

Abstracts of the 2014 Meeting of the Florida State Horticulture Society

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Vegetable Section

Performance of Lettuce (*Lactuca sativa*) Grown in Soilless Media in Vertical Hydroponics. Robert. C. Hochmuth, W. L. Laughlin, and D. E. Toro, Suwannee Valley Agricultural Extension Center, UF, A. Gazula, Alachua County Extension, UF (bobhoch@ufl.edu) [V-1]

Florida growers use several types of hydroponic production systems to grow a wide variety of vegetables. One popular soilless media system in Florida is a vertical system of stacking polystyrene pots (VertiGro, Summerfield, FL). This system is popular for growing leafy greens such as lettuce (*Lactuca sativa*). The soilless media used in this system has traditionally been perlite and or coconut fiber, however, higher costs of those media has led to the need to research composted pine bark as an alternative media choice. A research trial evaluating four soilless media materials or combinations was conducted at the Suwannee Valley Agricultural Extension Center near Live Oak, Florida in 2013. Tropicana cultivar of lettuce was transplanted into VertiGro pots for two consecutive crops in the spring of 2013. The media treatments were: coconut fiber, composted pine bark, perlite plus coconut fiber on top two inches, and composted pine bark plus coconut fiber on top two inches. Yield and quality of lettuce at harvest was recorded with no significant differences among any of the four soilless media evaluated in the second planting. However, during the first planting, coconut fiber produced the highest yield followed by composted pine bark plus coconut fiber. The lowest yields were found with perlite plus coconut fiber, and composted pine bark alone. These results suggest composted pine bark may be an acceptable media in a VertiGro lettuce crop.

Yield Performance of Strawberry Cultivars Under Organic Production in High Tunnel and Open Field. Xin Zhao, Zack Black, J.M. Neumann, C.A. Chase, and J. López, Horticultural Sciences, UF. (zxin@ufl.edu) [V-2]

Interest in organic strawberry production is increasing among growers in Florida. However, research information about cultivar evaluation and selection for organic systems is rather limited. In this study, eight strawberry cultivars, including ‘Albion’, ‘Camarosa’, ‘Strawberry Festival’, ‘Florida Radiance’, ‘Winterstar’, ‘Treasure’, ‘Proprietary #1’, and ‘Proprietary # 2’, were

compared for their yield performance under organic production. The cultivar comparison was carried out in the open field and high tunnel plots, respectively, on certified organic land at the Plant Science Research and Education Unit in Citra, FL. A randomized complete block design with four replications was used in both trials. Bare-root strawberry plants were transplanted on October 24, 2013. ‘Camarosa’, ‘Strawberry Festival’, and ‘Winterstar’ showed good marketable yield potential in the high tunnel trial. ‘Strawberry Festival’ had the highest marketable fruit number and weight in the open field. In contrast, ‘Treasure’ had the lowest marketable fruit yield in both high tunnel and open field plots. Compared with the other cultivars, ‘Treasure’ showed significantly higher cull fruit percentages based on fruit weight and number in the high tunnel plots. In the open field, ‘Albion’, ‘Proprietary #1’, and ‘Proprietary # 2’ also exhibited high percentages of cull fruit besides ‘Treasure’. ‘Proprietary # 2’ demonstrated the highest average marketable fruit weight in both high tunnel and open field trials.

Going Organic to Diversify and Sustain the Strawberry Industry. Carlene A. Chase, X. Zhao, Horticultural Sciences, UF, O.E. Liburd, Entomology and Nematology, UF, Z. Gao, Food and Resource Economics, UF, and M.E. Swisher. Family Youth and Community Sciences, UF. (cachase@ufl.edu) [V-3]

With increasing expansion of Mexico into annual hill production of strawberries, the Florida industry is facing a critical challenge for winter strawberry market share. Diversification into organic strawberry production may offer a price premium that could help to sustain grower profitability. Additionally, there has been a dearth of research on organic strawberry in Florida, so that growers already producing organic strawberries and consumers are comparatively underserved. We will describe our interaction with industry stakeholders to identify research priorities and present preliminary results on a comparison of the utility of *Aeschynomene americana*, *Crotalaria breviflora*, *Crotalaria juncea*, and *Indigofera hirsuta* cover crops for off-season weed and sting nematode management in organic strawberry.

Challenges and Potential Solutions for Vegetable Producers in Miami-Dade County. Qingren Wang, T. Olczyk, Miami Dade County Extension, UF, S. Zhang, D. Seal, K. Migliaccio, Y. Li, TREC, UF, M. Ozores-Hampton, SWREC, UF, and G. Liu, Horticultural Sciences, UF. (qrlwang@ufl.edu) [V-4]

The production of winter fresh market vegetables in Miami-Dade County plays a significant role in supporting the local economy, employment, and revenues. This presentation provides an overview of acreage of major vegetable crops including beans, squash, sweet corn, Cuban sweet potatoes (Boniato), okra and tomatoes. However, vegetable producers are facing a number of challenges, such as strategies for marketing, food safety, overseas competition, implementation of Best Management Practices (BMPs), Good Agricultural Practices (GAPs), pest control, and soil and water management. Of which, marketing and food safety are top considerations, especially for small growers due to limited budget, and outbreaks of food borne disease could cause them out of business for either small or large producers. Good Agricultural Practices, such as Tomato-GAPs, have been put into a practice with a traceback system of the product. Integrated Pest Management (IPM) systems including cultural, biological, mechanical practices rather than solely relying on chemicals with sufficient scouting and efficient control measures are encouraged. Best Management Practices for the soil and water management in the vegetable

production need to move forward in this agricultural area due to a very vulnerable environment, especially with a shallow aquifer and the Everglades National Park.

Effects of Crown Diameter on Strawberry Growth and Yield. Ixchel M. Hernández-Ochoa, E. A. Torres Quezada, and B. M. Santos, GREC, UF. (ixchel@ufl.edu) [V-5]

Strawberries (*Fragaria × ananassa*) are a high value crop with about \$360 million in sales during 2012-13 season. The most common method for transplanting strawberries is using bare-root transplants brought from Canadian nurseries. Lack of uniformity on transplants is one of the main concerns when using this method. Growers have the choice to pay premium prices for good uniformity and size. However, there is a little research in quantifying the effect on plant growth and yield of bigger plants. A study was conducted during the 2013-14 season to assess the effect of cultivars and crown diameter on strawberry growth and early and total marketable yield. Cultivars used for this trial were 'Florida Radiance', 'Strawberry Festival', and 'Winter Star'. Transplants from each variety were divided in two sizes ≥ 10 mm. Treatments were set in a split plot design (cultivars in main plots) with four replications. For early yield, cultivar \times crown size interaction was not significant. Cultivar did not have a significant effect on early fruit weight. However, crown size had a significant effect on early marketable fruit weight, averaging 2 tons/acre compared to 1.2 tons/acre when using <10 mm crown diameter size. For total yield, cultivar \times crown size interaction was not significant. Moreover, there was not significant difference for cultivar and crown size at the end of the season, averaging 4.0 tons/acre. Having crown diameter size >10 mm would have benefits for growers since high prices are concentrated during the early season.

Water savings for commercial potato production in SW Florida: from seepage to center pivot. Xiaolin Liao, G.D. Liu, L. Zotarelli, B. Santos, Horticultural Sciences, UF, C. Snodgrass, Manatee County Extension, UF, A. Jones, Jones Potato Farm. (liaoxiaolin@ufl.edu) [V-6]

Seepage is the most used irrigation system for potato production in Florida but inefficient in water use. Central pivot irrigation is significantly more efficient. To evaluate the potential of water-saving under central pivot, studies were conducted on Jones Potato Farm in Parrish, Florida, where both central pivot and seepage irrigation systems are implemented. The water usage, potato yields and quality were compared between the two irrigation systems in 2013 to 2014 growing season. Two potato varieties were evaluated, 'Red LaSoda' and 'Atlantic' with four replicates. Two 20-foot long rows were used for tuber yield measurement for each replicate. ET value was 10.2 inches during the growing season. Our results showed tuber yield was 13.5 ± 1.0 and 12.7 ± 0.8 ton/acre for seepage and center pivot, respectively. Center pivot saved 55.1% water per unit of potato tuber production compared to seepage. Center pivot used 20.1 ± 1.0 inches of water per acre but seepage consumed 32.9 ± 1.6 inches of water. The former used 63.6% less water as compared to the latter. Additionally, in two freeze events of 2013, higher foliage coverage, greener plants, and less freeze damage were found in central pivot. Central-pivot provided freeze protection. The concentration of extractable nitrate in the soil was greater for the seepage than that for central pivot. This difference showed a new fertilization strategy is needed for the overhead irrigation system. More research is required to fully evaluate the potential of switching the conventional seepage irrigation to the overhead irrigation.

Interactions between N source and PGPR on tomato plant growth and nitrogen uptake.

Xiaohui Fan, S.A. Zhang, X.D. Mo, Y.C. Li, Y.Q. Fu and Z.G. Liu, TREC, UF.
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Two pot experiments were conducted in the greenhouse at the Tropical Research and Education Center, University of Florida to test the effect of nitrogen (N) source, rate and inoculation of plant growth-promoting rhizobacteria (PGPR) on tomato plant growth and N uptake. Treatments were no N (CK), Urea (UF) and polymer coated urea (CRF) each at 125 mg N kg⁻¹ soil⁻¹ (Low N as F1) and 250 mg N kg⁻¹ soil⁻¹ (High N as F2). Treatments inoculated with PGPR increased plant height compared to treatments without PGPR in both experiments. However, only CRF1+ PGPR had significant higher plant height than CRF1. Inoculation of PGPR increased dry shoot weight compared to no inoculation of PGPR at equivalent N rates. Only CRF and UF at the high N rate with PGPR had significantly greater shoot biomass than that from CRF and UF alone, respectively. For N uptake in tomato shoot, treatment with PGPR increased N uptake compared to the treatment without PGPR in the same N rate and N source. Only at the high N rate CRF with inoculation of PGPR had significantly higher total N uptake in shoot than CRF without inoculation of PGPR. The present results indicate that inoculation with PGPR may increase tomato plant growth and N uptake. However, the effect of PGPR varied and was influenced by many factors such as N source, N rate and soil fertility. Further investigations are warranted to confirm the effect of PGPR under different soil conditions.

Heavy Metal Content of Tomatoes Fertilized With A Biosolids. George H. Snyder,

Milorganite, Lake Worth, FL, and John L. Cisar, FLREC, UF. (phdlaboratory@hotmail.com) [V-8]

Biosolids re-cycle plant nutrients, but may also have constituents, such as heavy metals, that could contaminate food crops. Tomatoes (*Solanum lycopersicum*, var. Better Boy), grown in a greenhouse in a mined sand containing sphagnum peat (90/10 sand/peat, by volume), were fertilized with a biosolids fertilizer (Milorganite®), supplemented with K, several specialty organic fertilizers (Tomato Tone®, Dr. Earth®), and the soluble fertilizer Miracle-Gro®, all at the same rate of N, except that a 0.5X and 1.5X rate of biosolids was included. Fruit was harvested through four months after seeding. The greatest fresh weight of tomatoes was obtained with Tomato Tone fertilizer. The 1.5X rate of biosolids produced significantly ($P < 0.05$) lower fruit yield, but that treatment, and the 1X biosolids rate, produced greater yield than Dr. Earth and Miracle-Gro. Although the biosolids contained more As, Cd, Mo, Ni, and Pb than the specialty organic fertilizers, and presumably more than the soluble fertilizer, even at the 1.5X rate of biosolids there were no significant differences ($P < 0.05$) among the four fertilizers in the concentrations of these elements in the tomato fruits. The Dr. Earth fertilizer contained more Cu, and approximately the same amount of Zn as the biosolids, but the concentration of these two elements was not different in the tomato fruits produced by the four fertilizers.

Optimizing Gypsum Rate for Commercial Potato Production in NE Florida. Guodong Liu, Steve Sargent, Horticultural Sciences, UF, David Dinkins, Putnam County Extension, UF, Danny Johns, Blue Sky Farms. (guodong@ufl.edu) [V-9]

Calcium is essential for food production. However, excessive calcium application ties phosphorus up and decreases uptake of nutrients such as potassium, magnesium, iron, zinc, boron. The problems may cause economic losses. To optimize gypsum application rate and enhance P use efficiency, a gypsum trial was conducted with potato (var. Red LaSoda) at Blue Sky Farms in spring 2013. There were four treatments: 0, 500, 1000, and 2000 lbs/acre gypsum with four replicates. The Randomized Complete Block design (RCB) was used. At harvest, twenty potatoes from each of the 16 plots were cut open to determine internal tuber defects. These defects were categorized as hollow heart (HH), brown rot (BR), corky ringspot (CRS), internal heat necrosis (IHN) and brown center (low, medium, or high). The results were marketable tuber yields of 33,971, 32,138, 31,519, and 34,056 lbs/acre for 0, 500, 1000, and 2000 lbs/acre gypsum, respectively. The specific gravity was 1.050, 1.051, 1.051, and 1.052, respectively. The internal quality of the tubers was all the same. These data showed that there was not any significant difference in tuber yield or tuber internal quality between the treatments in the study. Soil test showed that the soil had 2750 lb CaO/acre which was 56-fold greater than the requirement of the crop. Therefore, there is a great potential to decrease gypsum application rate without sacrificing tuber yield and quality. This decrease of gypsum application may increase P use efficiency and improve the profitability and sustainability of commercial potato production in the area.

The Effect of Increasing Rates of Fertilizer on Insect Pests of Organically Grown Squash ‘Gentry’ (*Cucurbita pepo* L.). Danielle Treadwell, Horticultural Sciences, UF, Susan Webb, Entomology and Nematology, UF, Mihai C. Giurcanu, Statistics, UF, Michael Alligood, Suwannee Valley Agricultural Extension Center, UF. (ddtreadw@ufl.edu) [V-10]

Organic producers typically apply 100% of their nitrogen requirements as dry granular fertilizer in the bed prior to establishment of plastic mulch and drip irrigation due to the high costs of liquid fertilizer. Insects that feed on phloem sap, in particular, may reach higher levels when there is excess nitrogen available. This study examined the effects of three rates of a previously studied organic-compliant fertilizer on yield and insect pests of yellow crookneck squash, ‘Gentry’ (*Cucurbita pepo* L.). The design was a complete factorial arranged in an RCBD with three rates of fertilizer (75, 150, and 300 lb acre⁻¹) and three insect management treatments (floating row cover, organic-compliant insecticide as needed for aphids, whiteflies, and caterpillar pests, no insect control). Squash was planted on 18 inch centers on 5 ft beds on 25 April on transitional organic land at the Suwannee County Agricultural Extension Center in Live Oak, FL. Each plot was surrounded by a ten foot border parallel to the rows, and a fifteen foot border perpendicular to the rows. Adult insect counts were completed *in situ* weekly prior to squash harvest. Counts of adult whiteflies were modeled with a Poisson distribution and aphid counts with a negative binomial distribution. The use of row covers at planting resulted in fewer whiteflies and aphids overall compared to remaining treatments, but insect density was not related to fertilizer rate. Marketable yield was greatest in the 300 lb acre⁻¹ relative to remaining rates (P< 0.001).

Improvement of Lettuce for Resistance to Bacterial Leaf Spot. Huangjun Lu, EREC, UF. (hjlu@ufl.edu) [V-11]

Bacterial leaf spot (BLS), caused by the pathogen *Xanthomonas campestris* pv. *vitians*, is a devastating disease of lettuce in the world and is the most damaging disease of lettuce in Florida. This disease is highly unpredictable about where and when an outbreak will occur during the lettuce growing season. There are no chemicals for control of the disease. Use of host-plant resistance is the only ultimate solution to the problem. Recently, a new method for fast and accurate evaluation of a large number of lettuce germplasm lines has been developed in my laboratory. One line with high level of resistance and a number of lines with moderate resistance have been identified from 258 germplasm lines tested. Populations segregating for resistance are currently under development by crossing the resistant line with adapted cultivars or other germplasm lines for the purposes of breeding resistant cultivars for commercial use and identifying molecular markers for marker-assisted selection. Conventional breeding method and molecular technology will be used to improve lettuce for resistance to the disease.

Effect of Stockosorb on the Management of Bean and Cucumber Plants and their Insect Pests, Silverleaf Whitefly Using Three Levels of Irrigation. Dakshina R. Seal, TREC, UF, J.A.Norton and C.M. Sabines. (dseal3@ufl.edu) [V-12]

Soil water is an important constraint in growing vegetable crops. The inappropriate use of water in modern agriculture is strongly discouraged. The effects of deficient and of excessive soil moisture on plant growth are well known. In the present study, effect of Stockosorb, a water retaining chemical, to maintain appropriate plant health was studied in cucumber and beans. Stockosorb was applied at the rate of 20 lbs/acre for each of three rates of water which were 50, 80 and 100% of recommended water practice. A control treatment was used by irrigating standard rate of water in absence of stockosorb. Cucumber (*Cucumis sativus* L. 'Vlaspic') and bean (*Phaseolus vulgaris* L.) grown in the four levels of water management program affected populations of various insect pests. Mean numbers of silverleaf whitefly adults were significantly fewer in plants grown under low level of irrigation (50% and 80%) than those grown under high level of irrigation (100%). American serpentine leafminers, *Liriomyza trifolii* (Burgess) population abundance was high on nontreated control plants in comparison to all treated plants. Foliage quality did not differ among treatments. Mean numbers of flowers and fruits were the highest when plants were grown at the lowest level of irrigation (50%). Further studies are warranted to conclude the effect of stockosorb in growing various crops.

Management of Yellow Nutsedge (*Cyperus esculentus*) with Reduced Fumigant Application Rates in Combination with Totally Impermeable Film. Josh H. Freeman, NFREC, UF. (joshuafr@ufl.edu) [V-13]

Reduced use rates of two fumigant chemistries (iodomethane and dimethyl disulfide) were used in combination with totally impermeable film (TIF) mulch and compared to standard use rates with virtually impermeable film (VIF) mulch for the control of soil-borne pests and weeds. Yellow nutsedge (*Cyperus esculentus*) was the primary weed species present during these experiments. Nutsedge control was excellent with both fumigants. When combined with TIF, fumigant use rates could be reduced by 30-40% while maintaining similar nutsedge control and marketable tomato yield compared to standard use rates under VIF mulch. Plant back period was

extended by using TIF mulch in combination with dimethyl disulfide, but not with iodomethane. TIF in combination with reduced fumigant use rates could have several benefits including reduced input costs, decreased buffer zones, and decreased fumigant odor perception.

Alternative production system for cabbage production in northeast Florida. Charles Barrett, L. Zotarelli, L.G. Paranhos, P. Dittmar, C. W. Fraisse, J. J. VanSickle, Horticultural Sciences, UF. (soulpole@ufl.edu) (lzota@ufl.edu) (Student Best Oral Presentation Competition Entry) [V-14]

Most cabbage produced in Florida is cultivated using seepage irrigation. Seepage is an inefficient irrigation practice because it requires significant water withdrawals from the aquifer to maintain a high water table to irrigate the crop, which facilitates offsite movement of soluble nutrients and runoff. In recent years, interest has grown for alternative cabbage production systems that conserve irrigation water and nutrients. A plasticulture system has been developed and adapted for Florida cabbage production by UF/IFAS, and is currently under assessment for commercial use. The objective of this study was to evaluate the plasticulture cabbage production system in a commercial setting. Cabbage 'Bronco' was grown on 1.23m wide raised beds with black plastic mulch with drip irrigation. The beds were spaced at 2.03m with three or four rows of plants per bed with a total of four in-row spacing configurations. The four plant spacing/row configurations were 3-row: 20-20-20; 20-25-20 cm in-row spacings, totaling 72,657 and 55,704 plant/ha, respectively and 4-row: 25-25-25-25; 25-30-30-25 cm in-row spacings, totaling 77,501 and 71,042 plant/ha, respectively. There were eight 396m long beds; four of which were raised conventionally and four organic. Each plant spacing/row configuration was grown both conventionally and organically. Cabbage was harvested from four sub-plots 3m long, spaced equidistantly along the length of each bed. Marketable yields were comparable among treatments at 32.2, 39.6, 38.6, 37.9 Mg/ha for the plant spacing/row configurations 20-20-20, 20-25-20, 25-25-25-25, 25-30-30-25, respectively. Yield data from the organically produced cabbage was not reported due to significant crop loss.

Evaluation of Compact Growth Habit Tomato Breeding Lines for the Florida Mature-green Fresh Market. Aline Coelho Frasca, Monica Ozores-Hampton, SWFREC, UF, John Scott, Craig D. Stanley, GCREC, UF, and Eugene McAvoy, Hendry County Extension Service, UF. (acfrasca@ufl.edu) (ozores@ufl.edu) (Student Best Oral Presentation Competition Entry) [V-15]

Compact growth habit (CGH) tomatoes (*Solanum lycopersicum*) are determinate plants, with shortened internodes and strong side branching due to the brachytic gene, *br*, that grow prostrate or upright due to unidentified gene(s). Compact growth habit tomatoes do not require staking, tying, or pruning, and can potentially be mechanically harvested, which could possibly lower Florida tomato production costs. Therefore, the objective of this study was to evaluate six CGH tomato breeding lines with two plant populations (single and double row) on yield and postharvest fruit quality. The experiment was conducted in a commercial tomato field in Immokalee, FL, during spring 2013 in a split-plot design. Fruit were harvested twice at mature-green stage and graded into marketable yield size categories and unmarketable. Postharvest evaluation included fruit firmness and color. Plant populations did not differ on yield for any of the size categories or harvests, except for large fruit at second harvest. Breeding line 8916 had

the highest marketable extra-large fruit yield in the first and total season harvest. Breeding line 8834 had the lowest total season harvest yields. The most common defects were sunscald and off-shape, constituting 11% and 9% of the average total fruit harvested, respectively. Plant populations did not differ on fruit firmness but there were differences in color. Compact growth habit tomatoes may be a viable option for the Florida mature-green fresh market based on yield and fruit quality.

Potassium Fertilizers for Vegetable Production. Marcel Barbier, Yuncong Li, Soil and Water Science, TREC, UF, Guodong Liu, Horticultural Sciences, UF, Fran Pierce, Soil and Water Science, TREC, UF. (marcelbarbier@ufl.edu) (Yunli@ufl.edu) (Student Best Oral Presentation Competition Entry) [V-16]

Potassium is the essential nutrients for plant grow and is absorbed by plants more than any other nutrients except nitrogen. Potassium fertilizer is one of three most applied agrichemicals by growers. Compared to nitrogen and phosphorus, there are much less efforts to optimize potassium fertilizer management practices because of less environmental concerns. However, the use efficiency of potassium fertilizers is still low and prices of potassium fertilizers have risen by over 3 times during last decade. It is necessary to develop the best management practices for potassium fertilizers and evaluate new type of potassium fertilizers. Comparison of various potassium fertilizers for growing vegetable crops in Florida will be presented.

Developing technologies for Florida-produced strawberry plug transplants: time in nursery and tray sizes. Emmanuel A. Torres-Quezada, GCREC, UF, Lincoln Zotarelli, Horticultural Sciences, UF, Vance M. Whitaker, and Bielinski M. Santos. GCREC, UF. (etorres1618@ufl.edu) (Izota@ufl.edu) (Student Best Oral Presentation Competition Entry) [V-17]

Most of strawberry (*Fragaria × ananassa*) production in Florida is planted with bare-root (BR) transplants, which is relatively inexpensive and provide acceptable fruit yield. However, in order to properly establish BR transplants sprinkler irrigation is required. It is estimated that approximately 600,000 gal/acre is applied during the first 10 days after planting. Strawberry plug (SP) is a potential alternative to BR, but one limitation is their high production cost, which doubles traditional BR (extra US\$ 2,600/acre). Developing techniques for SP production in Florida could reduce water requirements, while reducing productions cost with more economically accessible transplants. This project evaluated the feasibility of producing strawberry plugs in Florida. ‘Strawberry Festival’ plugs were produced in high tunnel in two consecutive seasons in 2012 and 2013. Two trials were established to evaluate most adequate SP time in nursery and tray sizes. First trial treatments consisted: a) BR transplants (reference), b) 4-wk-old SP, c) 4-wk-old SP + indole-3-butyric acid (IBA at 0.10% v/v), d) 6-wk-old SP, and e) 6-wk-old SP + IBA. Second trial treatments consisted: a) BR transplants, b) SP planted in 32 holes/tray, c) SP planted in 40 holes/tray, d) SP in 50 holes/tray, e) SP planted in 72 holes/tray. Results showed no difference between BR and Florida-produced 6-wk-old SP for total yield. Average yield was 8 ton/ha with no statistical differences between BR and tray size treatments. Results demonstrated the potential for SP production in Florida, which may reduce production costs and water usage for plant establishment.

Effect of drip irrigation and nitrogen, phosphorus and potassium applications on tomatoes growth and yield. Miurel T. Bermudez and Kelly T. Morgan, SWFREC, UF. (mbermudez05@ufl.edu) (conserv@ufl.edu) (Student Best Oral Presentation Competition Entry) [V-18]

The state of Florida ranks second compared with all US states in area planted and harvested tomatoes for the fresh market, with a total area planted of 30,000 acres and 29,000 acres harvested in 2012. The majority of Florida's tomato production is grown in sandy soils well-known for having low organic matter content and low water nutrient holding capacities. Important considerations in tomato production to obtain greater yields are fertilization and irrigation which are fundamentally linked; and are a major part of the costs of the tomato production budget. A study was carried to find the optimum tomato fertilization rate with drip irrigation in Florida on a sandy soil. The treatments involved were as: 1) no fertigation, 2) 50% UF/IFAS recommendation rates for tomato 3) 100% of the UF/IFAS recommendations, 4) 150% of the UF/IFAS recommendations) and 5) 200% of the UF/IFAS recommendations. The fertigation was done twice a week in experiments conducted twice on tomato-planted beds once in Fall 2013 and the second one on Spring 2014. Yields in 25 pound boxes per acre found for the Fall season by treatment were 507.8 for treatment 1, 1235.7 for treatment 2, 2041.8 for treatment 3, 2539.0 for treatment 4 and 2489.0 for treatment 5. First season yield results indicate that an increase in fertilizer application more than 150% of IFAS recommendation doesn't guarantee an increase in the tomato yields.

Spatial Distribution of the Leafminer, *Liriomyza trifolii* (Diptera: Agromyzidae) on Bean and Squash in Southern Florida. Shashan Devkota, D. R. Seal, C. Waddil, O. E. Liburd, and S. Ferguson, TREC, UF. (devkotasashan@ufl.edu) (dseal3@ufl.edu) (Student Best Oral Presentation and Paper Competition Entry) [V-19]

Liriomyza trifolii is one of the most serious insect pests of vegetable crop in Florida. Adult female punctures the leaf with the help of ovipositor and feeds on plant sap. Female lays eggs in these punctures. An adult female can lay 35-39 eggs per day, a total of 200-400 in lifetime. Immediately after hatching, larva starts mining the leaf and feeds on mesophyll layer of the leaf until the larva emerges from the leaf. *L. trifolii* infests host crops at the beginning of germination until harvest. In both bean (*Phaseolus vulgaris*) and squash (*Cucurbita pepo*), in the early stage of germination, population abundance was commonly low and the distribution pattern of adults and feeding mines were random ($\beta < 1$). With the passing of time, distribution patterns of *L. trifolii* adults and feeding mines become aggregated ($\beta > 1$). In the instance of high abundance, *L. trifolii* larvae and pupae showed aggregated distribution pattern. When bean (*P. vulgaris*) and squash (*C. pepo*) were at flowering and fruiting stage, population abundance of *L. trifolii* decreased significantly and adult distribution was observed random ($\beta < 1$) and regular ($\beta = 1$). In general, the abundance of *L. trifolii* was higher in bean (*P. vulgaris*) than in squash (*C. pepo*). This information of the present research studies carries great value in developing a pest management decision. Based on this information growers will be able to develop a site selective insecticide management program.

Growth Response Of Melonworm, *Diaphania Hyalinata* Linnaeus (Insecta: Lepidoptera: Pyralidae) to 4 Cultivars Of Cucurbit Grown In South Florida. Babu Ram Panthi, D.R. Seal, TREC, UF, G. Nuessly, EREC, UF and J.H. Capinera, Entomology and Nematology, UF, (panthibabu@ufl.edu) (dseal3@ufl.edu) [V-9] (Student Best Oral Presentation Competition Entry) [V-20]

Cucurbit crops are grown in large scale in southern United States where Florida has been the leader in fresh market production of cucumber, squash and watermelon. Melonworm is an important pest in limiting cucurbit production by causing economic damage in absence of any effective control measures. Melonworm larvae feed on all above ground parts (leaves, flowers and fruits) of cucurbit host plants. Female melonworm moth lay yellow oval eggs either singly or in cluster underside the leaf. Melonworm adults are active at night when most of oviposition takes place. Female melonworm oviposits 20-200 eggs in its lifetime. Duration of embryonic development varied from 2 to 5 days irrespective of cucurbit cultivars. Larval size and weight were more on squash than on Zucchini and other cultivars. Larval duration was 12, 13, 14, 13 days on pumpkin, squash, cucumber and zucchini cultivars respectively. Pupal weight and pupal duration were same on all cultivars. However, pupa development period was shorter on squash than on other cultivars. Preoviposition period was shorter (.5 days) on squash than on zucchini. This information will be helpful in sampling melonworm in cucurbits and developing a sound integrated pest management program.

Assessing Sting Nematode Impact and Soil Fumigant Performance on Strawberry Yield Using Multispectral Reflectance. J.W. Noling, A.W. Schumann, and M. Cody, CREC, UF (jnoling@ufl.edu) [V-21]

In Florida, the Sting nematode (*Belonolaimus longicaudatus*) is a widespread and important yield limiting pest. Plant stunting, yield losses, and patchy field distribution are well correlated with initial soil population density of the nematode. Multispectral reflectance field imaging technology was used to characterize plant stunting and to relate differences in relative strawberry crop yield (based on plant sizing) to within row, green vegetative cover. A tractor mounted GreenSeeker® optical sensor was used to scan strawberry rows to provide estimates of green canopy cover (NDVI) against a backdrop of black plastic mulch covering the raised bed. Cumulative differences in plant numbers and relative yield contribution within each of four plant size categories were then statistically compared with NDVI, and both values used to independently compare differences between various soil fumigant treatments and commercial strawberry fruit harvests conducted on a 2-3 day schedule over a December to April harvesting season. Accurate maps of fumigant treatment performance, GPS location, and sting nematode stunting severity of strawberry plants was well described by NDVI field mapping of experimental fields. Strawberry yields from commercially hand harvested large plots were highly correlated ($r^2 = 0.91$) with NDVI field assessment for each different fumigant treated plot. Ground truth surveying of plant size distribution and relative yield potential demonstrated the accuracy of in-field, remotely sensed GreenSeeker® information. These results illustrate how NDVI can be used to provide a quantitative measure of strawberry yield and to provide growers guidance on suitable alternatives to methyl bromide soil fumigation for nematode management.

Impact of Clopyralid on Strawberry Growth and Reproduction. Nathan S. Boyd, GCREC, UF and Peter Dittmar, Horticultural Sciences, UF. (nsboyd@ufl.edu) [V-22]

Clopyralid is the only post emergent broadleaf herbicide registered for use in strawberry in Florida. An experiment was conducted at the Gulf Coast Research and Education Center in 2013 to evaluate the impact of clopyralid rate (0, 140, 280 and 560 g ae/ha) and application timing (December 10 and 19, and January 2, 16, and 30) on strawberry vegetative and reproductive growth. Clopyralid damage was observed on plants when applied at the two highest rates. Four weeks after spraying there was a significant rate by application timing interaction ($p=0.0013$) on leaf number. Clopyralid applications on December 10 and 19 had no impact on leaf number whereas there was a 33 and 40% reduction in leaf number compared to the untreated control if sprayed at 280 or 560 g ae/ha on January 2. Similar trends were observed when clopyralid was sprayed on January 16 and January 30. Conversely, the number of floral buds per plant tended to be higher if clopyralid was sprayed later in the season. There was a marginally significant interaction ($p=0.0904$) between herbicide rate and application timing on berry yield. Lower yields were obtained at the highest herbicide rate compared to the untreated control when applied in December. Clopyralid applications later in the season did not impact yield.

Abundance of insect pests and mites on strawberry varieties grown in high tunnel and open field. Oscar E. Liburd, O.G. Dosunmu, A. Minott, Entomology and Nematology Department, UF; X. Zhao and C.A. Chase, Horticultural Sciences Department, UF. (oeliburd@ufl.edu) [V-23]

Using field trials and a tunnel system the presence of insect pests, mites and beneficials was recorded in strawberries grown under standard organic conditions. A high population of twospotted spider mites (TSSM), *Tetranychus urticae* Koch was recorded in the tunnel system throughout the sampling period. In the field, TSSM population was lower and varied throughout the sampling period. Among the insect pests, the seed bug *Neopamera bilobata* (Say) was the most common insect in both the tunnel and field sites. Secondary pests included the strawberry aphid, *Chaetosiphon fragaefolli* (Cockerell), green peach aphid, *Myzus persicae* (Sulzer), flower thrips, *Frankliniella* spp. and whiteflies, *Bemisia tabaci* Gennadius. Among the beneficials the six-spotted thrips, *Scolothrips sexmaculatus* (Perg.), green lacewing *Chrysoperla carnea* (Stephens) and spiders appeared to be more common than other beneficial arthropods.

Ornamentals, Garden, and Landscapes Section

Gumbo Limbo Trees Struggle with Three New Dieback Plagues: Puzzling Witches' Broom Symptoms, A CSI Mystery Plus Croton Scale and Rugose Spiraling Whitefly, A Favorite Native Tree Under Attack! Doug L. Caldwell, UF/IFAS Extension Collier County and A. J. Palmateer, UF/ IFAS Tropical Research & Education Center. (dougbug@ufl.edu) [OGL-1].

The gumbo limbo tree, *Bursera simaruba* (L.) Sarg., with its beautiful bark is a beloved, native shade tree. In the past it occasionally was bothered by aphids, but now it is under siege by three new pests. A witches' broom symptom or rosetting of the terminal buds has been investigated for phytoplasma infection by Dr. Nigel Harrison. Using a series of molecular diagnostic assays, foliage from 16 trees from three south Florida locations was tested. No phytoplasma infection,

except in one tree, was detected. It matched the aster yellows group strain, *Candidatus phytoplasma asteris*. Other possibilities such as a fungal pathogen will be discussed. The impact of the croton scale, a previously unreported soft scale species, *Phalacrocooccus howertoni* Hodges & Hodgson, which arrived in Collier County around 2008 and the rugose spiraling whitefly, *Aleurodicus rugioperculatus* Martin arrived in Collier County in October, 2011 will be discussed.

Evaluation of Anthracnose on Leatherleaf Fern Treated with Keyplex. Karen M. Stauderman, UF/IFAS Extension Volusia County, D.J. Norman, UF/IFAS Mid-Florida Research & Education Center and R.A. Atwood, Keyplex Inc. (kstauderman@ufl.edu) [OGL-2].

Anthracnose disease is the number one production problem currently for Florida leatherleaf fern (*Rumohra adiantiformis*) production. Anthracnose is the result of interactions between the fungus *Colletotrichum acutatum* and the fern plant. The most important of these interactions is the infection and colonization of fern leaves, which result in economic damage to the harvested product, the fern frond. Anthracnose impacts fern production by causing unsightly disease damage that renders the fronds unsalable. *Colletotrichum acutatum* is also the casual agent of post bloom fruit drop (PFD) in citrus. Keyplex products have been shown to significantly reduce PFD in citrus (EPA bio-pesticide label 73512-1). A trial in 2011 was conducted to determine if Keyplex could reduce anthracnose in leatherleaf fern and to determine what rate would be most appropriate. Treatments at 0.5, 1, and 2 pints to the acre resulted in significantly less disease incidence. In 2013 a follow up trial was conducted which reaffirmed there were significant differences between treated and untreated areas. Fern growers can utilize this information to increase returns per acre and potentially allow them to decrease their use of chemical fungicides.

Phytophthora Leaf Blight Caused by *Phytophthora nicotianae* on Natal Mahogany *Trichilia dregeana*. Robert T. McMillan Jr., Kerry's Nursery Inc., Homestead and R. M. Leahy, Florida Department of Agriculture and Consumer Services, Division of Plant Industry, Gainesville, FL. (rmcmillan@kerrys.com) [OGL-3].

Water soaked leaf spots were observed on 'Natal Mahogany', *Trichilia dregeana* Harv. & Sond. at a south Florida nursery in the summer. The leaf spots affecting approximately 5-8% of the nursery stock caused severe cosmetic damage to this newly crop. A *Phytophthora* sp. was isolated on modified rye seed agar (RSA;1). The FDACS-DPI determined the species to be *Phytophthora nicotianae* var. *Breda de Haan*. Ten uninfected leaves of *T. dregeana* were placed in each of two plastic boxes lined with damp paper towels. Five leaves were treated as control and the other five were inoculated. Leaves were misted with water prior to inoculation. Control leaves were inoculated with one, 3mm square on uninoculated RSA. Treated leaves were inoculated with 3mm squares of seven-day cultures of the *P. nicotianae* also on RSA. Leaves were then misted again, covered and incubated at 25C. Necrotic areas developed around the inoculums on day three, on three leaves. By day five, four inoculated leaves showed infection and by day six, all of the inoculate leaves were infected.

Rose Rosette Disease in Florida. Alex Bolques, FAMU Cooperative Extension/Gadsden County, M. Paret, G. Knox, B. Babu, and H. Dankers, UF/IFAS North Florida Research and Education Center, Quincy, T. Schubert, and C. Baker, UF/IFAS Department of Plant Pathology, Gainesville, and M. Orwat, UF/IFAS Extension Washington County. (abol@ufl.edu) [OGL-4].

Rose Rosette Disease (RRD) is a devastating plant infection that threatens Florida's rose (*Rosa* spp.) nursery industry as well as retail sales and landscape use. In late 2013, the disease was diagnosed on a rose sample submitted to the Florida Extension Plant Diagnostic Clinic at the UF/IFAS North Florida Research and Education Center in Quincy, FL. Researchers at the plant diagnostic clinic confirmed the presence of RRD by applying a molecular biology technique known as Reverse Transcription Polymerase Chain Reaction to detect RNA expression levels. Since then, RRD has been found in two other Florida counties. RRD is a virus vectored by a tiny Eriophyid mite, *Phyllocoptes fructiphilus* Keifer, however the mite has not yet been found in Florida. Currently, there is no cure for RRD. Infected plant warning signs include proliferation of shoots, distortion of shoots and leaves, elongated reddened leaves, distorted flower buds and the overabundance of thorns. Ultimately, the disease weakens the plant causing it to decline and die. Early recognition of RRD plant symptoms is a key component to containing the spread of the disease. UF/IFAS Extension and the Florida Department of Agriculture and Consumer Services, Division of Plant Industry are working together to provide commercial growers, professional landscape personnel, professional scouts and county Extension faculty with Rose Rosette Virus and Eriophyid mites information and scouting training.

Hedge Bamboo Growth Management Near Power Lines. A.D. Ali, J. Harlow, The Davey Institute, D. Hughes, Debbie's Gardening Solutions, S. Bernick, Rainbow Treecare Scientific Advancements. (A.D.Ali@davey.com) [OGL-5].

A twenty seven month study was conducted to evaluate the use of Plant Growth Regulators (PGRs) and mechanical methods to manage the growth of Hedge bamboo, *Bambusa glaucescens*, growing in proximity to power lines. Two formulations of the PGR paclobutrazol were tested; one as a foliar treatment, the other as a soil drench. Mechanical trimming was evaluated alone and in combination with the PGR soil drench. Both foliar treatment and soil drench resulted in comparable cost and acceptable bamboo height after a 27 month period. Mechanical trimming resulted in the least cost; however, height was not acceptable at 27 months. Mechanical trimming in combination with PGR soil drench was effective during the first 12 months, but not during the second 12 months of the study.

Ornamental Pre-Emergent Herbicide Efficacy. Shawn T. Steed, UF/IFAS Extension Hillsborough County. (ststeed@ad.ufl.edu) [OLG-6].

Weeds are a considerable economic pest for woody ornamental plant growers. Pre-emergent herbicides are typically used to control weed seed germination and minimize impacts from weeds. Demonstration plots were created to screen 17 pre-emergent herbicides, one organic mulch, and one organic mulch/herbicide combination for efficacy against fall/winter weeds commonly seen in woody plant production in Hillsborough County. Used potting soil containing weed seeds was used as the foundation of the plot substrate. Weed seeds from green kylinga (*Cyperus brevifolius*), bittercress (*Cardamine hirsute*), doveweed (*Murdannia nudiflora*), beggars ticks (*Bidens alba*), prostrate spurge (*Euphorbia maulata*), hyssop spurge, (*Euphorbia*

hyssopoflia) artillery plant (*Pilea microphylla*) and crabgrass (*Digitaria* spp.), were collected from local nurseries and raked into the top one inch of the plots. Pre-emergent herbicides were then applied over the top of the 4.3 ft² plots. Herbicides and weeds were observed at 30 and 60 days after treatment for efficacy and compared.

Green Beer & Witches Brew: Themed Pesticide Training. Karen M. Stauderman, UF/IFAS Extension Volusia County, M. Lenhardt, UF/IFAS Extension Brevard County, M. Lollar, UF/IFAS Extension Seminole County. (kstauderman@ufl.edu) [OGL-7].

Annually, pesticide license holders seek Continued Educational Units (CEUs) to maintain their state certification. Traditional educational methods used by County Extension offices occur in routine classroom settings. Many of the licensees are technology oriented and are choosing online training to acquire their CEUs. There is a need to attract licensee holders to return to the classroom setting. Objectives: Attract audiences to attend pesticide training. Increase knowledge by 20% from audiences attending themed trainings. Build attendance in classroom settings by 25%. Methods: Two pesticide training classes were offered in Volusia County having Halloween and St. Paddy's Day themes. Marketing efforts including Facebook, web sites, email list serves and print media. Holiday décor and descriptive food terms including 'witches brew' and 'green beer' were used to capture audiences. County agents and staff dressed in costume themed attire. Results: Audience levels grew from the popularity of the themed programs with a 54.7% gain in attendance. Post survey results revealed knowledge level gains of 22.4%, and 21.2% after attending the Halloween and St. Paddy's Day training, respectively. Overall, 76% (n=35) and 94% (n=64) of the Halloween and St. Paddy's day attendees, indicated they would attend a theme-style training again. Attendees also admitted that 69.7% and 76.9% felt confident to pass the certification test. Impact: Using theme-styled educational programming is an effective way to draw audiences that may not attend traditional classroom settings. Audiences responded positively to these creative learning programs. Volusia County themed pesticide trainings are becoming preferred options to obtain CEUs.

How do the Hazard Communication Standard (HCS) and the Globally Harmonized System (GHS) Apply to Your Clients? Elizabeth V. Campoverde, H. Mayer and M. Lamberts. UF/IFAS Extension Miami Dade County. (evcampoverde@ufl.edu) [OGL-8].

The Hazard Communication Standard (HCS) - administered by the United States Occupational Safety and Health Administration (OSHA) - is designed to ensure the dissemination of information about chemical hazards and protective measures. The HCS is now aligned with the Globally Harmonized System (GHS) of Classification and Labelling of Chemicals. This is a worldwide initiative to promote standard criteria for classifying chemicals according to their health, physical and environmental hazards. This HCS/GHS update provides a coherent approach to classify chemicals and communicate hazard information on labels and safety data sheets. Its objective is to improve the quality and consistency of hazard information in the workplace. It also enhances the safety of all workers by providing understandable information and to reduce international trade barriers for American businesses. As of December 1, 2013, OSHA required all employers to have trained their employees on this update. UF/IFAS Miami-Dade County Extension agents quickly responded to this need and delivered a series of trainings for employers and employees based on information on the OSHA website. 266 participated in these trainings.

Where 207 (78%) responded a self-assessment survey showing a 3.8 out of 5.0 scale (76%) knowledge gain and intent of changes of practices of 4 out of 5.0 scale (80%). Participants reported being more confident in their ability to work with the new labels and Safety Data Sheets (SDSs) once they become available. All participants received a certificate of attendance and those with pesticide licenses received CEUs.

Effects of Media Formulation and Fertilizer Rate On Growth of Transplanted Tissue-cultured Plugs of *Dracaena* ‘Waikiki’. Adam D. Caple, Malcolm M. Manners, Department of Horticultural Science, Florida Southern College, Lakeland, John L. Griffis, Jr., Marine and Ecological Sciences Department, Florida Gulf Coast University, Ft. Myers, Andrew F. Kawabata and Kheng T. Cheah, Tropical Plant and Soil Sciences Department, University of Hawai‘i at Manoa, Honolulu, Hawai‘i. (acaple@mocs.flsouthern.edu) (mmanners@flsouthern.edu) (Student Best Oral Presentation Competition Entry) [OGL-9].

Dracaena ‘Waikiki’ is a new introduction by the Hawai‘i Export Nursery Association. It was discovered in Mauritius in 2004, as an unnamed, cultivated plant. DNA analysis has confirmed that it is a *Dracaena* but is a different species from any other *Dracaena* currently in the trade. No recommendations on appropriate potting media or fertilizer programs for this plant have been published. In this experiment, 2-month old tissue-cultured plugs were transplanted into 15.2 cm standard pots filled with one of three potting media: volcanic cinders and coco-chips (2:1), coco-peat and parboiled rice hulls (2:1), or sphagnum peat and perlite (1:1). These media were supplemented with either of two rates of a slow-release (5-6 month) 15-6-12 fertilizer formulation, for a total of six treatments. Plants were grown in a shaded greenhouse and irrigated automatically. After six months, plants grown in peat-perlite media supplemented with the lower of the two fertilizer rates (7.6 g/pot) were significantly taller than plants grown in any other fertilizer/medium combination. Plants at the lower fertilizer rate were more likely to grow upright (desirable), whereas plants grown at the higher rate (17.3 g/pot) often leaned or fell over (undesirable). All of the tested media/fertilizer combinations can produce a marketable plant of ‘Waikiki’, but the traditional peat-perlite medium can produce a larger plant in fewer days. It appears that the lower fertilizer rate is adequate for production of this cultivated variety, regardless of potting medium.

Influence Of Soil Type On Nitrogen Leaching Of Controlled Release Fertilizers. Austin L. Grimshaw, Brian M. Schwartz, and T.L. Grey. Dept. of Crop & Soil Sciences, University of Georgia, A.R. Kowalewski. Dept. of Horticulture, Oregon State University, Paul L. Raymer. University of Georgia, Dept. of Crop & Soil Sciences. (a.grimshaw.ag@gmail.com) (tifturf@uga.edu) (Student Best Oral and Paper Presentation Competition Entry) [OGL-10].

Misuse of nitrogen fertilizers has become an ever increasing problem in management of turfgrass lawns and fields. The environmental impacts of these practices are especially evident in sandy soils that are low in organic matter which can bind nitrogen, or in new turfgrass systems that have not developed mature root systems which are capable of nutrient uptake before leaching occurs. Controlled and slow release fertilizers are designed to release nitrogen over a longer period of time which should improve the efficiency of nitrogen use and reduce leaching. A lysimeter study was performed at the University of Georgia to determine if an experimental fertilizer (E 15-0-0) would reduce leaching compared to UMAXX (47-0-0) and an analog

fertilizer (16-4-8). Leached nitrate-nitrogen (NO₃-N) and ammonium-nitrogen (NH₄-N) samples were collected from a United States Golf Association (USGA) specified root zone mix, a native Florida Immokalee fine sand, and an Annapolis sandy loam from near the Chesapeake Bay in Maryland. The experimental fertilizer leached more NO₃-N than the other fertilizer types in all soils. The analog fertilizer leached more NH₄-N during both trial years in the Florida and USGA soils. Developing an improved controlled release fertilizer would decrease the likelihood of leached nutrients. Further study should be performed in the field to more accurately simulate real world conditions that affect fertilizer application and fate to effectively evaluate nitrogen loss characteristics of these fertilizers.

Mowing Requirements And Costs To Maintain Bermudagrass Are Influenced By Cultivar Selection and Trinexapac-Ethyl Use. A.R. Kowalewski, Horticulture, Oregon State University; B.M. Schwartz and A.L. Grimshaw, Crop and Soil Sciences, University of Georgia; J.N. McCrimmon and J. Layton, Environmental Horticulture, Abraham Baldwin Agricultural College. (Alec.Kowalewski@oregonstate.edu) (tifturf@uga.edu) (Student Best Oral and Paper Presentation Competition Entry) [OGL-11].

The average 18-hole golf course is predominantly comprised of rough areas. If the mowing frequency of these turfgrass areas were reduced without compromising aesthetic value by using cultivars with inherently slow vertical growth combined with plant growth regulators, the labor hours, fuel and budget allocated to turf maintenance could be vastly decreased. The objective of this research was to determine if bermudagrass (*Cynodon* spp.) cultivar selection and trinexapac-ethyl (TE) use can significantly reduce the mowing events required to maintain bermudagrass at a 1.0 inch height with mowing frequency based on the one-third rule without compromising turfgrass aesthetics. In 2011 ‘Discovery’ bermudagrass treated with TE required the lowest number of August mowing events to maintain the turf at a 1.0 inch height, followed by ‘Discovery’ without TE and ‘Tifway’ treated with TE. In 2012 ‘Discovery’ and ‘TifGrand’ treated with TE required the lowest number of mowing events. In 2011 and 2012 ‘Celebration’, ‘Patriot’, ‘Tifway’, and ‘TifGrand’ without TE, as well as ‘DT-1’ with or without TE required the greatest number of mowing events. In 2011 turf quality of ‘Celebration’, ‘TifGrand’ and ‘DT-1’ was reduced by TE applications, while in 2012 the quality of these cultivars as well as ‘Tifway’ was reduced by TE applications. The visual quality of ‘Discovery’ bermudagrass was not affected by TE application; however, this cultivar produced some of the lowest quality ratings with and without TE.

Impact of Soil Composition on Nitrate and Phosphate Removal Efficiencies: A Bioretention Mesocosm Study. Alex Bolques, FAMU Cooperative Extension/Gadsden County and J. Cherrier, FAMU, School of the Environment. (abol@ufl.edu) [OGL-12].

While much is known about the design criteria and application of rain gardens and bioretention systems, their effectiveness for nitrogen and phosphorus removal is variable and inconsistent. Some studies have suggested that this variability is due to differences in soil composition. The goal of this work was to evaluate how heterogeneous (sandy and sandy loam) and homogenous (ASTM C-33 sand only) soil mixtures impacted nitrate and phosphate removal in planted and non-planted bioretention mesocosms (RT=24 h). Planted mesocosms for each soil treatment contained three drought and water tolerant native plant species, while non-planted mesocosms

contained soil only. Overall, N & P removal were more variable in the heterogeneous mesocosms than in homogenous mesocosms. Net nitrate removal in planted heterogeneous mesocosms was 80% and in non-planted mesocosms was 67%, while phosphate removal was negligible in both planted and non-planted. Conversely, for the planted homogenous mesocosms we observed significant and consistent nitrate (88%) and phosphate (100%) removal efficiencies. For the non-planted homogenous mesocosms, removal efficiencies were lower and more variable, 75% nitrate and 50% phosphate removed. These results demonstrate that bioretention mesocosms containing ASTM C-33 sand media perform better than soils containing organic materials reducing the incidence of nitrate and phosphate net concentration in the outflows. Collectively, these results show that nitrate and phosphate removal in bioretention systems is highly dependent on both soil type and the presence or absence of plant material suggesting that soil composition is critical for maximizing the nutrient removal efficiencies in rain gardens and bioretention systems.

Developing a Method for Large Scale Solarization and Recycling of Used Potting Soil.

Shawn T. Steed, UF.

Used potting soil from the environmental horticulture industry is a problematic waste. In conversations with growers, it is estimated that about 10% of plants with potting soil are culled and disposed of in the industry. These culled plants and soil are typically dumped on site and generally not reused. In an effort to recycle this waste, a series of methods were tested to solarize the used potting media. Solarization is a sustainable, inexpensive, and effective method to reduce pathogens, nematodes and weeds. Plastic thickness, soil depth, and covering configurations were manipulated to generate best outcomes. Successful methods were achieved scaling from a mid-scale (one yd³) to large-scale (3.5 yd³) approach. Highest temperatures in the study reached a maximum of 159 F in the large-scale experiment. Solarization reduced nematode populations compared to untreated used soil. Weed seed germination at 14 days was reduced about 91% compared to untreated soil.

Best of the Best-How to Optimize Nursery BMP Techniques. Juanita Popenoe, UF/IFAS Extension Lake County, M. Lollar, UF/IFAS Extension Seminole County and E. Felter, UF/IFAS Extension Orange County. (jpopenoe@ufl.edu) [OGL-14].

The Florida Department of Agriculture and Consumer Services requires growers to implement and maintain verified Best Management Practices (BMPs) for Nutrient Management, Irrigation Management, and Water Resource Protection. These practices are intended to improve water quality while maintaining agricultural production. An obstacle to many growers fulfilling these requirements, is an understanding of the tools and techniques required to implement the most important practices of measuring media electrical conductivity (EC) and pH, and measuring and adjusting irrigation uniformity. Management tools were evaluated including Electrical Conductivity (EC) Meters, pH meters, and irrigation uniformity. EC Meters were evaluated using the pour-through method, the 2:1 extract method, and the substrate-paste method. Soil pH was measured with soil probes and solution probes from various manufacturers and results compared. Catch cup methods to assess irrigation uniformity and distribution were compared. Complying with state mandated programs is a daunting task for the high-energy nursery

production industry. The results of this thorough investigation of which tools and implementations work best will allow more growers to feel confident in implementing BMPs.

Educational Enhancement Advantages to Using Teamwork in the Training of Green Industries Best Management Practices. Bobbi J. Jarvis, Citrus County Extension; M. Lenhardt, Brevard County Extension; B. Moffis, Lake County Extension; J. Moll, Pasco County Extension; L. Singleton, Sumter County Extension. (bjjarvis@ufl.edu) [OGL-15].

Objectives: To increase learning and enhance the quality of the trainings for those in attendance, to increase the number of participants and trainings offered in the four-county region, and to raise awareness of the importance of state-mandated Green Industries Best Management Practices (GI-BMP) certification trainings. **Methods:** Horticulture agents from Citrus, Hernando, Pasco, and Sumter counties collaborated to co-train the five different modules of the day-long GI-BMPs. Trainings were scheduled in each of the four counties utilizing the green industry audience of each agent. Teaching agents also marketed all the classes in the four counties, not just their own. Agents taught the subjects they had the most expertise in to help participant's gain knowledge and encourage meaningful impacts. Additionally, agents learned new skills by observing the teaching techniques employed by their fellow agents for each of the segments. **Results:** An increased awareness of GI-BMP practices was realized by 237 landscape professionals who attended GI-BMP Training from 2009-2011. SHOULD we update with at least one more year's participation data? Program participants reported increased satisfaction in learning as a result from a variety of instructors and teaching styles. Eighty-five percent (n=237) successfully became GI-BMP certified by passing the post-training exam. According to a 2010-2011 end of class impact survey, 77% (n=113) of participants stated that they would use the recommended fertilizer rates and methods of applications taught in GI-BMP training. **Conclusions:** With five different trainers, participants benefitted from a variety of delivery styles from a new instructor for each segment. Agents also learned new methods to engage the audience from their colleagues, increasing their own knowledge and professional development. Additionally, the host county benefitted from many qualified trainers and an expanded audience based on marketing from neighboring counties.

Microirrigation Workshops and Results in Hillsborough County. Lynn Barber, UF/IFAS Extension Hillsborough County. (lbarber@ufl.edu) [OGL-16].

Water conservation and quality issues are top priorities for Florida. Population growth (estimated at 25% by 2020 to 21.8 million) means we will need 26.4% more water – an additional 9.1 billion gallons of fresh water every day. Education is the key. In 2013, Microirrigation Workshops educated more than 500 local residents on the installation and benefits of microirrigation, as well as potential problems, solutions and maintenance. Pre- to post-workshop knowledge gain reflected a 58% increase on microirrigation and 62% on installation of microirrigation. More than 78% noticed a decrease in their outdoor water usage since attending the workshop, and 73% of those who installed the microirrigation system estimated 112 gallons and \$8.00 per month saved. Microirrigation Workshop results show that all survey respondents found the class helpful in conserving water in their landscapes. More specifically, four practices were learned by more than half of respondents: only applying $\frac{3}{4}$ to 1 inch of water per irrigation application (63%); maintaining 3 inches of organic mulch (66%); using a rain gauge to monitor

rainfall and adjust watering (57%); and following the Florida-Friendly Landscaping™ principle, Right Plant-Right Place (67%). From these survey results, as well as those collected from Rainwater Harvesting Workshop attendees, we believe few people truly know how much water they use and how much a gallon of water costs; thus we are using Dr. Michael Dukes' calculations to judge relative accuracy of our survey results. Our comparison of survey results to expected water savings according to Dr. Dukes' calculations will be presented.

Innovative Approaches, Methods and Techniques for Improving Water Quality. Jane Morse. UF/IFAS Extension Pinellas County. (jmorse@co.pinellas.fl.us) [OGL-17].

Objective: Pinellas County is the most densely populated county in Florida and is 97% built out which creates large amounts of non-pervious surfaces that result in massive amounts of stormwater runoff. Because of this, 85% of the waters are impaired. With the high percentage of impaired waters and the potential of large fines from the EPA, the County was determined to improve water quality and save money. **Methods:** The County instituted a fertilizer ordinance in January 2010 to reduce the amount of pollutants reaching Tampa Bay with a two-pronged approach. The first was to reduce chemicals and the second was to mandate education regarding green waste for certification. UF/IFAS Extension serves as the County's educational provider and contributed to the development of the course. Some of the topics covered include: lawn and landscape cultural practices; turf management; and debris management.

Results: Ninety classes taught 3,074 people between Oct 2010 and Sept. 2013 with an average knowledge increase of 37%. The passing rate was 98%. **Conclusions:** The increase in knowledge these landscape maintenance personnel have achieved should translate into management of green waste so it does not reach the storm drainage system and does not bring pollutants to Tampa Bay and other water bodies thereby improving water quality.

Watershed Education: Hillsborough, Manatee, Pasco, Pinellas and Polk Counties. Bobbi J. Jarvis, UF/IFAS Extension Citrus County, S. McGee, UF/IFAS Extension Polk County, and M. Denny, UF/IFAS Extension Manatee County. (bjjarvis@ufl.edu) [OGL-18].

Education is the key to water conservation, water quality awareness and behavior impacts, all top priorities for Florida. Population growth (estimated at 25% by 2020 to 21.8 million) means Florida will need 26.4% more water – an additional 9.1 billion gallons of fresh/potable water every day. Three counties hosted “Water Schools” in 2013 geared to elected officials, resource managers and concerned citizens. Intent was to increase participant's awareness/knowledge of local and regional water issues, regulatory stakeholders' responsibilities, science available from UF/IFAS Extension and the influence water issues have on public policy. For elected officials, the objective was for them to utilize the knowledge gained to make sound policy decisions for future planning and development. Methods included in-class presentations by topic experts, class participation and tours of regional water resource facilities. Post-evaluations were conducted each day indicating knowledge increased in all counties for all participants. A three month follow-up of participants reflected implementation of changes in their policies/practices which altered water conservation techniques, and similar workshops were hosted at local levels within the participant's span of control. Lessons learned by organizers included: balancing attendee numbers, improving representation of various target audiences, more hands-on activities, providing reusable versus plastic water bottles and “preaching to the choir”. Positive results in all five counties will result in future external and internal funding for water school continuance.

Advanced Master Gardener Training to Improve Service at Plant Clinics. Theresa Badurek. UF/IFAS Extension Pinellas County. (tbadurek@co.pinellas.fl.us) [OGL-19].

The objective of this project was to increase the knowledge, skills, and confidence levels of our plant clinic Master Gardener volunteers. This agent created an advanced Master Gardener training series to accomplish this. First, a list of critical plant clinic knowledge was identified. The topics chosen were: advanced plant identification, questions to ask clients, what resources (text and electronic) to use, using a microscope, advanced plant pathology for Master Gardeners, common problems of fruit and vegetable crops, landscape and household pest identification and control, and weed identification and control. These topics were divided into ten three-hour classes to be held once a month. Next, a prerequisite of at least eight hours of volunteer service per month at any one of our plant clinic locations was required to qualify for this series. We did this to ensure that the training would be put to use educating clients and not used solely for personal enrichment. We have completed six of the ten classes as of February 2014 and plan to complete the series in June 2014. The results of the program so far have been very positive. Although it is sometimes difficult to evaluate the impact of this training on our clientele we have noted a decrease in the Master Gardeners reliance on the horticulture staff to answer many client questions. The Master Gardeners taking the classes have reported an average of 60% increase in knowledge over the course so far and report feeling more confident when working with plant clinic clients.

Mass Media For Program Distribution: City of Tampa Television, Spotlight Tampa. Lynn Barber. UF/IFAS Extension Hillsborough County. (labarber@ufl.edu) [OGL-20].

Reaching larger audiences while utilizing fewer resources is a stark reality for educational institutions. By using television as a mass media tool, we were able to reach more residents while providing environmental horticulture information that is current, timely and relevant. The Florida-Friendly Landscaping™ (FFL) Television Segments presented on Spotlight Tampa run 12 times each week for several months on City of Tampa Television (CTTV), covering a ten county viewing area, and are placed on YouTube and Video on Demand at CTTV's website. Horticulture-related topics, such as microirrigation; mulch; rainwater harvesting; composting, the Bette S. Walker Discovery Garden (our teaching/demonstration garden in the Extension Service's courtyard), rain gardens, and holiday plants were presented. We have seen increased attendance at our workshops, in the number of walk-in clients, telephone calls, emails and website hits from these viewers. Positive responses from our partners, City of Tampa Water Department and City of Tampa Television, have resulted in requests that we continue to provide these environmental educational programs on a regular basis. Residents have also requested continuation of our participation in Spotlight Tampa. This mass media programming is easily transferrable to other universities by developing relationships with local television stations. Live or pre-recorded segments are more resource efficient than programming on an individual to individual basis.

Bringing Water Quality Education to the World via eXtension. Susan Haddock, UF/IFAS Extension Hillsborough County. (haddocks@hillsboroughcounty.org) [OGL-21].

eXtension is an interactive learning environment originally developed by Texas A&M and is a national collaborative initiative of the Extension System. The eXtension Campus provides a format for educational materials to be accessible by anyone, anywhere internet access is available. Providing education via eXtension allows users to progress through curriculum in a logical step wise process. Certificates of completion or continuing education units may be awarded to enrollees. Curriculum development tools enhance the designer's ability to evaluate enrollees based on pre and post tests and follow-up surveys. Other valuable statistical information may be collected to further program development and reporting to University and governmental stakeholders. This presentation demonstrates an eXtension accessible format for an urban water quality educational program.

Krome Section

The Introduction and Commercialization of West Indian Avocados to Fairchild Tropical Garden Living Collection, South Florida, USA. N. Ledesma, R. Campbell and T. Walton, Fairchild Tropical Botanic Garden, Coral Gables [K-1].

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. West Indian avocado selections have promise for South Florida as cultivars for plantation and estate agriculture. Working with local collaborators we have identified superior selections within localized areas of diversity, collected budwood and established a living collection at the Fairchild Farm Genetic Resource Center of FTBG in South Florida. More than 200 different selections of West Indian Avocado were collected during 4 years. As a genetic resource, these selections hold promise for the improvement of disease resistance (phytophthora root rot), fruit quality and productivity of avocado throughout Tropical America and the world. Evaluation of fruit and tree characteristics began in 2005 and we have now identified several green- and red-skinned cultivars with promise for commercial and landscape use in Florida and in Tropical America, Africa and Asia.

Laurel Wilt in Avocados—The Evolution of a Powerful Threat to South Florida's Commercial Tropical Fruit Industry. J. Wasielewski, Miami-Dade County Extension, UF, J. H. Crane, Tropical Research and Education Center, UF [JK-2].

A battle is being waged in the avocado groves of South Florida where the region's largest and most economically important fruit crop is under attack. Avocados account for approximately 7500 acres in Miami-Dade County and have an economic impact of \$54 million to the regional economy. The avocado industry has already lost over 2500 trees due to laurel wilt since the introduction of the disease to Miami-Dade County in 2011. Laurel wilt is disease that affects

plants in the *Lauraceae* causing rapid wilt and sudden death. It is caused by a fungus, *Raffaelea lauricola*, that was accidentally introduced, along with its original vector, the redbay ambrosia beetle, *Xyleborus glabratus*, to the United States in May of 2002 in Port Wentworth, Georgia. The state of the battle against laurel wilt is in constant flux. Current recommendations are evolving rapidly as we gain more knowledge and funding becomes available for further research. Laurel wilt continues to advance and new strategies are necessary to lessen the economic blow of the continued loss of trees due to this disease. Methods currently being assessed for the future are varied and include the use of detector dogs and or drones to scout for the disease as well as a multitude of other viable options.

How to Make a Simple and Inexpensive Passive and Pressurized Infusion System for Systemically Applying Pest Control Substances to Fruit Trees. J. H. Crane, W. Montás, E. A. Evans and R. Olszack, Tropical Research and Education Center, UF [K-3].

Laurel wilt (*Raffaelea lauricola*; LW) is a lethal fungal pathogen that spreads by several ambrosia beetle species (e.g., *Xyleborus glabratus*) and through root grafts among adjacent avocado (*Persea americana*) trees. LW spread through root grafts among avocado trees has resulted in much more tree mortality than by beetle infestations. Research has demonstrated that control of LW requires applications of systemic fungicide by infusion prior to disease infection. However early cost analysis of infusion methodology indicated it may not cost effective to treat entire grove. The current disease control recommendation is to infuse healthy avocado trees only adjacent to trees infected with LW; these infected areas of a grove are termed hot spots. We borrowed design components from local producer and commercial tree service company systems in an effort to make less expensive but serviceable passive and pressurized infusion systems. Our infusion systems equipment cost six to eight times less than commercial systems. Recent cost analysis includes these less expensive systems, labor to apply fungicide, and fungicide material to control laurel wilt and suggests use of these infusion systems may be cost effective, especially when used to treat hot spots.

Conservation and Commercial Development of *Mangifera* Species (Wild Mangos) in Florida, USA. N. Ledesma, and R. Campbell, Fairchild Tropical Botanic Garden, Coral Gables [K-4].

In Southeast Asia there is a wide diversity of *Mangifera* species that bear edible fruit, with 69 taxonomically recognized (Kostermans and Bompard, 1993). Among these species, *Mangifera indica* is the most important commercial fruit crop, although *M. lalijiwa*, *M. odorata*, *M. caesia* and *M. foetida*, among others, are routinely cultivated or collected for sale from wild trees. Several *Mangifera* species have been collected and are under evaluation at Fairchild Tropical Botanic Garden in South Florida, FL, USA over the past 15 years. More than 33 accessions of *Mangifera* species from Borneo, peninsular Malaysia, Thailand, Hawaii, and Puerto Rico have been accessioned into the genetic collections of Fairchild Tropical Botanic Garden since 1994. *Mangifera caesia* (wani), *M. pentandra* (Assam poah), *M. griffithii* (ranca ranca), *M. laurina* (Mangga ayer), *M. quadrifida* (Assam kumbang), *M. rubrapetala* (raba), *M. casturi* (kastooree), *M. lalijiwa* (honey mango), *M. odorata* (kuini), *M. pajang* (pajang), *M. torquenda* (lamatan), *M. foetida* (bachang), and other possible *Mangifera* species are under evaluation. These wild edible mangos are in critical danger of extinction and represent an important resource for the future of

mangos. Data presented includes their adaptability to modern cultivation and potential as commercial crops.

Pomological and Chemical Characterization of Black Sapote (*Diospyros dygina*). T. A. Silva, USDA-ARS Subtropical Horticulture Research Station, Miami, H. Gubbuk, Department of Horticulture, Akdenis University, Antalya, Turkey, M. Winterstein, and A. Salas, Florida International University, Agroecology Program Department of Earth and Environment, Miami, FL [K-5]

The objective of this work was to establish physical and chemical characterization of black sapote fruits (*Diospyros dygina*). Samples of 30 fruits were characterized by evaluation of length and width, weight, color, percentage and number of seeds per fruit, peel percentage, pulp percentage, total soluble solids (TSS), titratable acidity (TA), pH and SS/TA ratio, fresh and dry weight. There were significant differences among seedlings. Black sapote fruit demonstrated very good physical and chemical qualities for market with an average of 60-65% pulp.

Application of Hydrogen Cyanamide to Increase Bloom Uniformity in Low-Chill Peaches. M. Olmstead, Horticultural Sciences Department, UF [K-6].

Hydrogen cyanamide is an important tool for growers of low-chill fruit crops in subtropical production regions. This chemical can help plants break dormancy to enhance the emergence of leaves shortly after bloom and fruit set. Leaf emergence is important for the production of sugars, structural carbohydrates and volatile flavor components in low-chill fruit that often have a compressed fruit developmental period. The objective of this preliminary study was to observe the application of two rates of hydrogen cyanamide (HC; Dormex[®]) on 'UFSun' and 'UFOne' peach varieties. Two rates were applied (2 or 3%; v/v + surfactant) in 'UFSun' while only 3% was applied in 'UFOne'. Controls were included in which no chemical was applied. HC was effective at increasing lateral budbreak in both peach varieties, and there was no difference between the 2 and 3% rate in 'UFSun'. Terminal budbreak was not affected in 'UFSun'; however application of HC did increase terminal budbreak in 'UFOne'. Neither variety exhibited phytotoxicity symptoms at either rate when applied 3-4 weeks before anticipated budbreak. This preliminary study has shown that when applied before bud swell, HC can improve terminal and lateral budbreak in low-chill peaches. However, timing of the application can do severe damage to flower and leaf buds and must be considered to avoid crop loss.

Results of a Taste-test Methodology Used to Compare 20 Fresh-market Muscadine Grape Cultivars to an Accepted Standard Cultivar, 'Fry'. J. Breman, Columbia County Extension, UF, P. Andersen, North Florida Research and Education Center-Quincy, UF, J. Jump, Columbia County Extension, UF, and A. Simonne, Family, Youth and Community Sciences, UF

Taste-test methodology using a standard in successive rounds of comparisons with other cultivars produced a relative ranking that might be helpful for selecting fresh-eating muscadine grape cultivars for production and consumer marketing. Twenty-one volunteers taste-tested a total of 20 muscadine grape cultivars compared to the standard 'Fry' in successive rounds of blind samples of 7, 7, and 6 cultivars August 21, 2012. Tasters rated cultivars as "much worse = -2", "worse = -1", "same = 0", "better = +1", "much better = +2" than 'Fry'. Taster responses

were summed to develop a relative rating of all cultivars. ‘Black Beauty’, ‘Sugargate’ and ‘Summit’ were rated first, second and third over ‘Fry’. ‘Darlene’ was rated equal to ‘Fry’. Fruit juice total soluble solids (TSS) was measured with a refractometer, reported as °Brix, juice total acidity (pH) was measured with a pH meter, and mean berry weight of 10 berries were measured August 22, 2012 from sub-samples of the tasted lots. Grape cultivar rating was positively correlated with TSS °Brix ($r = 0.86$). The correlation coefficients between panelist rating and acidity ($r = 0.46$) and berry weight ($r = 0.69$) were low. Factors other than TSS may influence taster preference for fresh-market muscadine grape cultivars.

Some Notable Characteristics of Seedless Muscadines Observed in FAMU's Grape Breeding. Z. Ren, S. Leong, J. Lu, and X. Xu, Center for Viticulture, Florida A&M University Tallahassee, FL [K-8].

Six seedless muscadine hybrids were obtained from the grape breeding programs in FAMU, all showed parthenocarpy seedless. The fruits were small, uniform in ripening, and may be harvested with clusters.

Effect of Floral Bud and Fruitlet Thinning on ‘Emerald’ Southern Highbush Blueberry. G. England, Lake County Extension, UF [K-9].

Producers of commercial southern highbush blueberries strive to harvest the majority of their crop in the first few weeks of the Florida harvest window, which generally runs from mid-March to the first week of May, to capitalize on the typically higher monetary return on early harvested fruit. A relatively high yielding cultivar named “Emerald” is planted on a majority of farms in central Florida. Due to the extended harvest period for “Emerald”, significant quantities of fruit are not ready for harvest at a time when prices are at the optimum. A study was initiated in December 2013 to determine if there is any effect on earliness and/or crop value associated with no thinning and thinning either tight floral buds, bloom or developing fruitlets. A hand held “Cinch” peach bloom thinner was utilized to thin approximately 30% of tight buds, bloom or developing fruitlets. Harvest will be conducted weekly to determine yield and compared with weekly reported USDA prices for economic comparison.

Effect of Pinebark Percentage on Herbicide Movement and Efficacy in Blueberry. P. Dittmar, Horticultural Sciences Department, UF [K-10].

Florida blueberry production uses pinebark beds and growers have begun to mix pinebark with native sandy soils to reduce the cost. The objectives of these studies is to establish weed control in soils with different percentages of pinebark and the movement of simazine through the soil profile. In the first study, pine bark mulch was mixed with 0, 20, 40, 60, and 80% pinebark in pots. Goosegrass (*Eleusine indica*) and redroot pigweed (*Amaranthus retroflexus*) were seeded and then simazine at 3.4 kg ha^{-1} was applied to the soil surface. Pine bark at 0 and 20% pinebark had lower goosegrass germination than 100% pinebark. Germination of redroot pigweed was similar to goosegrass. Current recommendations developed in fields with 100% pinebark are still important for fields mixing pinebark and soil at 80 to 100% pinebark. In the second study, 100% pinebark was placed in soil columns cut horizontally or vertically. Simazine at 2.3 kg ha^{-1} was applied over the soil surface and irrigated 2.54 cm day^{-1} for 4 weeks. At 4 weeks after

treatment, the sections of the column were separated and redroot pigweed was seeded. Using sections cut horizontally, pigweed emergence at 5.1 cm was the lowest. Of the vertically cut sections, pigweed emergence was lowest at 4.7 to 5.6 cm deep. Cutting the soil column either vertically or horizontally provided weed control at the same depth of 4.7 to 5.6 cm deep in the soil profile.

Molecular Characterization and In Silico Expression Analysis of a MYB Gene Family in Muscadinia Grapes (*Muscadinia rotundifolia*). L. Oglesby, A. Ananga, V. Giorgev, and V. M. Tsoleva, Center for Viticulture and Small Fruit Research, Florida A&M University. [K-11]

Anthocyanins are the major color pigments in plants. The color of red grapes is triggered by the release of anthocyanins from the skin of grape berries. Elucidating transcriptional regulatory networks in muscadine grapes is vital to understanding the molecular and biochemical processes in the flavonoid biosynthesis. To understand anthocyanin biosynthesis mechanism in muscadine grapes, the cDNAs encoding MybA1, MybA2, and MybA3 was isolated from cDNA libraries prepared from skin tissues of (*Muscadinia rotundifolia*). In this study, we have identified MybA1, MybA2, and MybA3 gene sequences from muscadine grapes and confirmed their putative MYB proteins. The putative homologues will also be assigned in *V. vinifera*, and *V. amurensis* based on the phylogenetic tree. Tissue-specific expression pattern analyses has been used to confirm the predicted homologues. Amino acid sequences of the cDNAs shows high homology to the sequences from related plants. Transcript expressions of MybA1, MybA2, and MybA3 genes are abundant in the red skins cultivars, confirming that these genes have major roles in determination of muscadine skin color. The outcome of this research will contribute to understanding of the color variation in muscadine grape berries, which is correlated with the evolutionary events occurring in the MYB gene family of grapes, but it will also strengthen functional genomic studies in North American native grapes.

Handling and Processing Section

Maintaining Quality and Safety of Blueberries by Natural and Non-residue Chemicals. [Xiuxiu Sun](mailto:xiuxiu.sun@ars.usda.gov) and K. Zhou, Department of Nutrition and Food Science, Wayne State University, Detroit, MI; J. Narciso, C. Ference, and J. Bai, USDA, ARS, US Horticultural Research Lab, Fort Pierce. (xiuxiu.sun@ars.usda.gov) (Jinhe.bai@ars.usda.gov) (Student Best Oral Presentation Competition Entry) [HP-1]

Blueberries are high-value fruit with strong antioxidant capacity and other health-promoting benefits. Controlled release chlorine dioxide (ClO₂) or chitosan coating plus different essential oils were applied to fresh blueberries to preserve their quality and safety during postharvest storage. *In vitro* studies revealed that six essential oils and ClO₂ gas inhibited the growth of food pathogen bacteria and fruit decay fungal pathogens. Controlled-release ClO₂ and three essential oils, carvacrol (CAR), cinnamaldehyde (CIN) and trans-cinnamaldehyde (ECIN) with high antimicrobial capacity were applied to blueberries *in vivo*, and the anti-microbial activity of each treatment was monitored during cold storage and at room temperature. Controlled-release ClO₂ and a combination of CAR, CIN or ECIN with chitosan coating effectively reduced microbial growth and slowed fruit softening. Our results suggest that controlled-release ClO₂ and chitosan

coatings containing essential oils are effective in extending the shelf life of fresh blueberries and other fruits.

Validation of *Enterococcus* spp. as Surrogate for *Salmonella* under Stagnant Dry Heating of Peanuts. Pardeepinder K. Brar and M.D. Danyluk, Citrus Research & Education Center, UF. (pbrar27@ufl.edu) (mddanyluk@ufl.edu) (Student Best Oral Presentation Competition Entry) [HP-2]

Enterococcus is used as a surrogate for *Salmonella* in thermal processing of almond. It is not validated as for use in peanut processing. Our objective was to evaluate *E. faecium* (ATCC 8459) or *E. faecalis* (ATCC 29212) as a surrogate for *Salmonella* during peanut thermal processing. Peanut kernels (unblanched, medium runner) were inoculated to ca. 7-8 log CFU/g, after drying to original % moisture and water activity (A_w), with nalidixic acid resistant strains of *S. Enteritidis* phage type (SEPT) 30, *S. Seftenberg*, *S. Tennessee*, *E. faecium* (ATCC 8459) or *E. faecalis* (ATCC 29212). Kernels (50 g) were exposed to dry stagnant heat at 120±1°C (20, 30, 40 min), 130±1°C (10, 20, 30 min) or 140±1°C (10, 20, 30 min) (n=6). Populations were enumerated on selective and non-selective media supplemented with nalidixic acid (50 µg/ml). Log reductions of *E. faecium* were significantly higher ($P < 0.05$) than SEPT30 (130°C: 30 min; 140°C: 10 min), *S. Seftenberg* (130°C: 30 min; 140°C: 10 min) and *S. Tennessee* (130°C: 30 min). Log reductions of *E. faecalis* were significantly higher ($P < 0.05$) than all *Salmonella* strains under almost all conditions. A log reduction exceeding 5 log CFU/g was only seen for *S. Tennessee* after 30 min at 140°C. Calculated D- and Z-values were highest for SEPT30; D-values: 15.2 min at 120°C, 11.3 min at 130°C, and 7.9 min at 140°C and z-value 70.4°C. *Enterococcus* does not appear to be a valid surrogate for *Salmonella* during thermal processing of peanuts under dry air conditions.

***Salmonella* Internalization Based on the Influence of Temperature Differential between Red Tomatoes and Postharvest Water.** Ashley N. Turner and M.D. Danyluk, Citrus Research & Education Center, UF. (an.turner12@gmail.com) (mddanyluk@ufl.edu) (Student Best Oral Presentation Competition Entry) [HP-3]

When warm tomatoes from the field are submerged into colder water, water may infiltrate the fruit pulp, allowing phyto- and foodborne pathogens to internalize; the potential for internalization into tomatoes at cooler pulp temperatures is unknown. Our objective was to evaluate *Salmonella* internalization into red tomatoes under various water temperature/pulp temperature differentials. Red tomatoes at 21°C were submerged into a 6 log CFU/ml *Salmonella* cocktail, at 26, 24, 21, 18, and 16°C (±5, ±3, and 0°C temperature differentials) for a maximum of 5 minutes. Tomatoes were then surface sterilized, blossom and stem scar ends removed, and cores excised. Core segments were cut into three pieces: an upper segment just below the stem scar (A), a middle segment (B), and a lower segment above the blossom end (C). *Salmonella* populations in each segment were enumerated by Most Probable Number (MPN) analysis following standard US Food and Drug Administration Bacterial Analytical Manual methods. *Salmonella* populations in each segment were analyzed using ANOVA. Differences were considered significant at $P \leq 0.05$. In segment A, *Salmonella* populations were highest at the -5 and -3°C temperature differentials following 300 seconds submersion, 0.5±0.2 and 0.5±1.0 log MPN/segment, respectively. No significant differences ($P \geq 0.5$) existed between *Salmonella*

populations in segment A between temperature differentials at any time interval tested. After 300 seconds, *Salmonella* populations were 0.48 and 0.43 log MPN/segment higher at -5 and -3°C temperature differentials than 5 and 3°C temperature differentials. *Salmonella* internalized into red tomatoes at 21°C at low levels at all temperature differentials tested.

Suppression of Volatile Production in Tomato Fruit Exposed to Chilling Temperature and Alleviation of Chilling Injury by a Pre-chilling Heat Treatment. Libin Wang, E. Baldwin, W. Zhao, A. Plotto, X. Sun, Z. Wang, and J. Bai, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce; J. Brecht, Horticultural Sciences Department, UF. (Libin.wang@ars.usda.gov) (Jinhe.bai@ars.usda.gov) (Student Best Oral Presentation Competition Entry) [HP-4]

Chilling exposure of tomatoes to 5°C for longer than 6-8 days can cause surface pitting, irregular (blotchy) color development and other symptoms of chilling injury (CI). The objectives for this study were to investigate whether a 4-day exposure of tomato fruit to chilling at the mature green stage of development would impact flavor quality after ripening, and if a pre-chilling heat treatment could alleviate the internal CI. Mature green 'FL 47' tomatoes were gassed with ethylene and then divided into the following four treatments: 1) heat treated in 52°C hot water for 5 min, then exposed to 5°C for 4 days before being transferred to 20°C, or 2) heat treated then placed directly at 20°C without chilling, 3) chilled at 5°C for 4 days then transferred to 20°C without prior heat treatment, and 4) untreated control. All samples were held at 20°C until ripened. Fruit were analyzed at the red-ripe stage for volatile components and submitted to a sensory panel for aroma evaluation. Results showed that chilling treatment generally suppressed production of aldehyde, alcohol, ketone, ester, sulfur, and terpene volatile compounds, including the following abundant and/or important volatiles: 2-methylbutanal, hexanal, benzaldehyde, 6-methyl-5-hepten-2-one, β -ionone, hexanol, and 2-isobutylthiazole. Heat treatment alone did not affect most volatile levels after ripening. Heat treatment prior to chilling exposure alleviated the reduction of the volatile compounds caused by chilling exposure, which agreed with the sensory panel results in that panelists preferred "heating + chilling" treated fruit over fruit that were chilled only.

Investigating the Range in Acceptability of Muscadine Varieties. Kelly Brown, C. Sims, A. Odabasi, Food Science and Human Nutrition Department, UF; D. Gray, Mid-Florida Research & Education Center, UF-IFAS; P. Conner, Horticulture Department, University of Georgia, Tifton, GA. (kellyebrown@ad.ufl.edu) (csims@ufl.edu) (Student Best Oral Presentation Competition Entry) [HP-5]

The objective of this research was to investigate the range in acceptability of muscadine grape (*Vitis rotundifolia*) cultivars and new breeding selections and to correlate overall liking to other quality measurements to determine the main drivers of liking of this unique grape. Twenty-two cultivars or breeding selections grown at the University of Georgia - Tifton Campus were tested. Each week, between four and six cultivars were harvested at optimum maturity and tested at the University of Florida. Four commercial grape cultivars from retail, (*Vitis vinifera* and 'Concord') were also tested for comparison purposes. A panel familiar with muscadine grapes used the hedonic general labeled magnitude scale (Hg-LMS) to rate overall liking, and the acceptability of appearance, flavor, pulp texture, and skin texture. Texture profile analysis and puncture testing

were done using a TA.XT plus Texture Analyzer to assess the texture characteristics. Other analyses included soluble solids, pH, and titratable acidity. The data were subjected to analysis of variance to determine differences between cultivars. Correlation and principal component analysis were used to identify relationships between sensory scores and the quality data. The factors observed to be highly correlated with overall liking scores were muscadine flavor liking ($R=0.94$) and muscadine pulp liking ($R=0.88$). A negative correlation ($R=-0.77$) was found between skin liking and skin strength. These experimental results can lead muscadine breeders to develop cultivars which have a more widespread appeal, thus expanding the fresh muscadine market and making a significant contribution to the agricultural economy of the state.

California Avocado in Florida? Finding the Perfect Avocado for Production in East-central Florida. Cristina Pisani and M.A. Ritenour, Indian River Research and Education Center, UF; E. Stover and A. Plotto, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce; O.A. Gutierrez, and D. Kuhn, USDA, ARS, Subtropical Horticulture Research, Miami. (cpisani@ufl.edu) (Ritenour@ufl.edu) (Student Best Oral Presentation Competition Entry) [HP-6]

Avocado (*Persea americana* Mill.) is a high-value fruit and most US consumption is imported. Cultivars with good fruit quality and horticultural traits may provide a useful alternative crop in east-central Florida to complement citrus production. A population of Hass x Bacon and Bacon x Hass was planted in Fort Pierce USDA-ARS for a genetic mapping study. Extensive phenotypic data on tree growth, fruit quality (fruit weight, seed weight, fruit size and diameter, oil content, number of fruits per tree, fruit dry weight, fruit and pulp firmness, and peel color), and disease resistance is being collected over the next three years. During our first year of data collection, we identified six selections with promising fruit quality and postharvest shelf life characteristics, and tested them in an informal taste panel with 10 judges using store-bought Hass as the standard. As part of the tasting, each panelist was asked to rank their top four favorites. The Hass standard ranked first or second in every panelist's ratings, but the new selections appeared likely to be commercially acceptable. Based on discussions with industry representatives, the top three selections will be included in replicated Indian River trials of cultivars and selections to identify superior performers in this region. Parameters for inclusion are a dark skin at maturity which hides blemishes, creamy texture and Hass-like flavor, good horticultural quality, and a pedigree which is predominately from Mexican and Guatemalan races to provide greater cold-hardiness and possibly greater tolerance to laurel wilt.

“Note by Note” Cooking: Can Raw Food Ingredients Be Replaced by Chemical Components? Elise Bourcier, AgroParisTech, Paris, France. (elise.bourcier@gmail.com) (Student Best Oral Presentation Competition Entry) [HP-7]

Molecular gastronomy is a new field in food science, which relies on the understanding of the mechanisms occurring during culinary processes, such as the effect of heat on the food matrix, the effect of formulation, and interactions between food components. “Note-by-note” cooking derived its concept from the knowledge of these mechanisms. Dishes are conceived and prepared using pure compounds as ingredients to produce all the characteristics of a traditionally cooked dish, having same odor, taste, color, shape, texture, trigeminal sensations and nutritional

properties. However, food composition is so complex that to reconstitute a food with pure chemicals remains somehow impractical. For example a “note by note” recipe of “mozzarella-tomato” exists, but the tomato portion is reconstituted from tomato powder instead of pectin, water, sugars, acids and volatiles. On the other hand, in that recipe, the mozzarella is made with whey, water, lactoserum, dehydrated yogurt, salt, iota carragenans, agar-agar and neutral oil. Likewise, in a “note by note orange soufflé”, an orange extract from orange peel oil is used to create the orange flavor instead of individual volatiles, and the “soufflé” part is made with dehydrated egg whites, water, sugar and salt. Hence, this new concept based on the work of chemists gives a new tool for culinary chefs to innovate. They can create traditional meals without the raw food ingredients, or they are free to innovate and produce uncommon associations of flavor and texture.

Taste Research: Chemical and Molecular Advancements. Smita Raithore and E. Baldwin, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce. (smita.raithore@ars.usda.gov) [HP-8]

In the past, flavor research has primarily focused on aroma volatiles as they were considered to be the major aspect of flavor. Taste is a relatively new and unknown area in flavor research. With the advent of liquid chromatography/mass spectrometry (LC/MS), it is now possible to understand the role of taste compounds in flavor perception. Similar to gas chromatography-olfactometry (GC-O), high performance liquid chromatography-gustation allows identification of compound(s) contributing to a particular taste stimulus. This involves fractionation and isolation of taste-active compounds with the help of various types of chromatography techniques, identification of the taste-active compounds by sensory panel and then elucidation of structure using LC/MS or Nuclear Magnetic Resonance (NMR). This technique allowed identification of many taste compounds in foods but does not answer the fundamental question of how taste is perceived. Advances in taste perception began with the landmark discovery of the first olfactory receptor in 1991 that encouraged taste researchers to investigate the molecular aspects of taste. Since then various taste receptors have been discovered that have widened our knowledge of taste perception.

High Incidence of Diplodia Infection Was Found in HLB Symptomatic Orange Fruit. Wei Zhao, J. Bai, G. McCollum and E.A. Baldwin, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce. (wei.zhao@ars.usda.gov) [HP-9]

Citrus huanglongbing (HLB) is one of the most devastating diseases of citrus that is caused by α -Proteobacteria *Candidatus Liberibacter*. *Diplodia natalensis* Pole-Evans is a fungal pathogen which has been known to cause a postharvest stem-end rot of citrus, the pathogen infects citrus fruit under the calyx, and the fruit decay typically occurs following harvest and is exacerbated by exposure to ethylene. There are no reports about any relationship between HLB disease and Diplodia infection. In this study, we report the finding of a high incidence of Diplodia infection in HLB-symptomatic citrus fruit. Diplodia DNA was initially identified in HLB-symptomatic fruit by cloning and sequencing analysis of the PCR products generated by a universal-fungal primer set that targets the 18S rRNA gene, and was then confirmed by another set of specific primers targeting Diplodia β -tubulin gene. Based on qPCR analysis, we found a significantly greater incidence of Diplodia in the columella of HLB-symptomatic fruit, harvested from HLB

symptomatic trees, than in non-symptomatic fruit, harvested from trees not symptomatic for HLB (70% and 5%, respectively). *Diplodia* infection was confirmed by morphology of conidia in isolates from the calyx abscission zone of HLB-symptomatic fruit. Decay rate assay was conducted using 150 non-symptomatic and 150 HLB-symptomatic orange fruit. And in agreement with qPCR results, two weeks following exposure to ethylene (10 ppm, 4 days) the incidence of stem end rot in HLB-symptomatic fruit (66.7%) was significantly greater than in non-symptomatic fruit (6.7%), indicating a much higher incidence of *Diplodia* infection in HLB-affected fruit.

Survival of *Salmonella* after Pesticide Application and Harvesting of Tomato Fruits During Screenhouse Production. Angela M. Valadez, Citrus Research and Education Center, UF; W. Lester, Hernando County Cooperative Extension Service, UF; Lawrence D. Goodridge, Department of Food Science and Agricultural Chemistry, McGill University, Montreal, Canada; and Michelle D. Danyluk, Citrus Research and Education Center, UF (mddanyluk@ufl.edu) [HP-10]

During produce production the edible portions of fruits and vegetables may become contaminated when contaminated water is used to mix foliar sprays. A screen house trial was conducted to assess the risk of spraying pesticides, known to support *Salmonella* survival in the lab, onto tomato plants. Rifampicin-resistant *Salmonella* Typhimurium LT-2 (ST; 10^7 CFU/ml) were inoculated into tomato pesticides (seven) diluted to the lowest recommended spray concentrations. Screenhouse grown mature green tomato fruits were sprayed and collected after 3, 7 and 10 days post-application. Five replicates were collected from each treatment; each replicate consisted of three tomatoes (n = 15 samples of three tomatoes per treatment per time point). Samples were processed within 1 h of collection. *Salmonella* populations were enumerated on rifampicin-supplemented selective and non-selective agars and enriched. ST populations fell below the limit of detection in Copper Count N within three days. There was no significant difference ($P > 0.05$) in *Salmonella* survival between groundwater and the other pesticides at day 0, 3 and 7. Enrichments were positive on day 10 for groundwater, Dimethoate, Penncozeb, Platinum, and Tanos. Populations ($1.4 \log$ CFU/ml) could be enumerated from tomatoes sprayed with Envoke at day 10. *Salmonella* can survive on tomatoes after being applied in groundwater and all but one of the foliar pesticides tested. *Salmonella* can survive on tomatoes following contact with contaminated foliar sprays.

When *Salmonella* isn't *Salmonella*: Misidentification by Rapid Testing Methods. Lawrence Goodridge, Department of Food Science and Agricultural Chemistry, McGill University, Montreal, Quebec, Canada. (Lawrence.goodridge@mcgill.ca) [HP-11]

Several recent large outbreaks of foodborne illness due to consumption of whole cantaloupes contaminated with *Listeria monocytogenes* in 2011 and *Salmonella* spp. in 2012 prompted the Food and Drug Administration to begin inspections and microbial sampling at a subset of cantaloupe packinghouses in the United States. The objective of the current study was to evaluate several commercially available test methods to determine their usefulness to rapidly determine the presence of foodborne pathogens in cantaloupe packinghouses. Environmental samples, water samples, and whole cantaloupes were tested for the presence of *Salmonella* spp. and *Listeria monocytogenes*, by enriching the samples and testing the enrichments using a

commercially available immunological based assay. Enrichment cultures of 17 of 48 samples (35%) tested positive for *Salmonella* using the commercially available assay. All of the enrichments that tested positive were plated on *Salmonella* spp. selective agar, and 71% of the enrichments yielded typical *Salmonella* colonies. Typical colonies were analyzed by real time PCR (RT-PCR) using a commercially available assay, and RT-PCR produced a positive result for 12 of the isolates. However, further molecular (Riboprinting, 16s rRNA sequencing) and biochemical characterization of these isolates identified them as *Proteus* spp. (10 isolates), and *Citrobacter freundii* (2 isolates). These results indicate that extreme care must be taken when using rapid testing methods to conduct environmental and cantaloupe testing for foodborne pathogens, especially *Salmonella* spp. The method of analysis must be carefully chosen and further confirmatory steps must be taken to ensure that the initial test results are valid.

Development of an Integrated System to Rinse, Sanitize and Cool Fresh-Market Strawberries. Drew F. Schiavone, S.A. Sargent and A.D. Berry, Horticultural Sciences Department, UF. (adberry@ufl.edu) [HP-12]

Late season (March 2012) strawberries were commercially harvested into hinged containers (clamshells) and evaluated for quality after cooling by either forced-air cooling or hydrocooling. Forced-air cooling was accomplished in commercial cooling tunnels (clamshells in corrugated cartons) for 60 min. For hydrocooling, individual clamshells were immersed for 15 min in an agitated, ice-water bath with chlorine (200 ppm), briefly drained, then placed in returnable plastic containers (RPCs). Cartons and RPCs were stacked on separate pallets and commercially stored for 14 d at 1 °C. Whole clamshell subsamples were graded on-site for fresh appearance after 7 and 14 d, and subsamples were transported to the Postharvest Horticulture Laboratory in Gainesville, FL where the fruit was stored overnight at 2 °C for subsequent evaluations. Pulp firmness, appearance, marketable berries, soluble solids content and titratable acidity were conducted on days 7+1 and 14+1. Following 7 d storage, fresh appearance of hydrocooled fruit was 3.8 % higher than forced-air-cooled; after 14 d hydrocooled fruit had 23.1% fresher appearance and significantly less decay than forced-air cooled fruit. Hydrocooled fruit were 12.0% and 30.1% firmer than forced-air cooled fruit on days 7 and 14, respectively. However, regardless of cooling method, fruit were considered commercially unmarketable after 14 d storage. After 7 d, combined treatment means were: SSC = 5.55 °Brix, TTA = 0.50 %, the Brix-acid ratio = 11.17 and pH = 3.77. These results indicate that hydrocooling had no detrimental effect on the fruit quality parameters measured and has the potential to better maintain quality during storage.

Correlations between Subjective Quality Evaluations and Quantitative Analysis of Fresh Fruits and Vegetables. M. Cecilia N. Nunes, Department of Cell Biology, Microbiology and Molecular Biology, University of South Florida, Tampa. (mariacecilia@usf.edu) [HP-13]

Subjective quality evaluations are often used to rate the appearance and texture of fresh fruits and vegetables (FFVs). Unlike formal sensory panels, they are usually performed by a single trained person. Although these evaluations are sometimes criticized as being inexact, in the absence of a formal sensory panel they are valuable to quality control, and to determine the ripeness stage or the end of shelf life. Color charts and rating scales have been developed for several FFVs but limited information is available regarding the correlation between subjective

evaluations and physicochemical attributes. The objective of this work was to correlate subjective quality data with quantitative analytical data collected for several FFVs. Avocados, blueberries, peppers, strawberries and tomatoes were exposed to a range of different temperatures and humidity conditions for varied periods of time, and quality evaluated using both rating scales and physicochemical analysis. Overall, there was a significant correlation between most of the subjective quality attributes evaluated and the physicochemical analysis performed. Subjective color was significantly correlated with hue angle except for blueberries and tomatoes for which subjective color had a stronger correlation with L* values. In strawberries, correlation between subjective color and anthocyanin content was also highly significant. Shriveling or stem freshness was strongly correlated with weight loss whereas subjective firmness was significantly correlated with instrumental texture. Results from this work showed that subjective quality evaluations of FFVs can be a reliable and simple method to estimate changes in color, softening, water loss, and ultimately changes in specific chemical components.

Postharvest Quality of Forced-Air Cooled or Hydrocooled Strawberry. Vanessa Caron, M. Carnelossi, S. Sargent and A. Berry. Horticultural Sciences Department, UF. (sasa@ufl.edu) [HP-14]

Strawberries are usually field-packed and are not treated with any sanitizer before storage and transportation. Forced-air cooling (FAC) is the current cooling method, which takes up to 2 h and can result in non-uniform fruit temperature. Hydrocooling (HC) has shown promise to improve sanitization while facilitating rapid cooling and uniform fruit temperature. This study aimed to identify the effects of cooling method on quality of late season strawberries during storage. Strawberries ('Albion') were commercially harvested into rigid, "clamshell" containers in early morning and 7/8-cooled in clamshells the same day by FAC or by immersion HC. FAC required 1 h, whereas HC with chlorine (200 ppm) required 10 min. Fruit were stored under simulated commercial conditions (7 d at 1°C, 7 d at 5°C, and 1 d at 20°C). However, after 7 d fruit from both treatments were rated as unmarketable, having "extremely poor" freshness and shriveled appearance ratings. Initial decay incidence (primarily fungal) was high (20%) and after 7 d and 14 d storage rose to 70% and 90%, respectively. Firmness of sound fruits for both treatments remained constant for 7 days; however after 14 d, HC fruit were 0.3 N firmer than FAC fruit. FAC fruit lost less weight (2% to 6%) than HC fruit throughout storage, although the latter were weighed with free water present. Anthocyanin content decreased during storage; after 7 d FAC fruit had >30% higher content than HC fruit.

Mango Fruit Aroma Volatile Production Following Quarantine Hot Water Treatment and Subsequent Ripening. Jeffrey K. Brecht and K. Cordasco; Horticultural Sciences Dept., UF. A.J. Lounds-Singleton, and S.A. Talcott, Food Science & Human Nutrition Department, UF; E.A. Baldwin, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce. (jkbrecht@ufl.edu) [HP-15]

Mangos are an important tropical fruit crop worldwide that are appreciated for their attractive peel and flesh colors, juicy texture, sweetness, and unique aroma. Mangos exported to the U.S. receive quarantine hot water treatment (QHWT) at 46.1 °C for 65 to 110 min (depending on fruit shape and size) to prevent fruit fly introduction. However, little is known about changes in fruit

aroma following QHWT. Therefore, we examined the aroma volatile production of ‘Tommy Atkins’ mangos after QHWT applied at typical commercial maturity stage (green externally with internal color change initiated) for 0, 70, 90 or 110 min. The QHWT duration required by APHIS for the mango fruit in this study is 90 min. The fruit were thus treated for the required time plus 20 min shorter and longer durations. Following QHWT, fruit aroma volatiles were evaluated within 2 h and after 4 days at 23 °C. Immediately after QHWT, there were higher levels of acetaldehyde and ethanol in heat-treated mangos and beta-pinene was higher after the 70- and 90-min QHWT. Limonene decreased and alpha-copaene was absent immediately after the 110-min treatment, and caryophyllene decreased with all QHWT durations. After 4 days at 23 °C, few QHWT effects on aroma volatiles persisted. Ethanol increased with the 110-min QHWT and alpha-copaene, which was very high in control fruit, was lower in heat-treated mangos. The results of this research suggest that the QHWT being applied to mangos imported into the U.S. probably does not significantly affect the aroma quality of those fruit.

Temperature and Relative Humidity Conditions During Transport of Commercial Gift Fruit Citrus Shipments. Mark A. Ritenour, Indian River Research and Education Center, UF, and P.D. Spyke, Arapaho Citrus Management, Inc., Fort Pierce. (Ritenour@ufl.edu) [HP-16]

To better understand the conditions that gift-fruit citrus experience during transport to various destinations within the U.S., two experiments were conducted during the 2013-14 season to evaluate fluctuations in temperature and relative humidity (RH) within cartons of fresh citrus gift-fruit sent via either the United States Postal Service (USPS) or FedEx. In both experiments, 10 dataloggers (HOBO U12) were used with both internal temperature/RH and an external temperature probe hidden in the recess of an outer seam, while the remaining dataloggers (HOBO UX100) did not have external probes. An evaluation sheet was included within each carton for receivers to indicate when the carton was received and to evaluate and comment on the fruit condition. The first study consisted of 18 half-bushel cartons sent to six different destinations (CO, MN, NY, PA, VA, and WA). The second study consisted of 22 half-bushel cartons sent to 11 different destinations (CA, CO, GA, MA, MN [2 cities], NY, PA, TX, WA, and VA). In most cases, fruit arrived in excellent condition, with only an occasional decayed or damaged fruit noted. Peel breakdown was also rare, but often seemed to be external defects (e.g., melanose) rather than actual peel breakdown. A few cartons shipped during the winter storms arrived with freeze injury. In general, temperature tended to fluctuate more in FedEx than in USPS shipments, with some being exposed to freezing conditions. RH was usually maintained between 90% and 100%, but tended to fluctuate more in FedEx shipments.

A New Clamshell to Decrease Moisture Loss and Extend Storage Life of Small Fruit. Jinhe Bai, E. Baldwin, A. Plotto, X. Sun, L. Wang, Z. Wang, J. Narciso, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce; and C. Seavert, Oregon State University, Corvallis, OR. (Jinhe.bai@ars.usda.gov) [HP-17]

To improve quality and extend storage life of small fruits and vegetables, a humidity efficient clamshell was designed for retail packaging. Quality attributes and shelf-life of lychee, sweet cherry, strawberry, blueberry, Chinese bayberry, and loquat fruits packaged in the new clamshells and commercial clamshells were compared during storage at 0, 5, 10 and/or 20 °C. Water loss of fruit in the new clamshells decreased by at least 62%, in comparison to commercial

clamshells at all storage temperatures. As a result, fruit in the new clamshells had less surface shriveling and flesh softening (cherry, strawberry and blueberry), stem (cherry) and calyx (strawberry) browning and drying, and pericarp browning (lychee). Oxygen and CO₂ concentration in both clamshells did not substantially change from the atmosphere, and there was no anaerobic metabolism in the packaged fruits. Blueberries inoculated with a fruit decay organism, *Colletotrichum acutatum*, or non-inoculated, were packaged in the clamshells and stored at 1 and 20 °C, and there was no difference in decay incidence despite the higher internal humidity caused by the reduced open areas. The new clamshell extended shelf-life of fruits by an average of 178% in comparison to commercial clamshells. The new prototype has been used to produce 15,000 one-pound clamshells for laboratory and commercial experiments. *(Some of the material discussed in this abstract and associated manuscript comprises the subject matter of a patent application currently pending with the US Patent and Trademark Office. If you are interested in licensing the technology described herein, please contact Dr. Jinhe Bai or Dr. Liz Baldwin. Dr. Bai or Dr. Baldwin can direct you to the appropriate US Department of Agriculture (USDA), Agricultural Research Service (ARS) personnel who can answer your questions and provide you with further information regarding licensing opportunities. In the event that either Dr. Bai or Dr. Baldwin is not immediately available, please contact the Technology Transfer Coordinator for the USDA-ARS South Atlantic Area Office in Athens, GA).*

Lipid-Based Edible Coatings Improved Shelf Life and Sensory Quality of White Bell Peppers (*Capsicum annuum* L.) without Affecting Ascorbic Acid Content. Amy H. Simonne, Department of Family, Youth and Community Sciences, UF; C.M. Moore and N.R. Green, Department of Nutrition and Food Science, Auburn University, Auburn, AL; E.H. Simonne, M.G.F. Chowdhury, and J. K. Brecht, Horticultural Sciences Department, UF; R.D. Hagenmaier, USDA, ARS, Citrus & Subtropical Products Laboratory, Winter Haven; F.M. Woods, Department of Horticulture, Auburn University, Auburn, AL; R.R. Eitenmiller, Department of Food Science and Technology, University of Georgia, Athens, GA. (asim@ufl.edu) [HP-18]

Areas in the world without stable power need postharvest techniques that increase shelf life without refrigeration. The effects of candelilla wax coatings were followed during postharvest ambient storage by measurement of color, water loss, levels of alcohol dehydrogenase (EC 1.1.1.1) and pyruvate decarboxylase (EC 4.1.1.1) enzymes and sensory evaluation. U.S. Fancy and No. 1 grade 'Dove' and 'Ivory' white bell peppers with no surface blemishes were washed and sanitized, then coated or not on the day of harvest with formulations containing 8%, 15.2% or 16% candelilla wax and stored for up to 21 days at 25 °C and 75%-80% relative humidity. Uncoated peppers lost 15% of their original weight during 12 days of storage; whereas, all the coated peppers only lost 5% of their original weight during the same period. Coatings delayed color change (yellowing), but did not significantly affect ascorbic acid content ($p > 0.05$). The coated peppers received higher scores from trained panelists (N=15) for firmness, color, glossiness, and overall preference. The concentration of candelilla wax in the coatings used here seemed to be adequate for gas exchange as determined by internal gas concentrations and the activities of alcohol dehydrogenase and pyruvate decarboxylase enzymes.

Effect of Edible Coatings to Preserve Physico-Chemical and Sensory Quality for Fresh and Cooked Zucchini Products. M. Teresa Blanco-Díaz and R. Font, Instituto de Investigación y Formación Agraria y Pesquera, Almería, Spain. A. Plotto, J. Bai, J. Narciso and E. A. Baldwin, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce. (liz.baldwin@ars.usda.gov) [HP-19]

This research studied different edible coatings for quality preservation of zucchini slices. In the first experiment, antioxidants including calcium ascorbate (CAA), cysteine (CYS) or ethanol (ET) in edible coatings made from chitosan (CHIT), chitosan + glucose (CHIT+GLUC), whey protein concentrate (WPC), soy protein isolate (SPI), carboxymethyl cellulose (CMC), hydroxypropyl methylcellulose (HPMC) and soy bean oil (SB) were tested for effects on appearance and weight loss of the zucchini slices stored at 6 °C and 20 °C. In a second experiment, the best coatings (CHIT, HPMC, SPI and SB including CAA+ET as antioxidants) were tested for effects on color of fresh-cut zucchini slices at two different storage temperatures (6 °C and 12 °C). The effectiveness of CHIT, SPI, with or without antioxidants, was observed and HPMC and SB were eliminated from further testing. The use of antioxidants contributed to higher L* values (lightness) and h°_{ab} (hue angle) while reducing b* values (yellowness-blueness) as an indication of less discoloration than for water-treated controls. Finally, selected coatings were tested in a third experiment monitoring firmness and sensory quality before and after boiling, steaming, griddling, frying and microwaving. The use of CAA+ET and SPI increased firmness of zucchini slices after boiling, and along with CHIT, preserved firmness after steaming. SPI and antioxidants promoted an increase in overall color and visual liking for fresh samples, while SPI increased zucchini flavor, general flavor and overall liking of boiled and steamed samples. Both SPI and CHIT increased color quality and visual liking for microwaved zucchini samples.

Low Ester Unpurified Citrus Pectin for Use as Suspension Stabilizers for Industrial Applications. Gary Luzio and R. Cameron, USDA, ARS, US Horticultural Research Laboratory, Fort Pierce. (gary.luzio@ars.usda.gov) [HP-20]

Citrus Section

Leaf Carbohydrate and Nutritional Responses to Stem Girdling and Drought Stress With Respect to Understanding HLB (Greening) Symptoms in Citrus Leaves. G. Cimo¹, R. LoBianco¹, P. Gonzalez², W. Bandaranayake² and E. Etxeberria² & J.P.Syvertsen^{2*}

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The most important problem in world citrus production is the bacterial disease Huanglongbing (HLB; greening) caused by a phloem-limited bacterium that is vectored by a phloem-feeding psyllid. The earliest visible symptoms of HLB in leaves are an asymmetrical chlorosis referred to as “blotchy mottle”, thought to be from starch accumulation from a phloem dysfunction and a decline in root health. We tested the hypothesis that such visible symptoms are not unique to HLB by stem-girdling two year-old seedling trees of two citrus rootstocks in the greenhouse. Girdling induced a 4-fold greater starch content in leaves on well-watered trees while starch content in woody roots of girdled trees decreased up to 19 fold relative to non-girdled trees. Drought stress induced some starch accumulation in non-girdled roots but there were no effects

of drought stress on root sucrose or starch in girdled trees. Girdling reduced leaf transpiration in well-watered trees. Leaves on girdled trees clearly had visible blotchy mottle symptoms but no visible symptoms developed on non-girdled trees. The up to 50% increase in leaf starch increased leaf DW per leaf area (LA) and consequently reduced many leaf nutrients on a leaf DW basis. Most of these differences disappeared when expressed on a LA basis. Leaf boron (B), however, was inversely related to leaf starch when both were expressed on a LA basis. In the absence of HLB, girdling increased leaf starch, decreased root starch, and duplicated the asymmetric blotchy mottled visual leaf symptoms that have been associated with HLB-infected trees.

Enzyme digestion of HLB-infected tissues: A better approach to study phloem anatomy.

Naveen Kumar, Ed Etxeberria, Craig Brodersen, Cody Narciso, University of Florida, IFAS, Citrus Research and education Center, Lake Alfred, FL [C-2].

Abstract. At anatomical level citrus greening (HLB; Huanglongbing) is characterized by excessive deposition of starch, p-proteins, and callose in phloem tissue of various plant parts. The presence of these polysaccharides and proteins often obstruct observations of key anatomical details of phloem tissue. In the present investigation, we evaluated the effect of carbohydrate and protein metabolizing enzymes on leaf tissue aimed at studying ultra-structural details of phloem which remain hidden in HLB-infected phloem tissue. HLB-affected ‘Valencia’ orange leaf samples were collected from the groves of CREC, Lake Alfred, Florida. Leaf petioles were detached, immediately stored in liquid nitrogen and transported to the laboratory. The petioles were kept in superchilled ethanol (100%) and stored in -20°C freezer for 2 days. Petiole samples were warmed to room temperature for 2 hr in distilled water and thereafter thoroughly washed. Samples were thin sectioned using a razor blade and again washed with distilled water. Petiole sections were incubated in combination and individually with 0.1% Proteinase K and 0.1% Amylase at various time intervals. After enzymatic treatments sections were washed with 100% ethanol, vacuum dried and prepared for scanning electron microscopy. Enzymatic treatments of samples revealed clear images of phloem tissue with visible pit fields on side walls, sieve tubes, and sieve plates. However, none of these structures were clearly visible in untreated HLB-affected petiole samples. The data fails to explain any possible lateral transmission of CLAs.

Seasonal Production of Phloem Tissue in HLB-Affected Trees. Craig Brodersen, Cody Narciso, Mary Reed, and Ed Etxeberria, Citrus Research and Education Center, UF [C-3].

A hallmark symptom of citrus Huanglongbing (a.k.a. HLB or Citrus Greening) is the progressive degeneration of the phloem tissue. Despite the apparent partial to total collapse of phloem elements in HLB-affected leaves and limbs, new vegetative growth continues to develop for several seasons. In fact, HLB-affected branches with evident HLB symptoms and seemingly obstructed phloem are capable of fruit production for some time. These observations suggest that, for undetermined periods of time, photoassimilate transport takes place in the older supporting and newly developed flush tissue. Here, we examined the phloem tissue of HLB-affected stems and of new flush on HLB-affected stems for several seasons. Our observations indicate that seasonal waves of cambial activity and phloem production, concurrent with vegetative flushes, are capable of temporarily alleviating phloem transport blockage caused by HLB-affected phloem tissue.

Root density and water uptake of trees infected with Huanglongbing. D. M. Kadyampakeni, K. T. Morgan, Southwest Florida Research and Education Center, UF and A. W. Schumann, Citrus Research and Education Center, UF [C-4].

Citrus production in Florida is the largest in the United States with a value of production of \$1.34 billion. However, the number of bearing trees has declined steadily by 30% in the past 10 years largely due to Huanglongbing (HLB, also known as Citrus greening) (*Candidatus Liberibacter asiaticus*) and Canker (*Xanthomonas axonopodis*) diseases. Huanglongbing has been shown to reduce limit root mass that could lower water and nutrient uptake. With such biological threats limiting citrus production, it is important evaluate root distribution and water use patterns in HLB infected trees to develop appropriate recommendations for optimizing production. Studies conducted on Florida Spodosols and Entisols showed that about 64% to 82% of the fibrous roots (< 0.04 inch diameter) of healthy trees were concentrated in the irrigated zones of drip- and microsprinkler-irrigated trees and the rest were found in the non-irrigated zones. The root densities (for roots < 0.02 inch diameter) of non-HLB affected trees at 0 – 6 inch soil depth at the Entisol site were 1.7 to 4-fold greater than the HLB affected trees at the Spodosol site in the irrigated and non-irrigated zones, respectively. Mixed results were observed in Spring 2011 where HLB affected trees under drip irrigation at the Spodosol site used 8-fold more water per unit canopy volume and 3.4-fold per unit leaf area than the smaller non-HLB affected trees at the Entisol site under the same irrigation system. However, similar water use patterns between HLB and non-HLB affected trees were observed in Summer 2011. The data show that HLB affected and non-HLB affected trees have similar irrigation water requirements as long as the trees have sufficient canopy and leaf mass.

Preliminary data on water uptake by Huanglongbing infected trees. D. M. Kadyampakeni, K. T. Morgan, Southwest Florida Research and Education Center, UF [C-5].

Understanding citrus water use and soil moisture distribution in Huanglongbing (HLB) (*Candidatus Liberibacter asiaticus*) infected and affected groves is critical for devising appropriate recommendations for optimizing water use and sustaining citrus yields. Thus, a study is being conducted to investigate water use patterns and soil moisture movement in central, west central and southwest Florida. Treatments being evaluated include: 1) IFAS recommended scheduling, 2) daily irrigation, and 3) irrigation scheduled half the number of days between irrigation recommended by IFAS. The irrigation amounts of the daily and intermediate irrigation schedule are reduced to provide similar amounts of water to the IFAS recommendation over long periods of time. Preliminary results indicate that water use per unit leaf area ranged from 0.09 to 0.9 oz·h⁻¹·inch⁻² at all sites depending on irrigation schedule. Moisture contents were similar among irrigation schedules varying between 5 to 20%, 1 to 14% and 5 to 25% at 6-, 12-, and 18-inch soil depths, increasing with depth possibly as a result of uptake in the top 12 inches. These preliminary findings should help in refining limits for available water contents and estimating irrigation demand estimations to sustain citrus productivity of HLB infected trees.

The Florida Citrus Soil Water Atmosphere Plant (SWAP) Project: Review and Final Summary of Yields and Tree Health. Leon Hartwell Allen^{1,*}, David V. Calvert², Mortimer Cohen², Robert R. Pelosi², James S. Rogers¹, and Ernest H. Stewart³, ¹USDA-ARS, CMAVE, Gainesville, FL, ²Indian River Research and Education Center, UF/IFAS, Ft. Pierce, FL, ³USDA-ARS at Indian River Research and Education Center, Fort Pierce, FL. (Hartwell.Allen@ars.usda.gov) [C-6]

The Florida Citrus Soil Water Atmosphere Plant (SWAP) Project at the UF-IFAS Indian River Research and Education Center had three blocks each of soil tillage (mixing) treatments of shallow tilled (ST), deep tilled (DT), and deep tilled plus lime (DTL) on a Spodosol (Oldsmar fine sandy loam). Each block had three adjacent submerged subsurface plastic drains and three adjacent open drains. Pineapple orange and Marsh grapefruit scions on six rootstocks were transplanted in November 1970. Yields are reported from 1973-74 to 1984-85 in 12-tree units by scion, rootstock, tillage treatment, and subsurface drain type. By the last harvest, cumulative yields of Pineapple orange were greatest for rootstocks of Rough lemon, Rangpur lime, and Cleopatra mandarin, immediate for Sour orange and Carrizo citrange, and least for *Poncirus trifoliata*. Ratings of the fifth annual survey of tree health were made in November 1984. Major trends were: (i) the number of healthy trees continued to decrease; (ii) the number of trees with citrus blight symptoms continued to increase, especially on Rough lemon rootstock; (iii) trees on the Cleopatra mandarin rootstock continued to be the healthiest; and (iv) Carrizo citrange and *Poncirus trifoliata* rootstocks showed the most chronic and recent water damage.

Decision-Support Program for Managing Citrus Fertigation. A.W. Schumann, University of Florida, IFAS, Citrus Research & Education Center, Lake Alfred, FL 33850 [C-7].

Fertigation, especially through drip equipment, remains one of the most efficient methods for delivering water and nutrients to citrus trees at the right place and time. Recent results from intensive daily fertigation or open hydroponic studies demonstrated that newly planted citrus blocks can be brought into production sooner and with higher yields in the first five years when using well managed daily fertigation than with conventional irrigation and granular fertilizer. Increasing numbers of growers expressed an interest to use advanced citrus fertigation in new plantings, but lacked the necessary toolkit to design and then to properly manage the new systems. Therefore a Windows® - based decision-support program (DSP) was developed to assist growers with citrus fertigation. The irrigation scheduling section of the program was based on transpiration estimates of trees according to their size, planting density, and the average daily evapotranspiration records at a given time and location, obtained from historical long-term FAWN databases. The fertigation schedule was intrinsically linked to the transpiration demand because soluble nutrient uptake is facilitated by and depends on the mass movement caused by the transpiration stream. Thus the same temporal patterns and tree size factors used to calculate daily irrigation requirements could be used to schedule frequent (including daily) fertigation applications. This approach produced a customized 12-month sigmoidal fertilizer application curve model which could be adjusted for expected yield and total annual nitrogen allocations by interactively adjusting the model parameters in a graphical display.

Growth, Health and *Liberibacter asiaticus* Titer for Diverse Citrus Scions on Mandarin vs. Trifoliolate Hybrid Rootstocks in a Field Planting with Severe Huanglongbing. Ed Stover and Greg McCollum, USDA/ARS, USHRL, 2001 S. Rock Rd., Ft. Pierce, FL [C-8].

USDA advanced citrus scion selections are routinely planted on multiple rootstocks, to assess potential incompatibility and to enhance field-survival of each selection. Such plantings were established at the Ft. Pierce farm from 2000-2004, with trees planted on both mandarin (Sun Chu Sha and Cleo) and trifoliolate hybrid (Swingle, Carrizo, US-812, US-852) rootstocks. This site is Nettles sand, has never been limed and is exclusively irrigated with shallow well water of neutral pH. Huanglongbing (HLB) was identified at this site in 2006 and has infected virtually the entire grove. This study was conducted to determine effects of rootstock type on tree growth, health and *Liberibacter asiaticus* (Las) titer. Tree height, width, trunk cross-sectional area, fruit number, overall health, and HLB symptoms were assessed in March 2014. Fifty four scion types were evaluated, each with one tree on Sun Chu Sha (SCS) and a second tree on a trifoliolate hybrid. Tree mortality was 30% on trifoliolate hybrid rootstocks and 15% on SCS. For surviving trees, HLB symptom severity was slightly but significantly greater on SCS as were all assessments of tree growth. Five scion genotypes were planted with multiple trees on each of four rootstocks (SCS, Cleo, Swingle, and Carrizo). Mortality was greater on trifoliolate hybrid rootstocks (9.5% on Swingle, 9.1% on Carrizo) than on mandarin rootstocks (4.8% Cleo, and 0% on SCS). Tree growth was greater on mandarin rootstocks. Data will be presented on Las titer in foliage and roots, as well as soil and water pH and bicarbonate levels.

Foliar Sprays of Delegate WG and Closer 240 SC with Adjuvants for Control of Asian Citrus Psyllid and Citrus Leafminer. Jawwad A. Qureshi, Barry Kostyk and Philip A. Stansly University of Florida/IFAS, Southwest Florida Research and Education Center, Immokalee, FL 34142 (email: jawwadq@ufl.edu) [C-9].

The Asian citrus psyllid (ACP) *Diaphorina citri* and citrus leafminer (CLM) *Phyllocnistis citrella* are key insect pests of citrus. ACP vectors *Candidatus Liberibacter asiaticus*, causal pathogen of Asian form of “huanglongbing” (HLB) or citrus greening disease and CLM facilitates spread of citrus canker. Both ACP and CLM need new flush for egg laying and development of immatures thus requiring almost simultaneous management. Delegate WG (active ingredient spinetoram) and Closer 240 SC (active ingredient sulfoxaflor) were evaluated at 4 oz/ac rate with six different adjuvants 435 Oil, Citrus Wrap, Diamond R, Dyne-Amic, Activator 90 and CitruFilm at 2% of the application volume. Foliar sprays using air blast speed sprayer were evaluated at a commercial grove near Labelle, FL (Hendry County) on 12-year-old *Citrus sinensis* (L.) Osbeck “Hamlin” orange trees producing new growth infested with ACP and CLM. Significant numbers of dead ACP nymphs compared to untreated control at 4 days after treatment (DAT) were observed in all treatments except Closer 240 SC + Activator 90. All treatments but especially Delegate WG provided significant suppression of live ACP nymphs compared to the untreated control through 28 DAT. ACP adults were significantly reduced in all treatments through 41 DAT, except for Closer + Diamond R or Activator 90 at 34 DAT. Effectiveness of Delegate WG or Closer 240 SC was not influenced by adjuvant type. Over all sampling dates, a significant effect of insecticide on ACP nymphs was observed in favor of Delegate WG, but not adjuvants. All Closer 240 SC treatments reduced CLM larvae through 8 DAT and all Delegate WG treatments through 28 DAT except Delegate WG + Activator 90 at 19

and 28 DAT and Delegate WG + Diamond R at 28 DAT. Treatment effects were more pronounced against ACP than CLM. No phytotoxicity was observed.

Metalized Polyethylene Mulch To Reduce Incidence Of Huanglongbing And Improve Growth Of New Citrus Plantings. Scott Croxton and Phil Stansly - South West Florida Research and Education Center UF/IFAS Immokalee, FL [C-10].

Polyethylene mulch was evaluated for deterring colonization by Asian citrus psyllid (ACP) *Diaphorina citri*, reducing incidence of Huanglongbing (HLB) or citrus greening disease and accelerating growth of young citrus. UV reflective low density polyethylene mulch metalized with aluminum, low density whitefaced polyethylene mulch and bare ground all using drip irrigation in a randomized complete block design were tested and compared to the current grower standard using micro-sprinkler irrigation with four replications located at the Southwest Florida Research and Education Center in Immokalee, FL. Populations of ACP and other arthropods were monitored on new flush while ACP movement was monitored using yellow sticky cards. Incidence of HLB was evaluated twice during the 20 month study period using qPCR. Trunk cross sectional area, soil moisture, and surrounding weed biomass were also monitored. Metalized mulch reduced pest populations and HLB incidence compared to all tested alternatives. In addition, metalized mulch increased tree growth and soil moisture while reducing weed pressure. Results of this study present a good case for the use of metalized plastic mulch for young citrus plantings.

Rapid in-field diagnosis of Huanglongbing disease using computer vision. Alireza Pourreza, Won Suk Lee, ABE, UF, and Ed Etxeberria, CREC, UF [C-11].

Citrus greening or Huanglongbing (HLB) is a very destructive disease which has had an undesirable impact on the quality and quantity of the citrus production in Florida during the past few years. No effective treatment has been reported for this disease yet; therefore, rapid diagnosis and removal of the HLB affected trees can protect the entire grove from further infection and help the Florida citrus growers with field strategies. One of the early symptoms of HLB is the accumulation of starch in HLB affected citrus leaves. As a result, uneven yellow blotch mottles pattern on the leaf surface appear. This symptom is highly analogous to some nutrient deficiency symptoms. Starch has a unique capability of rotating the polarization planar of light at a certain waveband. A computer vision approach was employed in this study to highlight the starch accumulation on citrus leaf and differentiate the HLB infection from nutrient deficiency symptoms. This system was tried under real in-field conditions for HLB positive, HLB negative, and zinc deficient samples. Two simple image descriptors including mean and standard deviation were extracted from the sample images and utilized in a step-by-step classification model. The results indicated that this method can identify HLB affected citrus leaves from healthy and zinc deficient samples with 97% accuracy.

Selection of a Suitable Method to Determine Boscalid Sensitivity in *Alternaria alternata*, the Causal Agent of Alternaria Brown Spot of Citrus. Vega, B. and Dewdney, M.M. Citrus Research and Education Center, Plant Pathology Department, UF, Lake Alfred, FL [C-12].

In Florida, the production of tangerines and tangerine hybrids relies on fungicide applications to control brown spot, caused by *Alternaria alternata*. The emergence of quinone outside inhibitor

(QoI) resistance in *Alternaria*-infecting tangerine populations, led to new fungicide registrations for disease control, such as the fungicide boscalid (succinate dehydrogenase inhibitor [SDHI]). Three media: complete medium (CM), minimal medium (MM) and potato dextrose agar (PDA) and four methods: mycelial growth inhibition, conidia germination, spiral-gradient endpoint dilution (SGEP), and resazurin-based microtiter (RZ) were evaluated to assess boscalid sensitivity using 16 isolates never exposed to the fungicide. CM agar and PDA supported the best mycelial growth rate and yielded lowest EC₅₀ (effective concentration to inhibit 50% growth) values by evaluating mycelial growth inhibition. The effect of boscalid on conidia germination was also tested using water agar-amended with fungicide. Boscalid was not able to inhibit conidia germination even at higher concentrations (>50 µg/ml). Finally, the effect of boscalid was evaluated using the SGEP method and the RZ assay. The mean EC₅₀ value obtained by the SGEP was significantly higher ($P < 0.001$) than that obtained by the RZ, but was not significantly different ($P > 0.05$) than that generated by the mycelial growth inhibition test. In conclusion, RZ was the best method to assess boscalid sensitivity, and it will be useful for monitoring fungicide sensitivity of *A. alternata* populations over time.

Plant Growth Regulator Tests to Reduce Preharvest Fruit Drop From Citrus Trees Affected With Huanglongbing. L. Gene Albrigo, University of Florida Citrus Research and Education Center, Lake Alfred, FL 33884 (albrigo@ufl.edu) [C-13]

Beginning with the 2012-13 citrus harvest season preharvest fruit drop significantly increased presumably due to the general spread of HLB throughout the citrus industry of Florida. Tests of several plant growth regulators were initiated in the fall of 2013 to determine if any treatment(s) would reduce the amount of preharvest fruit drop on several citrus cultivars. Citrus Fix (2, 4-D 1.3 oz ai/ac), PoMaxa (NAA 584 gm ai/ac) and ProGibb (GA 20 gm ai/ac) were applied in September and October (45 days apart) to ‘Pineapple’ orange, ‘Star Ruby’ grapefruit, ‘Murcott’ mandarin and ‘Valencia’ orange trees in 125 gal/ac. Drop % for control trees were 10.5 to 37.5. ProGibb plus Citrus Fix consistently reduced fruit drop from 20 to 29 %, which was an increase in crop of 2 to 10.5 % depending on cultivar. In another trial using S-ABA, Retain (AVG) as well as two formulations of ProGibb and ProGibb + Citrus Fix, the ProGibb treatments and ProGibb + Citrus Fix reduced preharvest fruit drop 27 to 29 % for actual increases in fruit retention of 3.1 to 6.7 %. Winter PGR application trials will also be reported on. In general it appears that the traditional application of GA or GA + 2, 4-D can reduce some of the excessive fruit drop associated with huanglongbing disease.

Citrus Undercover Production Systems: A New Environment for Disease and Cultural Management of Fresh Fruit. Barrett R. Gruber (bgruber@ufl.edu), B.J. Boman, IRREC, UF, A.W. Schumann, F.G. Gmitter, J.W. Grosser, CREC, UF [C-14].

Huanglongbing (HLB, “greening”) disease is associated with the bacterium *Candidatus Liberibacter asiaticus*, vectored by the Asian citrus psyllid (*Diaphorina citri*), and has led to yield reductions of Florida fresh citrus fruit in the past decade. Growing fresh citrus varieties within totally enclosed structures (Citrus Undercover Production Systems, CUPS) could potentially offer a sustainable route to significantly reduce the negative influences of HLB. A CUPS project was initiated in Fort Pierce in November, 2013. New ‘Ray Ruby’ grapefruit trees on Sour Orange and US-897 rootstocks were obtained from disease-free-certified commercial

nurseries. These young trees were planted within pole-and-cable, anti-insect screen enclosures (12,000 square feet each) at a high density (871 trees/acre). All trees are currently receiving drip fertigation to precisely control irrigation and nutrition delivery. As an additional experimental treatment, half of all trees inside the CUPS structures were planted within root-pruning 10 gallon pots to determine if container growing is capable of inducing early fruit cropping and limiting canopy vegetative growth. This is an on-going project and, to-date, no visible symptoms of HLB or *D. citri* individuals have been detected within the CUPS enclosures. Current weather observations also reveal that solar radiation, wind gust speed, and reference evapotranspiration rates are attenuated within the CUPS enclosures, compared to the non-covered, open-air control plots. These weather observations indicate that abiotic stresses and airborne disease pressure might also be mitigated by the screened CUPS enclosures.

Mechanical harvesting with and without CMNP – the Fort Basinger Experience. Fritz Roka, Bob Ebel, Barb Hyman, SWFREC, UF, and Tim Spann, California Avocado Commission, Irvine, CA. (fmroka@ufl.edu) [C-15].

A three year mechanical harvesting trial was initiated at the Lykes Citrus grove near Fort Basinger, Florida in May 2011. The trial tested the performance of continuous canopy shakers with and without abscission (CMNP) during four harvesting dates that spanned the “late-season” Valencia harvest period. The first harvest occurred in early May 2011 and three subsequent harvest dates followed in two week intervals through mid-June. Data were collected by tree row (between 60 and 90 trees per row) to allow the equipment to operate as it would during a commercial harvesting situation. During each harvest date, five treatments (two forward speeds, two shaking intensities, and hand harvest) were replicated twice. The same treatments were imposed on the same set of trees during 2012. In 2013, all 40 rows were harvested between May 14 and 17. Mechanical harvesters were used but without abscission. While fruit recovery data from the mechanical harvesters were collected, the primary purpose of the 2013 yield data was measure any yield effects that may have been caused by the treatments in 2011 and 2012. Regardless of harvesting treatments, trees harvested in early May generally yielded higher than trees whose harvest dates were delayed until mid-June. Trees treated with CMNP allowed mechanical harvesting equipment to achieve higher removal and fruit recovery percentages at lower shaking intensities. Negative yield effects were measured on mechanically harvested trees the second and third year after treatments were imposed, although migrated to some degree by CMNP.

Development of Harvesting Equipment Systems for Higher Density Citrus Grove Architectures. Tom Burks, Naji Aldisory, Bill Castle, Fritz Roka and Lee Jones [C-16].

In the 1990s, Florida had 845,000 acres of citrus and was competitive with Brazil. That number has since reduced to 473,000 acres due to hurricanes, canker eradication program, urban development, economic downturn, and finally the discovery and spread of Huanglongbing, which causes tree decline and death. Many of the factors affecting the Florida citrus industry concern other citrus producing states such as Texas, Arizona, and California. The national threat of HLB has set the stage for developing new approaches and technologies for citrus production and harvesting which secure a future means to thrive in the midst of various invasive diseases and pests. One approach being considered is Advanced Citrus Production and Harvesting

Systems (ACPHS) that use high density semi-dwarfed trees, and open hydroponics with optimized nutrient and water availability, which accelerates plant growth. Adopting ACPHS for citrus production could increase yield production per acre, while simultaneously shortening the time to return on investment, which means that grove life can be shortened by disease pressure and still remain viable economically. However, this new grove architecture presents new engineering problems for managing production and harvest of citrus groves. Since ACPHS has smaller trees planted at high density with limited operational area, existing machines are not suitable. When coupled with appropriate equipment technologies, ACPHS offers a way to overcome some of the challenges facing the citrus industry and may pave the way toward a new era of prosperity for the Florida and US citrus industry.

In this paper the authors introduce a new Over the Top Citrus Harvester (OTPCH) which has been specifically designed for high density semi-dwarf trees. This machine has unique features that will allow the machine to harvest trees as young as four years old, and adapt to the growing tree as it reaches maturity at approximately 8 ft tall and 8 ft wide. Proposed planting density for ACPHS trees of around 375 trees per acre yielding approximately 700 field boxes per acre may be harvested at speeds approaching 1.5 mph. Preliminary trials suggests that harvesting removal efficiencies of 94% or better can be achieved based on grapefruit harvesting trials. Future trials on ACPHS orange trees are planned for later in the spring of 2014 and may be available prior to publication.

The Status of Mechanical Harvesting. Jackie K. Burns, CREC, UF. (jkbu@ufl.edu) [C-17] - Cancelled

Can WashGard (carnauba wax adjuvant) applications deter phloem feeding insects on woody plants? Mahmut Dogramaci, Craig Campbell, Lance Osborne and Janet Narciso [C-18].

Ficus whitefly, *Singhiella simplex* (Singh), is a significant pest of ficus plants, especially weeping fig, *Ficus benjamina* L. Ficus whitefly is a new exotic pest established in several counties in Florida since 2007. The pest can cause complete ficus plant defoliation when left uncontrolled. WashGard is a plant based wax product. The main ingredient in WashGard, carnauba wax, has been widely applied as a polish, food preservative, and to reduce sunburn in apples. But over the past several years it has also been used as an adjuvant to increase the adherence of copper sprays to citrus tree leaves. The adjuvant prolongs the time that copper residue remains on the leaves thereby improving the management of citrus canker disease which is caused by the bacterium *Xanthomonas axonopodis*. Previous studies have shown that WashGard application could reduce piercing-sucking insect feeding such as Asian citrus psyllid, *Diaphorina citri* Kuwayama, the vector of citrus greening disease. In this study, we applied WashGard to potted ficus plants for management of ficus whitefly. The plants were treated with 3 and 10% WashGard plus 0.05 and 0.1% adjuvant (Tween 80) respectively. Both the treatments significantly reduced whitefly populations and plant foliar damage. Preliminary results indicate that WashGard application forms a wax layer on plant leaves that works as a physical barrier to phloem-feeding insects. We would like to test tank mixes of WashGard with insecticides that may enhance woody plant pest management such as reducing citrus canker disease and citrus psyllid feeding thus reducing citrus greening disease. Further studies are needed to quantify the effects of WashGard in controlling insect pests.

Overview of Bactericide Research Being Conducted on Citrus Greening. John Ramos, R.G. Shatters, Jr., and E. Stover, USDA, ARS, U. S. Horticultural Research Laboratory, Fort Pierce, FL. (Robert.Shatters@ARS.USDA.GOV) [C-19]

The Use of Laser to Enhance Penetration of Antimicrobials into *Citrus* Leaves
Ed Etxeberria, UF, Citrus Research and Education Center, Lake Alfred, FL 33850 [C-20].

The use of antimicrobials has become a major component of the ongoing efforts to curb or minimize the effects of Huanglongbing (or citrus greening). However, penetration of aqueous antimicrobial substances to citrus trees is hampered by the presence of a waxy cuticle covering green and fleshy parts, and by the presence of bark tissue on secondary tissues (such as mature stems). Microscopic laser light beams are capable of abrading the cuticle allowing the penetration of soluble aqueous substances into the leaf. Using fluorescent deoxy-glucose (a phloem mobile substance), we were able to demonstrate the rapid penetration into the leaf, and consequently into the phloem of the midveins and petiole. In this presentation, I will be discussing the laser-enhanced uptake of experimental control and antimicrobial substances into citrus leaves and their movement within potted trees.

Natural Resources Section

Status Check on Florida Agritourism, Who's Running the Show? M.E. Henry, Polk County Extension, UF [NR-1].

Florida agriculture treads on a unique cusp of benefiting from and competing with the state's number one industry, tourism. While many other Southeastern states have developed cohesive efforts to connect consumers to agriculture through agritourism, a strong relationship among statewide agritourism operations has yet to be developed in Florida. Although Florida has a strong government program to encourage statewide tourism, Visit Florida, the current status of agritourism promotion is highly dependent on local tourism boards or agencies. For example, while tourism agencies in north Florida have been working in this area for several years, other areas of the state lack support for agricultural operations willing to offer on farm agricultural experiences. Citrus fruit attracts visitors to stop at many independent businesses during their travels, yet visitors crossing the Florida-Georgia border are largely left to struggle through their own web-searches and good fortune to find agricultural operations offering on farm experiences. A review of statewide agritourism resources for consumers and agricultural operations is provided. Suggestions for future collaboration and program development are provided based on observations from agritourism departments in other Southeastern states.

Solar Energy Applications For Small Farms And Home Gardens. Edmund L. Thralls and Richard V. Tyson, UF/IFAS Extension Orange County, Orlando, FL [NR-2].

UF/IFAS Extension Orange County, Orlando, FL, maintains a 3 acre demonstration area called the Exploration Gardens containing 7 themed horticultural gardens. Among these is a quarter acre Small Farm and Home Demonstration Garden. Vegetable growing techniques for both commercial and home applications are on display including raised beds, grow boxes, floating raft,

vertical stacked, and nutrient flow technique (NFT) hydroponic systems, as well as square foot and container gardens. The vertical and NFT hydroponic systems require electricity to provide daily fertigation. The nearest electrical box is 700 feet away, so it was decided to add solar electric panels to power the recirculating pumps. The vertical stacked (Verti-Gro® and Hydro-Stacker™) systems receive intermittent fertigation requiring an alternating current (AC) timer, charge controller, inverter and battery. The recirculating NFT systems use direct current (DC) power with the solar panels connected to a DC marine bilge pump with only a small charge controller in between. The NFT system operates continuously during sunlight hours. These systems will be described in detail. One NFT system was placed over an aquaculture tank in an onsite greenhouse and is receiving water and supplemental nutrients from the fish tank. Results of heirloom tomato and mini-cucumber variety trials in the greenhouse NFT aquaponic system will be discussed. Solar power offers opportunities for growers to produce hydroponic vegetables “Off the Grid,” with easily applied setup and maintenance techniques and provides Extension Agents a resource for teaching renewable energy applications.

Preliminary Investigations on an Integrated Pest Management Scheme to Protect Barn Owls and Agricultural Workers from Invasive Africanized Honey Bees. Caroline A. Efstathion and William H. Kern, Dept. of Entomology and Nematology, Fort Lauderdale Research and Education Center, UF, and Richard N. Raid, Dept. of Plant Pathology, Everglades Research and Education Center, Belle Glade, UF [NR-4].

Since 1994, agricultural producers in the Everglades Agricultural Area of south Florida have participated in a University of Florida sponsored barn owl nesting box program, with the ultimate goal of environmentally-friendly, and sustainable rodent control. The combination of prime nesting sites and an abundant food supply has given rise to some of the highest barn owl densities in North America. For over a decade, the program existed without competition for the nesting boxes from other wildlife species. However, in recent years, Africanized honey bees (AHB) have presented a growing challenge to this desired rodent predator, frequently swarming and colonizing nesting boxes, as hives frequently reproduce by fission. Less selective than European honey bees when choosing a nest site, AHB also choose locations that can also pose dangers to agricultural workers, such as loading ramps, packing houses, pallet piles, culverts, and even tractors.

A push-pull integrated pest management protocol is presently being investigated to alleviate this safety hazard. The intent is to deter bees from inhabiting owl boxes by applying a bird-safe insecticide, permethrin, while simultaneously attracting them to pheromone-baited swarm traps. These swarm traps are highly visible and located eight feet off the ground, thereby reducing conflict with agricultural workers. The bee traps are monitored weekly and swarms are removed. The use of highly visible bee traps located off the ground will reduce the likelihood of workers being attacked by defensive bee colonies and could ultimately save human lives, as well as protecting this beneficial but threatened avian species.

Can Herbicide Usage be Reduced by Practicing IPM for Waterhyacinth (*Eichhornia crassipes*) Control? Lyn A Gettys, Samantha N Sardes and Carl J Della Torre III, Fort Lauderdale Research and Education Center, UF/IFAS, Philip W Tipping, USDA Invasive Plants Research Laboratory, Davie, FL [NR-5].

Waterhyacinth is the most intensively managed floating aquatic weed in Florida. It is usually managed with herbicides, most often with 2,4-D. More than \$3 million in public money is spent in Florida annually to manage floating aquatic weeds –including waterhyacinth and waterlettuce – in public waters, so even a small reduction in the amount of herbicide used for waterhyacinth management could represent significant long-term savings for Florida resource managers. Several biocontrol agents are utilized for waterhyacinth management in many countries with mixed results. The newest biocontrol agent for waterhyacinth is *Megamelus scutellaris*, which was first released in 2010 and is currently being evaluated on waterhyacinth in Florida. In these experiments we evaluated the impact of combining different rates of 2,4-D with biological control agents on waterhyacinth growth and development. We used a 3 x 2 factorial with 3 rates of 2,4-D (control, low rate, operational rate) and 2 levels of insect biocontrol (no insects, unrestricted attack by *Neochetina* sp. weevils and *Megamelus scutellaris*) in a RCBD with 5 blocks (replications). Plants were cultured for 3 months after 2,4-D treatments, then rated, harvested and analyzed to evaluate the combined and individual effects of insect biocontrol and herbicide rates on waterhyacinth growth and development. These experiments revealed that herbicide-treated plants without biocontrol insects recovered from 2,4-D damage, while herbicide-treated plants with biocontrol insects did not. These results suggest that it may be possible to reduce 2,4-D applications for waterhyacinth management if biocontrol insects are introduced to or present in the treatment area.

Evaluating the Efficacy of Aquatic Herbicides on Emergent *Rotala* (*Rotala rotundifolia*). Carl J Della Torre III, Lyn A Gettys and Samantha N Sardes – Fort Lauderdale Research and Education Center, UF/IFAS, (Student Best Oral Presentation Competition Entry) [NR-6]

Rotala (*Rotala rotundifolia*) is a relatively new invader of flood control canals in south Florida. *Rotala* is well-controlled by 2,4-D and triclopyr, but the long irrigation restrictions associated with these auxins preclude their use because many homeowners, growers and other stakeholders draw irrigation water from flood control canals. In this project we examined the effects of most products labeled for aquatic use on the emergent growth form of *rotala*. Modes of action included three auxins, seven enzyme inhibitors (two PPO, three ALS, one EPSPS and one HPPD) and one unclassified product. Herbicides were tested at maximum and half-maximum label rates; a silicone surfactant was included in all mixes. The auxins performed as expected and the EPSPS inhibitor glyphosate had little effect on *rotala*. The PPO inhibitor flumioxazin was more efficacious than the PPO inhibitor carfentrazone but provided only short-term control. The most effective ALS inhibitor was imazamox, which resulted in better control than penoxsulam and bispyribac-sodium. Plants exposed to fluridone (PDS) and topramezone (HPPD) showed early characteristic bleaching; some regrowth occurred but regrowth was lower in plants treated with 16 oz/acre of topramezone than with 7.7 oz/acre of fluridone. Further testing is planned to evaluate combinations and a wider range of rates in non-auxin products that performed well in these experiments.

ENGAGING HOMEOWNER ASSOCIATIONS TO REDUCE NUTRIENT RUNOFF IN STORMWATER PONDS. M. Atkinson, County Extension, UF; P. Monaghan, E. Ott, Agricultural Education and Communication, UF, G. Hansen, Environmental Horticulture, UF [NR-7]

Community stormwater ponds are important for water quality due to their ecological function, they also serve an aesthetic purpose and increase property value. Homeowners in communities desire a clean look to their stormwater ponds which demands pond managers to utilize short-term solutions like copper sulfate which could create long-term problems for water quality and pond health.

This project, through a community based social market approach, emphasizes that by helping to keep the ponds in good condition with preventive measures like Florida-Friendly Landscaping practices, homeowners are helping the environment and their own property investment. The techniques of social marketing include identifying specific target audiences for behavior change; key secondary audiences that influence behavior; deciding on behaviors to be promoted; reducing the barriers to change; determining the best ways to make change easy and enjoyable and finally, testing effective methods of promotion.

One goal of this project is to encourage homeowners to be more engaged in the health of their ponds, and creating a community advisory board is an excellent guide to doing that. The advisory board is involved with helping to develop strategies to increase homeowner engagement with pond health, helping design strategies to work with homeowners' associations for neighborhood ponds, and helping determine what type of shoreline plantings and buffer zones homeowners would be more receptive to being introduced in their neighborhoods.

Are Homeowners Willing to Pay a Price Premium for Environmentally Friendly Lawn Fertilizers? Hayk Khachatryan, Guzhen Zhou, and Michael Dukes [NR-8].

Urban sprawl in the past decades has substantially increased the area of maintained urban landscapes in the United States. In 2005, the area devoted to turfgrass was estimated at 40 million acres, which accounts for a quarter of the total urban area and a third of any irrigated cropland. Previous research discussed social and economic benefits associated with well-maintained residential lawns, mostly focusing on support for green ecosystems, community development, and real estate values. However, a host of research papers also pointed out improper landscaping practices, such as excessive fertilizer application, which may result in substantial negative impacts to the environment. This study will investigate homeowners' preferences for environmentally-friendly lawn care practices, specifically focusing on homeowners' choice of lawn fertilizers in Florida.

Using an online survey questionnaire, over 300 homeowners were asked to choose fertilizers from a number of hypothetical choice scenarios. Additionally, attitudinal and a standard set of socio-demographic variables were collected. Results from the mixed logit regression analysis showed that, on average, homeowners were willing to pay price premiums for fertilizers with controlled release nitrogen, phosphorus free, natural, organic, and "pet-friendly" attributes. Implications for relevant urban policies are discussed.

FERTILIZER AND IRRIGATION EDUCATION: MY BREVARD YARD FOR THE PROTECTION OF THE INDIAN RIVER LAGOON. M. LENHARDT, S. SCALERA, L. SEALS, UF/IFAS BREVARD COUNTY EXTENSION. (Lenhardt@ufl.edu) [NR-9]

The Indian River Lagoon contains the most diverse ecosystem in the continental United States. Years of nutrient loading from septic systems, fertilizers, and storm-water run-off have contributed to the IRL's impaired status. In Florida, landscapers are required to have a license to apply fertilizer and receive continuing education to keep their licenses valid. Homeowners that also apply fertilizer and irrigation require no such education or licensing. Realizing this need, UF/IFAS Brevard County Extension horticulture agents adapted the Green Industries Best Management Practices training to develop *My Brevard Yard*, a creative approach to teach homeowners how to apply fertilizer and irrigate their properties in an environmentally sound way. My Brevard Yard consists of a one hour classroom and 'hands-on' workshop plus an optional site visit. Collaboration with local municipalities helps promote the workshops in their local communities. Five My Brevard Yard workshops with 64 participants have been held. Pre and post tests indicated a 23.4% knowledge gain in topics such as proper walking speed for applying fertilizer, the recommended amount of slow release nitrogen for turfgrass, and the importance of using soil tests to develop a fertilization program. The My Brevard Yard workshops and site visits were designed to capture a variety of practice changes. These changes can range from applying the recommended amount of fertilizer, applying fertilizer at the correct time, and using proper irrigation practices. The adoption of various practices, multiplied by a large number of residences, can result in the improved health of the Indian River Lagoon.