

Citrus Section Abstracts

Kim D. Bowman, Presiding

MONDAY MORNING SESSIONS

10:00-12:00 Concurrent Sessions -A

10:00 Performance of Seedless Pineapple Oranges on Four Rootstocks. Gregory McCollum and Kim

D. Bowman, USHRL, USDA.

Irradiation of seeds of Pineapple orange resulted in the generation of several mutants with reduced seed count. In order to determine the horticultural characteristics of these mutants, trees of three selections (1-10-8, 1-10-60, and 1-10-98) were propagated on four rootstocks (Swingle, Carrizo, Cleopatra mandarin, and sour orange) and field trials were established at two locations in Florida (Groveland and St. Cloud) . Data has been collected over five harvest seasons (1994, 1995, 1996, 2002, 2003) on fruit yield and juice quality (color, soluble solids and total acidity). Fruit of each selection ripen in mid season as is the case with other pineapple oranges, but have significant differences in fruit characteristics. All three selections produce fruit with very few seeds; many fruit have no seeds. The low seed count could make these selections much more valuable for the midseason fresh market fruit market than the pineapple oranges that are presently available.

10:15 Rootstock Observations among 'Hamlin' and 'Valencia' Orange Trees Growing at Central Ridge and Flatwoods Locations. William S. Castle and James C. Baldwin, CREC, UF.

'Hamlin' field trials were planted at the north (Tavares) or south (Lake Placid) end of the central Ridge region, and two 'Valencia' trials were established in flatwoods sites near St. Cloud or Immokalee between 1987 and 1991 at conventional tree spacings on soils typical for each region. Trees on 17 to 26 of essentially the same rootstocks including most commercial ones were planted at each location in a replicated experiment. Yield was either measured or estimated annually for about 5 years and 2 to 4 years of juice quality data were collected at all locations except Lake Placid.. The rootstocks were primarily citranges, citrumelos, mandarins, and other sexual and somatic hybrids. Among these, trees of 'Hamlin' and 'Valencia' on F80-5 citrumelo, Benton, Carrizo, Troyer, and C-32 citranges, x 639 (a Cleopatra mandarin x trifoliolate orange hybrid) produced the highest cumulative yields. In addition, 'Valencia' on PTM-1584 (a trifoliolate orange x Milam hybrid) was one of the highest yielding combinations as was 'Hamlin' on Benton citrange at one location. Juice quality was not greatly affected by rootstock. PS/box was typically 5.5 for 'Hamlin' trees and 6.7 to 7.2 for 'Valencia' trees. Tree survival after 15 years was generally > 80% although at one Ridge location, many trees were freeze-damaged and eventually removed, and trees on sour orange and Bittersweet sour orange at all locations eventually succumbed to citrus tristeza virus.

10:30 The 10-year Performance and Survival

of 'Marsh' Grapefruit Trees on Sun Chu Sha Mandarin and Various Citrumelo Rootstocks on Riviera Sand Depressional, an Alfisol. William S. Castle, CREC, UF, and Mace G. Bauer, IRREC, UF.

'Marsh' grapefruit (*Citrus paradisi* Macf.) trees were planted in 1991 in double-row beds formed from Riviera sand, depressional, an Alfisol with a loamy horizon at depths between 20 to 40 in. Each bed of ca. 75 trees was planted with trees of only one rootstock. There were two replicate blocks and in each block there was one replication (bed) of trees on each rootstock. The rootstocks were 6 unnamed citrumelos (*C. paradisi* x *Poncirus trifoliata* [L] Raf.), Swingle citrumelo, and Sun Chu Sha mandarin (*C. reticulata* Blanco). Cropping began in the 1993-94 season and was measured for all trees through the 2001-02 season, a total of 8 years. Mean cumulative yield varied little among rootstocks and ranged from 26 to 31 boxes/tree. Fruit samples collected in the last two cropping years showed no difference in juice quality among rootstocks. Trees on Swingle and several other citrumelos were ca. 9.5 ft tall at age 10 years and the largest trees were 30% taller. Tree health including tree decline and ultimately tree loss appeared to be strongly related to relative elevation. Visual symptoms of tree decline were observed first in the area of lowest elevation, but ultimately were observed throughout the planting. Recorded observations of the perched water table showed that the soil was saturated to the surface for extended periods in the lowest area, and to a lesser extent in other areas. Sun Chu Sha rootstock was apparently better adapted to the site conditions than the citrumelo rootstocks based on longevity. However, many of those trees were also removed due to unsatisfactory commercial performance.

10:45 **Tale of Two Rootstocks: US-852 and US-812.** Kim D. Bowman, USHRL, USDA; Robert E. Rouse, SWFREC, UF.

New citrus rootstocks for commercial use in Florida have been under active development by the USDA-ARS citrus breeding project for over twenty years. Two hybrid citrus rootstocks that appeared especially promising after ten years of field testing were released for commercial use by USDA around the start of the new millennium. The first of these to be released, US-852 rootstock, is a hybrid of Changsha mandarin (*Citrus reticulata*) with English Large Flower Trifoliolate Orange (*Poncirus trifoliata*) and was released by ARS in August 1999. The other rootstock, US-812, is a hybrid of Sunki mandarin (*C. reticulata*) with Benecke trifoliolate orange (*P. trifoliata*) and was released by ARS in May 2001. Both US-852 and US-812 were described in their release notices to have exhibited outstanding effects on sweet orange fruit yield in field trials, as well as inducing good fruit brix and creating trees with a moderate size. Resistance or tolerance to Citrus tristeza virus was also noted for both rootstocks. Differences between the two rootstocks in other traits and field performance since release appear to be shifting one of them toward commercial importance and the other to relative insignificance. Implications of these observations for future strategies in rootstock development will be discussed.

11:00 **Promising new rootstocks US-897 and US-802.** Kim D. Bowman and Ute Albrecht, USHRL, USDA.

Several new citrus rootstocks that have shown good promise for commercial use in Florida are nearly ready for release by USDA. Two of these, US-897 and US-802, are being proposed for release in the coming year. Both have exhibited good performance in a 19-year field trial with sweet orange and also shown great promise in addressing some industry problems in other shorter-duration trials. US-802 is

a hybrid of Siamese pummelo and Gotha Road trifoliolate orange. This rootstock has demonstrated exceptional vigor and durability in an assortment of field sites. Most exciting among these is good tolerance to *Diaprepes* weevil and *Phytophthora* diseases in one trial location with Winder soil in Indian River County. Also notable among the positive attributes of US-802, is the demonstration of resistance to citrus tristeza virus (CTV) and citrus blight. Probably the most serious fault of US-802 for some applications is the large tree size and relatively lower fruit brix that result from its high vigor. The other rootstock in this duo, US-897, contrasts sharply with US-802 in effect on vigor. US-897 produces a dwarf to semi-dwarf tree size with sweet orange, grapefruit, and mandarin scions, reflecting its origin as a cross of Cleopatra mandarin with Flying Dragon trifoliolate orange. Like US-802, US-897 has exhibited good tolerance to *Diaprepes* weevil and *Phytophthora* disease in a flatwoods site, perhaps somewhat surprising in combination with its low vigor. The two new rootstocks appear to provide some valuable new rootstock options for Florida citrus growers.

11:15 The Super Sour Rootstock Project. Kim D. Bowman, USHRL, USDA.

Sour orange is often considered the standard for comparison with other rootstocks in Florida. It makes long-lived, highly productive trees that have broad adaptability to most Florida soil types and induces the scion fruit to have high quality. Sour orange also has good tolerance or resistance to several of the common biotic and abiotic problems of citrus in Florida, including *Phytophthora* diseases, citrus blight, salinity, and freezes. Unfortunately, sour orange also has one major fault that is often devastating in impact: it suffers from a rapid tree decline when trees with sweet orange, mandarin, or grapefruit scions become infected with certain strains of citrus tristeza virus (CTV). The Super Sour Project is targeted at creating a new sour orange-type rootstock that possesses all of the positive attributes of sour orange, but also has field resistance to CTV. Correcting other less important faults of sour orange (such as susceptibility to citrus nematode) is also included among the objectives. Making use of molecular information indicating that sour orange is a hybrid species derived from the mandarin (*Citrus reticulata*) and pummelo (*Citrus grandis*), the primary approach is to create a series of pummelo x mandarin hybrids and select the one with the most outstanding rootstock characteristics using a process of molecular screening, greenhouse testing, and field trials. Good progress has been made in selecting parental mandarins and pummelos, creating hybrids, and beginning the selection of the most promising candidates. Some Super Sour hybrids have been entered into field trials.

11:30 Economic Longevity of Trees on Swingle citrumelo and the Variability to Adaptation among Soils of the Indian River Production Area. Mace G. Bauer, IRREC, UF, William S. Castle, CREC, UF, Brian J. Boman, IRREC, UF, and Tom A. Obreza, UF.

In previous field work, we established that certain soils and soil characteristics limit the economic life of trees on Swingle citrumelo (*Citrus paradisi* Macf. x *Poncirus trifoliata* [L.]Raf.) rootstock. However, there are also many productive groves of orange and grapefruit trees planted more than 15 years ago in the Indian River area where Swingle is apparently well adapted to the regional soils. We surveyed citrus growers in the Indian River region in order to better understand the range of soil conditions suitable for Swingle rootstock. We identified excellent- and poor-performing blocks of citrus trees on Swingle citrumelo and recorded their locations in a geographic database. We questioned each manager about management history and crop performance. Tree performance was clearly related to soil series as identified in USDA-NRCS soil surveys. Trees growing in Winder, Chobee, and Riviera depressional were consistently rated poor to substandard. Ratings of good to excellent were typical for

trees on Wabasso, Malabar, Pineda, and some other less common soils. Intermediate tree performance was reported at a large number of sites with no apparent relationship to the soils present. Tree performance was linked to soil series which in turn was related to landscape position. These relationships are discussed.

11:45 Relationships among rootstock, mineral content and peel thickness of Hamlin orange. Morgan K.T., R.E. Rouse, SWFREC, UF; S.H. Futch, CREC, UF; M.A. Zekri, Multi-county citrus agent, Hendry County; F.M. Roka, SWFREC, UF.

Reports started emerging in late December 2004 that the number of split fruit in Hamlin oranges were higher than in previous years. Reports included several loads, which were mechanically harvested, being rejected at the juice plant as a result of split fruit. Reports of rejected loads from hand-picked blocks were mentioned as well. Initial visual inspection of the fruit at the affected groves indicated that the peel thickness of Hamlin oranges appeared to be thinner than usual. A more extensive investigation ensued in which fruit samples representing three rootstocks were collected from seven locations in the Immokalee area. Previous studies have demonstrated positive correlations among fruit size and peel thickness and tree nutrition. Along with fruit size, juice quality, and peel thickness measurements, samples of the juice and dried peel were analyzed for Ca, P, and K by rootstock and location. ANOVA indicated significant differences in fruit size and peel thickness were attributable to location, while rootstock had no significant effect on neither size nor peel thickness. Likewise, no apparent correlation existed among fruit size, fruit quality, and peel thickness with Ca, and P concentrations. However, a correlation was indicated between fruit size and peel thickness with K concentrations in the juice and fruit peel.

LUNCH BREAK

MONDAY AFTERNOON SESSIONS

1:30- 3:00 **Concurrent Sessions - B**

1:30 Mechanical Harvesting Has Little Effect On Citrus Tree Health And Productivity.
Kuo-Tan Li, Jim Syvertsen, and Jackie Burns, CREC, UF.

Mechanical harvesting of citrus trees often causes visible injuries including shedding of leaves, flowers, and young fruit, breaking of branches, bark scuffing and exposure of roots. To assess the impacts of mechanical harvesting on citrus tree health and productivity, we measured fruit recovery efficiency, leaf and shoot removal, tree water relations, leaf gas exchange, and chlorophyll fluorescence of mature 'Hamlin' and 'Valencia' orange trees either harvested by hand or harvested mechanically using a linear-type trunk shaker operating at 4 Hz, 70.8 kg mass weight, and 13 cm displacement for various shaking durations. Our shaking treatments effectively recovered 90% to 94% of fruit without bark damage. Compared to hand harvesting, trunk shaking removed 10% more leaf area and twigs, and caused some root exposure. After a restricted irrigation regime, trees in dry soil developed drought symptoms after excessive trunk shaking. When trees were properly irrigated before and after harvest, however, mechanical harvesting did not impair tree water relations or leaf function. Return bloom, growth, and yield of 'Hamlin' trees were not affected by mechanical harvesting. Trunk shaking at full bloom did not

affect 'Valencia' fruit set, but trunk shaking after mid-May might reduce yield due to removal of immature green fruit from the next crop.

1:45 Yield impacts on 'Valencia' oranges from late season mechanical harvesting without abscission agents. Roka, F.M., SWFREC, UF; J.K. Burns, and R.S. Buker, CREC, UF.

Mechanical harvesting of citrus stops around May 1st every year as growers observe quarter-size green fruitlets being removed by the shaking operations. Previous research by Whitney indicated that 'Valencia' yields the subsequent year decreased by at least 20% when trees were trunk shaken after May 15th. The question of this study was whether decreasing the shake time duration or utilizing a canopy shaker would lessen yield impacts when 'Valencia' trees were shaken after May 15th. In 2003, an experiment was designed to measure the yield impact on the 2004 'Valencia' orange crop when trees were mechanically shaken through mid-June 2003. On four harvest dates, nine treatments were replicated four times in a commercial, 15-year-old, 'Valencia' block near Immokalee, FL. Each plot contained 7 trees. Treatments included four settings of a trunk and canopy shaker along with hand-harvested control plots. Trunk shaker settings varied by duration of shake (10, 7, 4, and 2 seconds). Canopy shaker settings varied by cycles per minute (245, 230, 215, and 145 cpm). Harvest dates in 2003 were May 6th, May 20th, June 3rd, and June 17th. The harvest treatments were repeated on the same trees in 2004, approximately one-year later (May 4, May 18, June 1, and June 15, 2004). Average per tree yields were calculated. ANOVA indicated significant differences in yields were attributable to harvest date and treatment. Yield reductions, as compared to the handpicked controls, ranged from 20 to 50% depending on duration and aggressiveness of shake.

2:00 Growth Conditions and Crop Load Affect Sheepnosing in Grapefruit. J.P. Syvertsen, CREC, UF; L. G. Albrigo, CREC, UF; M.A. Ritenour, IRREC, UF; J.M. Dunlop, CREC, UF; R. C. Vachon, The Packers of Indian River Ltd.

We manipulated tree growth and yield in several groves in the Indian River (IR) and central Florida areas over 3 growing seasons and evaluated the elongated, sheepnosed shape of grapefruit. High rates of N fertilization and elevated early season (Feb.-July) temperature within tree canopies increased the percentage of sheepnosed fruit (2004. Proc. FSHS 117). The worst sheepnosing measured was in an IR white grapefruit block where packout of late season round and flat fruit was only 20%. An additional 200 lbs K / Acre (above the normal 200 lbs) in the spring increased packout to 48%. In another IR white GF block with only 41% packout, withholding all irrigation increased packout to 70%. Overall packout averaged >90 % in red grapefruit in the same IR grove. In the 2003-4 season, fruit shape deteriorated between early and late harvests in all IR blocks that we evaluated. Red grapefruit trees in central Florida generally had much lower percentages of sheepnosed fruit than in the IR. Removing 90% of the crop in June increased sheepnosing 3 to 6 fold at harvest in the remaining fruit. Sheepnosing was worse on the south and west canopy positions than in the north and east sides. Fruit loss from hurricane winds reduced yields in the 2004-5 season and sheepnosing increased as the season progressed. Overall, comparable trees with low crop loads had more sheepnosed fruit than high crop load trees. These studies underscore the importance of early season temperatures, fertilizer management practices and crop load in determining sheepnosing problems in grapefruit.

2:15 Citrus Blight Incidence under Different Soil Fertilization and Liming Programs in Florida Flatwoods. B. J. Boman, IRREC, UF, R. D. Berger, Plant Pathology, UF. K. Derrick, CREC, UF, A. Battikhi, IRREC, UF.

Blight is a major disease affecting citrus trees in Florida. The causal agent(s) of this disease have not yet been determined or agreed upon. Symptoms are typified by shortened internodes on branches, and severely cupped and yellowed leaves, in spite of water availability, as well as flushing of leaves and blooms before death. A study was carried out on "Valencia" oranges, at Indian River Research and Educational Center, Fort Pierce, Florida, during the period 1993-2001, to test and compare a Brazilian fertilization program (BP), with a local program (FL). The BP succeeded in reducing blight on citrus, in Brazil. It uses lower amounts of fertilizers than the conventional FL program. Two liming rates were used since previous work showed lesser blight incidence on citrus at high soil pH values. By 2001, the lowest incidence of blight was in the FL low lime (FLLo) treatment (11%), followed by BP low lime (BPLo) with 20%, then by BP high lime (BPHi) treatment (33%). The highest was for the FL high lime (FLHi) treatment with, 39% diagnosed as having blight. Average yields of FLHi and FLLo treatments were higher during 1996 and 1997 than those of BPHi and BPLo treatments. Whereas, during 1999, 2000, and 2001, average yields of BPHi and BPLo were higher than those of FLHi and FLLo treatments. These yields were only significantly different, according to Duncan's Multiple Range Test, during the years 1997 and 2001, where the average yields for BPHi, BPLo, FLHi, and FLLo were: 56.0; 54.1; 36.9; and 44.2 MT/Ha, respectively. There were only minor differences between the field observations and the protein laboratory tests for blight disease detection.

2:30 Survey for Stem-Pitting Citrus Tristeza Virus in Commercial Citrus Groves in Florida. P. J. Sieburth, and K. Grau, DPI, Florida DACS.

Citrus tristeza virus (CTV) has affected how citrus is grown in Florida since the 1950s. The brown citrus aphid, first detected in Florida in 1995, is an efficient vector of CTV capable of spreading severe forms throughout the state. The use of *Citrus tristeza virus* molecular markers led to the discovery of aphid transmitted stem-pitting forms of CTV (SP-CTV) in Polk County. A survey to determine if SP-CTV was present was undertaken for the eleven counties representing 80% of commercial citrus production. Five sweet orange and two grapefruit sites per county were surveyed using a hierarchical bulk sampling procedure. Immunocapture reverse transcriptase polymerase chain reaction (IC-RT-PCR) with Type II primers was used for initial screening followed by other SP-CTV markers for positive samples. Fifty-three percent (42/79) of the sites surveyed tested negative in all samples. The majority of sites testing positive, 61%, had a less than 5% chance of any single tree in that block testing positive. Only six sites had a greater than 10% chance of any one tree testing positive for the SP-CTV markers. There were two different patterns of markers present: Profiles I and II. Not all of these isolates have been evaluated in biological indicators so whether they can cause significant damage and what the threat is to the citrus industry has yet to be determined. Currently, a strong Citrus Budwood Registration Program and increasing the number of budwood source trees under screen will prevent the spread of severe forms of CTV through the nursery industry.

2:45 Sucrose transport into Citrus juice cells: evidence for an endocytic transport system. Ed Etxeberria and Pedro Gonzalez, CREC, UF and Javier Pozueta-Romero, Nafarroa, Spain.

To investigate the mechanisms of sucrose transport and its accumulation into 'Murcott' mandarin (*Citrus reticulata* Blanco) fruit, developmental changes in determinants of sink strength such as sucrose metabolizing enzymes, and sucrose transport across both plasmalemma and tonoplast membranes were analyzed. Concurrently with sucrose levels, sucrose synthase, sucrose phosphate synthase and sucrose phosphate phosphatase increased throughout fruit development. Plasmalemma and tonoplast vesicles isolated from fruits collected at different developmental stages were analyzed for their transport capabilities. Sucrose uptake into energized plasmalemma vesicles was inhibited by gramicidin, which is in accordance with the presence of an active symport mechanism of unidirectional transport of sucrose from the apoplast into the cytosol. Unexpectedly, tonoplast vesicles were shown to lack active transport mechanism of sucrose into the vacuole. More importantly however, and in conformity with recent findings showing the occurrence of an endocytic mechanism of ion uptake in maize root cells (*Zea mays* L.), *Citrus* juice cells were shown to incorporate membrane impermeable dyes into their vacuoles in the presence of sucrose. High definition confocal microscopy revealed the co-localization of membrane impermeable markers in cytoplasmic vesicles and the formation of vesicles at the plasmalemma. The data provide evidence for an endocytic system of transport that allows direct incorporation of sucrose from the apoplast to the vacuole bypassing both the plasmalemma and tonoplast membranes.

3:00 **Sectional Business Meeting**

3:15 **BREAK**

3:30-5:00 **Special Workshop**

"Citrus Canker in Florida: Status and Prospect for the Future"

Speakers: Tim Gottwald, USDA/ARS
 Tim Riley, USDA/APHIS
 Tim Schubert, FDACS
 James Graham, CREC

5:00 **End of Afternoon Session**

TUESDAY MORNING SESSIONS

10:00-11:30 **Concurrent Sessions - D**

10:00 **The Evaluation of Chemical Control of the Asian Citrus Psylla, *Diaphorina citri* Kawayama (Homoptera: Psyllidae) and Management Approaches on Florida Citrus.** Carl C. Childers and Michael E. Rogers, CREC, UF.

The Asian citrus psylla is a recognized pest of Florida citrus, especially young trees being brought to early production. Adults overwinter on both mature and young citrus flush while the nymphs develop only on new flush. The insect attacks new growth and females deposit their eggs on this newly expanding flush with subsequent establishment of nymphal colonies. The biology of this insect pest is reviewed along with damage produced as a result of feeding injury by both adult and nymphal stages. Various insecticides have been evaluated for controlling both Asian citrus psylla adults and nymphs and methods for their assessment are presented from research conducted on Florida citrus since 2001. Management approaches for psyllid control on Florida citrus are presented.

10:15 Thrips (Thysanoptera: Thripidae) species that are pests on Florida Grapefruit Varieties: Their Biologies, Seasonal and Relative Abundance, Damage to Fruit and Control. C. C. Childers, CREC, UF; Philip A. Stansly, SWFREC, UF.

The orchid thrips, *Chaetanaphothrips orchidii* (Moulton), *Danothrips trifasciatus* Sakimura, and the greenhouse thrips, *Heliiothrips haemorrhoidalis* Bouche can cause serious rind blemish injury to clustered fruits of grapefruit varieties in Florida. Red grapefruit varieties tend to produce more interior clustered fruit that provide a more protective environment for these pest thrips. Damaged fruit can be rejected for the fresh market depending on the extent of rind blemish. Any of the three thrips species are capable of causing rind blemish injury from onset of clustered fruit touching in early May until harvest. Adults as well as first and second instar larvae are the feeding stages. Only *H. haemorrhoidalis* completes its entire life cycle within the tree canopy either between touching fruit or twigs or between leaves or twigs and touching fruit. All three thrips species have alternate plant hosts in Florida including various weed hosts within citrus groves, especially *C. orchidii* and *D. trifasciatus*. Current recognized effective insecticidal control options are limited to the use of Danitol 2.4EC at one pint per acre or chlorpyrifos 4EC at five pints per acre. Scouting is essential to minimize both fruit damage and insecticidal applications due to the long potential period of vulnerability to thrips feeding.

10:30 Scarring Damage on 'Murcott' Tangors Caused by the Flower Thrips *Frankliniella bispinosa* (Morgan). Michael E. Rogers and Carl C. Childers, CREC, UF.

Scarring damage on 'Murcott' fruit can result in a significant portion of the crop being rejected for fresh market. Scarring damage on 'Murcott' is primarily attributed to wind scar with little attention given to insect pests as the cause of some of this scarring damage. In the spring of 2004, a project was initiated to determine whether the flower thrips, *Frankliniella bispinosa* (Morgan) (Thysanoptera: Thripidae), could cause scarring damage on 'Murcott' tangors. In this study, 'Murcott' blooms were caged with and without flower thrips. After petal fall, the developing fruit were examined for presence of scarring damage. Fruit produced from 'Murcott' blooms that were caged with flower thrips had noticeable scarring damage whereas fruit produced by blooms that were caged without thrips did not sustain any scarring damage. All caged fruit were then continuously monitored throughout their development to characterize the nature of the thrips scarring damage as the fruit expanded in size. During the spring of 2005, caging studies were used to examine the number of thrips required to cause scarring damage to the developing fruit. Various insecticides were also evaluated to determine their effectiveness in controlling flower thrips on 'Murcott' blooms. Additionally, because insecticides applied to the open blooms of 'Murcott' have the potential to negatively affect pollinators, applications of insecticides applied at full bloom and petal fall were compared in terms of prevention of thrips

scarring damage. Based on the results of this work, management of thrips scarring damage in 'Murcott' tangors will be discussed.

10:45 Effect of application time and glyphosate formulations on weed control efficacy in young citrus groves. Samunder Singh, Megh Singh and Steve Futch, CREC, UF.

Weed competes more vigorously with young citrus trees due to space, favorable temperature and available soil moisture. Herbicide rates and application timings in relation to the stage of weed growth may affect the degree of control. The objective of this work was to maximize the control of weeds using different rates of glyphosate applied at various growth stages of weeds. Two glyphosate formulations (Roundup UltraMax and Touchdown IQ), mixed with 2% ammonium sulfate at 0.84, 1.26 and 1.68 kg ae/ha were evaluated for weed control efficacy under field conditions. Treatments were applied by a tractor mounted boom sprayer fitted with Teejet nozzles delivering 190 L/ha volume at 150 kPa. Spraying was done at two wk intervals on 1, 15, and 30 May and 14 June during 2002 and 2003 in a plot size of 18 by 3 m, with 4 trees per plot of 2-3 yr age and replicated 4 times. The field was infested with several broadleaf and grassy weeds, dominant being Brazil pusley (*Richardia brasiliensis* (Moq.) and Texas Panicum (*Panicum texanum* Buckl.), respectively. Weed mortality was recorded at two weeks interval until 10 wk of spraying. Data on visual mortality of broadleaf and grasses was subjected to arcsin transformation for ANOVA. One Way ANOVA was performed for significance of formulations, rates, and application time. Higher efficacy of glyphosate was recorded when sprayed in end May compared to mid or early May; effect was significantly reduced with delay in spraying to mid June. Mortality of grassy weeds was higher than 80% at all spraying dates, however, higher weed control efficacy was observed when sprayed on 15 or 30 May. Maximum weed control was observed at 6 wk after spraying; a decrease of 10-20% was recorded at 10 WAT (weeks after treatment), respectively for grasses and broadleaf weeds. No difference was observed between the two formulations of glyphosate on their weed control efficacy. Glyphosate at 1.68 kg/ha provided significantly better control of broadleaf weeds than lower rates; however, lower rate of 1.26 kg/ha provided similar control of grass weeds to that of 1.68 kg/ha.

11:00 The impact of three hurricanes in 2004 on the Florida Citrus Industry: Lessons learned, what we know and what we don't know. L.G. Albrigo¹, J. Attaway¹, K. Bowman², R. S. Buker¹, W.S. Castle¹, K.W. Hancock³, C.W. McCoy¹, R.P. Muraro¹, M.E. Rogers¹, M.A. Ritenour¹, T. Spreen¹, P.D. Spyke⁴, J.P. Syvertsen¹, L.W. Timmer¹, R.C. Vachon⁵. UF, IFAS; ²USHRL-ARS; ³Citrus Consultant, Ft. Pierce, ⁴Arapaho Groves, Ft. Pierce and ⁵The Packers of IR, Ft. Pierce.

Florida citrus areas were hit with an unprecedented three severe hurricanes within a six week period in August and September 2004. All segments of the Florida Citrus Industry were impacted either directly or indirectly. Citrus nurseries suffered extensive losses and many bearing trees were uprooted, broken or lost many leaves and fruit. Compared to the 2003-04 season, overall orange crops were reduced by 37% while grapefruit yields were reduced by 68%. Re-establishing grove operations and water management were major obstacles for growers affected by the hurricanes. Tree damage, survival, and recovery depended on pre-existing pest pressures, cultivar selection, tree canopy size, grove architecture, cultural practices the hurricanes force. For example, in young rootstock trials in Indian River County, there were large differences in resistance to tree blow-over that were apparently

attributable to previous root weevil damage to different rootstocks. Several researchers, growers and production managers contrasted different recovery practices which sometimes affected return bloom in 2005. This article brings together some lessons learned about hurricane preparedness and recovery practices for citrus production. Wind and flooding effects on pest and disease susceptibility and tree recovery will be summarized. The economics of crop loss and short- and long-term impacts on domestic and world markets will also be discussed.

11:15 The effect of the 2004 hurricanes on citrus flowering potential for the 2005 season. James Salvatore and Mark Ritenour, IRREC, UF; L. Gene Albrigo, CREC, UF.

Up to 3 hurricanes (Charley, Frances and Jeanne) passed over the same citrus areas of Florida. Indian River citrus experienced 2 hurricanes, lower West Coast areas one, and Central Florida citrus areas had all three hurricanes pass over. On a percentage basis, relatively few trees were permanently damaged, but many trees in the higher wind locations lost some fruiting wood and had extensive leaf loss. A strong fall flush was stimulated by heavier leaf loss. Waves of fall flush occurred after each hurricane in proportion to the leaf loss, which ranged from 40% to 90% of the leaves. Some of the earliest fall flush was damaged by subsequent hurricanes. On trees that had heavy leaf loss, fall flushes were yellowish and appeared weak. Data from other studies suggests that the early fall flushes could mature sufficiently to allow their buds to be induced into flower buds. Fall flush that occurred after Jeanne probably could not. Data collected in the Indian River District shows that bud break from post-Jeanne flushes is more than three weeks later than from spring and summer 2004 flush. Spring and summer flushes prior to the hurricanes flowered. In trees from blocks with no natural windbreaks, outer trees on the upwind side were more defoliated than interior trees, and the sides of trees facing into the wind were more defoliated than their leeward sides. The lower areas of the trees experienced less defoliation than the middle to upper sections. There was also significantly more defoliation on flush from spring 2004, compared to summer 2004.

11:30 Discussion / End of Meeting

Handling & Processing Section Abstracts

M. Joseph Ahrens, Presiding

MONDAY MORNING SESSION

10:00-12:00 **Concurrent Sessions - A**

10:00 **Production of Narrow-Range Size-Classes of Polygalacturonic Acid Oligomers.**
Randall G. Cameron, USDA-ARS, Citrus and Subtropical Products Laboratory, Winter Haven.

The structural components of citrus processing residues with significant functionality are the homogalacturonan regions of pectin. Functional properties of these regions include ion binding,

propensity for gelation, water retention and the ability to elicit defense responses to pathogenic challenges. They are also sites of attack by commercial pectinolytic enzymes used as processing aids for viscosity reduction, enzymatic peeling and conversion of peel polysaccharides to monomeric sugars for subsequent fermentation. More recently endo-polygalacturonases have been used as a research tool to probe the mode of action of pectin methylesterases and to map pectin fine structure. A major limitation in studying the functionality of these oligomers has been the difficulty associated with their preparation, which was largely due to limitations on chromatographic detection. In this study, I report on the production and detection of narrow-range size-classes of polygalacturonic acid oligomers. Three size-classes with a degree of polymerization ranging from 1-8, 8-24 and 22-45 galacturonic acid residues were prepared by enzymatic digestion followed by a combination of differential pH and alcohol precipitation. These size-classes can now be used to probe the mode of action of endo polygalacturonase, to study their ability to elicit defense responses to pathogenic challenge and test their properties related to ion binding, gelation and water holding capacity.

10:15 Differentiating Orange Juices Using Fourier Transform Infrared Spectroscopy (FT-IR). K.L. Goodner and J.A. Manthey, USDA-ARS Citrus and Subtropical Products Laboratory, Winter Haven.

Data from Fourier transform infrared spectroscopy (FT-IR) using a horizontal attenuated total reflectance (H-ATR) adapter are compared to various instrumental and chemical methods for differentiating commercial orange juices using multivariate statistics. Statistical models were generated using the data from an electronic nose, a head space gas chromatograph, mass spectrometer based chemical sensor, and results of standard chemical tests. The separation was similar to that obtained from the other methods, but has the disadvantage of the statistics being more time consuming due to the large number of variables. Seven not-from-concentrate and 3 from-concentrate orange juices were analyzed with adequate separation using the data from the FTIR. This technique compares favorably with the other methods examined in previous years.

10:30 Vitamin C, B-Carotene, Lycopene and Sugar Concentrations in 'Flame' Grapefruit Juice with Various Phosphorus and Potassium Rates. H. Dou, S. Jones, Florida Department of Citrus, Citrus Research and Education Center, UF, T. Obreza, Soil And Water Science Department, UF, and B. Rouse, Southwest Florida Research and Education Center, UF.

Flame grapefruit trees on Swingle citrumelo rootstock were planted in 1998. Phosphorus fertilizer was applied at 0, 24, 48, and 96 kg P/ha in 1999-2000 to establish a range of soil-test P, and none was applied since spring 2000. Potassium fertilizer was applied every year since planting at 0, 93, 186, and 372 kg K/ha. The P and K treatments were applied in all factorial combinations. Nitrogen and other cultural practices followed the recommendations (<http://www.crec.ifas.ufl.edu/>) for citrus production. Fruit were harvested in January 2003 and 2004, respectively, equally from all sides of the tree from 5 blocks totaling 25 trees. Harvested fruit were hand-juiced and prepared for vitamin C, pigments, and sugar analysis by an HPLC system coupled with analysis-specific columns. The results indicated that vitamin C and total sugar (sum of glucose, fructose, and sucrose) was higher in year 2004 than 2003 fruits. The highest vitamin C and sugar levels were in the treatment block with low P and optimal K (0 x 186) while the lowest was found in the optimal P and low K (48 x 0) block among the five treatments. This trend was reflected in fruit sucrose concentration, but not in fructose and glucose concentrations in fruit juice. In turn, B-carotene and lycopene were the highest in the optimal P and low K (48 x 0) treatment during year 2003 and 2004 respectively. No significant difference was found among the rest of treatments. The study demonstrated

that high level of P or K does not increase the fruit vitamin C, pigments, and sugar concentrations. Since flame grapefruit is characterized and perceived by consumers as being rich in antioxidant compounds, and high in nutritional value, consider using only the optimal fertilization rates. Increasing P and K fertilization rates does not increase the fruit internal nutritional value of the desired and healthful compounds found in Flame grapefruit.

10:45 **Field Performance, Chemical Composition and Sensory Evaluation of Grape Tomato Varieties.** D. Studstill, E. Simonne, S. Sargent, A. Simonne, B. Hochmuth, and S. Kerr, Horticultural Sciences Department, UF.

Grape tomatoes (*Lycopersicon esculentum* Mill.) have recently gained in popularity among consumers because they can be eaten without being cut, they are deep red in color, and their flavor is intense. Most grape tomatoes are of the >Santa= variety and are marketed under the >Santa= variety name. Because seed availability of 'Santa' is limited, many growers are looking for a Santa-like variety. The growth, tasting characteristics, and chemical composition of eight red commercial varieties were determined in 2004 on tomatoes grown with plasticulture. 'Sweet Olive' was the earliest, 'Chiquita' was pink instead of red, and 'Red Grape', 'Sweet Olive', and 'Tami G' showed no green shoulder. Range in flesh pH (4.21-4.48), titratable acidity (0.31 –0.50 % citric acid equivalent), and soluble solids (3.75-7.40°Brix) were narrow, and similar for all varieties. In the taste test, 'Santa' was not rated consistently better than 'Red Grape', 'St. Nick', 'Sweet Olive', or 'Tami G'. The characteristics of 'St. Nick' and 'Tami G' were overall closest to those of 'Santa'.

11:00 **Sensory Evaluation of Fresh Pineapple.** K.F. Schulbach, Food and Environmental Toxicology Lab, UF, C.A. Sims, Food Science and Human Nutrition Dept., UF.

Pineapples from 5 different countries and from 6 different producers were evaluated approximately monthly over a 14-month period. Descriptive Sensory Analysis was conducted using eight descriptive terms, sweetness, sourness, pineapple flavor intensity, firmness, juiciness, off-flavor, banana character, and coconut character, along with a rating for overall acceptability. A linear regression model relating overall acceptability to the other sensory attributes showed that only the attributes sweetness, pineapple flavor intensity and off-flavor were statistically significant, and the regression model with these 3 factors had good predictability of overall acceptability ($R^2 = 0.885$).

11:15 **High Tech Flavor Extraction from Fruits and Vegetables.** G. Mann, TreattUSA, Lakeland.

Industry has long been interested in capturing the scents and aromas of fresh fruits and vegetables. As new demands for other products derived from horticultural products arise, technology has kept pace. Long gone are the days of simply capturing volatiles with a still or simple reflux system. Technology such as spinning cone filtration has allowed precise and efficient recovery of a full range of components from fruits and vegetables as well as meat and potatoes! The demand for flavors without calories has driven the technology.

11:30 **Volatile Constituents and Character Impact Compound of Florida's Tropical Fruit.** K. Mahattanatawee, K.L. Goodner, and E. Baldwin, USDA-ARS, Citrus and Subtropical Products Laboratory, Winter Haven.

The pleasant floral, fruity flavors of many fruits have attracted consumer attention with the promise of good nutrition and health. Fruit flavors exist as complex chemical mixtures including both volatile and nonvolatile (i.e. sweet and sour tastes) flavor components, however character impact compounds for individual fruit tend to be volatile. Since many of the volatile components are not aroma active, GC-Olfactometry (GCO), using the human nose as detector, was employed to determine which volatile components had aroma activity. Headspace and liquid-liquid extraction methods of flavor volatiles were employed coupled with GC/MS and GCO for guava, carambola and mango. The overall flavor profile and character impact compounds of these Florida-grown fruits will be discussed. This information will be of interest to the flavor, food-beverage, and tropical fruit industries.

11:45 **Effect of Seasonal Variation on Enzymatic Hydrolysis of Valencia Orange Peel.** M. R. Wilkins, W. W. Widmer, R. G. Cameron and K. Grohmann.

USDA, ARS SAA Citrus and Subtropical Products Laboratory, Winter Haven

Approximately 10 million tons of oranges are processed in Florida each year, producing approximately 5 million tons of waste consisting of peel, seeds and segment membranes. Most of this peel is currently dried and pelletized to produce citrus pulp pellets, a low value cattle feed. Several researchers have converted orange peel waste into valuable sugars using both acid and enzymatic hydrolysis. After hydrolysis, many of these sugars can be utilized to produce ethanol, a valuable fuel, and other chemicals. This study focuses on the effect of harvest time and maturity on sugar yields from the enzymatic hydrolyses of Valencia orange peel. Valencia oranges were obtained from the same grove at three times during the 2005 harvest season, early March, early April and early May. A commercial juice extractor was used to extract juice and the processing waste collected for hydrolysis. Peel was comminuted to a size less than 0.7 mm in a food processor. Cellulose, hemicellulose and pectin were hydrolyzed using pectinase, cellulase and beta-glucosidase enzymes to produce sugars. Glucose, fructose, galactose, arabinose, xylose, rhamnose and galacturonic acid yields as determined by HPLC both before and after hydrolysis are over the season are compared and will be discussed.

LUNCH BREAK

MONDAY AFTERNOON SESSIONS

1:30- 3:00 **Concurrent Sessions - B**

1:30 **Design of Perforation-Mediated Modified Atmosphere Packaging for Shredded Carrots: Mathematical Modelling and Experimental Validation.** J. Montanez, F.A.R. Oliveira, M. Pinelo, P. Mahajan, Department of Process & Chemical Engineering, University College Cork, Ireland, L.M. Cunha and M.C. Manso, Post-Harvest Research Sub-Unit, CECA-ICETA, University of Porto, and University Fernando Pessoa, Porto, Portugal.

Perforation-mediated modified atmosphere packaging consists of packing fresh produce in an air-tight package perforated by one or more tubes. The interplay between the product respiration rate (RR) and the rate of gas exchange through the tube(s) promotes an increase in CO₂ and a decrease in O₂

concentration, the atmosphere eventually levelling off. The objective of this work was to design and validate a package for shredded carrots, based on mathematical models earlier developed for predicting RR and gas exchange rate. Different amounts of product and tube dimensions were selected and experiments were performed at 10°C. Predicted and experimental gas compositions were quite different and anaerobiosis was observed in almost every package. This might be explained by an increase of RR during storage, as earlier reported for shredded carrots stored in air. Another set of experiments was then performed, halving the amount of produce, and the equilibrium gas composition was in the recommended range. The RR at steady state was calculated by a mass balance and it was found that the values were approximately two-fold those obtained with the predictive model, which explains the difference between prediction and validation results. The respiratory quotient was however similar, approximately 1, which shows that storage time increases RR but does not influence the underlying mechanisms. It can therefore be concluded that the design of MAP for shredded carrots needs to take the effect of storage time on RR into consideration. As a rule of thumb, package design might be based on the double of RR predicted by existing models.

1:45 **Forced-Air Cooling of Strawberries In Reusable Plastic Containers.** M.B. Meana*, K.V. Chau, J.P. Emond, M.T. Talbot, Agricultural and Biological Engineering Department, Institute of Food and Agricultural Sciences, UF

Reusable plastic containers (RPC) have become very popular, first in Europe and now in North America. Cooling data of strawberries packed in clamshell containers and placed in RPC's will be presented. These data include the cooling rates at different fruit locations inside each clamshell, at different locations of the clamshells within each RPC, at different locations of the RPC within the stack and the effect of blocking off some of the open by-pass areas in the RPC to force more air through the fruit in the clamshells. A portable forced-air cooling unit was designed and constructed. The airflow rate through the unit can be controlled and the unit can accommodate 5 layers of RPC's. The cooling tests were conducted at a commercial cooling facility.

2:00 **1-Methylcyclopropene delays ripening of the perishable 'Donnie' avocado.** J. Arias and J. Crane, Tropical Research and Education Center, UF, D.J. Huber and S.A. Sargent, Horticultural Sciences Department, UF.

West Indian (WI) avocados generally have a short storage and shelf life, reducing their marketing window. The effect of 1-MCP (1-methylcyclopropene) on fruit firmness, color, and postharvest storage life was investigated using 'Donnie' avocado, a large, WI avocado with a short postharvest shelf life. Fruit were harvested from a commercial orchard in Homestead, Fla. and treated with air or 1 ppm 1-MCP in sealed containers at 7°C (45°F) for 24 h. After treatment, fruit were packed in commercial flats and stored for 7 days at 7°C (45°F) and 14 days at 13°C (55°F) and then exposed to ambient temperatures for an additional 5 days. During storage and post storage exposure to ambient temperatures, fruit were rated for firmness and color on days 5, 12, 19, and 21 and 2 and 5, respectively. Fruit treated with 1-MCP were significantly firmer and greener after 5 days of storage than non-treated fruit. 1-MCP treated fruit were firmer and greener after storage compared to non-treated fruit. The data show that 1-MCP has potential to extend the useful storage life of 'Donnie' avocado fruit.

2:15 **Effects of Pre- or Postharvest GA Application on Storage Quality of Florida 'Ruby' Red Grapefruit and 'Fallglo' Tangerines.** M.A. Ritenour, M.S. Burton, Indian River Research and

Education CenterUF, and T. G. McCollum, USDA_ARS Horticultural Research Laboratory, Ft. Pierce.

Gibberellic Acid (GA) has been reported to delay peel senescence of citrus fruits. Since physiological and pathological disorders of citrus tend to occur more frequently on senescent tissues, GA treatments are used in some citrus-growing areas to maintain quality through market channels. Studies were conducted during the 2002-03 season to investigate the effects of pre- or postharvest GA treatments on postharvest fresh fruit quality and quality retention during storage of 'Fallglo' tangerines and 'Ruby' Red grapefruit. As expected, preharvest GA treatments delayed color development of 'Fallglo' tangerines at harvest and after degreening. Extending ethylene exposure from 6 to 18 hours allowed GA-treated fruit to color similar to non-GA treated fruit degreened for only 6 hours. Preharvest GA treatments increased peel puncture resistance, but also led to a slight reduction in soluble solids content (SSC). Preharvest GA treatments had no significant effect on juice content, titratable acidity (TA), or SSC:TA ratio. After storage, preharvest GA treatments generally increased the incidence of postharvest stem-end rot (SER). Extending ethylene exposure to overcome GA-delayed color development only enhanced the development of postharvest SER further. Inhibition of color development in harvested 'Fallglo' tangerines dipped in GA was not significant immediately after degreening, but was significant 14 days after degreening. Postharvest GA dips, either before or after degreening, generally had no effect on postharvest decay or disorders of 'Fallglo' tangerines during storage. Similar GA treatments on 'Ruby' Red grapefruit often resulted in phytotoxic injury and increased decay during storage. At the concentrations used, pre- or postharvest GA treatments do not improve postharvest quality retention of Florida-grown 'Fallglo' or 'Ruby' Red Grapefruit during simulated storage.

2:30 **HPLC-MS Analysis of Furanocoumarin Dimers in Immature Rio Red Grapefruit.** J. A. Manthey, USDA-ARS, Citrus and Subtropical Products Laboratory, Winter Haven.

Furanocoumarin dimers in grapefruit juice are involved in grapefruit/drug interactions. The majority of these compounds putatively occur as complex conjugates of bergamottin, epoxybergamottin, and dihydroxybergamottin, with molecular weights of 692, 708 and 726 amu. These compounds are readily detected by both UV (310 nm) and electrospray ionization mass spectrometry. Detection by the latter technique is 10-100 times more sensitive, and provides a means of analyzing the trace levels of these compounds in extracts of early developing grapefruit. These analyses showed that the furanocoumarins, with the exception of the dimer at 692 amu, occur in very early grapefruit. The concentrations of these compounds are high in the early fruit, and decrease moderately during further fruit development. The relative concentrations of a number of other psoralens, coumarins, and flavonoids were monitored by HPLC-coupled photodiode array (UV) detection, and were observed to fluctuate significantly during early grapefruit development.

2:45 **Utilization of Citrus Products Other than Juice.** D. Thompson, Diaeta Corp, Winter Haven.

Although at first in the 1800s the Florida citrus industry was established on fresh fruit, it was really built on juice after WWII. Juice and fruit have continued as the mainstays, with a healthy but relatively small flavor and aroma industry. Recently, with the ability to recover more dry matter without damaging the constituents of the peel, this product, peel and pulp, or whole dried citrus powder has become available. The dried and wholesome whole citrus powder can be more valuable than the juice or the whole fruit. In addition to the sugars, which are at the same concentration in the peel/pulp as in the juice, citrus

bioflavonoids are there in abundance. There is a strong demand for these products. They have been shown in hundreds of scientific papers and dozens of clinical trials to reduce weight, reduce cancers, reduce hypertension, improve eyesight, improve cardiovascular health, prevent radiation damage and a host of other health issues.

3:00 **Sectional Business Meeting**

3:15 **BREAK**

3:30-5:00 **Concurrent Sessions - C**

Visit Special Sessions or other Sectional Programs

5:00 **End of Afternoon Session**

TUESDAY MORNING SESSIONS

10:00-11:30 **Concurrent Sessions - D**

10:00 **Non-traditional Use of Crops in Florida. The Ethanol Boom.** M.J. Ahrens, Lake Alfred FL.

Florida is a major agricultural state as we all know, as related to horticultural crops in particular. Many of these crops are specialty crops such as strawberries. Much of the vegetable production is highly specialized and commands premium prices in the cool season. Of course, with this comes considerable risk. The second largest horticulture industry is citrus, the first now being ornamentals. But as a single crop, citrus is king. You will remember that there are nearly a million acres of citrus, much of this is now centered around La Belle. The FCOJ was a boon to our industry. However, and today unfortunately, that same technology has made OJ a commodity with commodity prices. A really efficient operation can return net before taxes of about \$330/acre. With the demand for ethanol, citrus byproducts, vegetable production waste, and specific crops such as sugarcane and industrial hemp, if in a vertically integrated system, can return over \$700/acre. This is more than the combined profit of fruit production and juice processing together. Dry tons and conversion costs are discussed as a new ag industry for south Florida.

10:15 **Quality Attributes Limiting Papaya Postharvest Life at Chilling and Non-chilling Temperatures.** E. Proulx, Dept. Sols Genie Agroalimentaire, Universit e Laval, Quebec, Canada, M.C.N. Nunes, Food Sci. Human Nutr. Dept., UF, J.P. Emond, Agric. Biol. Eng. Dept., UF and J.K. Brecht, Hort. Sci. Dept., UF.

Papayas were harvested twice, in April and May, at color break ripeness stage and held at constant temperatures of 0, 5, 10, 15 or 20  C for 14 days in order to determine the quality attributes that limit papaya marketability at different temperatures. Evaluations of weight loss, instrumental and visual color, flesh firmness, shriveling, chilling injury (CI) symptoms, chemical composition, and decay were performed initially and every other day. Fruit stored at 0, 5 or 10  C were transferred to 20  C for 2 days at the end of storage to evaluate CI symptom development. A significant maturity difference between the harvests

affected CI susceptibility, in that CI symptoms developed faster and were more severe in the less mature fruit. At the non-chilling temperatures of 15 and 20 °C, papaya marketability was limited primarily by flesh softening, followed by color change indicative of over ripeness and by shriveling; at the chilling temperatures of 0, 5, and 10 °C, marketability was limited by development of CI symptoms and, to a lesser extent, by shriveling. Storage temperature had little effect on the soluble solids, pH, titratable acidity or ascorbic acid. Papaya marketability in this study was not limited by decay except as a secondary manifestation of CI following transfer to 20 °C after 2 weeks of storage at chilling temperatures. The quality curves constructed for each temperature showed that a single quality attribute cannot be used to express loss of quality of papayas over the range of temperatures evaluated.

10:30 Simulated Long-distance Transport of Strawberries in a Passive Modified Atmosphere Marine Container. G.S. Riad and J.K. Brecht, Hort. Sci. Dept., UF.

Strawberries are extremely perishable due to their susceptibility to decay, softening, and water loss. Rapid establishment of a modified atmosphere (MA) with elevated CO₂ is considered to be critical for long distance strawberry shipments in order to inhibit these negative changes, especially decay. However, passive MA systems that may be used for strawberries develop MA slowly. We stored 'Camarosa' strawberries for 10 days in a closed system at 2 °C with the strawberry weight:void volume ratio chosen to simulate transport in a 40-foot marine container. An atmosphere of 5% O₂ plus 15% CO₂ developed in the MA after 10 days and appeared to be beneficial in that there was some delay in fruit senescence and also prevention of microbial growth, however, sharp increases in respiration rate and the respiratory quotient beginning on day 8 of storage in MA indicated initiation of anaerobic respiration. After 10 days in air or MA, the strawberries looked fine, but after an additional 12 hours at room temperature there was already significant microbial growth on the air-stored fruit, which may have been due to latent infections that couldn't be expressed at 2 °C. These results indicate that 5% O₂ plus 15% CO₂, although commonly used for domestic strawberry shipments, may not be appropriate for transit times longer than 7 days. It appears that about 9 to 10% O₂ plus 10 to 11% CO₂ may be a better gas composition for transit times greater than 7 days since the strawberry respiration rate was at a minimum in that atmosphere range.

10:45 An Assessment of Methods to Clean Citrus Fruit Surfaces. J.A. Narciso, USDA-ARS, Citrus and Subtropical Products Laboratory, Winter Haven.

A move away from harsh chemicals towards more natural or organic postharvest treatments for citrus has prompted interest in alternate sanitizers for cleaning citrus in packinghouses. In this study we compare the efficiency of sanitizing methods on oranges. The oranges were collected from the field, rinsed under running tap water and surface sterilized in a hot water bath. A cocktail of organisms previously isolated from the surfaces of oranges taken from a commercial grove (including *Penicillium digitatum*, *Geotrichum citri-aurantii* and *Colletotrichum gloeosporioides*) was made and the oranges were inoculated by dipping them into the spore mix. They were air dried for 24 hours and washed with warm water, sodium hypochlorite and a commercial solution of peroxyacetic acid. The fruit were allowed to air dry after which time they were washed in sterile buffer to remove any remaining microorganisms. The buffer was analyzed for the presence of these organisms. The commercial solution of peroxyacetic acid was the most effective in removing the microorganisms from surfaces of the oranges.

11:00 New Class of Enzymatic Cleaners in the Food Industry. Stephen Gorton, Envirogen

Inc, Baltimore MD.

For years the agricultural industry has had to rely on caustic cleaners to remove dirt and molds from fruits and vegetables. These products are damaging to the environment and the people that handle them. Most, if steps are not taken to reduce them, can end up in peoples stomachs. Many of them also can damage the fruits or vegetables themselves. And some even damage the processing and handling equipment. Detergents, stoichiometric chemicals such as chlorine, and fungicides are all used in the process of trying to get the fruits and vegetables in a presentable, sellable condition, as well as remove potential pathogens. Our company has developed a class of products which rely on enzymes to breakdown these dirt and films that are environmentally friendly, non-toxic to humans and animals, and which are not caustic to machinery. Enzymes have long been known for their specific action, but have been difficult to use in many applications and have been expensive to produce. What we now can offer to the agriculture community is an inexpensive stable blend of enzymes and biotics which can effectively replace traditional stoichiometric chemicals.

11:15 **The Potential Of A Novel Product Citrus Clean For Citrus Postharvest Decay Control.**
Juixu Zhang and Joe Ahrens, Florida Department of Citrus, Citrus Research and Education Center, UF.

Postharvest decay is one of the most important factors affecting fresh citrus fruit quality and marketing values. Fungicide application is a major step in citrus postharvest disease control. Due to the adverse effects of conventional fungicides, new alternatives are needed. In the recent years, a new, environmentally friendly, and enzyme-based product, Citrus Clean, has been developed by EnviroGen company. The potential of this product for citrus postharvest decay control was evaluated. Citrus Clean actively suppressed the growth of the selected postharvest fungal pathogens, *Penicillium digitatum*, *Diplodia natalensis*, *Phomopsis citri* and *Phytophthora palmivora*. Pineapple oranges, treated with Citrus Clean solutions at 1, 5, 10, 50 or 100% on a simulated commercial packingline 24 hours after fruit inoculation with an imazalil sensitive *P. digitatum* isolate (PD-36), exhibited a green mold reduction of 22.0, 47.5, 62.7, 79.7 and 81.0%, respectively, 4 days after fruit had been stored at 21°C. The commercial fungicide imazalil (1,000 ppm) reduced green mold by 80.9%. Similarly, Fallglo tangerines, inoculated with an Imazalil resistant *P. digitatum* isolate (PD-30) and dipped in Citrus Clean concentrations of 1, 5, 10, 50 and 100% for 1 min, showed a green mold reduction of 24.3, 46.0, 62.1, 73.6, and 74.7%, respectively, 7 days after fruit storage at 21°C. The test results indicate that Citrus Clean consistently achieved more than 70% green mold control at a concentration of 50% or higher. Citrus Clean shows a good potential as a prospective product for citrus mold control and fungicide resistance management.

11:30 **Discussion / End of Meeting**

Krome Section Abstracts

J. Pablo Morales-Payan, Presiding

MONDAY MORNING SESSIONS

10:00-12:00 **Concurrent Sessions -A****Applied Genetics (10:00-11:00) and Student Competition (11:00-12:00)**

10:00 **William Grove Genetic Resource Center: A scientific and Outreach Facility for South Florida.** Noris Ledesma and Richard J. Campbell. Fairchild Tropical Botanic Garden, Coral Gables, FL.

In 2004, Fairchild Tropical Botanic Garden (FTBG) received a donation of 20 acres in the agricultural district of Miami-Dade County from Mr. Frank Williams. The property had approximately 19 acres of commercial avocados, consisting of modern varieties with current commercial potential. A preliminary master plan is under development for the property. The property will be divided into a commercial avocado orchard of approximately 16 acres and a 4-acre public outreach facility. The commercial component will be maintained according to standard agricultural practices for Miami-Dade County. The proceeds of the commercial farm will be used to help develop the overall project. The public outreach and research center will house the living genetic bank for avocado, mango, jackfruit, mamey sapote, sapodilla, canistel, abrico (*Mammea americana*), caimito, spanish lime (*Melicoccus bijugatus*) and tamarind. Each crop has its own scientific focus for development and use. A public education facility will be developed with a point of purchase outlet for specialty fruit, products and outreach materials. A teaching and research building will be constructed to house staff of the Tropical Fruit Program of FTBG, a classroom and a synoptic teaching collection. Williams Grove will serve as a valuable fruit genetic resource and outreach facility for Florida and Tropical America.

10:15 **Why Would We Breed Cacao in Florida?** Raymond J. Schnell, USDA, ARS, SHRS, Miami; J. C. Motamayor, Masterfoods Inc., Miami FL; J. S. Brown, USDA, ARS, SHRS, Miami, FL; D. N. Kuhn, Florida International University, Miami; C. Cervantes, USDA, ARS, SHRS, Miami; and C. T. Olano, USDA, ARS, SHRS, Miami, FL.

The U.S. chocolate and confectionary industry is a major consumer of U.S. agricultural commodities. The industry uses over 3 billion pounds of sugar annually, much of it produced in Florida. Over 650 million pounds of milk and milk products, 322 million pounds of peanuts, 43 million pounds of California almonds and 1.7 billion pounds of corn syrup sweeteners are also used. The total value of these U.S. produced commodities is estimated to be over 1.5 billion USD and over 70,000 people are employed in this industry. The seed of *Theobroma cacao* L. is the only source of chocolate and the plant is not grown commercially in the U.S. Production of cacao in tropical America has been severely affected by two fungal pathogens causing diseases known as witches' broom (WB) and frosty pod (FP). These, along with another pan-tropical fungal disease, black pod (BP), were responsible for over 700 million USD in losses in 2001. Currently, WB and FP are confined to Central and South America; however, commercial populations in West Africa and South Asia are highly susceptible to both diseases. Traditional cacao breeding programs have only been marginally successful in producing resistant material with suitable commercial characteristics. In 1999, the USDA-ARS, in collaboration with Masterfoods Inc., initiated a project to apply modern molecular genetic techniques to cacao breeding. The objectives were to develop an international Marker-Assisted-Selection (MAS) breeding program focusing on disease resistance. International collaboration and the development of new disease resistant cultivars are ensuring that crop losses are manageable and contributing to a stable supply of

cocoa beans for U.S. companies.

10:30 **Pedigree Analysis of Florida Mango Cultivars.** Cecile T. Olano, R. J. Schnell, and W. E. Quintanilla, National Germplasm Repository, USDA ARS, Miami; and R. J. Campbell, Fairchild Tropical Botanic Garden, Miami.

The Florida mango cultivars were historically described as hybrids between Indian types (monoembryonic) and Southeast Asian types (predominantly polyembryonic). Early molecular data including isozyme and Randomly Amplified Polymorphic DNA analysis supported the hybrid origin. The Florida varieties are distinctive and combine the best characteristics of both Indian and Southeast Asian types. Although adapted to Florida conditions they perform well across many different environments and several, including 'Tommy Atkins', 'Keitt', 'Haden', 'Irwin', and 'Parvin' are used for commercial production in many tropical countries. Using 14 microsatellite markers we analyzed 69 Florida varieties as well as Indian and Asian cultivars to construct likely pedigrees for each Florida cultivar. Parentage analysis was performed across four generations based on introduction dates of accessions into Florida and selection dates for Florida varieties. The cultivars were sampled from the accessions maintained at the National Germplasm Repository and by Fairchild Tropical Botanic Garden. Results suggest that as few as four Indian cultivars, the land race known as 'Saigon' and the criollo 'Turpentine' were involved in the early cultivar selections. Thirty seven of the 63 parents identified across the four generations were other Florida cultivars. The inbreeding coefficient among the Florida types is estimated at 0.254. Diversity analysis indicates that the Florida types were more closely related to Indian than to Southeast Asian types and that the Florida group is not more diverse than either of the originating parental groups. Average gene diversity (H_{nb}) of 0.51, 0.47 and 0.452 were found for Indian, Southeast Asian and Florida types, respectively. Based on this analysis, Florida does not represent a secondary center of diversity; however, the Florida group is unique and a subset of the Florida types has proven to have an unusual level of production stability and environmental adaptability.

10:45 **Inheritance of Fruit Color in Surinam Cherry (*Eugenia uniflora* L.).** John Griffis, Jr., Tropical Plant & Soil Science Dept., University of Hawaii at Manoa; and Malcolm M. Manners, Citrus and Horticulture Dept., Florida Southern College, Lakeland, FL.

Surinam cherry is commonly used in Florida, Hawai'i, and in many tropical regions of the world as an ornamental shrub. The fruits are also commonly eaten fresh or used in cooking although some fruits may have a somewhat unpleasant resinous flavor. Most plants bear fruits that are red to red-orange in color. Plants bearing dark-colored (purple or "black") fruits have been reported, but are uncommon. Ten grafted clones of a dark-fruited, non-resinous selection ('Zill Dark') of Surinam cherry were purchased from Zill's Nursery and planted on the Florida Southern College campus in the mid 1990s. Four of these clones were planted in an isolated area of the campus, away from any red-fruited plants. Surinam cherry plants appear to self-pollinate easily and these isolated plants set many dark-colored fruits. In spring 1999, 150 fruits were removed from one of these isolated clones and were planted in community pots in the FSC greenhouses. Most of the seeds had germinated after a month and were repotted into individual 3" pots. Several months later, the seedlings were potted up into 1-gallon containers where they remained for 2½ more years. Only a few plants came into bloom during this time. In spring 2002, the surviving seedlings (120) were potted up into 3-gallon containers, spaced in full sun conditions, and placed on drip irrigation. Plants were fertilized with slow-release fertilizer. In

central Florida, blooming of Surinam cherry tends to be asynchronous except in the early spring of the year, when most plants bloom all at the same time. In spring 2003, most of these seedling plants bloomed and set fruit. Fruits were collected and examined. Of the 120 plants remaining from the initial planting, 88 had dark (or purple) fruits, 26 had red or red-orange fruits and 6 did not bear any fruit. From this preliminary trial, it appears that a single gene determines fruit color in Surinam cherry. It also appears that the 'Zill Dark' selection of Surinam cherry is heterozygous for this trait with dark (purple) dominant over red.

11:00 **Tracing the Pedigree of 'Cynthiana' Grape by DNA Microsatellite Markers.** Lelan Parker*, Patricia Bordallo, and Violeta Coloba. Center for Viticulture and Small Fruit Research, Florida A & M University, Tallahassee, FL.

While there are good quality wines being made from muscadine and white bunch grapes in Florida, there is no identified well-adapted Florida grape for quality red wine that is color-stable. Cynthiana (also known as Norton) is considered one of the best American grape varieties for fine wine, and is suspected to have good tolerance to PD (Pierce's disease) and low susceptibility to foliar and fruit disease and is being successfully grown for commercial wine production in southern Louisiana, as well as Missouri, Arkansas, and Virginia. Since this grape variety also produces color stable wines, it has great potential in Florida but needs to be evaluated before it can be recommended. Most of the grapevine varieties in existence today are centuries old and are considered to have arisen by various means: domestication of wild vines, spontaneous crosses between wild vines and varieties and crosses between two variety. Due to the importance of the genetic background of the particular grape variety for maintaining its best physiological equilibrium and optimum performance under specific environmental conditions it is extremely valuable to understand the genetic events, which led to its appearance and to trace the parentage. Using the methods of molecular analysis the parent cultivars and the offsprings can be recognized, the pedigrees describing the genetic history of grape variety can be reconstructed. While molecular marker types such as isoenzyme and RAPD techniques are of limited use for parentage studies (Ohmi *et al.*, 1993; Buscher *et al.*, 1994), microsatellites have proved to be the marker of choice for this purpose since they are transmitted in a codominant Mendelian manner. In a cross, each of the parents passes one allele per locus to the offspring and in consequence, each allele displayed by the offspring must also be present in at least one of the two parents. By examining the microsatellite allele composition of an individual and its two presumptive parents, it is possible to confirm or reject the proposed parentage. Microsatellite markers are used routinely in forensic investigations dealing with paternity disputes, and have recently found application in pedigree reconstruction in grapevines. It is assumed that Cynthiana/Norton is originated from *Vitis aestivalis*, Michx. We are investigating the parentage of Cynthiana grape via data mining in the existing North American grape germplasm collections, ampelographic analyses and specifically expressed in the variety microsatellite markers.

11:15 ***Meloidogyne floridensis*, A New Root-knot Nematode Infecting Peach in Florida.** Jason D. Stanley*, Department of Entomology and Nematology, UF, Gainesville, FL; J. A. Brito, Division of Plant Industry, Gainesville, FL; D. W. Dickson, Department of Entomology and Nematology, UF, Gainesville, FL.

Meloidogyne floridensis is a recently described species of root-knot nematode that infects and reproduces on peach (*Prunus persica*) rootstocks Nemaguard, Nemared, Okinawa, and Guardian.

These rootstocks are resistant to the root-knot nematodes *M. incognita* and *M. javanica*. *M. floridensis* was found initially in 1966 in Gainesville, FL on a site used for peach rootstock screening and was considered to be *M. incognita* race 3. In addition to the original population of *M. floridensis*, seven additional populations have been detected in Florida from Alachua, Hendry, Hillsborough, Indian River, and Seminole Counties. These populations were found infecting: cucumber, eggplant, tomato, an unidentified bean (*Phaseolus* spp.), and lilac tasselflower, a weed associated with tomato. Studies are currently underway to compare morphological characteristics, morphometrics, host preferences, pathogenicity, and esterase isozyme profiles of isolates from each of these populations.

11:30 Novel From of Caribbean Fruit Fly (Tephritidae) Suppression: Classical Biological Control of the Preferred Host *Psidium cattleianum* Sabine (Myrtaceae). Frank J. Wessels*, Entomology and Nematology Dept., UF, James P. Cuda, Department of Entomology and Nematology, UF, Gainesville; and M. Tracy Johnson, USDA Forest Service, Volcano, Hawaii.

The Caribbean fruit fly (CFF) is a common agricultural pest known for its wide host range of almost 100 species, including several important fruit crops. CFF can cause direct yield loss, and its presence can affect shipments to quarantine sensitive markets. In Florida and Hawaii, various control techniques have been used with limited success. A novel approach for reducing fruit fly populations is classical biological control of their preferred naturalized host plants. In addition to being an important host, strawberry guava, *Psidium cattleianum* Sabine, also is considered a highly invasive plant. *P. cattleianum* is native to southeastern Brazil, but is present in Florida, Hawaii, and throughout the Caribbean. In Brazil, a survey of the entomofauna associated with *P. cattleianum* identified five potential biocontrol agents. The most promising was a leaf-galling scale insect, *Tectococcus ovatus* Hempel (Hemiptera: Eriococcidae). Large infestations of *T. ovatus* cause premature leaf drop and inhibit fruiting, thereby reducing fruit fly breeding sites. Biological studies and host specificity testing are underway in Florida and Hawaii to determine if *T. ovatus* is suitable to release as a biological control agent.

11:45 Some Aspects of Soil Suppressiveness to *Meloidogyne arenaria* by *Pasteuria penetrans*. George M. Kariuki* and D. W. Dickson, Department of Entomology and Nematology, UF, Gainesville, FL.

Pasteuria penetrans is known to cause soil suppressiveness to root-knot nematodes. Our objective is to determine whether suppressiveness can be moved, established and managed. *P. penetrans* and *Meloidogyne arenaria* were established in a field located at the Plant Science Research and Education Center, Citra, FL. Host crops for *M. arenaria* are being grown in summer and winter. At the end of the each cropping seasons a baseline population of *M. arenaria* and *P. penetrans* were determined. *P. penetrans* increased from an average of 1.3 endospores/second-stage juvenile (J2) to an average of 5.0 endospores/J2 over one season. Three treatments, nontreated control, 1, 3-dichloropropene (1,3-D) at 168 liters/ha and chloropicrin at 263 kg/ha (both broadcast) were imposed in spring 2004. At the end of the summer crop, 49% of nematode females in the nontreated control were infected by *P. penetrans*, followed by 1, 3-D with 33%, and chloropicrin with 22%. The number of *P. penetrans* endospores attached per J2 was 39, 34, and 16 in 1,3-D, nontreated, and chloropicrin treated plots, respectively. These treatment effects were different ($P < 0.05$). The study affirms that *P. penetrans* induced suppressiveness can be transferred, the soil fumigant 1, 3-D reduces numbers of root-knot nematode without decreasing *P. penetrans*, and that chloropicrin is detrimental to suppressiveness

induced by *P. penetrans*.

LUNCH BREAK

MONDAY AFTERNOON SESSIONS

1:30- 3:00 **Concurrent Sessions – B**

Crop Protection

1:30 Use of Plant Pathogens as Bioherbicides to Manage Weeds in Fruit Crops.

Raghavan Charudattan. Plant Pathology Department, UF, Gainesville, FL.

Certain fungal, bacterial, and viral pathogens can be mass-produced and used as biological herbicides to control weeds in crops. This approach, referred to as the “bioherbicide” or the “inundative” biological control strategy, is based on our ability to manipulate certain pathogens to cause highly damaging levels of disease epidemics during critical periods of weed interference and minimize present and future weed impacts. A few bioherbicides have been developed and used commercially to manage weeds in various crops, including fruit crops. In fact, the first bioherbicides registered by the EPA was developed for control of a weed in Florida citrus. Currently, we are developing several bioherbicides to manage weeds in citrus, vegetables, pastures, and natural areas. Weeds such as invasive grasses, purple nutsedge, pigweeds, and tropical soda apple have been targeted. A bioherbicide system based on the use of a cocktail of two or three pathogens has been shown to be effective for the control of guineagrass, torpedograss, cogongrass, and other grasses. The grass bioherbicide and its applicability to citrus weed management will be discussed.

1:45 Diseases of Tropical and Subtropical Fruits Induced by Phytoparasitic Nematodes.

Donald W. Dickson. Department of Entomology and Nematology, UF, Gainesville, FL; and J. A. Brito, Division of Plant Industry, Gainesville, FL.

Abstract not available.

2:00 Exotic Scale Insects (Hemiptera:Coccidea) and Whiteflies (Hemiptera:Aleyrodidae) in Florida’s Tropical Fruits: An Example of the Vital Role of Early Detection in Pest Prevention and Management.

Amanda Hodges. Department of Entomology and Nematology, UF, Gainesville, FL; and Gregory Hodges, Florida Department of Agriculture & Consumer Services, Division of Plant Industry, Gainesville, FL.

The warm, tropic to subtropical climate of Florida in conjunction with trade and travel patterns creates an optimal environment for the introduction and establishment of exotic pests. For some of Florida’s tropical fruit species, such as mango, avocado, papaya, passion fruit, guava, and carambola, exotic scales, mealybugs, and whiteflies have been especially problematic. Examples of some of these pests reported to the Florida Department of Agriculture, Division of Plant Industry (FDACS-DPI) database will be described. Additionally, information on scales, mealybugs, and whiteflies that could impact Florida’s tropical fruit crops, if introduced, is provided. The past and potential impacts of exotic scales, mealybugs, and whiteflies provide a good example of the importance of the early detection of non-

native pests. The Southern Plant Diagnostic Network (SPDN), coordinated through the University of Florida, promotes the early detection of exotic pests through diagnostics, education, and information technology. The SPDN, one of the five regions in the National Plant Diagnostic Network (NPNDN), primarily links land grant university diagnostic labs in the southern region. Even though the SPDN/NPNDN is mainly a network linking universities, the SPDN/NPNDN also communicates and cooperates with state and federal regulatory personnel, as appropriate for exotic pest issues.

2:15 **ChemSearch: A Searchable Pesticide Database for Tropical Fruit Crops.** Daniel J. Sonke, Jennifer L. Gillett, and Norman C. Leppla. Entomology and Nematology Department, UF, Gainesville, FL.

The University of Florida, Institute of Food and Agricultural Sciences is completing a pilot project during which selected faculty members evaluated the efficacy of ChemSearch, a commercial database created by CDMS Inc. for making up-to-date pesticide recommendations. This project led to a national initiative by CDMS to provide ChemSearch at reduced cost to university and government institutions. ChemSearch is the industry's premier searchable database for agricultural chemicals and contains product label information for over 1,600 crop protection and special products, including 24Cs, Section 18s and Supplemental Labels. ChemSearch is updated daily, easy to learn, searchable by crop, pests, active ingredient, state, etc. to provide a label summary. The ChemSearch database was searched for pesticides currently registered for tropical fruit crops in Florida, e.g., avocado, banana, carambola, guava, lychee, mango, papaya, sapote, and others. The number of available insecticides, fungicides, and herbicides were compared and representative examples will be presented for selected tropical fruit crops. Finally, tips will be provided for easily conducting rapid and comprehensive searches of the ChemSearch database.

2:30 **Mite and Homopteran Pests of Papaya and Their Control.** Jorge E Peña, Tropical Research and Education Center, UF/IFAS, Homestead, FL.; A. Pantoja, University of Puerto Rico, Mayaguez, PR.; L. Osborne, Mid-Florida REC; R. Duncan, Tropical Research and Education Center, UF/IFAS, Homestead, FL.; M. de Cos, Tropical Research and Education Center, UF/IFAS, Homestead, FL.; S. Halbert, Florida Department of Agriculture and Consumer Services, Gainesville, FL; G. Evans, Florida Department of Agriculture and Consumer Services, Gainesville, FL; and A. Hammond, Florida Department of Agriculture and Consumer Services, Gainesville, FL.

Homopteran pests in papaya fields in Florida, include mealybugs (*Paracoccus marginatus* Williams and Granara de Willink), scales (*Philephedra tuberculosa* Nakahara and Gill, *Coccus hesperidum* L. and Diaspidids (*Aspidiotus destructor*, *Acutaspis* sp., *Hemiberlesia* sp.), aphids (Aphididae), leafhoppers (*Empoasca stevensi* Young) and whiteflies (*Trialeurodes variabilis*) and mite pests (*Tetranychus* spp., and *Polyphagotarsonemus latus*). The frequency the homopterans mentioned above, characteristics of their injury and the presence of their natural enemies was determined from November 2000 through October 2001 using 2 sampling methods in 3 commercial papaya fields in Homestead, FL. Results from chemical control tests against scales, mealybugs, and mites in papaya are reported.

2:45 **Toxicity of Insecticide-Treated Spheres to Caribbean Fruit Fly, *Anastrepha suspensa* and Mediterranean Fruit Fly, *Ceratitis capitata* (Diptera: Tephritidae).** Oscar E.

Liburd, Entomology and Nematology Department, UF, Gainesville, FL; Timothy C Holler, USDA-APHIS-PPQ-CPHIST, Gainesville, FL; Jay Cee L. Turner, Entomology and Nematology Department, UF, Gainesville, FL; and Amy L. Moses, USDA-APHIS-PPQ-CPHIST, Gainesville, FL.

The Caribbean fruit fly, *Anastrepha suspensa* (Loew), and the Mediterranean fruit fly, *Ceratitidis capitata* (Wiedemann) are major tephritid pests that attack a wide range of tropical and subtropical plants. The potential for establishment of these fruit fly species in major U.S. fruit-producing areas (i.e. California, Florida and Texas) has demanded the need for the development of effective reduced-risk pest management tactics to control these flies without the use of broad-spectrum toxic insecticide sprays. In laboratory studies we evaluated the use of toxic bait stations for control of *A. suspensa* and *C. capitata*. Flies were exposed to five treatments in no-choice tests and evaluated at 2, 4, 24, 48 and 72 h. Treatments included: 1) a new sphere design treated with 1% Spinosad, 2) an old sphere design treated with 1% Spinosad, 3) old sphere design treated with 2% imidacloprid, 4) an untreated new sphere design (control), 5) an untreated old sphere design (control). Experimental design was completely randomized block with 4 replicates. During the first 24 h only the treatment that consisted of the old sphere design with 2% imidacloprid significantly reduced the survival *A. suspensa* below the control. However, at 48 and 72 h, respectively, significantly more *A. suspensa* survived in both controls compared with other treatments. There were no significant differences at 48 and 72 h between any of the treated spheres. Similar results were recorded for *C. capitata*. The results indicate the potential for using our new sphere design treated with 1% Spinosad for controlling *A. suspensa* and *C. capitata*.

3:00 **Sectional Business Meeting**

3:15 **BREAK**

3:30-5:00 **Concurrent Sessions – C**

Crop Protection, Stress, and Germplasm

3:30 **Mango bud mite, *Aceria mangiferae*: Bionomics and Control Under Florida Conditions.**

Jorge E. Peña, Tropical

Research and Education Center, UF/IFAS, Homestead, FL.; E. Palevsky, ARO, Volcani Center, Bet Dagan, Israel; G. Otero,

Colegio Post-Graduados, Chapingo, Mexico; and R. Ochoa, USDA, SEL, BARC, Beltsville, MD.

The densities of the mango bud mite, *Aceria mangiferae* were inspected on 22 mango cultivars. Cv's 'Keenan', an unknown cultivar, cv., 9819, 'Brander', and 'Bombay Green' had significantly more mites than cvs. 'Joellen', 'Duncan', 'Red Itamaraca', 'Smith', 'Wally' and 'Hindi'. During a second phase of the study conducted on cv 'Keitt' from September 2002 to January 2004. Apical resting buds were chosen as the sampling unit. Lower numbers of *A. mangiferae* were found from March through July 2003 compared to higher mite densities from September to February. More *A. mangiferae* were found in peripheral scales than in the scales conforming the meristematic dome within the apical bud. Distribution of eggs and motile stages within a bud scale showed that more eggs were found in the bud scale pubescent area than on hairless areas. Within plant distribution of *A. mangiferae* showed more mites on the upper and middle tree canopy than on lower portions of the canopy. We determined the

proportion of mite-infested buds as a way to use this technique in commercial monitoring of *A. mangiferae*. Results of an experiment to test effectiveness of different acaricides and effect of mite densities on yield of mango in Florida are discussed.

3:45 **Effect of All Purpose Colloidal Cleaner® on Insect Control and Growth of Containerized Red Sugar Apple**

(*Annona squamosa*) and Growth, Yield, and Fruit Quality of Green sugar apple and 'Gefner' Atemoya Under Field

Conditions. Mark P. Kohout, Jonathan H. Crane, and Aaron Palmateer, Tropical Research and Education Center, Homestead, FL.

The effect of colloidal cleaner on growth and insect control of containerized one year-old red sugar apple trees was investigated under shade-house conditions. The effect of colloidal cleaner on growth, yields, and fruit quality of green sugar apple and 'Gefner' atemoya trees was also investigated under field conditions at the Tropical Research and Education Center. Containerized sugar apple trees were sprayed 15 times with water or colloidal cleaner at 7-day intervals. Tree trunk diameters, height, and number of new leaves were recorded. Insects identified as attacking containerized plants included brown scale (*Coccus longulus*), pink wax scale (*Ceroplastes* sp.), and citrus mealy bug (*Planococcus citri*). There were no significant growth differences among treatments of containerized trees and insect infestations were only temporarily controlled. Green sugar apple and 'Gefner' atemoya trees in the field were sprayed with water or colloidal cleaner or non-sprayed 3 times at a 7 day interval and 8 times at a 14 day interval. There was no significant difference among treatments for trunk diameter and shoot growth of sugar apple or 'Gefner' atemoya trees. Non-sprayed sugar apple and 'Gefner' atemoya trees had significantly more fruit than sprayed trees.

4:00 **Diurnal Changes in Dewpoint Temperature During the Freeze Season in North Florida.** Paul Lyrene, Horticultural Sciences Department, UF, Gainesville, FL.

This study was designed to determine whether there was a circadian pattern that might be useful in predicting short-term changes in dewpoint at three agricultural locations in north Florida. Data from the Florida Agricultural Weather Network were studied for nights during the winter half of the year that featured good radiation conditions and frost or dew formation. A well-defined circadian rhythm was found, with 2 peaks and 2 valleys per 24-hour period. The cycle included a morning rise, a midday slump, an evening recovery, and a nighttime fall. For the Alachua station, which is typical of the three stations studied, the mean change in dewpoint over 47 nights was -3.7 °C between 1 h after sunset and 15 min before sunrise. Between 15 min before sunrise and 2 h after sunrise, the dewpoint at Alachua rose by an average of 5.7 °C. This morning rise is believed to be due to evaporation of water that was deposited during the night by frost, dew, distillation, and guttation. The midday slump results when turbulence mixes this new water vapor with drier air above. The evening recovery is due to declining wind speed, which allows the surface air to gain water vapor from evaporation and transpiration, and the nighttime decline is due to the removal of water vapor from the air at instrument level (2 m above the ground) as a result of dew or frost formation. Although the nighttime decline in dewpoint was a pronounced feature, not every night showed a decline, and the extent of decline varied considerably.

4:15 **Growth, Yield, and Fruit Quality of Carambola Trees as Affected by Soil Water Depletion.** Rashid Al-Yayhai, Bruce Schaffer, and Jonathan Crane, Tropical Research and Education Center, UF; and Frederick S. Davies, Horticultural Sciences Department, UF, Gainesville, FL.

Irrigation scheduling of carambola (*Averrhoa carambola* L.) trees in South Florida is typically based on the date (calendar system) or soil appearance. The EnviroScan™ system continuously monitors soil water content with multi-sensor capacitance probes and is used to schedule irrigation based on the “onset of stress” principle. Our objective was to compare growth, yields, and fruit quality of 8-year-old ‘Arkin’ carambola trees on Golden Star rootstock at four soil water depletion (SWD) levels in Krome very gravelly loam soil. Soil water content rarely fell below the “onset of stress” level for irrigation and there were no differences in tree growth, yields, or total soluble solids at SWDs ranging from 0% (field capacity) to 17%. We hypothesize that soil water remained at non-stress levels via capillary rise from the water table and adequate rainfall. Mature carambola trees growing in this soil type required considerably less irrigation than is the normal practice without adverse effects on crop growth, yield or fruit quality.

4:30 **Collecting *Mammea americana* L. in Tropical America: Potential for Florida.** Richard J. Campbell. Fairchild Tropical Botanical Garden, Coral Gables, FL.

The abrico (*Mammea americana* L.) is a Tropical American fruit crop with potential for plantation and estate agriculture in Florida. The fruit are large (600 to 2000 g) and the flavor is agreeable for most as a fresh fruit and as a preserved product. There has been little systematic selection of superior clones of abrico either within or outside of its native range. The fruit is consumed locally throughout Central America and the Caribbean, but it has never attained appeal within an international market. Over the last 5 years the Fairchild Tropical Botanic Garden (FTBG) has endeavored to make a collection of superior clones of abrico. Clonal material has been collected in the Dominican Republic, Costa Rica, El Salvador, Guatemala, Hawaii, and most extensively in Nicaragua. The criteria for selection have been a large fruit, heavy production, agreeable flavor and ease in separation of the flesh from the seed(s). There are currently 14 selections under trial in South Florida at the Williams Grove Genetic Resource Center of FTBG. Production and fruit quality data collection began in 2005.

4:45 **The Introduction of West Indian Avocados to South Florida.** Gilberto Aleman, Noris Ledesma, and Richard J.

Campbell, Fairchild Tropical Botanic Garden, Coral Gables, FL; and Juan Carlos Herrera, Campo Verde de la Familia, Jesus Maria, Costa Rica.

The avocado (*Persea americana* Miller) is an important fruit crop for subsistence farmers, small- and large-scale producers throughout the tropics. In the lowlands of Tropical America, local selections of West Indian avocados dominate regional markets. These local West Indian avocado selections are often of superior fruit quality and adaptation to the climatic and edaphic conditions of the area. There has been little effort into the systematic identification, collection and maintenance of these West Indian avocado genetic resources from Tropical America. These local West Indian avocado selections hold the promise for South Florida as cultivars for plantation and estate agriculture. As a genetic resource, these selections hold promise for the improvement of disease resistance, fruit quality and productivity

of avocado throughout Tropical America and the world. Fairchild Tropical Botanic Garden (FTBG) has initiated a 2-year project for the collection of West Indian avocados in lowland Costa Rica, Nicaragua, El Salvador, Guatemala and Panama. Working with local collaborators we have identified superior selections within localized areas of diversity, collected budwood and established a living collection at the Williams Grove Genetic Resource Center of FTBG in South Florida. Evaluation of fruit and tree characteristics began in 2005.

5:00 **End of Afternoon Session**

TUESDAY MORNING SESSIONS

10:00-12:15 **Concurrent Sessions - D**

Marketing, Cultivar Evaluation, and Management

10:00 **Recent Developments in World Production and Trade of Lychee (*Litchi chinensis*)
Industry: Implications for Florida**

Growers. Edward A. Evans, Tropical Research and Education Center, UF/IFAS, and R. L. Degner, Food and Resource Economics Department, UF-IFAS.

Production of lychee in Florida expanded rapidly in the 1990s following Hurricane Andrew in 1992. From about 200 acres pre-hurricane, acreages increased to the current level of about 1,300 acres. Growers were drawn to the high returns and favorable prospects due to a couple of factors. First, the demand for lychee was being driven by an increasing U.S. Asian and Hispanic population projected to continue increasing. Second, it was thought that the U.S. market was fairly well protected due to the distance from the main production areas in Asia and because of phytosanitary restrictions. The feeling was that the highly perishable nature of the fruit would make it extremely difficult to ship considerable quantities via sea freight from Asia. Since Lychee is a host to a number of exotic pests, including oriental fruit fly, lychee fruit borer, and Asian fruit fly, imports were restricted from many countries considered to be fruit fly zones. Hence, apart from small amounts shipped from Mexico, the market was considered reserved for domestic growers. However, recent developments have proven the consensus wrong, as there has been a surge of lychee imports from China and Taiwan. This has resulted in domestic prices plummeting well below those obtained three to five years ago. From average returns of \$10,000 per acre five to six years ago, growers now receive on-average \$2,000 per acre. Many growers in 2004 sought federal assistance under the USDA Trade Adjustment Program. We examine recent developments in the world production and trade of lychee, and outline some of the implications for U.S. growers.

10:15 **Antioxidant Potential of Fruits and Vegetables : Evaluation of Blueberry Cultivars Using *in vitro* assays.** Juliana Fant, Ben Grandon, Bala Rathinasabapathi, Steve Olson, and Paul Lyrene. Horticultural Sciences Department, UF. Gainesville, FL.

Fruits and vegetables have been recognized as important sources of health promoting antioxidants in our diet. Blueberries among fruits and collard among vegetables have been known for high levels of

antioxidant phytochemicals. Our objective is to screen blueberry and collard germplasms for genetic variability for total antioxidant potential. It is expected that if variability can be identified for this trait, the nature and properties of the antioxidant chemicals involved can be better understood. Extracts of blueberry fruits from two cultivars including Florida Rose were tested for their total antioxidant potential using in vitro assays.

10:30 Optical Techniques to Estimate the Color and Quality of Mangoes. Tomas Ayala-Silva, Raymond Schnell, Alan Meerow, and Mike Winterstein. USDA-ARS National Germplasm Repository. Subtropical Horticultural Research Station. Miami, FL.

The visual appearance of fresh fruits and vegetables is one of the first quality determinants made by the consumer. Often the appearance of the commodity is the most critical factor in the initial sale. In Florida, the color of the mango is an important factor and everyone admires a handsome mango more or less generously overlaid with red. Red skin is considered a necessity in mangos shipped to northern markets, even though the quality may be inferior to that of non-showy cultivars. Mango is a minor crop in the United States with 650 ha currently under cultivation in Florida and 870 ha in Puerto Rico. Mango is a popular dooryard fruit tree in Florida, Hawaii, Puerto Rico and Guam and is available as fresh fruit year around in North America, Japan and Europe. In the past, the evaluation of mango color has been subjective and based on visual ratings. Large errors are associated with these types of ratings making evaluation of the heritability of fruit color difficult. The present paper illustrates the use of a colorimeter to quantify fruit color and quality. Mango color was measured with a Minolta Chroma Meter CR-400 portable tristimulus colorimeter and fruit chromaticity was recorded in Commission Internationale d'Eclairage L^* , a^* and b^* color space coordinates. In this system of color representation the values L^* , a^* and b^* describe a uniform three-dimensional color space, where the L^* value corresponds to a dark-bright scale, a^* is negative for green and positive for red, whereas b^* is negative for blue and positive for yellow. The colorimeter was calibrated against a standard white plate ($L = 97.79$, $a = -0.43$ and $b = +2.25$) under normal lighting conditions. For each sample, color values were measured at the base, cavity and apex on each mango. Detailed data was obtained from six cultivars in 2003 and 2004. Fruit and seed size and weight, brix and fruit number were also evaluated. The ability to quantify color readings could allow us to estimate the heritability of this trait and aid in the selection of parents to use in breeding new cultivars.

10:45 Evaluation of Banana Cultivars in the South of Haiti. Ludger Jean-Simon. American University of the Caribbean, Les Cayes, Haiti, and World Concern Haiti, Les Cayes, Haiti.

A field experiment was established in August 2004 in order to evaluate the productivity and the tolerance to Black Sigatoka of the banana cultivars FHIA 21, CRBP 39, FHIA 17, FHIA 23, FHIA 18, FHIA 01, FHIA 25. The local cultivars Musqué and La Reine are used as control treatments. The experimental design is a randomized complete block of 9 treatments and 3 replications. The experimental unit consists of a row of 5 plants with a plant spacing of 3 m within and between rows, thus an area of 45 m² per experimental unit. Six month growth and severity of Black Sigatoka were evaluated. Data were collected and analysis of variance performed for number of leaves per plant, plant height, pseudostem diameter, third leaf area, and disease level. No significant difference was found between the banana cultivars for the number of leaves, stem diameter, and the susceptibility to Black Sigatoka. The cultivars FHIA 25, with a six month height of 1.6 m had the fastest height growth. 'FHIA 25' also had the largest leaf size, with a third leaf area of 0.4 m². In overall, the banana plants had an

average of 8.8 leaves, a height of 1.1 m, a pseudostem diameter of 7.4 cm, and a leaf area of 0.2 m². The level of susceptibility to Black Sigatoka was low for all the banana cultivars under study. The banana cultivar FHIA 25 have shown the fastest initial growth of all the materials under evaluation.

11:00-11:15 BREAK

11:15 Pruning Intensity and Fruit Load Influence on Vegetative and Fruit Growth in 'Alexandra' Early Maturing Peach. Claude Bussi, Institut National de Recherche Agronomique, Marcel-les-Valence, France; Françoise Lescourret, Institut National de Recherche Agronomique, Centre de Recherche d'Avignon, France; Michel Genard, Institut National de Recherche Agronomique, Centre de Recherche d'Avignon, France; Robert Habib, Institut National de Recherche Agronomique, Centre de Recherche d'Avignon, France; and Myriam Siham, Gulf Coast Research and Education Center, UF. Wimauma, FL.

Management of fruit and shoot number in peaches (*Prunus persica*) is an important consideration to improve fruit quality. Between 2000 and 2002, three experiments were conducted in Gotheron, France, to test the impact of different pruning and fruit load levels on an Alexandra early maturing peach. Light, medium and high pruning were applied each year for the same fruit load except for the third year. The third year, in addition to pruning levels, three fruit load levels were used. With high pruning, average fruit weight and diameter increased, which appeared to limit the yields on the second year but not on the third. Fruit weights and soluble solid concentration always decreased when fruit load increased. High pruning levels also seemed to enhance shoot growth. Vegetative growth increase might explain fruit growth improvement as it enhanced available photosynthates. Pruning intensity and fruit load should be adapted to ensure acceptable yield and fruit quality.

11:30 Comparative Study of Two Training/Trellis Systems and Canopy Management Practices for 'Carlos' and 'Noble' Muscadine Grapes. Violeta Coloba and Stephen Leong. Center for Viticulture and Small Fruit Research, Florida A & M University, Tallahassee, FL.

The grape best management practices project (BMP) at FAMU Center of Viticulture & Small Fruit Research has been initiated with the financial support of VAC (Viticulture Advisory Council) two years ago. As a major accomplishment a 4.2-acre experimental vineyard was established during the 2003-2004 season to evaluate the various experimental factors of the project. The research was based on a complete randomized block design. Four vines per variety were planted as sampling units. Each set of experiments had two replications and the following factors: a) Grape varieties: 6; b) Training/ trellis system: 6 and c) Spacing: 3 set of planting density (determined specifically for muscadine and Florida hybrids). During the 1st and 2nd growing cycle the large amount of biometrical data for "growth performance", "yield components", "time and pattern of fruit ripening" "fruit composition" and "pruning weight" were evaluated as a direct result of the various treatments: variety, planting density, and training/trellis system. The preliminary results for Carlos and Noble muscadine varieties demonstrated significant variation between the "yield components", "fruit ripening pattern" and "fruit composition" of single wire, double cordon (SWDC) and Munson T-cross arm, double cordon (MTDC) training/trellis

systems, with better performance of the divided canopy. Our results are one preliminary indication of the very high importance of carefully designed and selected training /trellis system and canopy management for maintaining the best physiological equilibrium of the particular grape variety and its optimal performing under specific environmental conditions.

11:45 **Papaya transplant growth rates as affected by 5-aminolevulinic acid and nitrogen fertilization.** J. Pablo Morales-Payan and William M. Stall. Horticultural Sciences Department, UF. Gainesville, FL.

Experiments were conducted to assess the effects of nitrogen (N) fertilization and 5-amino levulinic acid (5-ALA) on the growth of papaya for transplants. Seedlings were grown in Styrofoam containers filled with sphagnum/vermiculite/perlite growing medium. N and 5-ALA were applied at sowing and 15 days after emergence, respectively. N and 5-ALA rates affected overall growth as well as time to attain adequate size for transplanting. The best plants were produced with the highest N and 5-ALA rates.

12:00 **Seaweed Extracts Effects on Guava (*Psidium guajava*) Rootstock Growth.** J. Pablo Morales-Payan and William M. Stall. Horticultural Sciences Department, UF. Gainesville, FL.

Seaweed (*Ascophyllum nodosum*) extracts (SSE) were evaluated for their effect on the growth of guava seedlings for rootstock. Seedlings were grown in Styrofoam containers filled with sphagnum/vermiculite/perlite growing medium and treated with soil and foliar SEE at various rates. In general, SEE increased seedling growth and reduced the time from emergence to adequate size for use as rootstock.

Ornamental, Landscape & Garden Section Abstracts

Adrian Hunsberger, Presiding

MONDAY MORNING SESSIONS

10:15-12:00 **Concurrent Sessions - A**

10:15 **Container-Grown Ornamental Granular Herbicide Trials.** L. Miller, Hillsborough County Extension, UF; J. Popenoe, Lake County Extension, UF; Robert Stamps, Mid-Florida Research and Education Center, UF; Raymond Miller and Darin Lickfeldt, Dow AgroSciences, Zionsville, IN.

Weed control is a continual challenge for Florida container nurseries despite the numerous chemical control options at their disposal. Failure to adequately control weeds while using granular herbicides in container nurseries may be caused by too much or too little rain/irrigation, by the presence of weeds that are not controlled by the herbicide(s) label, by improper rate selection or by inaccurate/non-uniform application. These trials were designed to show that when applied correctly, most products will

control target weed species successfully. Snapshot 2.5 TG, Showcase, OH2, Rout, Broadstar, Dimension, Treflan, handweeded and untreated controls were applied in December 2004 in randomized block trials on *Viburnum odoratissimum* (3 gal.) and *Quercus virginiana* (5 gal) at two nurseries in Hillsborough and Sumter counties. Applications were made with a broadcast spreader to dry foliage followed by application of 0.5 to 0.75 inches of irrigation water. Weed control was measured in February and April 2005. Results varied somewhat between nurseries, but Showcase, Broadstar, Dimension and Snapshot gave the best control in February.

10:30 **Comparison of Vase Life of Ornamental Asparagus Cultivars and Species.** Robert H. Stamps, Diane K. Rock and Annette L. Chandler, Mid-Florida Research and Education Center, UF.

The cut foliage industry in Florida started in the 1890s when producers started growing *Asparagus setaceus* (plumosa "fern"). Since then, a number of additional species and cultivars of ornamental asparagus have been tried for use as florists' greens. Ten cultivars and species were grown in containers in a shadehouse with 70% light exclusion. Over a seven year period, stems were periodically harvested for vase life evaluations. After harvest, stems were submerged in water, packed in plastic bags and stored for 2 weeks in corrugated fiberboard boxes held at 40°F. After storage, stems were held under simulated home/office conditions in glass containers filled with deionized water. Average overall vase life durations ranged from 24.4 days for *A. densiflorus* 'Myers' to 6.2 days for *A. officinalis* var. *pseudoscaber* and generally broke out into a number of somewhat discrete groupings: *A. densiflorus* 'Myers' > *A. africanus*, *A. setaceus* > *A. falcatus*, *A. virgatus*, *A. retrofractus* > *A. densiflorus* 'Sprenger', *A. officinalis* subsp. *prostratus*, *A. crispus* and *A. officinalis* var. *pseudoscaber*. Vase lives, at least for some of the species, varied considerably from harvest to harvest.

10:45 **Evaluation of Easter-lily, *Lilium longiflorum*, as a Perennial in South Florida.** Joseph Garofalo, Miami-Dade Extension, UF.

The Easter-lily, *Lilium longiflorum*, is reported by some South Florida residents to perform as a true perennial in their gardens. However, data are lacking which would prove or disprove this claim. Local nurseries do not force Easter-lilies in South Florida, mainly because daily temperatures tend to be 75 F or higher during the winter production period. High temperatures are reported to reduce the number of flowers per bulb and to promote uneven flowering, which make it difficult, if not impossible, to time the crop for Easter bloom.

During the first week of December, 2003, 100 bulbs were planted of 'Nellie White', probably the most common commercially-grown cultivar. These were Holland-grown bulbs, size 7-8 (inches in circumference), which were shipped pre-chilled in moist sphagnum peat. The bulbs were planted in pots and grown to determine if they would flower under local conditions; no attempt was made to time them for Easter of 2004. All of the bulbs bloomed, producing an impressive display.

In December, 2004, 250 new 'Nellie White' bulbs were planted, 150 size 7-8 and 100 size 9-10. Data were collected on days to bloom and flower count per bulb. Fifty of the 2003 bulbs were evaluated for repeat bloom. Results indicate that Easter-lilies are easy to flower in South Florida as a garden crop and that many will rebloom the second year. Protection from bulb-rotting organisms is essential. Additional research is required to determine if long-term survival is possible.

11:15 **Color Break in Orchid Flowers.** Robert T. McMillan, Jr., Kerry's Bromeliad Nursery, Inc., Homestead, FL.

Color Break in orchids was once thought to occur solely in Cattleyas has been reported in Odontoglossum, Cymbidium, Vanilla, Epidendrum, Encylia, Oncidium, Phalaenopsis, and many other orchid genera. There are two distinct stains, mild and severe, causing both petals and sepals to be marked with irregular areas which develop at random and which are lighter or darker than the normal flower color. There is no malformation or distortion of flowers. The leaf symptoms range from absent to mild mosaic symptoms. Severe color-break is characterized by variegation in the flower, where the normal pigment of the petals and sepals is replaced with irregular patches of tissue that is either more or less intense in color than the normal flower. Inoculation studies were conducted with Cattleya and Phalaenopsis with the mild and severe virus strains. Virus free seedling plants were used throughout the study. ELISA was used to verify the presence of the virus strain. Both petals and sepals from the Cattleya and Phalaenopsis were marked with irregular areas that developed at random and were lighter or darker than normal flowers. Leaves from both orchids randomly showed mild mosaic symptoms to none. The severe color-break showed variegation in the flower, where the normal pigment of the petals and sepals were replaced with irregular patches of tissue that was either more or less intense in color than the normal flower. In some Cattleya flowers the virus caused necrotic flecking. The leaf symptoms of the severe strain was a mosaic mottling of light and dark green tissue rough with the dark green areas raised above the light green tissue as longitudinal ridges and bumps. In some plants the leaves twisted and deformed.

11:30 **Growth of Selected Bedding Plants as Affected by Different Compost Percentages.** Wagner A. Vendrame and Ian Maguire, Tropical Research and Education Center, UF; Kimberly K. Moore, Fort Lauderdale Research and Education Center, UF.

Growth of petunia 'Ultra Rose' (*Petunia hybrida* Hook.), Dahlberg daisy 'Golden Fleece' (*Dyssodia tenuiloba* B.L. Rob.), marigold 'Little Hero Orange' (*Tagetes patula* L.), and impatiens 'Super Elfin Blue Pearl' (*Impatiens walleriana* Hook. f.) was compared in commercial substrates and substrates containing different compost percentages, as follows: 1) Fafard Growing Mix 2 (70 % sphagnum peat moss, perlite, and vermiculite); 2) Metro- Mix 350 (45 – 55% horticultural grade vermiculite, sphagnum peat moss, processed bark ash, dolomitic limestone, and a wetting agent); 3) 0% compost, 60% sphagnum peat, 25% vermiculite, 15% perlite; 4) 30% compost, 30% sphagnum peat, 25% vermiculite, 15% perlite; 5) 60% compost, 25% vermiculite, 15% perlite; 6) 100% compost. The compost was derived from biosolids and yard trimmings. Plants were transplanted into 4-inch containers and treatments were top-dressed with Osmocote 14N-14P₂O₅-14K₂O incorporated at 3 g/container. Root to shoot ratio was evaluated for all treatments and plants were rated for quality. For petunia, best root to shoot ratio was achieved in Fafard Growing Mix 2, 0% compost, and 30% compost. The best rates were obtained in 0% and 30% compost. Root to shoot ratio for daisy was not significantly different among the treatments, except for Metro-Mix 350, which provided the lowest ratio. However, Metro-Mix 350 provided plants with the best rates. Root to shoot ratio was not significantly different among all treatments for marigold. However, the best rates were achieved for Metro-Mix 350, 30%, 60%, and 100% compost. For impatiens, root to shoot ratio was best in 30% compost, while rates were similar among treatments, except for Fafard Growing Mix 2, which resulted in the lowest rate.

11:45 **Fort Lauderdale Trial Garden – Year 3.** Kimberly K. Moore, Fort Lauderdale Research

and Education Center, UF.

Rooted cuttings of vegetatively propagated annuals from Danziger, Fides, Euro American and Fischer were planted over three planting dates (August 26 – Danziger; October 21 – Fides and Euro American; December 8 – Fischer). 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 also was conducted in March.

LUNCH BREAK

MONDAY AFTERNOON SESSIONS

1:30- 3:00 Concurrent Sessions - B

1:30 **Analysis of Species Richness and Species Diversity in Landscape Palms in Southeastern Florida.** George E. Fitzpatrick, Fort Lauderdale Research and Education Center, UF.

Southeastern Florida, due to its subtropical climate, has a higher species richness and species diversity of palms than other parts of the state. While just 11 species are regarded as native to Florida, and another 14 species are now recognized as naturalized in the state, over 70 palm species are regularly offered for sale by commercial nurseries, and are used in landscaping in southeastern Florida. Visual surveys of residential landscapes, with lot sizes of 100 feet by 150 feet or less, have revealed a wide variety of species richness and species diversity of palms grown in urban gardens. A property with no palms in its landscape has S of 0 (S = Species richness) with H' (H' = Shannon-Weaver Diversity Index) of 0. Other properties of comparable size had S = 11 with H' = 2.214, although most properties surveyed had S less than 5 and H' considerably less than 2.0

1:45 **Gardening for Butterflies.** Anita S. Neal and S. Brodeur, St. Lucie County Extension, UF.

We attend workshops, plant weeds in our yard, endure our plants being ravaged by hungry, fat little critters, all for the sake of catching a glimpse of a fluttering beauty. These flying, fluttering flowers with the sun shining on their wings create a warm spot in many a heart. Their beauty is enough to stop a body dead in their tracks. The Spanish call them mariposa, and we know them as butterflies. Gardening to attract butterflies starts with a plan. To develop a butterfly demonstration garden on the St. Lucie County Extension grounds, first a group of Jr. Master Gardeners identified the needs of a butterfly, the types that could be found in the butterfly zones of Florida and which plants would be a nectar or larval food source. The gardeners narrowed the list to the butterflies and plants that would be

appropriate for this area. The group was taught how to design a garden, visited a butterfly garden and created individual landscape plans for the garden. A local landscape architect captured all of the ideas into a final design. The gardeners have designed an educational kiosk to explain the butterfly life cycle and the major elements that one must consider in developing a garden for butterflies. The Jr. Master Gardeners are very proud of the garden and its designation is an educational element of the St. Lucie County Extension site.

2:00 **Digital Photography.** Ian Maguire, Tropical Research and Education Center, UF.

The advancement of digital photography is an important development for scientific research. Research institutes throughout the world have switched to digital photography due to the increase in image quality, falling costs of equipment, development of easy to use cameras and the amount of time saved when using a digital camera. Although digital photography is one of the newest forms of scientific documentation, there are many principles and techniques that are unexplored. Simple methods for improving the ability to purchase affordable equipment, using a digital camera's manual override setting, suitable backdrops and use of reflectors for photography, and practical steps for using a digital camera on a microscope are discussed.

2:15 **Deficit Irrigation Enhances Drought Resistance in Warm-Season Turfgrasses.**

Joon H. Lee* and Laurie E. Trenholm, Department of Environmental Horticulture, UF; J. Bryan Unruh, West Florida Research and Education Center, UF.

Due to increasing concerns over turfgrass water use, research was conducted to determine the response of five warm-season turfgrasses to deficit irrigation and to gain a better understanding of relative drought tolerance of the grasses. St. Augustinegrass (*Stenotaphrum secundatum* [Walt.] Kuntze.) cultivars 'Floritam' and 'Palmetto', 'Sealsle 1' seashore paspalum (*Paspalum vaginatum* Swartz.), 'Empire' zoysiagrass (*Zoysia japonica* Steud.), and 'Pensacola' bahiagrass (*Paspalum notatum* Flugge) were established in lysimeters in the University of Florida Envirotron greenhouse facility in Gainesville. Irrigation was applied at 100%, 80%, 60%, or 40% of evapotranspiration (ET). Evaluations included: shoot quality, leaf rolling, leaf firing, leaf relative water content (RWC), soil moisture content, chlorophyll content index (CCI), canopy photosynthesis (PS), multispectral reflectance (MSR), root distribution, and water use efficiency. There were no differences in visual quality, leaf rolling, leaf firing, RWC, CCI, or PS between 80 or 100% irrigation. Grasses irrigated at 60% of ET had more optimal physiological responses than grasses irrigated at 40% of ET. Sealsle 1 and Palmetto had a deeper root system at 60 or 80% of ET while Floritam had the least amount of root mass. Photosynthesis was positively correlated with visual assessments such as turf quality, leaf rolling, leaf firing, and sensor-based measurements such as CCI, soil moisture, and MSR. Reducing the amount of applied water by 20% did not reduce turfgrass quality and maintained acceptable physiological functioning.

2:30 **Susceptibility of Four Cut Flowers to a Fungal Contaminated Soil.** E. R. Malek*, Doctor of Plant Medicine Program, UF; K-H. Wang and R. McSorley, Department of Entomology and Nematology, UF.

Soil from a snapdragon (*Antirrhinum majus* L.) production site in south Florida was contaminated with *Fusarium* spp. and *Pythium* spp., with the former being more predominant. The objective of this

experiment was to evaluate the susceptibility of four cut flowers, 'Echo Pink' lisianthus [*Eustoma grandiflorum* (Raf.) Shinn.], 'Potomac Rose' snapdragon, 'Queen of Africa' white dill (*Ammi majus* L.), and 'Qis White Cut' larkspur [*Consolida ajacis* (L.) Schur.], to the pathogens in this soil. The growth of the flower species was compared between the fungal contaminated and autoclaved soils. Plant heights of snapdragon, lisianthus, and larkspur were shorter ($P < 0.10$) in the contaminated soil than in the autoclaved soil at the termination of the experiment. Root and shoot weight, number of flower buds, blooms, and total flowers were less ($P < 0.05$) in the contaminated soil for snapdragon. For lisianthus, shoot weight, number of flower buds, and total number of flowers were lower ($P < 0.05$) in the contaminated soil. However, for larkspur only the total number of flowers was fewer ($P < 0.10$) in the contaminated soil. Although the shoot weight of white dill was reduced in the contaminated soil, flower yield was not changed by the soil treatment. Root damage was significantly greater ($P < 0.01$) on snapdragon and larkspur than on lisianthus and white dill. Results showed that white dill was tolerant to the fungal pathogens in this soil. Pathogenic fungi have been isolated from the roots of the diseased plants, but further experiments are needed to confirm the pathogenicity of these fungi.

2:45 Adult Diaprepes Root Weevil Leaf Feeding Effects on Growth and Gas Exchange of Buttonwood and Live Oak. Alexander Diaz*, Catharine Mannion and Bruce Schaffer, Tropical Research and Education Center, UF.

Diaprepes root weevils *Diaprepes abbreviatus* L. (Coleoptera: Curculionidae), feed on a wide variety of ornamental plants grown in southern Florida. Although most damage to plants is caused by larval root feeding, adult leaf feeding has been observed to cause moderate to severe defoliation. Studies were conducted to evaluate the effects of adult Diaprepes root weevil leaf feeding on net CO₂ assimilation, stomatal conductance, transpiration and growth of buttonwood and live oak. Leaf gas exchange of buttonwood in two separate experiments showed variable results. In the first experiment leaf gas exchange of young and mature leaves were not affected by adult weevil leaf feeding. In the second experiment, after 2 months mature leaves of infested plants had higher net CO₂ assimilation, stomatal conductance and transpiration than controls. In both experiments leaf area of buttonwood tended to be less for infested plants than non infested plants. Leaf, stem and root weight was not affected by weevil infestation in the first experiment. In the second experiment root weight was lower for the infested plants than the non-infested plants. Leaf gas exchange of live oak was not affected by adult leaf feeding. Adult weevils did not cause any significant damage to live oak foliage and leaf gas exchange was not affected by herbivory. All weevils died within a month and the experiment was terminated. These results indicated that Diaprepes root weevil preferred the tender foliage of buttonwood over live oak and leaf feeding did not reduce leaf gas exchange during the two months that plants were infested.

3:00 Sectional Business Meeting

3:15 BREAK

3:30-5:00 Concurrent Sessions - C

3:30 Evaluation of Root Drench and Topical Insecticide Treatments for Control of the

Lobate Lac Scale, *Paratachardina lobata* (Chamberlin) (Hemiptera: Kerriidae). F.W. Howard and Bryan Steinberg, Ft. Lauderdale Research and Education Center, UF.

Chemical treatments of plants for control of the lobate lac scale, *Paratachardina lobata* (Chamberlin) (Hemiptera: Coccoidea: Kerriidae), were evaluated. A root drench treatment with imidacloprid applied to mature *Ficus microcarpa* (Moraceae) trees, applied at rates of 0.14, 0.28 and 0.57 g/cm trunk dbh, was highly effective. Counts of mature female scale insects 103 days post-treatment showed almost complete mortality of the scale insect population and the trees remained almost entirely free of lobate lac scales for at least 523 days post-treatment. The following treatments were tested as topical applications to wax-myrtle, *Myrica cerifera* L. (Myricaceae): bifenthrin at 0.24 ml/l mixed with Hasten® sticker spreader at 1 ml/l; imidacloprid at 0.3 ml/l; ultrafine horticultural oil at 9.9 ml/l; acephate at 0.9 ml/l; malathion at 1.3 ml/l; malathion at 1.3 ml/l mixed with ultrafine horticultural oil at 9.8 ml/l; Organicide® at 16 ml/l; and Hasten® sticker spreader alone at 1 ml/l. Counts of first instars and mature female scale insects 4 weeks post-treatment showed that the most effective treatment was bifenthrin (Onyx®) plus Hasten®, which resulted in almost 100% mortality of each of these stages. In a separate test, bifenthrin (Onyx®) killed 100% of 1st instars and mature female lobate lac scales when applied with or without Hasten® spreader sticker to infested *Inga edulis* (Fabaceae).

3:45 Effects of a Parasitic Wasp (*Coccobius fulvus*) on Cycad *Aulacaspis* Scale (*Aulacaspis yasumatusi*) at Montgomery Botanical Center, Florida. C. Wiese, Montgomery Botanical Center, Miami, Fla., D.M. Amalin, R. Coe, USDA, Miami, Fla., C. Mannion, Tropical Research and Education Center, UF

Aulacaspis yasumatusi (cycad aulacaspis scale) has been a continual pest of cycads since its introduction into Florida in 1995. *A. yasumatusi* attacks many species of cycads including popular ornamentals like *Cycas rumphii* and *Cycas revoluta*. *A. yasumatusi* is now a threat to both the cycad nursery industry and native cycad populations. Previous research indicates that some available pesticides can help manage this pest. However, they are often not as effective at controlling *A. yasumatusi* on particularly large or dense plants, where it is difficult to reach the scale with foliarly applied pesticides. Therefore, a study was conducted to evaluate the effect of a parasitic wasp, *Coccobius fulvus*, on *A. yasumatusi* at Montgomery Botanical Center, Miami, Florida. We observed that the number of parasitoids increased as the number of scale increased despite regular releases of the wasp. Results indicated that use of *C. fulvus* as a biological control agent does not provide adequate control of *A. yasumatusi* alone. However, the amount of control achieved may be considered adequate when combined with appropriate chemical controls as part of a broader integrated pest management program.

4:00 New Observations on Some Established Insect Pests of Woody Ornamentals in Naples, Florida. Doug Caldwell, Collier County Extension Service, UF.

Observations over the last 4 years will be presented that help fill in gaps on the behavior and biology of the black olive caterpillar, *Characoma nilotica* (Lepidoptera: Noctuidae) and the geiger tree beetle, *Physonota calochroma floridensis* (Coleoptera: Chrysomelidae). Updates on the new product, Safari™ (dinotefuran from Valent) for cycad aulacaspis scale, *Aulacaspis yasumatsui* (Homoptera: Diaspididae) will be included.

4:15 **Iguana Be Gonna.** Kim E. Gabel, Monroe County Extension, UF.

Iguanas are no longer just household pets, but are becoming South Florida landscape pests by eating landscape plants, burrowing holes next to sea walls, defecating on docks and in swimming pools to name a few. A survey will be conducted of Florida Extension Agents, UF wildlife researchers, State of Florida Fish and Wildlife officials and South Florida Botanical Gardens focused on information about: 1) Counties that have wild iguana populations, 2) what plants iguana species eat, 3) what plants iguanas don't eat and 4) what control measures are successful to control the iguanas.

4:30 **Computer Generated Signs for Demonstration Gardens.** D.B. Shibles and A. E. Yasalonis, Polk County Extension Service, UF.

A common problem associated with small demonstration gardens, as well as large botanical gardens, is the lack of clear plant labels. Even if the plants are labeled with a name, there often is little to no specific information about the plant, such as it's origin, it's mature size, it's light requirements, pH preference, etc. An inexpensive and attractive plant labeling system was implemented by the Polk County Master Gardeners in the Florida Yards and Neighborhoods Demonstration Gardens at the Polk County Extension Office. Sixteen inch ladder posts and plastic coated display cards were purchased from Parker Davis Products. Laser labels, 5 x 6.5 inches, were purchased from Gardenware. The desired plant information was printed on the laser labels with a standard computer and laser printer, and stuck onto display cards. The ladder posts, with the display cards, were then inserted into the ground by the plants. The laser labels were large enough to accommodate several lines of information which could easily be read by a visitor standing a short distance away. The ladder posts, display cards and labels have proven to be durable and even washable. If one is lost or stolen, it can quickly and inexpensively be reproduced and placed back in the garden.

4:45 **Growing and Marketing Cilantro and Italian Parsley 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, FL.

Stephen=s Produce began growing and marketing cilantro and Italian parsley 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 2004-2005, 0.35 acres were under cultivation and clientele were being served at two weekend green markets. Cilantro and parsley were two of the 30 crops grown and have 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 2003-2004 season, 32 plantings of cilantro and 10 plantings of parsley were made for the 32 week sales season which began 18 Oct and concluded 22 May. These crops were cut, bunched, banded, and lightly spray washed the day before sales. They were generally sold for \$1.00 per bunch for the first three years; prices were increased to \$1.50 for the 2004-05 season. An average of 43 bunches of cilantro and 33 bunches of parsley were sold each week in 2003-2004.

5:00 **End of Afternoon Session**

TUESDAY MORNING SESSIONS

10:00-11:30 Concurrent Sessions - D

10:00 **The Landscape Aftermath Following Hurricane Charley in Charlotte County.** R. E. Mitchell, Charlotte County Extension Service, UF.

A major 2004 hurricane season left much of Florida damaged, not only structurally, but also with devastated landscapes. One particularly violent hurricane, Hurricane Charley, slammed into Southwest Florida on August 13, 2004 with a direct hit on Charlotte County. The 145 mile per hour winds tested trees, shrubs and all other plants with an irresistible force that left the landscape literally destroyed. Accordingly, beyond the obvious initial destruction, remaining landscape subject "survivors" have shown storm-related affects that have taken months to be revealed. Observations across the Charlotte County landscape continue to portray latent decline, long term environmental changes and recovery in 2005.

10:15 **The Effect of Hurricane Force Wind on Hat-Racking of *Mangifera indica*, *Bursera simaruba* and *Cocoloba uvifera*.** Stephen H. Brown, Lee County Extension, UF.

Hat-racking or topping of a tree has become illegal in some municipalities in Florida. The practice is thought to initiate decay, attract wood boring insects and causes excessive sprouting of weakly attached new branches. The latter is considered a public hazard in the event of storms or hurricane force winds. Data collected from three species of hat-racked trees, *Mangifera indica*, *Bursera simaruba*, and *Cocoloba uvifera*, shortly after Hurricane Charlie indicates that hat-racked trees are less susceptible to wind damage than previously thought. The affected area experienced hurricane force wind of 140 m.p.h. In the most severely affected species, *M. indica*, the ratio of broken to attached sprouts was 1:6. In the least affected species, *C. uvifera*, the ratio of broken to attached sprouts was 1:24.

10:30 **Communicating Hurricane Impacts of Landscape Plants to Florida's Citizens.** Dan Culbert, Okeechobee County Extension, UF; Adrian Hunsberger, Miami-Dade County Extension, UF; and Pamela Crawford, Color Garden, Inc.

Four major hurricanes and a tropical storm ravaged Florida yards in 2004. The public requested immediate information on which species fared well, which suffered the most, and how to mitigate windstorm damage. A comparison of the different kinds of communication channels that were used to quickly relay information to property owners are described in this paper. Comments on how effective these methods were viewed by property owners and managers are reported. A discussion is also offered on how to develop a more rigorous landscape failure analysis using the hurricane impact

information collected by Florida landscape professionals.

10:45 **"Florida Style Gardening"- an Educational Series for New Residents.** P.W. Brown, Pinellas County Extension, UF.

A large percentage (81%) of the residents in Pinellas County have moved into Florida from other states. They bring with them preconceived ideas about gardening that may not be applicable to the growing conditions in their new location. This can lead to frustration about gardening in Florida. "Florida Style Gardening is an 18 hour educational program targeting these new residents with information about the soils, growing conditions, growing seasons and environmental landscape considerations specific to the Tampa Bay area. This series has been offered twice, 2004 and 2005. A survey of participants reveals changes in attitudes about gardening and changes in behavior regarding water usage, fertilization, pesticide usage, and the use of mulch.

11:00 **A Certificate Course in Horticulture, a Successful Approach to Promote Professionalism Among the Green Industry in South Florida.** H. Mayer, A. G. Hunsberger and M. Beckford, Miami-Dade County Extension, UF.

As a result of the Miami-Dade County Extension effort and with the participation of UF faculty and other speakers, the Miami-Dade Extension Service created a "Certificate" course in horticulture for landscape maintenance and installation personnel, tree trimming services, county, city, park department employees, landscape architects, garden centers employees, home gardeners, and others. The goal of the program is to educate the participants in basic horticultural practices like: plant propagation, landscape design, plant selection and installation, pruning, irrigation, fertilization, turf selection, weed, pest, disease control, palm selection, and others. Due to space limitation, the class was limited to 60 participants with a waiting list of 20 people. The response surpassed all expectations. The Florida Nursery Growers and Landscape Association (FNGLA) showed interest in applying this course toward the FNGLA Certified Horticulture Professional (FCHP). The cost of the program is \$125 which includes Your Florida Landscape: A complete guide to planting and maintenance, Florida Lawn Handbook, A guide to environmentally Friendly Landscaping (FYN), Troubleshooting Lawn Pests (flash card), Helpful, Harmful, or Harmless (flash card) and Insect Identification Sheets (Ornamental and Turf Pests). The goal is to repeat this experience in the near future and to offer the program in English and Spanish. Also in order to reach more participants we are trying to create a video or DVD with the whole presentations.

11:15 **Growing and Marketing Green Onions 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, FL.

Stephen=s Produce began growing and marketing green onions in 2000 from a 0.14 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 2004-2005, 0.35 acres were under cultivation and clientele were being served at two weekend green markets. Green onions was one 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 2003-

2004 season, 32 plantings of green onions were made for the 32 week sales season which began 18 Oct and concluded 22 May. Onions were pulled, bunched, and banded the day before sales. Soil was spray washed out of their roots. They were generally sold for \$1.00 per bunch for the first three years; prices were increased to \$1.50 for the 2004-05 season. An average of 57 bunches were sold each week in 2003-2004.

11:30 **Discussion / End of Meeting**

Vegetable Section Abstracts

Chad Hutchinson, Presiding

MONDAY MORNING SESSIONS

10:00-12:00 Concurrent Sessions - A

10:00 **Poblano Pepper Cultivar Evaluation for North Florida in the Spring of 2004.** R.C. Hochmuth and W.L. Laughlin, North Florida REC-Suwannee Valley, UF; E.H. Simonne, Horticultural Sciences Department, UF.

Florida is a leader in the production of bell pepper with 15,000-20,000 acres grown annually. Smaller acreage of specialty pepper is also grown in Florida. Increased interest in specialty crops, including several types of specialty peppers, provides new opportunities for Florida growers. Specialty peppers include: jalapeno, cubanelle, long hot cayenne, finger hots, habanero, and southwestern chile types, to mention a few. One other specialty type is the poblano pepper, used for "stuffing pepper" recipes. These peppers are called poblano when used as a fresh product or anchos when dried. A poblano pepper cultivar evaluation was conducted in Live Oak, Florida during the spring of 2004 to determine their adaptability to production in North Florida. Top early yield was found with 'Ancho Villa' and 'Ventura'. The highest seasonal yield was found in 'Ancho Villa' at 30,242 lbs/A followed by 'Ventura' at 23,838 lbs/A. The lowest seasonal yield was found with 'Ancho 211' and 'Tiburón' with 17,544 and 18,132 lbs/A, respectively. Fruit dimension measurements taken from each plot showed the fruit width to be greatest in 'Ancho Villa' and 'Tiburón' at 2.4 and 2.3 inches, respectively. Fruit length also varied among entries with 'Ancho Villa' (4.0 inches) significantly longer than the other cultivars. Fruit color ratings showed 'Ancho Villa' was significantly lighter green in color than each of the other entries.

10:15 **Growth and Yield of Hurricane-Damaged Tomato Plants.** K. Cushman and K. Armbruster, Southwest Florida REC, UF.

Florida 91 tomato seedlings grown on a commercial farm in south Florida were damaged by hurricane Frances 15 days after transplant (DAT). Plants were observed 34 DAT and placed in one of three categories according to size and apparent injury (best, good, and fair) to assess the ability of these plants to recover. Ten plants of each category were removed with roots intact and dry weights

recorded. Ten plants of each category were harvested 78 and 92 DAT. At the end of the season, five plants of each category were harvested and dry weights recorded. Injury caused by hurricane winds was most evident on sections of stem just below the soil surface 34 DAT. At this time, plants rated best had the greatest plant mass and the greatest root mass and stem diameter below the injury. In addition, plants rated good had greater plant mass and root mass and stem diameter below the injury than plants rated fair. Plants rated best produced the highest yield of extra large and total marketable fruit at first harvest, a time when prices were high. At the end of the season, however, plant and root dry weights were similar among plants rated best, good, and fair. Investigations of soil-borne diseases were inconclusive. These results indicate that tomato plants can sustain a surprising amount of wind injury and still produce acceptable yields, though early yields of extra large fruit may be reduced depending on the severity of injury.

10:30 **The Effects of the 2004 Hurricane Season on Greenhouse Vegetable Production in Florida.** Jeanmarie M. Mitchell* and Daniel J. Cantliffe, Horticultural Sciences Department, UF.

The 2004 hurricane season proved to be one of Florida's worst. The four hurricanes caused total agricultural losses at over \$2 billion. In response, the federal government appropriated \$13 billion of emergency assistance of which Florida received a half billion dollars. Many of Florida's producers were eligible for up to \$80,000 in aid. Among those who tried, but failed to qualify for this aid, were greenhouse vegetable producers. Although they are small in number, the greenhouse vegetable industry is growing throughout the state, and growers suffered millions of dollars in damages as a result of the hurricanes. A survey was conducted throughout March, 2005 to assess hurricane damages and collect general information on the status of the greenhouse vegetable industry in Florida. Twenty growers were interviewed. Results showed that 80% of the greenhouse vegetable producers suffered some type of damage as a result of the hurricanes. Of these, 50% had crop damage, and 75% suffered structural damages. Estimated totals for damages incurred are predicted to be over \$4 million. Other information collected included production area, greenhouse type, size, crops grown, production practices used, marketing and more. It is hoped that this research will illustrate the status of the greenhouse industry in Florida following the impact of the recent hurricanes and the extent at which greenhouse production is moving throughout the state.

10:45 **Accumulated Growing Degree Days as a Tool to Determine Key Developmental Stages in *Solanum tuberosum*.** Christine M. Worthington* and Chad M. Hutchinson, Horticultural Sciences Department, UF.

Potato planting in Northeast Florida's Tri-County Agricultural Area (St. John, Putnam, and Flagler counties, TCAA) typically runs early January through mid-March. Six planting dates (PD) (13, January 2004 and every two weeks, thereafter, to 25, March 2004) and two potato varieties ('Atlantic' and 'Harley Blackwell', *Solanum tuberosum* L.) were evaluated to determine key growth and development stages (emergence, full flower, and senescence), yield and quality based on accumulated growing degree days (GDD – 45° F base). 'Atlantic' is preferred for its chipping quality and high yield, but is susceptible to internal heat necrosis (IHN). 'Harley Blackwell' is noted for its resistance to IHN and comparable chipping quality to 'Atlantic'. For both varieties and all planting dates, 'emergence' and 'full flower' occurred approximately at 200 and 800 accumulated GDD, respectively. Accumulated GDD at harvest for PD's 1-6 were 1493, 1676, 1951, 2374, 2490 and 2840, respectively. Marketable yields for 'Atlantic' and 'Harley Blackwell' were highest for plants in PD 4 and both were significantly

different than PD 5 and 6. As GDD at harvest exceeded 2374, marketable yields for 'Atlantic' and 'Harley Blackwell' decreased 23 and 29% and rots increased 40 and 87%, respectively. Although rots increased as GDD surpassed 2374, IHN decreased by 53 % for 'Atlantic' and was not evident in 'Harley Blackwell'.

11:00 Distribution of Seed Mineral Nutrients and their Correlation in *Phaseolus vulgaris*.

Gokhan Hacisalihoglu, Biology Department, Florida A&M University; Leon V. Kochian, U.S. Plant, Soil, and Nutrition Department, USDA-ARS; Eduardo Vallejos, Horticultural Sciences Department, UF.

Common bean (*Phaseolus vulgaris* L.) is the world's most important food legume, especially in Latin America and Africa. In those regions, beans offer a low cost alternative to beef and milk because beans are a good source of protein, iron, dietary fiber and complex carbohydrates. Mineral nutrients are essential in growth and reproduction of all plants and deficiency of nutrients are limiting bean yield. Limited information is known about macro- and micro-nutrient concentration of seeds and their interactions. In an attempt to advance the understanding of nutrient efficiency in common bean, 79 bean lines were surveyed for seed mass, mineral nutrient concentration, and Zn efficiency. Analysis of data revealed extensive genetic variation. All eleven macro- and micronutrients tested were found in all bean lines. Zn concentration varied among lines and ranged from a low of 32.5 g/g in RIL148 to 67.1 g/g in RIL135, RIL5, RIL6, RIL15, RIL47, RIL137 and RIL150 had consistently the highest mineral concentrations among all lines. Significant correlation was found between seed Zn concentration and the concentrations of Fe, Cu, Mg, Mn and P; but not concentrations of Se, B, Ca, and S. These correlations are discussed together with Zn accumulation and Zn efficiency trait in bean. The results of this research will assist the bean breeding programs to increase the bio-availability of key nutrients.

11:15 Nitrogen Fertilization Scheduling of Hydroponically Grown 'Galia' Muskmelon. Juan C. Rodriguez, Nicole L. Shaw, Daniel J. Cantliffe, and Zvi Karchi, Horticultural Sciences Department, UF.

'Galia' muskmelons were originally developed for open-field cultivation in the desert regions of Israel. Nitrogen fertilization recommendations for 'Galia' production include altering N levels through four stages of plant growth: seeding to flowering, flowering to fruit set, fruit development, and fruit ripening through final harvest. It is unknown if N recommendations for field production would be appropriate for 'Galia' muskmelon grown hydroponically in soilless media. 'Galia' muskmelon was grown in a passively-ventilated greenhouse during three seasons in Gainesville, Florida using polyethylene-bag perlite culture. Nitrogen levels were applied with every irrigation at 80, 120, 160, 200, and 240 mg.L⁻¹. An alternating concentration that followed the four growth stages was also included (120-160-200-120 mg.L⁻¹). In all three seasons, there were no differences in average fruit weights or soluble solids content among the N treatments. In spring 2001, the plants receiving N in relation to their growth stage produced the greatest number of fruit per plant and per square meter at 6.4 and 15.5, respectively. In fall 2001, plants receiving 80 and 120 mg.L⁻¹ N produced significantly lower fruit numbers than all other N treatments. There was no difference among plants receiving 160, 200, and 240 mg.L⁻¹, or the growth stage for fruit number per plant, average 4.8. Petiole-sap NO₃-N concentrations during spring and fall 2001 suggested that optimal yields can be achieved if at least 3000 mg.L⁻¹ NO₃-N is maintained through fruit maturation. When petiole-sap concentrations were less than 2500 mg.L⁻¹, as in the case of plants receiving 80 or 120 mg.L⁻¹ N, significantly lower yields

were obtained.

11:30 Evaluation of Strawberry Cultivars Grown Under a High Tunnel in West Central Florida. Craig K. Chandler and James C. Sumler, Jr. Gulf Coast REC, UF; Silvia I. Rondon, Horticultural Sciences Department, UF.

Commercial strawberry production in Florida is almost all open field production; however, production under high clear-plastic tunnels has several potential advantages, including protection from rain and freeze damage. On 20 Oct. 2004, four cultivars currently important in west central Florida, 'Festival', 'Treasure', 'Camino Real', and 'Carmine', were planted in a 20 ft wide x 100 ft long x 12 ft high (at the apex) tunnel at Dover, Fla. Cultivars were randomly assigned to one 2-row bed in each of four blocks. Ripe fruit were harvested twice weekly from December through mid March. Data were collected on yield, fruit number, and incidence of fruit rots and arthropod pests. Cultivars differed significantly in yielding pattern, average fruit weight, and average number of arthropods per leaflet.

11:45 Effect of Glyphosate on Phylloid Strawberry Fruit. N.A. Peres, J.R. Duval, and T.E. Seijo, Gulf Coast REC, UF.

During the 2003-04 strawberry season, an increased number of phylloid strawberry fruit were observed. In affected fruit, achenes became masses of vegetative tissue and fruit were typically elongated and had enlarged sepals. Symptoms of phylloid strawberries usually have been associated with phytoplasmal diseases. A quick diagnostic test by PCR was developed for detection of phytoplasma, but all petioles and fruit tested negative. Glyphosate herbicide has also been reported to cause flower abnormalities and phylloid strawberries. The effect of three concentrations of glyphosate applied one day before or 4 weeks after transplant was tested on two cultivars, 'Strawberry Festival' and 'Camarosa'. At the highest rate (10% of the label rate) applied after transplant, severe phytotoxicity symptoms developed and no fruit was produced. At 1% of the label rate applied after transplant, plants developed moderate phytotoxicity symptoms including stunting and chlorosis. At this concentration, approximately 25% of 'Strawberry Festival' and 30% of 'Camarosa' fruit produced were phylloid. No other treatment had a significant percentage of phylloid fruit compared to the controls. Residues of the post-emergent herbicide glyphosate, usually applied to the row middles for control of weeds in strawberry production, can adversely influence flower differentiation and induce phylloid strawberry fruit..

LUNCH BREAK

MONDAY AFTERNOON SESSIONS

Concurrent Sessions

1:30- 3:00 Concurrent Sessions - B

1:30 A Spatial/Temporal Predictive Model for Survivability of Pea Leafminer (*L.*

***huidobrensis*) in South Florida.** K. Milla, Laboratory for Remote Sensing and Spatial Analysis, Agricultural Sciences Division, FAMU; and S. Reitz, USDA-ARS-CMAVE, FAMU Center for Biological Control.

The pea leafminer (*Liriomyza huidobrensis*) is a highly polyphagous pest capable of inflicting severe damage to many vegetable and horticultural crops. Affected crops include field- and glasshouse-grown vegetables and flowers. Although *L. huidobrensis* is indigenous to cooler, mostly highland areas of Latin America, over the last fifteen years it has been transported globally in infested plant material and has caused hundreds of millions of dollars in losses and control measures. To date, the pea leafminer has not become established in Florida, but it is a quarantine concern for the state in order to safeguard Florida's multibillion dollar vegetable and horticulture industries. Therefore, shipments of produce from countries where the pea leafminer is established are sometimes rejected because of infestations. Although the pea leafminer does not develop well in warm climates (>28°C), there is some debate over whether this species could establish in south Florida and become a threat to crops grown there. In this study, temperature surface maps were developed for the coldest months (December through February) for the cool seasons from 1996 through 2001 to determine the potential survivability of pea leafminer in south Florida based on temperature tolerances of this species. These contour maps delineate areas in which the temperature, for a particular month and year, fell below or exceeded the pea leaf miner's maximum temperature range of 28°C. Preliminary analysis indicates that conditions in some areas of south Florida could be potentially favorable for pea leafminer survival.

1:45 **Evaluation of Various Management Strategies for Controlling Melong Thrips, *Thrips palmi* Karny (Thysanoptera: Thripidae).** D.R. Seal, Tropical REC, UF.

One of the major insect pests of vegetable crops in the South Florida is the melon thrips, *Thrips palmi* Karny. Spinosad is commonly used to control this pest. To avoid development of resistance, various insecticide treatments were used to develop a sound management program against melon thrips. Spinosad at 7 oz/acre provided satisfactory control of melon thrips on bean squash and eggplant. Use of spinosad at lower rate in combination with some nonionic spreader and sticker provided similar level of control as spinosad at 7 oz/acre.

2:00 **Integrated Management of *Thrips tabaci* in Onion (*Allium cepa* L.).** Ludger Jean-Simon and Jean Robert Victor, College of Agriculture of Université Notre Dame d'Haiti.

A field experiment was conducted at Mersan, South Haiti during the period of November 2003 to April 2004 in order to evaluate the effect of organic mulching and sequential applications of the insecticides Azadirachtin, Lambda-Cyhalothrin and Profenofos on Thrips infestation and the yield of onion. A randomized complete block factorial design was utilized. The first factor consisted two variants : non-mulched and mulched onion while the second factor consisted of the variables control (without insecticide), Azadirachtin, Profenofos, Lambda-Cyhalothrin, Azadirachtin alternated with Profenofos, Azadirachtin alternated with Lambda-Cyhalothrin, Profenofos alternated with Lambda-Cyhalothrin, Azadirachtin alternated with Profenofos and Lambda-Cyhalothrin. Three applications of insecticides were realized. The experimental unit consisted of 5 double rows 3 m long with a spacing of 70 cm between furrows, thus an area of 10.5 m² per experimental unit. Within row plant spacing was 10 cm. The onion cultivar Granex Yellow was utilized. Thrips infestation was lowest when the onion crop received 3 consecutive applications of Lambda-Cyhalothrin. Onion yield was not significantly influenced

by pesticide application sequences, but mulching increased both the total yield and the commercial yield of onion. The total yield was respectively 16.98 and 20.56 t/ha for non-mulched and mulched onion, while the commercial yield was 12.79 and 17.06 t/ha respectively. The results of this experiment suggest that organic mulching can improve onion yield under the agroecological settings of the area of Mersan. Also, the insecticide Lambda-Cyhalothrin can be recommended for the control of the insect pest *Thrips tabaci* in onion.

2:15 Using Banker Plants to Control Insects in Greenhouse Vegetables. L.S. Osborne, Mid-Florida REC, UF; Z. Landa, South Bohemian University, Ceske Budejovice, Czech Republic; R.V. Tyson, Seminole County Extension, UF; and D.J. Taylor, Seminole County Sheriffs Department, Sanford.

Biological control practices are being introduced into Florida greenhouses to control silverleaf whitefly (*Bemisia argentifolii*), melon aphid (*Aphis gossypii*), and two spotted spider mite (*Tetranychus urticae*). The practices use banker plants (plants that aren't grown as a crop) housing pests that will not feed on the crop. These pests are organisms that natural enemies of the pests that attack the crop will feed on and reproduce. Papaya banker plants containing papaya whitefly (*Trialeurodes variabilis* [Quantance]) and the beneficial wasp *Encarsia transvena* were introduced into the hydroponic vegetable greenhouse at Polk Correctional Facility in Sanford, FL for silverleaf whitefly control with good results. An overview of the systems with specific examples will be presented.

2:30 Season-Long Aphid Control in Strawberries with Admire 2F® Imidacloprid Applied Once via Trickle Irrigation. J.F. Price, Gulf Coast REC, UF; S.I. Rondon, Horticultural Sciences Department, UF; and C.A. Nagle, Gulf Coast REC, UF.

The melon aphid (*aphis gossypii* Glover) and strawberry root aphid (*Aphis forbesi* Weed) are common in Florida strawberry production and occasionally require remedial action. Predators such as lacewing and syrphid larvae and lady beetles, and hymenopterous parasitoids normally control aphids there, but sometimes foliar insecticidal sprays are required to produce maximum, high-quality yields. Growers depending on releases of *Phytoseiulus persimilis* Athias-Henriot predatory mites to control twospotted spider mites (*Tetranychus urticae* Koch) are reluctant to apply foliar aphicidal sprays since most kill the predator. Single, early-season, trickle irrigation application of systemic imidacloprid insecticide to strawberry roots has been approved by the EPA to control aphids and other insects, however the performance has not been reported in Florida. If such an application could control aphids for most of the season then the benefits of both the predator mite and aphid control could be realized. Experiments in 2003-2004 and again in 2004-2005 were performed on replicated, 1-acre plots to compare aphid and whitefly control on strawberry crops when no aphicide was used and when Admire 2F® imidacloprid was applied via trickle irrigation at 24 ounces per acre soon after transplant establishment. In both experiments, there was season-long control of aphids. Low densities of *Bemisia argentifolii* (Bellows and Perring) silverleaf whiteflies occurred both seasons and conclusions regarding their control were not reached. Imidacloprid applied to strawberry roots soon after establishment is an effective means to control aphids and to avoid disruptive foliar insecticidal sprays.

2:45 Population Dynamics of *Belonolaimus longicaudatus* in Three Commercial Strawberry, *Fragaria X Ananassa*, Fields in Dover, FL. J.E. Hamill and D.W. Dickson,

Department of Entomology and Nematology, UF.

The sting nematode, *Belonolaimus longicaudatus*, is a highly virulent pathogen of strawberry grown during the winter months in Dover, FL. Sting nematode disease on strawberry is unusual in that all strawberry beds are fumigated with methyl bromide before planting. Studies were initiated to determine the population dynamics of this pathogen during the strawberry growing season. A bucket auger (13-cm-deep, 10-cm- diameter) was used to take soil cores monthly at six depths; 0 to 13, 13 to 26, 26 to 39, 39 to 53, 53 to 66, and 66 to 79 cm. Nematodes were extracted from each 100-cm³-soil sample using a centrifugal-flotation method. Soil temperature was recorded over the season and volumetric soil moisture was taken from each sample. Nematode numbers from samples taken during summer months (June to September) were not different ($P < 0.05$). However, nematode numbers from the 0 to 13 cm and 13 to 26 cm depths increased rapidly after strawberry planting in October and peaked in the 0 to 13 cm depth at 500 to 700 nematodes/100 cm³ of soil during January. Nematode numbers in the past years decreased rapidly after January and eventually stabilized at all depths sampled by June. The decrease of the nematode population densities after January appears to be related to food source (quality) and not temperature or moisture.

3:00 **Sectional Business Meeting**3:15 **BREAK**3:30-5:00 **Concurrent Sessions - C**3:30 **Effects of Application Strategies of Fumigant and Nonfumigant Nematicides on Cantaloupe Grown in Deep Sand**

Soils in Florida. J.E. Hamill and D.W. Dickson, Department of Entomology and Nematology, UF.

A 2-year study was conducted in a root-knot nematode infested site in which oxamyl was compared to fumigation with methyl bromide, 1,3-D, and 1,3-D plus chloropicrin (pic). In 2002, 1,3-D treatments produced higher fruit yields ($P < 0.05$). All treatment tactics of oxamyl, at planting, scheduled treatments, and rescue (determined by crop symptoms) were not different from untreated controls. Root-gall ratings in 2002 were lowest for 1,3-D at 112 liters/ha, followed by 1,3-D at 84 liters/ha with and without oxamyl. All oxamyl treatments had gall ratings not different from untreated plots ($P < 0.05$). In 2004 methyl bromide treatments and 1,3-D plus pic had the highest total marketable yields ($P < 0.05$). Treatments relying solely on oxamyl had yields equivalent to the untreated controls and gall ratings were not different from the untreated controls ($P < 0.05$). Mean root-gall ratings were lowest for methyl bromide plus pic and 1,3-D plus pic treatments ($P < 0.05$).

3:45 **Evaluation of Chloropicrin Soil Fumigation Programs for Potato (*Solanum tuberosum* L.) Production.** Chad M. Hutchinson, Horticultural Sciences Department, UF.

Soil fumigation products were evaluated for potato production (*Solanum tuberosum* L. var. 'Vivaldi') at the Plant Science Research and Education Unit in Hastings, FL. Treatments were arranged in an 8 x 2 x 2 factorial design. Fumigation factor treatments were no fumigation, Telone II (56 L/ha, conventional

treatment), chloropicrin (45 kg a.i./ha); chloropicrin (67 kg a.i./ha); chloropicrin (90 kg a.i./ha); Pic-Plus (45 kg a.i./ha); Pic-Plus (67 kg a.i./ha); and Pic-Plus (90 kg a.i./ha). Application method factor treatments were single shank (conventional treatment) and double sweep. Bed preparation factor treatments were non-pressed (conventional treatment) and pressed. Fumigants were applied 6-7 January, 2004. Potatoes were planted on 10 February and harvested 26-27 May, 2004. All Pic-Plus rates produced significantly more total and marketable production compared to the Telone II treatment (current standard, 40.5 MT/ha total yield). Chloropicrin treatments did not produce significantly more total or marketable yield than the Telone II treatment. There was no significant difference in total or marketable yield between the Telone II and no fumigant treatment or between the chloropicrin and Pic-Plus treatments at equal rates. Application method had no significant effect on tuber yield or size distribution of tubers. However, pressing the bed significantly improved both total and marketable tuber yield, improved tuber size, and reduced the percent culls. None of the factor interactions was significant. Percent of tuber surface covered with scab/scurf in no fumigant, Telone II, and Pic-Plus (67 kg a.i./ha) treatments was 36, 27%, and 1.7% respectively. Pic-Plus treatments improved overall appearance of the tubers at lower rates than chloropicrin treatments.

4:00 Effects of Horticultural Mineral Oil on Growth, Yield and Incidence of Pests and Diseases on Tomato and Pepper in South Florida. Phil Stansly and Jim Conner.

Horticultural mineral oil (HMO) is an inexpensive, environmentally safe, pest management alternative, acceptable, in the case of the product tested here, for organic production. However, there has been insufficient information on efficacy and direct impact to vegetables, including tomatoes and peppers under commercial conditions in south Florida. We conducted a series of field trials in Immokalee on pepper and tomato during two fall seasons and one spring. PureSpray Green®, a highly purified HMO with mean boiling point of 435 °F was tank mixed with fungicides, insecticides or sprayed alone at rates of from 0.5% to 2% at weekly intervals throughout the crop cycle. Pest populations were significantly reduced in response to these sprays included silverleaf whitefly, *Bemisia argentifolii*, Broadmite, *Polyphagotarsonemus latus*, green peach aphid, *Myzus persicae*, and surprisingly, southern armyworm, *Spodoptera eridania*, and pepper weevil, *Anthonomus eugenii*. It is not certain these effects were due to mortality, repellency or a combination of both. Some phytotoxicity and increased bacterial spot was observed with higher rates on fall tomatoes early during hot weather. Nevertheless, HMO appears to be a useful and as yet under exploited pest management tool for vegetable growers.

4:15 Evaluation of 25 Cultivars of Race 3 Bacterial Leaf Spot Resistant Bell Peppers. Darrin Parmenter, Palm Beach County Cooperative Extension, UF; Russell Nagata and Ken Pernezny, Everglades REC, UF; Eugene McAvoy, Hendry County Cooperative Extension, UF; and Kent Cushman, Southwest Florida REC, UF.

During the 2004 – 2005 growing season, two bell pepper (*Capsicum annuum* L.) cultivar evaluation trials were conducted in South Florida (Immokalee, Collier County, and Delray Beach, Palm Beach County) in an effort to determine those with desirable horticultural characteristics for the fresh market. In addition, resistance to race 3 of bacterial leaf spot (BLS) of peppers caused by *Xanthomonas campestris* pv. *vesicatoria* was also evaluated. Twenty-five bell pepper varieties were transplanted into commercial fields on two separate dates: October 4 (Immokalee) and November 23 (Delray Beach) in a completely randomized block design with 3 replications. All cultural and management procedures

were based on commercial best management practices. At Immokalee, after three harvests, Pepper Research PR99R-16 had the highest yield at 1,380 bushels/A. Enza Zaden 8338 and Rogers Crusader also had yields over 1,300 bushels/A. Other horticultural characteristics we evaluated were average fruit/plant, length x width ratio, number of lobes, and fruit wall thickness. BLS did not affect yield at Immokalee, however after the final harvest BLS ratings were taken. Susceptible check Jupiter had a mean foliage disease incident rating of 26% after the final harvest and was surpassed only by 7682 and 8328 from Enza. Data from the Delray Beach trial is currently being obtained and will be included in the presentation.

4:30 Impacts of Extreme Weather and Soil Management Treatments on Disease Development of *Pythium* spp. In Field Grown Pepper. S.K. Saha*, Doctor of Plant Medicine Program, UF; R. McSorley, K.H. Wang, Entomology and Nematology Department, UF, and R.J. McGovern, Plant Pathology Department, UF.

A field experiment with bell pepper (*Capsicum annuum* L.) 'Wizard X3R' was established (May 2004) in Citra, Marion Co., FL. The objective was to compare soil-borne disease development among six soil management treatments: cowpea (*Vigna unguiculata* (L.) Walp.) summer cover crop, solarization on a raised bed, solarization on a flat surface, cowpea cover crop followed by raised bed solarization, methyl bromide fumigation, and untreated control. Pepper seedlings were planted on 31 August and were monitored for mortality on weekly intervals until maturity. Hurricane Frances (5, 6 September) released 41 cm (16 inches) of rain in 24 hours resulting in a severe epidemic of *Pythium* spp. throughout the field. After this event, mortality of pepper seedlings was greatest ($P < 0.05$) in the two treatments involving cowpea cover crops. The extra organic matter in the treatments with cowpea likely increased the mortality levels. However, after Hurricane Jeanne (26 September), the methyl bromide (16.5% mortality) treatment had nearly twice the mortality as the flat solarization (8.8 % mortality) treatment showing a continuing trend throughout the season. Regardless of treatment, plots in the south end of the field had higher mortality ($P < 0.05$) than those in the north end, consistent with the slight grade from north to south. These results illustrate that subtle field differences such as gradation or water flow can effect inoculum distribution, resulting in mortality. In addition, extreme weather events may adversely affect expectations of various treatments such as the methyl bromide and the cowpea treatments that were not effective against this epidemic.

4:45 Differential Response of Common Bean Genotypes to Mycorrhizal Colonization. Gokhan Hacisalihoglu and Liam Longo, Biology Department, FAMU.

Mycorrhizas are the most important mutualistic symbiosis between fungi and plant roots. Arbuscular mycorrhizae (AM) enhance the growth, development and health of colonized plants. After entering roots, AM fungi differentiate to form branched tree-like structures (arbuscules). One of the major benefits of AM fungi is increasing phosphorus uptake from soil. The objective of this study was to quantify differences among 35 common bean (*Phaseolus vulgaris* L.) genotypes response to AM fungi. Plants were grown for 45 days in mycorrhizal or non-mycorrhizal soil and analyzed for plant height, shoot dry weight, root dry weight, days to flowering, and leaf spectral reflectance. Results indicate that there is substantial variation among bean genotypes for growth in AM soil and low-phosphorus. AM fungi significantly increased plant growth in terms of shoot weight and chlorophyll reflectance. This work is expected to lead to identification of genotypes that more efficiently acquire nutrients including phosphorus. Characterization of these bean genotypes and recombinant inbred

lines will further improve our understanding of the genetics and physiological mechanisms of AM fungi symbiosis in plant growth and yield. The current status of this project and further detailed results will be presented.

5:00 **End of Afternoon Session**

TUESDAY MORNING SESSIONS

10:00 -11:30 **Concurrent Sessions - D**

10:00 **A Biologically-Based System of Winter Production of Fresh Market Tomatoes in South Florida.** A.A. Abdul-Baki, Y.C. Lu, B. Hima, Z.A. Handoo, Beltsville Agricultural Research Center, USDA; W. Klassen, H.H. Bryan, Q.R. Wang, Y. Li, and M. Codallo, Tropical REC, UF.

A three-year field experiment was conducted at Homestead, Florida, to evaluate a biologically-based system for the production of fresh-market tomatoes (*Lycopersicon esculentum*, Mill.) in winter. The biologically-based treatments included the nematode-resistant cover crops [cowpea (*Vigna unguiculata* cv. Iron Clay), velvetbean (*Mucuna deeringiana*), and sun hemp (*Crotalaria juncea* cv. Tropic Sun)]. In addition, a soil fumigation treatment using methyl bromide/chloropicrin (MC-33) was included. The cover crops were seeded in summer, flail mowed in October, and the residue was incorporated into the soil. Fertilizer was applied to all treatments before the drip lines and the plastic mulch were installed. Nematode-tolerant tomato cultivars Sanibel and FL 6153 and nematode-susceptible cultivar Leila were used. Harvested fruits were graded following Florida Tomato Committee Standards, and separated into extra-large and large. Comparisons of production costs and net returns show that the biologically-based production system is economically viable and environmentally safe.

10:15 **Methyl Bromide Retention and Nutsedge (*Cyperus* spp.) Control with Different Mulches.** James P. Gilreath, Myriam N. Siham, and Bielinski M. Santos, Gulf Coast REC, UF.

Fumigation efficacy depends on the duration that the fumigant stays in the soil, which is influenced by the mulch permeability. The methyl bromide (MBr) retention of high and low density polyethylene mulches, and metallized and virtually impermeable films (VIF) were tested with a rate of 175 lbs MBr/acre and compared with a full-rate control (350 lbs/acre) using low-density polyethylene mulch and a non-fumigated control. Four days after treatment, MBr concentration in the soil was 700 ppm and 600 ppm higher with VIF and metallized mulches, respectively, as compared to low-density polyethylene mulches. Four weeks after MBr application, VIF and metallized films had the lowest nutsedge densities among all treatments. These results showed that VIF and metallized films allow reducing MBr rates without reducing nutsedge control efficacy.

10:30 **Effects of Time of Emergence on Purple and Yellow Nutsedge Area of Influence in Bell Pepper.** Bielinski M. Santos, James P. Gilreath, Camille E. Esmel, and Myriam N. Siham, Gulf Coast REC, UF.

Despite glyphosate (*N*-(phosphonemethyl) glycine) not having a label for tomato (*Lycopersicon esculentum* Mill.), glyphosate-like injuries have been reported on this and other vegetable crops. It has been hypothesized that these injuries have resulted from two possible situations: a) contamination of other pesticides during the packaging process, where the same packing lines are used, and b) inadequate multipurpose sprayer rinsing procedures. The objective of this study was to determine the tolerance level in which glyphosate does not detrimentally affect tomato growth and yield. This two-year study was conducted in Bradenton and Ruskin, Florida, USA with five glyphosate concentrations and a control (0, 25, 50, 100, 150, 200 mg/L) applied one day before transplanting. Tomato yield from 25 mg/L glyphosate-treated plants were not significantly different from the control, whereas the yield from 50 mg/L glyphosate treated tomato plants was approximately 70% of the control.

10:45 Tomato Nutrient Absorption and Nutsedge (*Cyperus* spp.) Management with Propylene Oxide. Bielinski Santos and James P. Gilreath. Gulf Coast REC, UF.

Among the current methyl bromide alternatives under study, propylene oxide (Propozone™) has shown potential to control soilborne diseases, nematodes, and weeds in polyethylene-mulched tomato. However, further research is needed to determine the appropriate application rates to control nutsedge in the crop. Also, the effect of this fumigant on tomato nutrient absorption has not been determined yet. Therefore, field trials were conducted for this purpose in Bradenton, Florida, USA. Tested rates of Propozone were 0, 190, 380, 570, 760, and 950 L/ha and were shank-applied in raised planting beds three weeks before 'Florida 47' tomato transplanting. Examined data indicated that there was a rapid decrease in nutsedge density with 570 L/ha. For phosphorus (P) and potassium (K) foliar content, there was a linear increase of P concentrations as rate increase, whereas K content increased rapidly after 190 L/ha. The highest tomato yields were obtained with 760 and 950 L/ha of Propozone.

11:00 Nematode and Nutsedge resurgence in Double-Cropped Cucumber after Methyl Bromide Chemical Alternatives and Solarization in Tomato. James P. Gilreath, Timothy N. Motis, and Bielinski M. Santos, Gulf Coast REC, UF; Joseph W. Noling, Citrus REC, UF; Salvadore J. Locascio, Horticultural Sciences Department, UF; and Daniel O. Chellemi, ARS-USDA, Ft. Pierce.

Field studies were conducted during four consecutive tomato (*Lycopersicon esculentum*)-cucumber (*Cucumis sativus*) rotations to examine the long-term residual effects of tomato methyl bromide (MBr) alternatives on soilborne pests in double-cropped cucumber. Four treatments were established in tomato fields: a) non-treated control; b) MBr + chloropicrin (67:33 w/w) at a rate of 350 lb/acre; c) 1,3-dichloropropene (1,3-D) + Pic (83:17 v/v) at 40 gal/acre + pebulate at 4 lb/acre + napropamide at 2 lb/acre; and d) soil solarization for 7 to 8 weeks + napropamide at 2 lb/acre. Each of the following seasons, cucumber was planted in the same tomato plots without removing mulch films. For nutsedge (*Cyperus rotundus* and *C. esculentus*) densities, solarized + napropamide plots had equal control as MBr + Pic during all four cropping seasons. However, nematode control with solarization was inconsistent over time. Marketable yield data proved that fumigation in tomato fields with either MBr + Pic or 1,3-D + Pic + pebulate + napropamide had a long-time effect on double-cropped cucumber.

11:15 Impact of Solarization and Methyl Bromide Alternatives for Greenhouse Hot Pepper Production in Costa Rica. Bielinski M. Santos, James P. Gilreath, Gulf Coast REC, UF; Jorge A. Solórzano-Arroyo, and Jorge Mora-Bolaños Laboratorio de Fitoprotección, Instituto

de Innovación y Transferencia de Tecnología Agropecuaria, Costa Rica.

Greenhouse studies were conducted in La Ceiba, Alajuela, Costa Rica, to examine the effect of fumigants and solarization on soilborne pest control and 'Campana' hot pepper (*Capsicum frutescens*) marketable yield. Fumigant treatments were: a) methyl bromide plus chloropicrin (MBr + Pic 98:2 w/w) at a rate of 500 kg/ha; b) emulsifiable concentrate of 1,3-dichloropropene (1,3-D) plus Pic at 275 L/ha; c) emulsifiable concentrate of metham sodium (MNa) at 275 L/ha; and d) non-treated control. Plots were either solarized for 8 weeks or not solarized. Hot pepper seedlings were transplanted in mulched beds. The solarized plots showed higher weed, rootknot nematode (*Meloidogyne* spp.), soilborne fungal and bacterial control than the non-solarized treatments. Among the fumigants, MBr + Pic and 1,3-D + Pic had the best performance against rootknot nematode populations. However, there was no significant difference in marketable yield between the solarized and non-solarized treatments. The fumigant 1,3-D + Pic had marketable yield 9% higher than MBr + Pic, whereas there was no difference between MNa and MBr + Pic.

11:30 **Determining Sublethal Glyphosate Rates for Fresh Market Tomato.** Bielinski M. Santos, James P. Gilreath, Camille E. Esmel, and Myriam N. Siham. Gulf Coast REC, UF.

Despite glyphosate (*N*-(phosphonemethyl) glycine) not having a label for tomato (*Lycopersicon esculentum* Mill.), glyphosate-like injuries have been reported on this and other vegetable crops. It has been hypothesized that these injuries have resulted from two possible situations: a) contamination of other pesticides during the packaging process, where the same packing lines are used, and b) inadequate multipurpose sprayer rinsing procedures. The objective of this study was to determine the tolerance level in which glyphosate does not detrimentally affect tomato growth and yield. This two-year study was conducted in Bradenton and Ruskin, Florida, USA with five glyphosate concentrations and a control (0, 25, 50, 100, 150, 200 mg/L) applied one day before transplanting. Tomato yield from 25 mg/L glyphosate-treated plants were not significantly different from the control, whereas the yield from 50 mg/L glyphosate treated tomato plants was approximately 70% of the control.

11:45 **Responses of Vegetables to Summer Cover Crops and Soil Amendments.** Qingren Wang^{1*}, Waldemar Klassen¹, Yuncong Li¹, Merlyn Codallo¹, Teresa Olczyk² ; ¹Tropical REC, UF; ² Miami-Dade County Extension Office, UF.

In field and in pot experiments to investigate the growth and yield responses of tomato and okra, the summer cover crops, sunn hemp, velvetbean, cowpea and sorghum sudangrass were grown and incorporated into the soil, and soil amendments, such as compost, biosolids, N-viro, coal fly ash, etc. were applied. The results showed that cover crops conserved soil water and nutrients by reducing their leaching, and the two legume cover crops and some of the soil amendments stimulated plant growth and improved tomato and okra yields. Among cover crops, the sunn hemp treatment produced the highest yield of tomato fruits. Tomato yields in the velvetbean treatment were lower than anticipated possibly because of its allelopathic effects on tomato. However velvetbean improved okra yields. Compost application increased soil fertility and improved soil physical properties. Thus compost decreased soil bulk density, but increased water holding capacity, etc. A leaching study showed that

under some circumstances legume cover crops caused high concentrations of NO₃-N in leachate. Likewise heavy loading of biosolids caused high concentrations of N to leach out of the soil profile. Coal fly ash was effective in retaining soluble phosphorus in the soil, but its long term application at heavy rates poses the risk of introducing high concentrations of trace elements in ground water.

12:00 **End of Meeting**

Best Management Practices Abstracts

Eric Simonne, Presiding

MONDAY AFTERNOON

Special Session

"BMPs for Vegetables in Florida: Current Knowledge and Implementation"

Introduction to the Session

With increased emphasis on global competitiveness and the preservation of water quality, the different segments of the vegetable industry have to face the legal and technical challenges of the Clean Water Act: produce economically without polluting. Can the vegetable industry in Florida meet this challenge? How close to meeting the load goals can we get? What projects are currently underway to generate unbiased knowledge and involve growers in BMP implementation?

1:30 **Overview of Agricultural BMP Efforts in Florida.** Brian Boman, Indian River REC, UF.

In 1999, the Florida Legislature enacted the Florida Watershed Restoration Act (FWRA) 403.067 F.S. The FWRA specifically outlines the process for the Florida Department of Environmental Protection (FDEP) to develop and implement total maximum daily loads (TMDLs) for impaired waters of the state. TMDLs are defined as the maximum amount of a pollutant that a waterbody can receive and still meet the water quality standards as established by the Clean Water Act of 1972. The FWRA requires that TMDLs be developed for all pollution sources "agricultural and urban" to ensure water quality standards are achieved. Through the TMDL process, a portion of the allowable amount of each pollutant will be allocated to each of the contributing sources. The FWRA affects all Floridians thus, in order to effectively implement the TMDL program, the FDEP coordinates its efforts with a variety of entities including the Florida Department of Agriculture and Consumer Services (FDACS), Water Management Districts, local Soil and Water Conservation Districts, UF/IFAS, the environmental community, agricultural producers, as well as concerned citizens. FDACS assumes the leadership

role when dealing with agriculture's non-point source pollution challenges. To accomplish this task FDACS must coordinate with FDEP and other stakeholders to identify, develop and adopt by rule science-based best management practices (BMPs) for agricultural land uses. BMPs must be environmentally protective, based on science, be economically viable, and they must be focused on real problems and solutions that work. The priorities for BMP implementation are to correct existing water quality and quantity problems and to minimize water quality and quantity problems resulting from agricultural operations. BMPs have been established for several commodity groups and/or areas throughout Florida. This paper summarizes the BMP development, adoption, and implementation phases for agricultural commodities in Florida.

1:45 Involving Vegetable Growers in BMP Demonstrations. Bob Hochmuth, Eric Simonne, David Studstill, Justin Jones, and Cliff Starling.

The long-term sustainability of commercial vegetable production requires increased fertilizer and irrigation efficiency. Three vegetable growers recognized as leaders in fertilizer and irrigation management in North Florida were selected to demonstrate how irrigation and fertilizer management are linked together and how management may prevent water movement below the root zone of two muskmelon and one watermelon field grown with plasticulture. The approach was to create irrigation rates by using drip tapes with different flow rates, inject colored dye in the irrigation water three times during the growing season, and dig in the root zone to determine the position of the dye. Similar results were found at all three locations: water movement was greater early in the season (1 to 5 weeks after establishment) and moved below the root zone (20 to 30 inches deep). Vertical movement was greater on a loamy soil than on the two sandy soils. The uniformity of water movement decreased as depth increased. Overall these results show that some leaching is likely to occur on light-textured soils, even when recommended practices are followed. Educational efforts should focus on fertigation management during the first weeks after crop establishment. Based on these observations, cooperators are considering improving their fertigation practices by using two drip tapes, reducing preplant fertilizer, using a 100% injected N/K program, and/or adding organic matter to the soil. This project shows that vegetable growers are more likely to try and adopt sustainable practices and BMPs when they actively participate in the process than when changes are mandated through legislation.

2:00 Nutrient BMP Issues and Solutions for the Suwannee River Basin, George Hochmuth, North Florida REC, UF.

The Suwannee River in northern Florida is an Outstanding Water Body, but one that has been identified with potential water quality problems. Several of the associated springs along the river have concentrations of nitrate-N exceeding the Federal safe drinking water standard. Six years ago the Suwannee River Partnership was begun as a means of pulling together a wide array of interested parties to address the water quality issues in the watershed. Funds from many sources have been brought to bear on research and extension programs in the region and to foster initiatives to encourage agricultural producers to adopt nutrient BMPs. UF/IFAS has been leading the research and extension efforts to develop and demonstrate BMPs appropriate for the agricultural enterprises in the Suwannee River watershed. An example of such a research and extension program is the large-scale on-farm demonstration project with row crop, dairy, and poultry operations. Large instrumented farm sites are used to test and demonstrate nutrient management BMPs dealing with manure and fertilizer management. This presentation will outline some of the nutrient issues in the Suwannee River

watershed and the on-going BMP work at several sites, and the successes to date.

2:15 **Vegetable BMPs: Where are we going to?** Lynda Garvin, Florida Department of Agriculture and Consumer Services.

Abstract not available.

2:30 **The FARMS Program.** David Brown, South West Florida Water Management District.

Abstract not available.

2:45 **Does P Deserve to be Called a Macronutrient in Florida?** Tom Obreza, Soil and Water Sciences Department, UF.

Phosphorus is required by plants in quantities approximately one-tenth as great as those of nitrogen and potassium. There is roughly as much phosphorus in plants as there is magnesium and sulfur, yet P appears prominently at the top of a fertilizer label flanked by N and K. Why has P historically been afforded such lofty status? The answer lies not with the amount of nutrient taken up, but with the relative availability in the soil. Soil fertility textbooks, with their usual Midwest bias, portray soils as hostile environments for soluble P, describing several mechanisms that strongly tie up applied P fertilizer in unavailable forms. Do sandy Florida soils possess these mechanisms to the same degree? Should P in Florida soils be thought of under a different paradigm? Consistently high soil test P measured in vegetable fields and citrus groves across the peninsula indicates that Spodosols and Alfisols are able to retain added P fertilizer. Moreover, the lack of crop response to further P additions suggests that residual P is not held in highly-unavailable forms. While regular application of N and K fertilizers is justified in Florida's intensive agriculture because these nutrients are highly leachable, P fertilizer should be applied only if justified by low soil test P.

3:00 ***Annual Business Meeting – Vegetable Section***

3:15 **BREAK**

3:30 **Phosphorus BMPs in the Everglade Agricultural Area: A success story.** Samira Daroub and Orlando Diaz, Everglades REC, UF.

The Everglades Agricultural Area (EAA), located south of Lake Okeechobee, comprises 280 000 ha of productive crop land. Around 80% of the land is planted to sugarcane, and the rest to vegetables, sod and rice. Flat topography, shallow organic soils and impermeable marl/limestone bedrock limit water storage options throughout the region. These organic soils are drained by pumping water through a system of farm and basin canals. Concerns regarding the quality of agricultural drainage water from the EAA to the Everglades Protection Area have led to a regulatory program that requires farmers to adopt Best Management Practices (BMPs) to reduce phosphorus (P) loads leaving the EAA basin by 25 percent compared to pre-BMP levels. There are mainly three different categories of BMPs: nutrient control practices, water management practices and particulate matter and sediment controls with each individual BMP assigned a point value. Growers are required to adopt a suite of BMPs totaling 25

points. Research and monitoring at the farm level as well as the basin level has shown high reductions in P concentrations and loads due to BMP implementation. In water year 2004, 147 metric tons of P was reduced due to BMPs with corresponding P concentration in water decreasing from 173 ppb (pre-BMP) to 69 ppb. During the ten years since BMP program initiation in 1995, the EAA basin's annual load reduction has averaged more than 50 percent and exceeded the levels mandated by law every year.

3:45 Integration and Verification of Water Quality and Crop Yield Models for BMP Planning: Goals and Objectives of a New FDACS Project. Ken Boote Agronomy Department, UF and Jimmy Jones, Agricultural and Biological Engineering Department, UF.

A new, long-term research project has been funded by the Florida Department of Agriculture and Consumer Services (FDACS) with the goal of improving water quality assessment and BMP implementation through the use of integrated modeling approaches and decision support tools in Florida. This 4-year project consolidates existing scientific program components in IFAS pertinent to modeling and water quality assessment, with efforts by a private engineering firm (Soil and Water Engineering Technology, SWET) that is implementing various water quality tools for use by FDACS throughout Florida. The work will integrate DSSAT crop yield models into the Watershed Assessment Model (WAM) model developed by SWET to improve capabilities for assessing alternative BMPs relative to their projected effects on yield and water quality. Project scientists will test and improve models for important Florida crops for ability to predict growth, final yield, N uptake, and N leaching under different N fertilization and irrigation schedules. Other scientists will develop improved soil-water modules to better handle flatwood soil conditions and the plastic mulch bed systems typical for many vegetable crops in Florida. Another aspect will be the development and evaluation of in-season decision aids for use as a BMP for reducing N leaching. Finally, the project will develop recommendations for minimum data to be collected in BMP experiments or monitoring programs. The group will document these models and their performance for users of the integrated system. The project involves faculty from a number of departments in IFAS. Our vision is to provide continuous updates and testing of various model components in the integrated system. The goal of FDACS is that the integrated tool will be used by FDACS and consultants to assist farmers in BMP planning relative to N and P fertilization and management aspects for important commodities in Florida. The WAM model predicts watershed levels of N found in stream flow, for example, and will integrate large spatial regions of acreages cropped to particular production practices. The integrated WAM/DSSAT model system is seen by FDACS as a complement to intensive well monitoring methods to verify compliance to BMP plans.

4:00 BMPs, Nutrient Load and Vegetable Yields. Pete Stofella and Dr. Zhenli He, Indian River REC, UF.

Water quality throughout south Florida has been a major concern for many years. Nutrient enrichment in the Indian River Lagoon (IRL) has been a major surface water issue and suggested as a possible cause of ecological degradation of the aquatic system. Restoration targets of 30 and 70% of total N and P loading were proposed for the St. Lucie Estuary in the Surface Water Improvement and Management (SWIM) Plan. This goal may be accomplished by improving water quality in the surface runoff from the St. Lucie watershed using best management practices (BMPs). The objective of this project is to demonstrate effectiveness and desirability of applying best

management practices (BMPs) in horticultural cropping systems (vegetable crops) to the agricultural producers in the Indian River area. The results from this project indicate that significant surface runoff occurred mainly in the rainy season and discharge depended on rainfall and other factors (soil types, crops & landscape, *etc*). The concentrations of N and P measured in runoff water from two tested vegetable farms were higher than the maximum levels of total N and P for surface water systems. The BMP (reducing basal fertilizer application rates by 30%) reduced N and P concentrations and to a lesser degree, decreased N and P loadings in surface runoff, which were also affected by runoff discharge rate. Similar yields were obtained from the BMP and conventional plots. The BMP (reducing basal fertilizer application rate) appear to be effective in reducing N and P loadings in surface runoff while sustaining similar crop yield.

4:15 BMPs as an Opportunity for Building Relationships with South West Florida Vegetable Growers. Monica Ozores-Hampton, Eric Simonne, Eugene McAvoy, Sanjay Shukla, Pam Roberts, Fritz Roka, Phil Stansly and Tom Obreza, South West Florida REC, UF.

Approximately 10,000 ha of staked tomato are grown each year in the winter-spring season in Southwest Florida. Tomatoes are produced with transplants, raised beds, polyethylene mulch, drip or seepage irrigation, and intensive fertilization. With the development of nutrient best management practices (BMPs) for vegetable crops and increased competition among water users, N recommendations must be high enough to ensure economical yields, but not excessive as to minimize the environmental impact of tomato production. The current UF-IFAS N fertilization rate of 224 kg/ha of N (with supplemental fertilizer applications under specified conditions) may need to be adjusted based on local soil type and irrigation system. Because growers should be actively involved in the development and implementation of BMPs, the objectives of this project was to establish partnerships with SW Florida tomato growers to evaluate the effects of N application rates on yield, plant growth, petiole N sap, insects and disease incidences. Nine on-farm trials were conducted during 2004-2005 season. Treatments consisted of N fertilizer rates ranging from 224 to 448 kg/ha, with each trial including at least the UF-IFAS rate and the traditional rate. Although total yields were comparable among N rates, there were differences in size category. Nitrogen rates had little effect on tomato biomass 30 and 60 days after transplanting (DAT). Changes in petiole sap NO₃-N and K concentrations were different with seepage than with drip irrigation, but tended to be above the sufficiency threshold. This project showed the importance of considering the type of irrigation in managing tomato and determining optimum N fertilizer rate. While working every week with growers is essential in helping them understand the importance of nutrient management, the reality of winter tomato production in Florida requires at times that decisions are based on market fluctuations and not on horticultural optima. On the other hand, stronger regulations may be imposed to some water basins when water quality does not improve.

4:30 Discussion Session. Eric Simonne, Horticultural Sciences Department, UF.

5:00 Adjourn