/IFAS; Jeffrey Keaffaber, Chemistry Dept., UF; and Kafui Awuma, Soil and Water Science, UF/IFAS. [SC6]

Determination of the sorption coefficients (Koc) of strongly hydrophobic organic chemicals (SHOCs) in aqueous systems is difficult due to their very low solubility and the potential to adsorb on container walls and vessels. Three probe SHOCs (β -endosulfan, anthracene and dieldrin) of aqueous solubility between 0.08 and 0.32 $\mu\text{g/ml}$ were used. Sorption of these compounds on teflon lined centrifuge tubes was measured in methanol-water systems. The volume fraction of methanol (f_c) ranged from 0.10 to 1. The solution concentrations of dieldrin and β -endosulfan were analyzed using High Pressure Liquid Chromatography (HPLC) with UV

detection. Liquid Scintillation Counting (LSC) was used to measure anthracene in solution. Sorption coefficients in aqueous systems were obtained by use of the solvophobic model and extrapolating the sorption coefficient to zero fraction cosolvent. More than 50% of β -endosulfan and anthracene was calculated to be adsorbed on the centrifuge tubes in aqueous systems. The sorption coefficients of dieldrin and anthracene on three carbonatic soils (Chekika, Krome and Perrine) were then determined in methanol-water systems at ($0.35 < f_c < 0.6$) that eliminated sorption on the centrifuge tubes. Using the Solvophobic model, the sorption coefficients in aqueous systems were extrapolated at $f_c = 0$. The sorption coefficients were then normalized with soil organic carbon content to obtain Koc values. These values will be compared to literature Koc values when discussing the validity of the methods used in our study to measure Koc of strongly hydrophobic organic chemicals.

11:30 Evaluation and Demonstration of Evapotranspiration-Based Irrigation Controllers.

S. Davis, M. D. Dukes, Agricultural and Biological Engineering, UF/IFAS; Sudeep Vyapari, Environmental Horticulture, UF/IFAS; and G. L. Miller, Crop Science Dept., North Carolina State Univ. [SC7]

A new technology for single family home irrigation that uses evapotranspiration (ET) data is being used to apply appropriate irrigation to the landscape. This technology has proven to conserve water in the western U. S.; however, testing has not been performed in Florida where rainfall amounts exceed those found in the western states. Therefore, this study was designed to test ET controllers in residential landscape plots to determine irrigation savings compared to a homeowner irrigation schedule under Florida conditions. Twenty plots measuring 7.62 m x 12.2 m were constructed at the UF Gulf Coast Research and Education Center. They are partitioned into 65% St. Augustinegrass (*Stenotaphrum secundatum*) and 35% mixed ornamentals to represent a typical Florida landscape. The ornamentals chosen are: Cape Plumbago (*Plumbago auriculata*), Crape Myrtle (*Lagerstroemia indica* 'Natchez'), Gold Mound Lantana (*Lantana camara* 'Gold Mound'), Big Blue Liriope (*Liriope muscari* 'Big Blue'), and Indian Hawthorne (*Raphiolepis indica*). Turfgrass areas are sprinkler irrigated and the ornamentals are irrigated with microirrigation. Three ET controllers are being tested and compared to two time-based treatments. The irrigation treatments are 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 (Dukes et al., 2002), and a time-based treatment that is sixty percent of the previous time-based treatment. Initial water application and turf quality results will be presented. In addition, controller performance will be compared to theoretical turfgrass needs.

Graduate Student Forum II: Agronomy

Monday June 4

1:30 Tifton-9 Bahiagrass Performance in a Silvopastoral System with Boer x Spanish Goats and Loblolly Pines.

N. Gordon-Bradley and O. U. Onokpise, Forestry and Natural Resources Conservation, Florida A & M Univ. [SC8]

Tifton 9 Bahiagrass has become one of the most productive and widely used forage grass species in the Southeast United States. However, its performance in an agrosilvopastoral system is not well known. Similarly, there is limited documentation of goats as possible livestock entities in a silvopastoral system. The perception of using goats for vegetation management other than for a grazing livestock remains very high. The present study is being conducted to determine stocking rates of Boer x Spanish goat crossbreeds in a silvopastoral system of loblolly pines and Tifton-9 bahia grass. Two stocking rates, 10 goats and 17 goats per hectare respectively, were placed in paddocks in which Tifton-9 Bahia grass had been planted between tree rows of loblolly pines at a spacing of 4 m x 12 m. The experimental design was a split plot design with two replications. Results showed that the mean pre herbage mass for the shaded area in 2005 was 4675.8 kg ha⁻¹ and 4450.28 kg ha⁻¹. The post

herbage mass for 2005 was 4242.68 kg ha⁻¹ for the shaded and 4122.24 kg ha⁻¹ for the unshaded. The 2006 results showed pre herbage mass for the shaded area as 4553.13 kg ha⁻¹ and 4424.24 kg ha⁻¹. The post herbage mass for 2006 was 4090.43 kg ha⁻¹ for the shaded areas and 3942.17 kg ha⁻¹ for the unshaded areas. It is anticipated that results obtained from these studies will be made available to producers' especially small landowners and limited resource farmers.

1:45 Type and Frequency of Excreta Application to Bahiagrass (*Paspalum notatum*) Swards Affects Plant Responses.

U. R. White, L. E. Sollenberger, K. R. Woodard, Agronomy; D. A. Graetz, Soil and Water Science, Y. C. Newman, Agronomy; and J. M. B. Vendramini, RCREC, UF/IFAS. [SC9]

Sixty to ninety percent of nutrients consumed by grazing livestock are returned to pasture in excreta, but distribution is heterogeneous. To better understand nutrient dynamics in pastures, more information is needed regarding the effects of excreta on forage responses. The objective was to determine the effect on bahiagrass herbage accumulation (HA) of excreta type and number of excreta applications per growing season. Treatments were the factorial combinations of excreta types (dung and urine) and application frequencies (1, 2, or 3/season). Dung and urine were collected from animals grazing bahiagrass and subsequently applied to ungrazed bahiagrass plots. A urine application was 2 L to a 60-cm diameter circle, while dung applications were 2 kg to a 30-cm diameter circle. Concentric circles (radii of 0-15, 15-30, and 30-45 cm) to a distance of 0.45 m away from the center of the excreta application were clipped monthly to measure HA. Total-season HA within the 0.45-m radius was greater following urine than dung (4260 vs. 2820 kg/ha). Number of dung applications had no effect on HA, but HA increased linearly from 3910 to 4670 kg/ha as urine applications increased from 1 to 3. HA decreased linearly as distance from the center of urine application increased (5330, 4850, and 3680 kg/ha for the three concentric circles). For dung the response was quadratic (2330, 3060, and 2770 kg/ha) with the lowest HA attributable to physical interference from dung. Urine had much greater impact on grass growth likely due to greater nutrient availability and less physical interference.

2:00 Use of Extracts from Native Grass Species for the Control of Cogongrass (*Imperata cylindrica* L.).

L. D. Reid, O. U. Onokpise, Florida A&M Univ.; and J. L. Norcini, NFREC, UF/IFAS. [SC10]

Cogongrass is one of the most invasive species in Florida and other Gulf Coast States and poses a major problem on forested lands, natural habitats, rights-of-way interstate highways. The present study was undertaken to evaluate the performance of cogongrass when grown in extracts of muhly grass (*Muhlenbergia capillaries* Lam.). Genets and ramets of cogongrass were transplanted into magenta vessels containing 10% solution of root and shoot extracts of muhly grass and magenta vessels were placed in a growth chamber maintained at 28°C, at a 16/8 hour photoperiod and a relative humidity of 55 %. The genets and ramets of cogongrass were evaluated for shoot and root growth, as well as rhizome extension at 7 days interval after transplanting. Preliminary results show that the extracts of muhly grass reduced shoot growth and rhizome extension of cogongrass. The muhly grass root extracts were the most effective in reducing the performance of cogongrass compared to muhly grass shoot extract. Root:shoot ratios of cogongrass also decreased by 50-70%. Thus, muhly grass extracts may contain some allelochemicals that could impact the invasiveness of cogongrass.

2:15 Bahiagrass Genotype Responses to Defoliation Frequency and Intensity.

S. M. Interrante, L. E. Sollenberger, Agronomy; A. R. Blount, NFREC, UF/IFAS. [SC11]

Existing bahiagrass (*Paspalum notatum* Flüggé) cultivars have minimal cool-season production likely due in part to a daylength response. A new genotype is less sensitive to daylength and possesses greater cold tolerance, but

its response to defoliation is unknown. The objective was to compare productivity and persistence of a photoperiod insensitive, cold adapted (PICA) diploid genotype (Selection 4) to those of diploids 'Pensacola' and 'Tifton 9' and tetraploids 'Argentine' and 'Tifton 7'. All were clipped every 7 or 21 d to 4- or 8-cm stubbles during May-October 2005 and 2006. There was no stubble height effect but there was genotype X frequency interaction for total-season dry matter (DM) harvested. For the 21-d frequency, Argentine and Tifton 7 had greatest yields (12.8 and 12.7 Mg/ha), and Argentine (11.7 Mg/ha) was superior to all others for the 7-d treatment. PICA (10.4 Mg/ha) yielded less than all but Pensacola (10.7 Mg/ha) for the 21-d interval and was lowest yielding for the 7-d interval (7.8 Mg/ha). PICA yields were comparable to others early and late in the growing season but less during the warmest months. Cut to an 8-cm stubble during 2 yr, PICA cover (-17 percentage units) decreased more than all genotypes but Tifton 7, but at the 4-cm stubble only Argentine performed better than PICA. In conclusion, PICA was generally lower yielding than the others due to lesser summer yields, and although change in cover was not consistent across stubble heights the large decrease when PICA was clipped to 8 cm is concerning.

2:30 Effects of Nitrogen Fertilization on the Dynamics of Re-growth and Yield for Tifton 85 Bermudagrass.

P. D. Alderman, K. J. Boote, and L. E. Sollenberger, Agronomy, UF/IFAS. [SC12]

With increased cost of N fertilization and narrowing profit margins, cattle and hay producers cannot afford to expend resources to fertilize their pasture unnecessarily. However, they also cannot afford to lose yield as a result of inadequate fertilization. Research on re-growth dynamics and yield responses to varying levels of N fertilization will give producers an indication of how much N fertilizer is needed to provide a given yield as well as healthy pasture. This research was also designed to provide information to develop and test a dynamic forage growth model of bermudagrass which would be used as a best management tool to predict response to management and N fertilization. A field study was conducted at the University of Florida Beef Research Unit at Gainesville, FL on established Tifton-85 bermudagrass pasture during four 1-month harvest cycles during summer 2006 season. Forage yield of Tifton 85 Bermudagrass (*Cynodon spp.*) increased with increase N fertilization rate. The degree of N enhancement in forage yield was greatest during mid-summer, and ranged from 1020 to 4150 kg ha⁻¹. During two of the 1-month growth cycles, weekly measurements of leaf area index, tiller number, leaf, and stem growth were taken to evaluate the dynamics of re-growth after cutting.

2:45 The Extraction of Chitosan from *Callinectes sapidus* (Blue Crab) on the Germination of Sweet Corn Seeds Inoculated with *Pythium aphanidermatum*.

C. Webster, Environmental Sciences Institute; O. U. Onokpise, Forestry and Natural Resources Program; J. J. Muchovej, Ornamental Horticulture; M. Abazinge and E. Johnson, Environmental Sciences Institute, Florida A & M Univ. [SC13]

Chitin, from which chitosan is derived, is the second most abundant polymer in nature after cellulose and is found mainly in crab, shrimp and prawn wastes. Chitosan is a hydrophilic polysaccharide, which is soluble in dilute aqueous organic acid solutions and insoluble in pure water. Chitosan has been used as a seed treatment and a pesticide. Seedling blight of corn (*Zea mays*) is caused by the fungus *Pythium aphanidermatum* can cause significant reductions in yield. The greatest damage to corn seedlings occur during germination either before or after emergence. Seed treatment is an important measure to inhibit the pathogen and for preventing the occurrence of the disease. The objective of this study is to extract chitosan from the blue crab exoskeleton and to investigate its effects on the germination of corn seeds inoculated with *Pythium aphanidermatum*.

3:00 Biocontrol of Cogongrass (*Imperata cylindrical* L.) Using Fungal Pathogens.

R. D. Smalls, O. U. Onokpise and J. J. Muchovej, College of Engineering Sciences and Technology, Florida A&M Univ. [SC14]

Mycoherbicides have been effectively used as an alternative to chemical control of several weedy species due to its environmental safety in agricultural systems. This study evaluates fungal pathogens as bioherbicides of cogongrass and their effects on greenhouse grown native turf grasses: centipede (*Eremochloa ophiuroides* Munro.), St. Augustine (*Stenotaphrum secundatum* Walt.), bermuda grass (*Cynodon dactylon* L.) and bahiagrass (*Paspalum notatum* Flugge.), and amenity grasses; muhlygrass (*Muhlenbergia capillary* Lam.), switchgrass (*Panicum virgatum* L.), maidencane (*Panicum hemitomom* Schult.) and Johnson grass (*Sorghum halepense* L.). Fungi, *Nigrospora oryzaae* and *Curvularia* spp. obtained from St. Augustine and *Bipolaris* spp. from cogongrass diseased leaves were isolated. Fungal conidia from these species were mass produced on PDA in the laboratory. Resultant aqueous suspensions of conidia were used as treatments and were sprayed onto leaves of the above grass species. One set of plants sprayed with sterile water served as controls. All treated plants were then subjected to 100% RH for 2-3 days and then returned to greenhouse conditions for one week. Preliminary results indicated that several different isolates of the *Bipolaris* spp. group of fungi were pathogenic to cogongrass as well as amenity grass (maidencane and switchgrass). Disease symptoms observed ranged from discrete lesions to leaf blighting. The greenhouse studies indicated pathogenicity of *Bipolaris* spp. and that further testing in the field is warranted.

Graduate Student Forum III: Crops

3:30 Water Deficit And Vapor Pressure Difference Effects On Leaf Area Expansion And Transpiration Of Soybean.

A. L. Fletcher and T. R. Sinclair, Agronomy, UF/IFAS. [SC15]

The effect of both water deficit and atmospheric vapor pressure difference (VPD) on transpiration rate (TR) of plants is well understood. However, their effect on whole plant leaf area expansion (PLAE) is less well defined. Generally, both PLAE and TR are unaffected by soil drying until transpirable soil water (TSW) \leq $\frac{1}{3}$. High VPD increases TR and may decrease the expansion of individual leaves. However, the effect of VPD on PLAE and the potential interaction with soil drying has not been examined. This study examined the effect of soil drying, VPD, and their interaction on TR and PLAE. Individual soybean plants with ~4 trifoliolate leaves were placed in growth chambers at either high (mean VPD weighted for PAR = 2.08 kPa) or low (mean = 1.27 kPa) VPD. Control plants were maintained well-watered, while a second set of pots was allowed to progressively dry over 14 days. The high VPD treatment increased TR of well watered plants by 24 % over the low VPD treatment. In both VPD treatments TR were similar to the well watered control until TSW \leq 0.25. Similar to TR, as TSW declined PLAE was unaffected until TSW \leq 0.24 in both VPD treatments. High VPD resulted in a progressive decrease in PLAE in the control plant. By the end of the experiment the daily increase in PLAE was only 43 % of the low VPD plants. These results show that both decreasing TSW and high VPD decrease PLAE, but that these two factors did not interact.

3:45 Growing Scotch Bonnet Hot Peppers (*Capsicum chinense* Jacq.) In Shade Houses: Maximizing Production By Manipulating Light Intensity.

C. Gardner, G. Queeley and T. Hylton, College of Engineering Sciences, Technology and Agriculture, Florida A & M Univ. [SC16]

Hot peppers can grow well under various lighting conditions. However, since there is not much documentation on

the optimum level of light required for production, growers tend to select levels of shade that may not give the best results. The objective of this experiment was to determine the optimum level of light (lux) required for production. The experimental design was a randomized complete block with 4 levels of shade providing the following lux measurements: Zero shade (10,000 lux), 27 % shade (6000 lux), 53 % shade (2000 lux) and 92 % shade (700 lux). Data were collected on growth and yield parameters of the crop and analyzed using regression and ANOVA procedures. By the completion of data collection, there was no evidence of flowering in the 700 lux treatment. We also found significantly fewer branches, larger leaves and taller plants compared to the other treatments. We found no significant difference in the times to flowering for the 10,000, 6000 and 2000 lux treatments. The 10,000 and 6000 lux treatments produced significantly larger fruits ($p < 0.05$) compared to the 2000 lux treatment. Fruits plant⁻¹ were the same for the 10,000 and 6000 lux treatments but the 6000 lux treatment produced significantly more fruits compared to the 2000 lux treatment. At 700 lux, absolutely no fruits were produced. However, marketable fruits plant⁻¹ at 2000 lux, 6000 lux and 10,000 lux were not significantly different.

4:00 Zinc Efficiency in Relation to Root Morphology, Ultrastructure and Antioxidative Enzymes in Rice (*Oryza sativa* L.).

W.R. Chen, MOE Key Lab of Environmental Remediation and Ecosystem Health, College of Natural Resources and Environmental Science, Zhejiang Univ.; Z.L. He, IRREC, UF/IFAS; X.E. Yang and Y. Feng, MOE Key Lab of Environmental Remediation and Ecosystem Health, College of Natural Resource and Environment Science, Zhejiang Univ. [SC17]

To elucidate physiological mechanisms of the Zn efficiency in rice (*Oryza sativa* L.), comparative studies on root morphology, ultrastructure, and oxidative enzyme activities were investigated between Zn-efficient rice genotype (IR8192) and Zn-inefficient rice genotype (Erjiufeng) grown under severely Zn-deficient ($pZn^{2+} > 11.5$), moderate Zn-deficient ($pZn^{2+} = 11.0$), and sufficient Zn ($pZn^{2+} = 9.7$) conditions. The results showed that Zn-deficiency decreased the biomass yield and root activity of both genotypes, but IR8192 can maintain fairly high biomass and root activity under moderately Zn-deficiency whereas the biomass yield and root activities of Erjiufeng decreased rapidly. Moderately-Zn-deficiency increased the root length, root surface and root tips of both genotypes, but the increase was greater for IR8192 than Erjiufeng. Under Zn-moderately deficient condition, many swollen mitochondria were observed in the root tip cells of Erjiufeng, whereas most root cells in IR8192 remained intact. Severe Zn-deficiency destroyed the fine structures of both genotypes. Alteration in the ultrastructure of these organelles were accompanied with elevated hydrogen peroxide (H₂O₂) content,

MDA content, and electrolyte leakage in both cultivars and the increases were less in IR8192 than in Erjiufeng. This may result from the differences existed in the activities of antioxidant enzymes between these two genotypes. In contrast to Erjiufeng, higher activities of antioxidant enzymes, ascorbate peroxidase (APX), peroxidase (POD), Catalase (CAT), and superoxide dismutase (SOD) were observed in IR8192 under Zn-deficient conditions. These results suggest that Zn efficiency in IR8192 is closely associated with its more efficient antioxidative system and intact root tip cell and functions under low Zn conditions.

4:15 Bahiagrass Yield, Nutritive Value and P uptake as Influenced by Cattle Manure Application Rate and Strategy.

K. Obour, M.B. Adjei, M. L. Silveira, RCREC, UF/IFAS; E. Valencia, Univ. of Puerto Rico-Mayaguez; and J. E. Rechcigl, GCREC, UF/IFAS. [SC18]

We evaluated the effects of cattle manure (CM) applied alone or in combination with ammonium nitrate (AN) on dry matter (DM) yield and nutritive value of bahiagrass (*Paspalum notatum* L. Fluegge). The N rates were 200 and 400 kg N ha⁻¹ applied as CM or CM plus AN (50/50% combination). Nitrogen rates were applied either in a single or split dosage. Bahiagrass was clipped at 28-d intervals for DM yield, crude protein concentration (CP) and

in vitro organic matter digestibility (IVOMD). During the 2-yr study, bahiagrass DM yield, IVOMD, and CP were greatest for the treatments that received CM+AN application. Increasing N rate from 200 to 400 kg ha⁻¹ increased DM yield, IVOMD, and CP for all application strategies, however nutrient uptake recovery was lower at the 400 kg ha⁻¹ N application rate compared to the 200 kg ha⁻¹ N rate. Averaged across the 2-yr, 44 to 69% of the applied P was recovered by bahiagrass when CM+AN was applied compared to 16 to 23% recovery when CM was applied alone. Soil test P in the A horizon (0 to 15 cm) on the average was reduced by 64 and 54% in 2005 and 2006, respectively, when CM+AN was applied compared to treatments that received only CM application. The results of this showed that applying CM in combination with an inorganic nitrogen source can provide greater forage yield of high nutritive value and also reduce P risk to the environment.

4:30 Using Growth Analysis to Select Radish Cultivars for Salad Crop Production Systems.

O. Monje, N. C. Yorio, S. L. Edney, G. W. Stutte, Dynamac Corp.; and R. M. Wheeler, NASA, Applied Technology Directorate, Kennedy Space Center. [SC19]

Early outpost missions to the Moon will benefit from salad crop production systems designed to supplement crew diets with fresh vegetables. Careful selection of three candidate radish (*Raphanus sativus* L.) cultivars, Cabernet, Giant White Globe, and Cherry Belle was conducted to optimize productivity in actual flight systems. Leaf area and dry mass, total dry mass, and hypocotyl dry mass were measured in sequential destructive harvests at 7, 12, 16, 18, and 21 days after planting (DAP). Cabernet produced the largest edible dry mass in 21 DAP. Giant White Globe produced twice as much leaf area as Cabernet or Cherry Belle, but its leaf photosynthetic capacity was only about 50% that of Cabernet and Cherry Belle. After 21 DAP, Giant White Globe produced as much total biomass as Cabernet, but produced only 50% as much storage root mass. Cherry Belle produced 40% less total biomass than Cabernet, even though the photosynthetic efficiency of its leaves was similar. However, its crop growth rate (CGR) was slower because it had less leaf area than Cabernet during the last 11 DAP resulting in the production of 50% smaller storage roots. Cabernet reached its peak CGR about 1 day earlier than Cherry Belle, and about 3 days earlier than Giant White Globe. The data suggests that Cabernet could be harvested after 14 DAP, without significantly reducing the edible yield obtained. This earlier maturation could result in considerable savings in power dedicated to lighting in salad production systems.

4:45 Determining Aerodynamic Conductance of SPAR Chambers from Energy Balance Measurements.

O. Monje, Dynamac Corp., Kennedy Space Center; L. H. Allen, Jr., USDA/ARS; and K. J. Boote, Agronomy, UF/IFAS. [SC20]

The aerodynamic conductance (gA) of SPAR chambers was determined from measurements of energy balance and canopy temperature over a closed peanut canopy. gA was calculated from the slope of a plot between sensible heat flux (H) and the canopy-to-air temperature difference. H and the canopy-to-air temperature were varied by manipulating chamber CO₂ concentration or vapor pressure deficit. Net radiation was measured with a net radiometer, latent heat flux (LE) was calculated from gas exchange measurements of evapotranspiration (ET), and H was calculated by subtracting LE from R_{net}. Canopy temperature was measured using two Apogee infrared thermometers placed at the same height as the net radiometer in a nadir viewing angle. The average gA over a 34 day-old peanut canopy was 3.9 mol m⁻² s⁻¹. The ability to determine gA in the SPAR chambers allowed the separation of canopy stomatal conductance (G_c) from contributions due to leaf boundary layer conductance and turbulent mixing penetrating the vegetation. Canopy G_c was calculated from surface conductance (G_s) and gA. G_s was estimated from rates of evapotranspiration measured with the SPAR gas exchange system. G_s of the 34 day-old peanut canopy was 0.45 mol m⁻² s⁻¹. The accuracy of the G_s measurements depends on the ability to measure the rate of soil evaporation within the chamber.

General Session: Nutrients, Crops/Climate, And Pest Management

Tuesday June 5

10:00 A Review of Sugarcane Fertilizer Nutrient Requirements for Different South-Florida Production Environments.

K. T. Morgan, SWFRECC; J. M. McCray, EREC; and R. W. Rice, Palm Beach County Extension, UF/IFAS. [SC21]

A UF/IFAS Task Force reviewed historical literature underlying fertilizer recommendations for sugarcane grown on organic and mineral soils in south Florida. Recently generated (but unpublished) nutrient response data were assessed and on-farm studies were designed to resolve knowledge gaps. Objectives were to confirm/update fertilizer recommendations and identify BMPs consistent with modern cultivars (higher yield potential) and evolving cultural practices (expansion into nutrient-deficient mineral soils and improved fertilizer sources). Nitrogen is generally not recommended for sugarcane production on organic soils (Histosols) since soil-N mineralization rates nearly equal or exceed the crop requirement. Phosphorus recommendations for Histosols are based on a soil-test water extraction that is increasingly unpopular with growers. Improved soil-P extraction chemistries for high-pH organic soils need to be investigated. Magnesium is rarely recommended, and sulfur inputs are only suggested as a soil-pH adjustment strategy to improve micronutrient availability.

Approximately 24% of the sugarcane acreage has expanded into sandy mineral soils (predominantly Spodosols), yet nutrient response data for these low water and nutrient retention soils are limited. On-farm nutrient application rate and timing research are currently being conducted, emphasizing N and P. Soil-test P calibration research is nearing completion for organic soils, but much more is needed for mineral soils. Silicon is described as a "beneficial" plant nutrient (not essential) for sugarcane and current work with Si needs to be completed before recommendations can be made. Field testing of Mg and S rates is needed to develop appropriate recommendations.

10:15 Free-Air CO₂ enrichment (FACE): Model Analysis of Gaseous Dispersion Arrays for Studying Rising Atmospheric CO₂ Effects on Vegetation.

Leon Hartwell Allen, Jr., USDA-ARS, Gainesville and S.E. Beladi, Agronomy, UF/IFAS. [SC22]

Atmospheric concentrations of carbon dioxide (CO₂) have risen from about 280 to 380 μmol mol⁻¹ from the beginning of the industrial revolution to 2007, due mainly to burning of fossil fuels. Various systems have been devised for studying impacts of rising CO₂ and other potential global environmental changes on green plants. These systems include leaf chambers, growth chambers with artificial lighting, greenhouses, sunlit controlled-environment growth chambers, open-top field chambers, and field free-air CO₂ enrichment (FACE) arrays. Each system has unique capabilities and limitation, with the advantages of FACE systems being large areas with undisturbed environmental conditions that allow secondary treatments within each array. Disadvantages include cost of CO₂, complexity, and inability to provide CO₂ X temperature interactions across wide ranges of temperatures. This modeling study was undertaken to provide predictions of CO₂ dispersion with several types of emission arrays including ground-level area-source emitters, upwind vertical vent pipe emitters, elevated within-block area-source emitters, and combinations of each, for vegetation ranging from a 40-m tall forest to a 0.3-m short grassland. A two-dimensional vertical eddy diffusion and horizontal mass transport model was used to predict CO₂ dispersion using vertical profiles of eddy diffusivity and horizontal wind speed.

The combination of elevated area-source emitters with upwind vertical vent pipes predicted the most uniform distributions of CO₂, but the upwind vertical vent pipe emitters alone gave satisfactory distributions, and

are easier to set up in the real world. As expected, predicted CO₂ costs were proportional to the height and area of vegetation.

10:30 Evapotranspiration: A Measurement System and Remote-Sensing Method for Regional Estimates.

K. F. Heimburg, Environmental Engineering Sciences Dept., UF and Agronomy Dept., UF/IFAS; L. H. Allen, Jr., USDA-ARS; and W. C. Huber, Environmental Engineering Sciences, UF. [SC23]

A method was developed for making evapotranspiration (ET) estimates based on measured air temperature, remotely sensed surface temperature, and net radiation (Rn). The slope and intercept of regressions of surface-to-air temperature gradients versus Rn were composite values of surface parameters. Five equations were developed to calculate ET from these composite values plus Rn and some combination of two of four surface parameters (bulk air transport, moisture availability, saturation deficit, and soil heat flux). The method was validated from ET measurements made over a pasture using the energy budget--profile Bowen ratio technique. A data acquisition and processing system, air sampling system, and time constant matched humidity, temperature, and radiation sensors were developed to log data and calculate half hour average surface energy budgets. Generally, radiation surface temperatures were not the same as effective heat transport surface temperatures. Because parameters were assumed constant, estimated instantaneous ET by this method was at times too high or low, but these errors tended to cancel in estimated cumulative ET. The method was well suited for use with 1-3 hour time resolution satellite data. The method evaluated surface parameters such as moisture availability, required no interpolation for ET estimates between data sets, was adapted to inevitable cloud-caused loss of satellite surface temperatures, and reduced calculation of ET to estimating total positive Rn and duration of positive Rn in a particular period. The ET estimates of this method were as accurate as the simple residual method which lacks some of the advantages of this method.

10:45 2004 Nematode Survey of Peanut Fields in Columbia County: Findings, Implications and Follow-Up.

W. D. Thomas, Columbia County Extension, UF/IFAS; J. R. Rich and M. Barber, NFREC, UF/IFAS. [SC24]

Nematode incidence and damage in peanuts have steadily increased over the last decade in Columbia County, Florida. Nematode population increases in North Central Florida peanut crops are primarily due to: 1) concentration of peanut into larger production units, resulting in shorter rotation intervals; 2) low economic value of crops traditionally utilized in rotation with peanuts; and 3) lack of adapted nematode resistant peanut variety (s) adapted to the production areas. A survey was conducted in 2004 to document the extent of the problem in Columbia County. The survey included 100% of the peanut growers and 25% of the total peanut acreage in the county for 2004. Over 60% of the acreage surveyed was found to have populations of *Meloidogyne arenaria race 1* (Rootknot) and *Pratylenchus brachyurus* (Lesion) sufficient to cause 20% or greater damage to the crop. Each grower received follow-up reports on the peanut field(s) sampled on their respective farm with a Crop Damage Potential Rating and recommendations for future nematode management of the field. As a result of the survey, we are in the second year of screening current peanut varieties and breeding lines in high incidence fields to identify any existing nematode tolerance/resistance for production and/or variety development.

11:00 Breeding for Root Knot Nematode Resistance in Peanut.

B. L. Tillman and D. W. Gorbet, NFREC-Marianna; J. R. Rich, NFREC-Quincy; and W. D. Thomas, Columbia County Extension, UF/IFAS. [SC25]

Root knot nematode is a yield limiting pest of peanut in several Florida counties. Breeding cultivars with resistance could boost yields and reduce the use of costly nematicides. The UF peanut breeding program is actively developing root knot resistant peanut material for eventual cultivar release. The primary source of

resistance is a single gene introgressed from wild relatives of cultivated peanut by researchers at Texas A&M University. The gene confers near immunity, but current cultivars are not adapted to Florida, or the southeastern US primarily because of their susceptibility to tomato spotted wilt virus (TSWV). We have also discovered that AP-3 and Hull, genotypes that do not have this gene, seem to tolerate root knot nematode infection in comparison to other genotypes. These "tolerant" genotypes also have resistance to TSWV and are better adapted to the southeastern US. We are currently testing breeding lines that have parentage related to the Texas single gene, AP-3 or Hull. These lines show much improved resistance to TSWV and appear adapted to Florida growing conditions.

11:15 Nature and Extent of Plant-Parasitic Nematode Problems in Florida Cotton and Peanut Production.

J. R. Rich, W. D. Thomas, H. E. Jowers, M. C. Donahoe, L. Johnson, C. L. Brasher, J.P. Bowden and C. Vann, UF/IFAS. [SC26]

Cotton and peanut are major agronomic crops in Florida and produced on greater than 36,000 and 50,000 ha, respectively, each year. Due to limited economic opportunities for production of other crops, these two crops are mono-cultured or grown in shortened rotation sequences which increase nematode problems in these crops. The most damaging nematode species affecting peanut are peanut root knot and lesion nematodes; on cotton, the southern root-knot and reniform nematodes are most damaging. Past surveys of nematode problems in Florida agronomic crops have been limited and were conducted 15-30 years ago. Significant cropping pattern shifts have since occurred with large increases in cotton and peanut production and dramatic decreases in field corn and soybean production. Surveys were conducted in late summer and fall of 2004-2006 in the major agronomic crop production areas of Florida. Selection of cotton and peanut fields for sampling was random to provide unbiased nematode assay results. A soil sample for nematode analysis represented 8-12 cores to 25-cm-deep taken randomly from a 10 ha area in farmer fields. Soil in a 100 cm³ sub-sample was processed using the modified sugar flotation-centrifugation extraction method. More than 200 farmer fields representing an estimated 7000 ha were sampled. Results showed that over 50% of the soil samples had nematode population densities capable of causing damage to a following crop. Damage caused by lesion nematodes was identified as an emerging problem in peanut and a greatly increased reniform nematode presence was found in cotton.

11:30 Methyl Bromide Transition Strategy for Florida Fruit and Vegetable Crops.

J. W. Noling, CREC, UF/IFAS. [SC27]

Florida growers, who have continued to rely on existing and internationally approved CUE supplies of methyl bromide, painfully recognize an increase in price, a future of diminishing supply, and the limits to which methyl bromide use rates can be reduced without loss of pesticidal efficacy and crop yield. Transition to another IPM strategy will require coapplication of different fumigants and herbicides and new cultural practices to achieve pest control efficacy and crop yield response similar to that of methyl bromide. Transition to the other chemical alternatives will also require significant changes to current practices, integration of new fumigant distribution and soil injection technologies, and new tillage and irrigation practices to enhance the performance of alternatives and reduce potential fumigant emissions from treated fields. Future use of the chemical alternatives will be subjected to further restrictions requiring reduced rates, expanded buffer zones, personal protective equipment, emission reduction strategies including more gas retentive plastic mulches to reduce overall field application rates and soil emissions of fumigant gases. Use of more gas retentive mulches will require changes in field application and soil injection equipment to insure accurate and uniform dispensing of such low fumigant application rates. Transition to the multi-chemical combination treatments will be more difficult and less forgiving than that of methyl bromide, and unavoidably, some factors that affect response inconsistency are not completely manageable or resolvable.

11:45 The Importance of Fumigant Synergies with Chloropicrin.

J. W. Noling, CREC, UF/IFAS and J. P. Gilreath, formerly GCREC, UF/IFAS. [SC28]

Given the importance of methyl bromide to Florida agriculture and diminishing supply of new production, it is imperative that the ways and means of reducing levels of methyl bromide usage in Florida agriculture continue to be evaluated. Mandated use of gas-tight, virtually impermeable plastic mulch film (VIF) in combination with methyl bromide formulations with increased chloropicrin content (i.e., 50% Mbr/50% Chloropicrin and 30% Mbr/70% Chloropicrin) has been proposed as a viable means of soilborne pest and disease control, and as a means of further reducing future CUE appropriations to Florida agriculture. The scientific basis for such efficacy claims regarding pest control synergies between methyl bromide and high proportions of chloropicrin (>50%) needs to be field validated under Florida conditions to substantiate claims of pest control efficacy and fumigant synergy. The primary objective of these studies were to evaluate lethal dosage and pest control synergies between different methyl bromide, methyl iodide and chloropicrin formulations, reduced application rates, and use of gas retentive mulch films. In these studies, superior control of yellow or purple nutsedge at reduced application rates of methyl bromide or methyl iodide and chloropicrin was achieved only with gas retentive films. Chloropicrin was observed to contribute little, either directly or synergistically with other fumigants for control of nematodes or yellow or purple nutsedge.