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Book of Abstracts

The Genetic Diversity of Caladium Cultivars. *Photo Credits: Zhanao Deng, Terri Bates, Sandi Holmes, and Keri Druffel.*

Book of Abstracts

Prepared by Germán Sandoya Miranda and Mary Lamberts

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Florida State Horticultural Society since 1888

Posters

Presiding: **Anna Mészáros**

[P-1-ANR] Assisting Florida Sod Producers with Protecting Water Quality by Quantifying Nutrient Inputs and Exports

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Adherence to the Florida Department of Agriculture's (FDACS) Best Management Practices (BMP) program is crucial for sod producers to protect water quality. Challenges arise due to perceived low fertilization rates and accelerated production cycles, particularly in South Florida. Challenges are exacerbated by the nutrient export that occurs when harvested sod carries away soil-bound nutrients and residual fertilizer. The sod BMP manual is undergoing revision, with a proposed emphasis on achieving a nutrient balance of nitrogen (N) and phosphorus (P) inputs/exports in sod operations. However, current published data on nutrient export needs to be more comprehensive, necessitating research efforts to fill this knowledge gap. This project, funded by a 2022-2023 FDACS BMP grant, aims to educate and improve sod producer BMPs by assessing current practices and quantifying nutrient inputs/exports through sod slab analysis. A Qualtrics survey was designed to measure sod producers' current BMP practices. Visits to sod farms were employed to collect sod slab samples for nutrient inputs/exports data processing. Results, particularly regarding N and P export, revealed variability across turfgrass species, highlighting the need for further research to determine nutrient sinks and explore the influence of soil depth on nutrient export during harvest. The project's future focus involves providing targeted training based on results to Florida sod producers and exploring additional funding opportunities to address remaining key questions. Results of this project will improve nutrient management inputs/exports budgeting by sod producers and facilitate adoption of practices that improve nutrient management for sod production statewide.

[P-2-ANR] Nitrogen Uptake Efficiency of Daikon Radish on Sandy Soils in Greenhouse Conditions: An Evaluation

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Cover crops can enhance soil health and nutrient cycling in agricultural systems. They offer many benefits, including the ability to recover residual nutrients. This is particularly important in areas like Florida, where sandy soils have low organic matter and are prone to nutrient leaching. This study aimed to investigate the nitrogen uptake, partitioning, and accumulation of daikon radish (*Raphanus sativus* var. *Longipinnatus*) in Florida conditions over a short period. In this experiment, two Florida sandy soils were planted with daikon radish and treated with three N rates (0, 50, and 101 kg N ha^{-1} as urea) in a randomized complete block with four replications. The findings revealed that increasing the amount of N fertilizer applied did not result in higher biomass production or more N accumulation in the shoots and roots of the plants. These preliminary results show that daikon radish plants grown without N fertilization could produce a similar amount of biomass as those with N applications in their early growth stage. This suggests that daikon

radish has the potential to adapt to the sandy soil conditions prevalent in Florida and could efficiently extract and utilize the residual N present in the soil in areas such as the row-middle of citrus.

[P-3-ANR] Floridians' Residential Fertilizer Behaviors, Practices, and Ordinance Awareness

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Floridians fertilize their landscapes with the goal of achieving green, healthy, and beautiful lawns. More than 100 Florida counties and municipalities have ordinances regulating residential fertilizer application to certain times of the year; these restrictions often vary by area. Researchers at the University of Florida conducted a statewide survey of 900 Floridians to assess their behaviors and practices surrounding residential fertilizer application and to gauge their awareness of and adherence to residential fertilizer ordinances. This study aims to identify knowledge gaps concerning residential fertilizer and local ordinances across Florida. Preliminary findings reveal uncertainty regarding ordinance awareness. Sixty percent of respondents were unsure if their area had residential fertilizer restrictions. Forty-two percent reported they would support the adoption of an ordinance that would limit residential fertilizer application. Other components of the survey addressed residents' landscape condition, lawncare practices, fertilizer use, attitudes towards fertilizer best practices, future fertilizer application intention, and engagement with Extension and other methods of information seeking. Results from this study will inform the creation of educational materials, such as a toolkit, with visually appealing fact sheets, social media graphics, and presentation slide sets. These materials will be available for public distribution to facilitate understanding regarding fertilizer use and regulations.

[P-4-ANR] Seed treatments increase germination rate in American beautyberry (*Callicarpa americana*).

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The American beautyberry (*Callicarpa americana*) is a flowering shrub endemic to the Southeastern United States and its bright purple berries are a great food source for wildlife. Native gardeners use it in landscaping therefore finding better propagation methods would assist their horticultural needs. Previous studies found that mechanical scarification of seeds by blending increased the germination rate of beauty berry in Florida. In this study additional treatments with sulfuric acid and hydrochloric acid were investigated. Over 4000 seeds were collected by hand-picking seeds from fruits (un-scarified) or by blending fruits which also provides mechanical scarification. Both mechanically scarified and un-scarified seeds were further treated with sulfuric acid. In a final test designed to mimic bird digestion, about 600 fruits were heated with hydrochloric acid in combination with pepsin. After treatments, seeds and fruits were planted in germination trays and left outside in the shade to germinate. Seeds began emerging from the soil at about 30 days post-planting. Preliminary data suggest that sulfuric acid treatments increased germination. If significant differences among treatments are found, this data could be useful to horticulturalists, as a significant increase in rate of germination due to a particular treatment could save time, money, and space.

[P-5-ANR] Utilizing Florida-Friendly Landscaping to Revitalize a Neighborhood Learning Garden in an Underserved Community

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In every aspect of this program Florida-Friendly Landscaping (FFL) principles are used as the framework to think about and implement solutions. We used FFL to rejuvenate a neighborhood learning garden situated in an underserved community. The project aimed to transform the garden into an educational hub that promotes sustainable gardening practices and environmental stewardship. The plant selection, watering practices, fertilization, and pest control are all governed under this management theory. Results indicate significant improvements in plant diversity, soil health, and aesthetic appeal following the adoption of FFL techniques. Community engagement, empowerment, and increased knowledge of sustainable landscaping practices are key outcomes of the revitalization initiative. The study underscores the potential of FFL as a tool for enhancing green spaces in underserved communities while promoting environmental education and community resilience. Recommendations are provided for scaling up similar initiatives and fostering partnerships between stakeholders to sustain long-term impact.

[P-6-ANR] Pheno Cam: A Camera Based Remote Sensing Method to Measure Phenology in Florida

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Remote sensing by camera has become a popular method to collect data from a variety of situations. Hunters use remote cameras to assess whether animals of interest are in the viewing area of the camera and property owners use remote cameras to monitor wanted and unwanted activity on his/her property. These cameras, commonly called trap cameras, also have utility in agricultural and natural resource settings where the same camera can be referred to as a pheno cam when used to collect and measure phenological data. Camera brand and features determine the cost of a remote sensing camera, but low-cost and reliable methods to collect photographic evidence of phenological change are currently available. The most important camera features for this project include the ability to: use sunlight to offset battery charge, change the frequency of picture collection, turn on/off features remotely, observe photos via an app, easily transfer data from the camera to a computer, and withstand harsh environmental conditions. This poster details the initial establishment of a pheno cam to measure cover crop growth for two species (*Avena sativa*, specifically Oat 'FL-5'; and *Secale cereale*, specifically Rye 'FL-405') that were included in a cover crop variety trial conducted at the North Florida Regional Education Center in Live Oak, FL in 2023-2024.

[P-7-C] Effects of oxytetracycline trunk injections on tree health of different HLB-affected citrus accessions.

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The citrus industry across the globe, including Florida, has been severely affected by the citrus greening disease (Huanglongbing, HLB), which is associated with the bacterium *Candidatus* Liberibacter asiaticus (*C*Las). While no single method has been found to completely control *C*Las, ways to mitigate its effects on citrus trees have been increasingly studied. One recent management method that has been attracting attention is oxytetracycline (OTC) trunk injections, but a limited number of cultivars have been studied, mainly focusing on the sweet oranges 'Valencia' and 'Hamlin'. The limited cultivars injected that are closely genetically related may cause differences in the effectiveness of treatment. There is a gap in knowledge about how OTC treatments affect cultivars with diverse genetic backgrounds. The aim of this study was to investigate the effects of OTC trunk injections on tree health of various United States Department of Agriculture developed citrus accessions. A completely randomized experimental design comprising 10-year-old mandarin, grapefruit, and sweet orange-like cultivars grafted on 'US-942' and 'US-812' rootstocks was used to study OTC trunk injection rates applied once a year at the recommended label concentrations (n = 21). Similarly, trees from the same cultivars grafted on the same rootstocks not receiving any injections were used as controls (n = 21). Throughout the experiment, tree health components were analyzed for any changes. Measurements included: canopy dimensions, leaf *C*Las titer, fruit size, drop and harvest count, and OTC residue in leaves. The results are helping researchers to utilize OTC trunk injections more effectively.

[P-8-C] Study of variety and rootstock effect on the incidence of *Delotococcus aberiae* in citrus plants in Castellon (Spain), using remote sensing data.

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The citrus industry in Spain is currently in a critical state due to the emergence of a new pest, *Delotococcus aberiae*. This mealybug is causing significant financial losses to the sector, and its complex management is placing the Spanish citrus industry in a precarious situation. The urgency of the situation underscores the importance of our study, which aims to develop a methodology to model the presence of the pest and study its incidence and effect on the crop over cultivars and rootstocks. The study was conducted in Castellón, Spain, analyzing a total citrus area of 100 hectares from 2020 to 2021. The farms chosen for the study were selected based on the impact of pests, with 47 hectares of healthy plants and 53 hectares of unhealthy. Citrus varieties studied were classified in early and late harvest and rootstock in *Citrumelo* and others. We conducted an analysis of the reflectance of spectral bands B4 and B8 (Sentinel-2), as well as the NDVI and RVI indices. Reflectance in the B4 and B8 increased from the beginning to the middle of the season but decreased from mid to the end of the season. The results confirm that the unhealthy citrus plants did not show differences in reflectance between plants onto *Citrumelo* rootstock and others. The reflectance of the unhealthy citrus plants was different between cultivars of early and late harvest, showing more vigor and greenness in unhealthy plants of the early than late harvest. Remote sensing could allow identifying the best behavior of the unhealthy cultivars according to the ripening season.

[P-9-C] Effect of Potassium Silicate on Performance and Growth of Mature Citrus Trees

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This study investigates the interactive effects of potassium silicate (Si) and phosphorus (P) on orange trees to determine the optimal Si-P ratio for enhancing tree growth and fruit quality. The study is conducted on Candler fine sand using an orange variety Valencia grafted on swingle rootstock. This variety was planted in February 2013. Treatments consist of three rates of Si (0.003, 0.005, 0.008 kg/ha) and two P rates (11.2 and 22.41 kg/ha), were applied from October 2022 to February 2024. Using a completely randomized block design, the experiment comprised 28 plots with 10 trees per plot with the central six trees within each plot for measurements. Measured variables encompassed soil and leaf Si and P concentration. Additionally, canopy size measurements and trunk diameter assessments, were performed semi-annually and fruit yield evaluations annually. Fruit quality was determined by examining total soluble solids (TSS) and acidity levels. Early results suggest moderate differences in leaf Si content between treatments and interactions between Si and other elements in the soil, such as Mg. This provides valuable insights on the effect of Si for the cultivation of orange trees and the enhancement of fruit production.

[P-10-C] Endophytic Potential of *Beauveria bassiana* in 'Valencia' Sweet Orange Trees Grafted on US-942 Rootstock

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Beauveria bassiana is an entomopathogenic fungus that is used as a biological pesticide for the control of citrus pests. The aim of this study was to assess tje potential endophytism of *B. bassiana* in citrus via single application to the foliage . 'Valencia' sweet orange trees (*Citrus* × *sinensis)* grafted on 'US-942' (*Citrus reticulata* × *Poncirus trifoliata*) were established under greenhouse conditions and assigned to a randomized block design replicated in two different

greenhouses. The treatment groups (n = 16) were sprayed asynchronously with *B. bassiana* at 10^7 spores/ml and the control groups (n = 16) with deionized water. To evaluate endophytism over time, a series of cohorts were destructively sampled and analyzed every two months. Sterile samples of plant organs (leaves, stems, roots) were placed onto potato dextrose agar in Petri dishes amended with a selective fungicide (PDA-dodine), and bactericides to determine the characteristics of *B. bassiana*. Plant height, stem diameter, and biomass were quantified from the cohorts to assess potential mutualistic effects. Results included: The foliage collected from the cohorts were stained with trypan blue and analyzed using differential interference contrast microscopy for detection of the endophyte within the intercellular spaces of the cells. Spore deposition was analyzed by pinning plastic coverslips onto the plants for each treatment and assessed using light microscopy. To analyze treatment coverage, foliage was collected from each treatment plant and pressed into PDA-dodine agar to quantify the number of colony forming units/leaf surface area. Surface area of the leaves was analyzed using Image J-Fiji™.

[P-11-C] Short-term effects of cover crops on soil properties and green house gas emissions on citrus production in Florida.

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Cover crops (CCs) have been reported as a sustainable management strategy to improve soil nutrient availability for citrus production. However limited information is available on the influence of CCs on soil nutrient cycling and greenhouse gas emissions (GHG). We examined the effect of replacing the traditional row middle of a commercial citrus grove in Florida with five different types of CCs: Cowpeas (CP), Oat (O), Sunn Hemp (SH), Sorghum Sudan grass (SS) and a mixture of Cowpeas/Sorghum Sudan grass (CP+SS). A grower standard was used as a control (C). After one year of CCs, the use of CCs significantly increased soil P, Ca, Mg, Cu, Fe, and organic matter (OM) availability in the row middles compared to C ($p<0.05$). For instance, results showed 260%, 100%, 172% and 216% increase in Ca concentration for SS, SH, O and CP, respectively. Treatment with CP results also showed increases in the soil Mn, B, and S content by 125%, 114% and 50%, respectively compared to C. The best CC treatment to improve soil nutrient availability was CP which improved P, Mg, Cu, Fe and OM by 52%, 199%, 152%, 21% and 25%, respectively. The results indicated no impact on soil respiration of methane (CH_4) and carbon dioxide (CO_2) for the CC treatments in the row middle compared to the C. Overall, our data suggest that CCs can enhance soil nutrient cycling, nutrient availability and soil respiration in the row middles compared to the C in Florida citrus groves after only one year of CC treatments.

[P-12-C] Nursery Characteristics and Field Performance of Novel Citrus Rootstocks

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The devastating effects of Huanglongbing (HLB) have negatively impacted the Florida citrus industry for almost 20 years, and growers need solutions. The rootstock is known to significantly influence tree tolerance to HLB, and there is an urgency to have rootstock cultivars that are more tolerant to the disease and impart superior horticultural traits to the grafted scion. This study evaluates nine novel citrus rootstocks for their nursery characteristics and field performance to identify those that most enhance yield, fruit quality, and disease tolerance under HLB-endemic growing conditions. In the nursery part of this study, seed germination, seedling survival, and the propensity for producing genetically uniform (true-to type) plants were assessed. The genetic uniformity was assessed by morphological characterization and SSR marker analysis. Concurrently, a field evaluation was conducted with 'Valencia' as the scion. Two additional rootstocks, sour orange, and Swingle were included as rootstock standards. Preliminary results from the nursery assessment showed germination rates of 44-99%, but most of the rootstocks appear to produce predominantly zygotic (not true-to-type) seedlings and would need to be propagated by cuttings or micropropagation. In the field study, US-1688 induced the highest yield and US-2132 induced the best juice quality during the 2022-2023 production season. US-1688 was recently released as SuperSour 4 and continues to be among

the best performing rootstocks. This study provides comprehensive insights and elucidates the promising potential of these novel rootstocks to meet the current challenges faced by the citrus industry, merging nursery characteristics with superior field performance and productivity.

[P-13-C] Fine-tuning zinc and potassium treatments to increase yield in sweet orange

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Huanglongbing (HLB), associated with the bacteria *Candidatus* Liberibacter asiaticus (CLas) and spread by the Asian citrus psyllid in Florida, disrupts hormonal pathways, leading to premature abscission, exacerbated preharvest fruit drop and decreased yield in citrus. Zinc (Zn) and potassium (K) are essential for plant growth and auxin homeostasis, which is key for fruit retention. This study aimed to determine the optimal timing for Zn and K applications to maximize fruit retention in HLB-affected citrus trees. Field studies were conducted in Hendry County, Florida, starting in fall 2023, using Valencia and Hamlin sweet oranges (*Citrus sinensis*) grafted onto Swingle citrumelo rootstock. The experimental design was a randomized complete block design (RCBD) with four timing applications and four treatments: control, Zn sulfate, K sulfate, and a combination of Zn and K. Data were collected on growth, fruit/juice quality, yield, force detachment and fruit drop. Both Hamlin and Valencia trees showed similar responses to all treatments, and the response was dependent on the time of application, suggesting that fruit developmental or maturation stage determines the response to the treatment. Initial results suggest that the optimal time for nutrient application may be one month before harvest. The physiological implications of this observation will be discussed.

[P-14-C] Methyl salicylate and gibberellic acid for the rehabilitation of HLB- affected sweet oranges.

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Huanglongbing (HLB), also known as citrus greening disease, is a serious bacterial disease affecting citrus trees. It is presumed to be caused by the bacterium *Candidatus* Liberibacter asiaticus and is primarily spread by the insect called Asian citrus psyllid. HLB, poses a significant threat to Florida's citrus industry, affecting over 90% of citrus acreage. Despite ongoing efforts, no citrus germplasm has shown resistance against HLB. As there is currently no solution for HLB, growers are heavily relying on grove management practices such as better plant nutrition and irrigation, application of exogenous plant growth regulators (PGRs), and antibiotic trunk injections. Methylsalicylate (MeSA) is the compound which transports in phloem and trigger the systemic acquired resistance (SAR) in plants. On the other hand, gibberellic acid is the classical plant hormone that is known to promote growth in HLB-affected citrus trees. This research focuses on managing Huanglongbing by pairing SAR inducing MeSA with growth promoting GA to enhance growth of HLB-affected trees. However, the exact mechanism of how salicylic acid and gibberellic acid contributes to plant defense response remains a significant gap in our understanding. Addressing this knowledge gap is important for a more comprehensive understanding of the role of PGRs in plant defense mechanisms. The differential gene expression results revealed that the transcript level of Rboh was significantly higher in the older leaves of control at day 7 which might be due to oxidative stress response among the treatments. Whereas the gene expression of LOX2 upregulated in the older leaves of control at day 14. In contrast, the leaves of MeSa trees had significantly higher CDR1 compared with other treatments on day 30 and day 45 which is likely due to the activation of SA signaling and the subsequent induction of SAR. Preliminary results that use of GA and GA + MeSA resulted in significant reduction in preharvest fruit drop. Although, fruit number, fruit size, TSS/TA, total yield (lbs) and yield efficiency showed no significant difference in treatments. Furthermore, the leaf and fruit attributes will be analyzed to have a more comprehensive understanding of these treatments.

[P-15-HP] Modified hydrocooling and optimized postharvest handling practices can improve the shelf life of water spinach during summer in humid subtropical regions.

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In an effort to improve the shelf life of water spinach (*Ipomoea aquatica* Forsk.) and amaranth (*Amaranthus tricolor* L.) during summer in humid subtropical regions like northern Taiwan, the study investigated the effectiveness of modified hydrocooling and optimized postharvest handling practices. Most farmers in Taiwan often compromised postharvest vegetable quality due to uneven cooling. The first trial implemented a modified hydrocooling system using a 10-minute 5°C shower with a multi-hole perforated pipe and smaller baskets for precooling to substitute the conventional method. The results showed that the modified hydrocooling improved cooling uniformity and reduced vegetable loss rates. Meanwhile, for some farmers needed to meet the specialized market requirement which extend vegetable shelf life, the second trial conducted optimized postharvest handling practices including storage vegetables at 11°C, consistently clean 10°C water for washing/hydrocooling, and wrapping vegetables in plastic film. These practices revealed significantly decreased the water spinach quality loss for longer duration but less effective for amaranth. Even with the addition of hypochlorous acid in washing/hydrocooling water, the shelf life of amaranth was difficult to extend due to severe pre-harvest leaf disease. In conclusion, the study showed that modified hydrocooling offers benefits for most conventional farmers by reducing vegetable loss rates. On the other hands, for farmers needed to meet the specialized market requirement, optimized postharvest handling practices significantly improves the quality of water spinach in longer shelf life. Also, the research emphasized the importance of disease management in amaranth cultivation.

[P-16-HP] Ethyl formate does not reduce decay or extend the quality of stored strawberries

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Ethyl formate (EF) is an approved insect disinfestation agent for stored fruits by USDA APHIS, potentially extending shelf life due to its reported antifungal properties. Freshly harvested strawberries (*Fragaria* × *ananassa*) cv. Camino Real underwent overnight cooling at 1 ºC and 95±2% relative humidity (RH) before uniform sorting and packing into clamshells of 15 fruits each. Sorted strawberries were subjected to 0%, 1%, 2%, or 4% EF concentrations (determined via Ideal Gas Law) in a sealed 7-gallon bucket for 1 hour at 1 °C and 95±2% RH, followed by 21-day storage under identical conditions. Quality assessments occurred every 2 or 3 days until day 14, with decay incidence monitored until day 21. Fruit weight loss reached 4% by day 14 across all EF treatments, yet firmness remains consistent. Fruit lightness (L*) remained stable until day 12 before declining, while redness (a*) and chroma decreased until day 12, then increased on day 14, indicating deteriorating quality. Approximately 15% of fruit decayed after 3 weeks, unaffected by EF treatments. However, the 4% EF treatment notably reduced calyx lightness, chroma, and hue angle from day 4 to day 14 compared to lower concentrations. Calyx and edibility ratings gradually declined, with an accelerated decline from days 7 to 14 in 4% EF-treated fruit. Overall, low EF concentrations did not improve quality or shelf life, and high concentrations may even shorten shelf life.

[P-17-OGL] Evaluating Olives as an Alternative Fruit Crop for Florida

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The cultivation of olives (*Olea europaea*) in Florida has expanded ten-fold over the last decade, as there are now over 60 growers managing 800 acres across 26 Florida counties. However, while Florida olive cultivation has significantly expanded - as has global olive oil demand - very little research has been conducted. Data collection from three separate trials (Jay, Wauchula, and Fort Pierce, Florida) started in Summer 2023 with the aim to help identify the most productive varieties and best cultivation practices for different Florida climate and soil types. Considering the differences in grove management practices and tree maturity, cultivars of various genotypes were tested in different locations, with 'Arbequina' being consistent in all trials. Additional cultivars tested are: 'Koroneiki' and 'Sikitita' at Wauchula; and 'Lecciana' and 'Sikitita' in Fort Pierce. Soil fertility, temperature, soil moisture, as well as leaf nutrient status, and phenological observations were quantified twice a year. Although no nutrients deficiencies were observed in soil and leaf samples, no consistent flowering and/or production patterns were observed. Data collection will continue and will provide much needed answers to the feasibility of olive tree production in Florida environment.

[P-18-OGL] Empowering Home Vegetable Cultivation through Container Gardening

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In rural Florida, like Putnam County, food insecurity and limited access to fresh produce contribute to poor nutrition. From data collected in 2021, Putnam County has one of the highest values of people who did not have access to a reliable source of food, at 15% of its population [1]. Many residents attempt home gardening but face challenges like crop failure. Introducing container gardening can enhance success rates and confidence, paving the way for further expansion and larger yields. Supported by the Putnam County Soil and Water Board, a three-hour program equipped individuals with the skills and resources for their first container garden. Participants learned about selecting suitable vegetables, soil mixes, pest management, and setting up self-watering pots. Each attendee received an EarthBox®, soil, fertilizer, and starter plants/seeds. The program ran in September 2022 and 2023, attracting 84 participants, with 27 respondents completing follow-up surveys for both years. Results showed promising outcomes: 89% utilized the EarthBox® for vegetable cultivation. Approximately 43% harvested enough for one meal for 2-4 people, while another 43% could produce 3-4 meals. Additionally, 77% expanded their container gardens, with half increasing by four or more containers. Container gardening programming offers homeowners greater success potential with proper knowledge and tools, fostering confidence and healthier communities through increased vegetable production.

[P-19-OGL] Establishing In Vitro Germination Protocols for Three Threatened Cactus Species

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The goal of this project was to establish a germination protocol for in vitro propagation of three threatened and understudied cactus species; *Harrisia aboriginium, Harrisia fragrans,* and *Ariocarpus fissuratus*. The broader goal of establishing a germination protocol is to create a bank of sterile seedlings for further tissue culture experiments and propagation. Tissue culture protocols for these specific species have never been published. Tissue culture can be used to create a large number of plants in a shorter period of time than would be possible using standard greenhouse or nursery practices. Establishment of an in vitro propagation protocol can assist in species restoration, extinction prevention or general improvement of horticulture protocols. This project tested two sterilization times in 1.8% sodium hypochlorite and two different germination media, half strength Modified Murashige and Skoog Medium (MSM) and full strength Woody Plant Medium (WPM). It was determined that the different sterilization times had no significant effect on *H. aboriginium* but, *H. fragrans* and *Ariocarpus fissuratus* may benefit from a more intense sterilization rate due to contamination. *Harrisia aboriginium* yielded very similar, but successful results across all treatments. *H. fragrans* germination rate was increased with the MSM. *A. fissuratus* seedlings also grew faster and healthier in the MSM treatment. This germination project yielded 283 sterile seedlings total across the three species. After the germination phase tested here, these plants could be used in a micropropagation project for each of the species.

[P-20-OGL] Genome size estimates of *Hibiscus rosa-sinensis* cultivars using flow cytometry

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Tropical hibiscus (*Hibiscus rosa-sinensis* L.) is famous for its vibrant flower color and robust flowering ability. Although extensive breeding efforts have contributed thousands of different cultivars, the basic cytometric information of this species remains largely unclear. Our study aimed to evaluate the genome size variation by using flow cytometry across 75 tropical hibiscus cultivars and experimental accessions. We concluded that root tips are a superior choice for flow cytometric analysis compared to leaf in tropical hibiscus due to the lower mucilage content of this tissue. The genome size estimation unveiled a wide spectrum of genetic diversity ranging from 3.06 GB in 'Queen Aussie' to 12.75 GB in 'Joann'. Overall, 8 cultivars possess a compact genome size under 4.11 GB, while 3 cultivars possessed significantly larger genome over 11 GB. Most of the material analyzed had a genome size of 7 - 9 GB. Furthermore, the genome size assessments of F1 hybrids revealed that progeny typically inherit genome sizes that closely resemble those of their parents. This suggests that successful crosses within tropical hibiscus were more likely to occur when parent plants share similar genome sizes and ploidy levels. Information generated in this study can be used to make informed decisions on breeding parents' selection and genomic resource development which will directly benefit the genetic improvement of tropical hibiscus.

[P-21-OGL] Empowering Communities with Gardening Education to Confront Food Insecurity

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The "Tri-Cities Community Garden Project" endeavors to alleviate food insecurity in Belle Glade, Pahokee, and South Bay by educating residents on vegetable gardening. Collaborating with local non-profits and UF/IFAS Extension Palm Beach County, the initiative offers a four-day course covering soil management, crop seasonality, irrigation, pest control, and nutrition. Led by Extension Agents and a Master Gardener Volunteer, the tailored curriculum aims to equip participants with practical gardening skills so they can produce food in local community gardens and at home. The program experienced a high participant turn out, with over 140 residents engaged in the program. Despite logistical challenges, such as transportation barriers, the average class attendance of 35 individuals underscores community interest and commitment. Furthermore, the majority express intent to apply newfound knowledge to cultivate their own gardens, indicating a potential for increased local food production and food security. The project's success is attributed to several key factors, including the communities' agricultural heritage, support from local leaders, and effective delivery of research-based information by Extension Agents.
Additionally, the Tri-Cities Community Garden Project promotes healthy eating habits, community cohesion, and food literacy. Its collaborative framework involving non-profits, government entities, and community stakeholders presents a replicable model for similar initiatives in other regions. In summary, the Tri-Cities Community Garden Project exemplifies a proactive approach to empower communities and address food insecurity through education, collaboration, and sustainable gardening practices.

[P-22-OGL] Progress on the Breeding of an Ornamental Redbud Adapted to North Central Florida

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The eastern redbud (*Cercis canadensis*) is a popular ornamental tree in the southern United States grown for its attractive purple flowers and beautiful foliage. In Florida, redbuds can be grown in zones 8a, 8b, and 9a where endemic

populations can be observed blooming in forests during spring. The objective of this research is to develop an ornamental redbud cultivar with purple foliage and weeping growth habit adapted to North Central Florida. The existing purple leaf weeping cultivar 'Ruby Falls' has a high chilling requirement and is not adapted to North Central Florida. A segregating F2 population was generated by harvesting seed from the F1 progeny of the cross 'Ruby Falls' with bulked pollen from three Florida native redbud seedlings. The segregating F2 population was planted in 2022 at the University of Florida and evaluated for terminal bud set date, bud break date, growth habit, and leaf color. Casual observation of the redbud seedlings detected variation in leaf cutting frequency between seedlings made by leafcutter bees (*Megachilidae*). Leaf Cutting data was collected in the fall of 2022 and 2023 to look for preferred leaf cutting preferences. Data on the phenotypic segregation of the traits measured will be presented.

[P-23-OGL] *In-Vitro* Micropropagation of Anthurium Using Various Plant Growth Regulators (PGRs)

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Anthurium, widely recognized for its appeal as a cut-flower and potted-plant, faces escalating market demand, making micropropagation an increasingly viable and efficient solution. This study focuses on establishing a robust protocol for *in-vitro* multiplication of *Anthurium cubense*, utilizing various plant growth regulators (PGRs) in the direct seed explant germination method. A substrate composed of MS medium, 15 g sucrose, 250 µL PPM, and 3 g agar was employed for *A. cubense* establishment, without exogenous additives. Shoot cuttings from *in-vitro* seedlings, specifically nodal segments, served as the explants, placed in culture jars with Murashige and Skoog (MS) supplemented with 30 g L-1 sucrose and 6 g L-1 agar. The treatments involved varied concentrations of 2,4-D (0, 0.4, 0.6, and 0.8 mg L-1) and BAP (0, 1, 2, and 3 mg L-1). Rooting was induced by inoculating the shoots with different NAA concentrations (0, 0.5, 1, 1.5, and 2 mg L-1). Throughout the experiment, growth parameters and phenotypic characteristics were assessed. Results indicated that the control treatment was optimal for shoot induction, while the concentration of 2 mg L-1 NAA proved most effective for root induction, yielding the highest number of *A. cubense* roots (11.75).

[P-24-OGL] Understanding Ecophysiological Responses of Cabbage Palm to Saltwater Intrusion and Silicon Amendment

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Along Florida's coastline, where shallow aquifers and permeable bedrock are common, the threat of saltwater intrusion looms large. Plants are known to react unfavorably to heightened salt levels in their surroundings. To investigate how salinity and silicon supplements affect Sabal palmetto, a salt-tolerant palm prevalent in South Florida, one-year-old saplings were cultivated at Montgomery Botanical Center. The study aimed to a) assess the impact of saltwater and silicon amendments, and b) establish effective plant health monitoring using optical sensor technology. Saplings were irrigated with saltwater treatments ranging from 0 (control) to 50 parts per thousand (ppt), alongside various silicon concentrations [0g (control), 0.24g, 0.58g, 0.84g]. Monthly leachate samples were collected to gauge nutrient content, pH, and electrical conductivity, with soil nutrient analysis conducted before and after the project. Phenotypic traits such as height, leaf count, and color were monitored. Optical non-destructive handheld sensor technology such as Li-Cor (LI-600), portable spectroradiometer (PSR$^+$ 3500), Soil Plant Analytical Development (SPAD), Normalized Difference Vegetation Index (NDVI), and atLEAF$^+$ chlorophyll meter were used to assess the plant health during this project. These findings carry practical implications for conservation management, landscaping, and implementing best

management practices (BMP). They offer insights into mitigating saltwater challenges and optimizing plant health monitoring.

[P-25-OGL] Cultivation and Seed Propagation of the Leafless Beaked Orchid, *Sacoila lanceolata* (Aubl.) Garay

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The Leafless Beaked Orchid is a terrestrial species native to Florida. It is commonly seen along highways and in other sunny, disturbed sites, producing tall spikes of scarlet flowers. It has potential as a landscape plant adapted to xeriscaped mixed flower beds, flowering in the spring. Hobbyists are said to have germinated seeds successfully, but the only scientific publication on the subject is a master's thesis by Kauth, in 2005, in which only one seedling was ever produced. We used greenpod culture of capsules a few days before they would naturally dehisce, and sowed seed on OSP P668 orchid germination media, a standard medium that we use for other orchids. After germination, large, translucent white protocorms formed, as happened with Kauth, but eventually they produced large numbers of normal seedlings. These were transferred to pots of sphagnum moss, and later to potting soil, and grown with our adult plants. We grow this species in 4-6 inch azalea pots, in peat/perlite potting media. Plants are kept moist from early March through November, receiving dilute liquid fertilizer biweekly. From late November through February, plants are kept completely dry. They lose their leaves and go dormant. When watering resumes, they flower within a few weeks, and then produce a new crop of leaves for the next season.

[P-26-OGL] Salinity Tolerance in Olive Tree Cultivars 'Oliana' and 'Lecciana'

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Growing olive plants in the coastal area of Florida is challenging due to poorly drained soils and low-quality groundwater, resulting in the buildup of salts that negatively impact plant development. Though some olive (*Olea europaea*) cultivars exhibit moderate tolerance to salinity stress, increasing salinity significantly affects plant growth. Therefore, this study was designed with the objective of evaluating the salt tolerance of two novel olive cultivars. In this work, salinity stress was induced in eight-month-old plants of 'Oliana' and 'Lecciana' cultivars. The plants were grown for 45 days in 4 L pots containing a sand media with three NaCl treatments (0 mM, 50 mM, and 100 mM) under greenhouse conditions, while irrigation was applied once a week with half-strength Hoagland solution. The experiment followed a completely randomized design with three replications, each consisting of nine plants. The effect of salinity stress was assessed by measuring the number and length of lateral branches, stomatal conductance, photosynthetic rate, fluorescence (F_v/F_m), and chlorophyll (Chl) contents (Chl *a*, Chl *b*, and total Chl). The measurements for these parameters were taken at three different time intervals: 15, 30, and 45 days after the treatment. Significant differences were observed in the number and length of lateral branches for treatments and cultivars. Both cultivars exhibited a decrease in stomatal conductance, photosynthetic rate, chlorophyll levels, and fluorescence under higher salinity stress. These results highlight the physiological basis of olive plants' ability to deal with salinity stress.

[P-27-V] Demonstrating the Advancement of Automated Irrigation Technology for Adoption in Fruit and Vegetable Crops

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The educational program focused on introducing automation technologies to north-central Florida fruit and vegetable producers utilizing drip irrigation systems. Specifically designed for long-term crop rotations, the program developed

portable automation technology and conducted full-scale demonstrations on local producers' fields. These demonstrations, along with participation in producer field days and meetings, reached 375 producers annually, showcasing the benefits of automation while requiring minimal infrastructure. Since its inception in 2021, the program has seen rapid adoption, with demonstrations conducted on 80 acres annually and subsequent adoption on 750 acres in Gilchrist County and approximately 1200 acres across the region. Producers have recognized significant benefits, including water conservation, increased nutrient efficiency, and cost savings. For instance, watermelon crops have seen an estimated reduction of two labor hours per acre across the season, resulting in an 80-hour savings per 40-acre field. While adoption has outpaced research efforts, ongoing collaboration with industry partners aims to further refine and assess the impacts of automation on water conservation, nutrient efficiency, and crop yield. Overall, the program's success in promoting automation technologies tailored to the region's agricultural challenges underscores their practical benefits and relevance in modern farming practices.

[P-28-V] Integrating Compost and Sunn Hemp Cover Crop Residue in an Organic Celery Production System

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Rapid leguminous cover crop decomposition and asynchrony with crop demand poses unique challenges in organic vegetable production, particularly in the Southeast and in long-season crops such as celery. A field trial was conducted in Nov-Feb (2023-2024) in Citra, FL comparing effects of cover crop residues and various composts using a split plot design with four replications. Whole plots involved sunn hemp residues (SH) vs. weedy fallow (WF), while subplots compared yardwaste compost (Yard; 22.4 mt/ha), vermicompost (Vermi; 11.2 mt/ha), compost mixture (Mixed; Yard 11.2 mt/ha + 11.2 mt/ha Vermi), and no-compost (Control). Soil respiration was assessed at 2, 27, 54, 78, and 110 days after transplanting (DAT) and celery yield was measured at 111DAT. At 2 DAT, Yard and Mixed maximized respiration in SH and WF, respectively, and SH enhanced respiration vs. WF in Yard and Mixed compost treatments. At 27 DAT, no differences in respiration were observed among composts in SH, although Vermi reduced respiration relative to Yard and control in WF. At 78 and 110 DAT, Yard enhanced respiration vs. control in SH, while no differences were observed among composts in WF. While celery yield was similar among treatments in WF, all composts enhanced FW compared to Control in SH, with Yard increasing FW by over 135% vs. Control. These findings suggest that while compost may not directly supply appreciable amounts of N, there is great potential to enhance soil microbial activity and promote nutrient cycling of cover crop residues through compost application thereby reducing N losses.

[P-29-V] Marker-assisted selection of pepper plants with resistances to both bacterial spot disease and root-knot nematodes

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Sweet bell peppers and specialty peppers are important vegetable commodities grown in Florida. Bacterial spot disease caused by *Xanthomonas euvesicatoria* is a major limitation for pepper productivity. Another production constraint is the damage to pepper plants' roots caused by root-knot nematodes (RKN, *Meloidogyne* spp.). Both these problems can however be managed in an environmentally friendly and cost-effective manner if resistant cultivars are available. We aim to develop new pepper cultivars with resistance genes for both bacterial spot and root-knot nematodes pyramided. We developed an efficient protocol based on amplified fragment length polymorphism (AFLP) markers, to facilitate the selection of plants that contain *Me3*, the dominant gene for RKN resistance and *bs5* the recessive gene for resistance to bacterial spot disease. The use of the markers in developing improved lines of pepper will be discussed.

[P-30-V] Weevil management in celery and parsley

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Listronotus sparsus (Say) has emerged as a pest of celery and parsley in southern Florida. Larvae of this weevil feed on petioles, crowns, and roots, reducing plant vigor and the quality of the crop. Field trials conducted since 2022 have evaluated the efficacy of foliar and drench applications of insecticides for *L. sparsus* control in celery and parsley. Foliar applications of cyantraniliprole and novaluron reduced weevil larval infestations in both crops. However, results suggest that high rates and repeated applications might be needed to achieve acceptable control in celery. The results of experiments evaluating the efficacy of a tray drench application of a neonicotinoid or cyantraniliprole before transplanting celery were inconclusive because of low weevil pest pressure. However, the drench application of a neonicotinoid or cyantraniliprole three weeks after transplanting controlled weevil infestations in parsley for at least five weeks.

[P-31-V] Identification and Cultivation of Superior Potato Varieties in Northeast Florida

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Potato cultivation in Northeast Florida plays a crucial role in bolstering US potato supplies between January to early June. In Florida, the crop can be stressed by elevated temperatures that may lead to reduced tuber yield, heightened incidence of physiological internal disorders (PID), and subsequent compromise of the crop's economic value. This research aimed to determine: i) potato traits most affected by higher temperatures and by nitrogen (N) and phosphorus (P) availability, as well as their correlation with yield, ii) cultivars exhibiting both yield stability and lower levels of PID, and iii) cultivars that exhibit yield stability and lower levels of PID under low and high N-fertilizer application and under low and high P-fertilizer application. Trials were established in Hastings, FL, from 2022-2024. The study encompasses 100 potato cultivars from different market classes. Measured traits included total yield (TY), marketable yield (MY), culls (PO) (rots, green, growth cracks, and misshaped tubers), specific gravity (SG), stand count, vine vigor, and vine maturity. Trait heritabilities and genetic values were estimated. We observed interaction between varieties and the different treatments (Heat, N, and P), and identified varieties that were more efficient under low nutrient conditions and high temperatures. Top performing cultivars in the heat tolerance study included Jacqueline Lee (362cwt/ac), Stobrawa (346 cwt/ac), and Bzura (328 cwt/ac). Top performing cultivars in the N study included Jacqueline Lee (333 cwt/ac), Serrana (326 cwt/ac), and Bzura (312 cwt/ac). Top performing cultivars in the phosphorus study included Muziranzara (379 cwt/ac), Tacna (362.51), and Bzura (315.98 cwt/ac).

[P-32-V] Evaluation of vegetable soybean adaptations to South Florida's tropical climate

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Vegetable soybean, also known as edamame, is a specialty crop harvested at an immature stage and consumed as pods. It has become increasingly popular in the United States due to its high nutritional value and good taste. Currently, most edamame consumed in the U.S. is imported as a frozen product. States such as Arkansas and Kentucky have started to grow this crop locally on a small scale to meet the high demand. South Florida, known for producing fresh vegetables sold nationwide, especially in the winter and spring markets, also has a highly diverse and growing ethnic population with significant local market potential. These factors make growers in South Florida highly interested in cultivating edamame to meet the demand in both national and local markets. Sixteen commercial edamame varieties were selected and assessed for differences in phenotypic performance, including emergence, yield, plant height, plant width, 10-pod weight, and pod size, to evaluate their production potential in South Florida. Varieties showed

significant effects on most traits studied. Emergence rates ranged from 0 to 85%, and fresh pod yield ranged from 4.41 to 14.34 t/ha among all 16 varieties. Varieties like Goo, Karikachi #3, and Midori Giant, despite having moderate emergence rates, produced higher fresh pod yields due to their larger plants, resulting in bigger pods. There were variations in average pod length (35.61 – 51.21 mm), width (9 - 14 mm), and thickness (5.46 - 8.74 mm) among the varieties, with Goo standing out significantly in size. Overall, Goo, Karikachi #3, and Midori Giant demonstrated particularly favorable yield and good pod quality, showing potential for commercial edamame production in South Florida. This study provides foundational knowledge on edamame production for South Florida growers and identifies suitable varieties for the region.

Agritourism Section

Presiding: **Gene McAvoy**

[AGR-1] Helpful Hints on Hosting on Farm Events

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Agritourism and farming conferences offer great opportunities to network with farmers from around the country, feature insight into the newest trends, and provide plenty of tips on hosting on farm events. The Mid-Atlantic Fruit and Vegetable Convention and the North American Farmers' Direct Marketing Association Agritourism Convention and Expo provide some very helpful hints on developing entertaining events to attract visitors to the farm. Farming is an extremely labor-intensive business, requiring long hours, extensive recordkeeping, and persistence. These attributes can contribute to transitioning the farm to a successful event space. A few things should be considered when hosting an on farm event. Event timing and duration should be planned to ensure participants receive the anticipated value in attending the event. Events should be advertised appropriately to attract target audiences. Creative funding and labor avenues should be explored to maximize revenues and attract community support. And additional entertainment and attractions should be explored to keep people entertained and returning to the farm. As with any new business venture, diligent research should be conducted before hosting people on private property. Fortunately, the majority of this research can be made enjoyable by visiting existing operations, attending conferences and conventions, and networking with fellow farmers and extension specialists.

[AGT-2] Supporting Agritourism Providers Through a Regional Agritourism Conference

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More and more Florida farmers are incorporating agritourism into their operation. Agritourism offers farmers an additional revenue stream and marketing tool. However, as with any new business venture, there are risks and uncertainties. To assist local farmers navigating local and state agritourism regulations, UF/IFAS Extension Martin County led a 2017 Regional Agritourism Conference and Farm Tour, in collaboration with industry, local government, and a University of Florida statewide team. The event brought together agritourism operators and policymakers to learn about existing agritourism operations, regulations, and resources. Reflective Likert-scale pre-/post-questions revealed knowledge gains (n=16 respondents) of over 100% in agritourism topics, such as business planning, best practices, consumer preferences, and marketing opportunities. In a 2019 follow-up survey, respondents (n=15) stated they had taken steps to improve their agritourism operation, including revising their business or marketing plans, researching liability insurance, installing recommended signage, visiting other agritourism venues, reaching out to service providers, and expanding their agritourism operation. All respondents indicated they had shared what they learned with others. As agritourism continues to expand in our state, Extension can help policymakers and agritourism operators communicate with one another to build mutual understanding and supportive working relationships.

[AGR-3] Agri-tourism needs assessment and opportunities, observations from Duval County

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Agri-tourism is an expanding industry in the United States, with revenue growing from $566 million in 2007 to $1.2 billion in 2022. It provides an option for producers to increase profitability while improving food system awareness. Practices that enhance profitability for small farmers are paramount in Duval County, Florida, where the average farm

income from 2007 through 2022 was a loss of roughly $6000. Agri-tourism operators must navigate all the complexities of farm management while complying with local zoning ordinances and state regulations. Successful venues also need effective marketing, food safety protocols, and customer service. Incorporating agri-tourism into a farm business is nuanced, and there is a need for extension to address the knowledge gap that exists for aspiring agri-tourism venues and existing operations seeking sustainable and thriving farm businesses. Duval County, with its flourishing small farms, urbanizing land-use, and established agri-tourism industry is a proving ground for needs assessment in this industry. Observations from this setting provide insight for developing impactful extension programming that will support this growing and evolving industry.

[AGR-4] Development of Digital Property Map - Mobile Application for Agritourism

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The rise in Agritourism means farms can expect guests on their property. A Digital Property Map App is a mobile application available on both iOS and Android phones that provides guests the confidence of knowing where they are located and what they're looking for on a property. This customized mobile application allows guests to see private roads, landmarks, attractions, boundary lines and the user's GPS location within a property even without cell service. Whether the property is in the agritourism, events, hunting, or experience industry, the mobile app will surface important information, all in one place; allowing property guests to make safe, informed and efficient decisions on how to navigate the property. The Digital Property Map is created in collaboration with the property owner and includes accurate, digital Geographic Information System (GIS) map layers that can be used for additional mapping purposes in the future.

[AGR-5] Tours Increase Agriculture Awareness and Extension Revenues

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Many Highlands County residents do not interact with agricultural operations and lack an understanding of how agricultural products become available to the end consumer. Offering tours can help clientele understand the intricacies of agriculture operations through experiential learning. As an extra benefit, profits from tours can add to Extension programmatic revenues, furthering the educational reach of programs. To educate clientele about food systems in Highlands County through tours of local agricultural ventures. To increase awareness and appreciation of agricultural businesses through experiential learning. To enhance program revenues to fund future educational outreach. Three, one-day long agricultural bus tours were planned for three dates in February of 2024. For each tour, the lead agent planned two to three stops each morning and two in the afternoon with a lunch break that featured a rib-eye steak provided as part of the tour ticket. Indicators such as an increase in agriculture awareness and knowledge, as well as tour satisfaction, were measured in a post-tour survey. 156 Highlands County Residents participated in the three tours. 104 post-tour surveys were filled out and collected. The surveys indicated a 52% increase in participants' knowledge of Florida agriculture. Participants also reported that their understanding of the importance of Florida Agriculture increased by 42% after returning from the agriculture tour(s). Agriculture tours increased knowledge and awareness of the importance of local agriculture operations and the commodities they produce while providing programmatic revenues.

Agroecology & Natural Resources Section

Presiding: **Nickie Munroe**

[ANR-1] The response of young D. Asper bamboo to increased nitrogen rates under greenhouse conditions in Florida.

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Bamboo, a giant tropical and temperate region grass, is used for food, timber, furniture, building and construction material, paper making, and other uses. With the US being the world's number one importer of bamboo shoots, many growers are venturing into bamboo production with little or no knowledge of the best management practices. There is no reliable literature conducted in Florida about the crop. Therefore, this study was conducted to develop site-specific nitrogen (N) requirements for young bamboo plants in a controlled environment. This study was done in a greenhouse at UF/IFAS Citrus REC in Lake Alfred. One-year-old bamboo plants were transplanted into 37.85 L pots and treated with varying rates of N (0,112,224, and 336 kg N ha^{-1}). Growth, photosynthetic rate, and tissue composition were measured biweekly for five months. Initial and final soil analyses were done. The results demonstrated that higher rates of N (up to a certain amount, i.e. 224 kg N ha^{-1}) increased growth rate, number of culms, and dry matter accumulation. Chlorophyll content and culm diameter were comparable. It was concluded that 200 kg/ha N was optimal for young bamboo plants since it showed the peak growth rate, number of culms, and dry matter compared to the rest of the treatments.

[ANR-2] Nitrogen mineralization and carbon dioxide emissions from amendments used in Florida soils with incubation data.

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High-yielding crops require high nitrogen inputs, and synthetic fertilizers are typically used for that purpose in specialty crop systems of Florida. Animal manures and amendments can contribute significantly to crop nitrogen needs and provide soil health benefits, but organic N contained in these products must be mineralized from organic to plant-available inorganic forms before uptake. Nitrogen mineralization can be affected by amendment properties, soil properties, and temperature. As it can be difficult to accurately estimate the rate of application needed to meet crop demand while avoiding negative environmental impacts (e.g., nitrate leaching and excessive CO_2 emissions), it's critical to better predict nutrient release from different amendments. The main objective of this study was to measure N release and CO_2 emissions from two poultry-based manures (one heat-treated and one charred) and two processed organic fertilizers made from livestock byproducts (e.g., feather meal, blood meal). We conducted an 8-week incubation using two Florida soils incubated at 10°C, 17°C, 24°C, and 30°C, measured plant-available N at 0, 1, 2, 4, and 8 weeks, and measured CO_2 emissions weekly. Results show that in both soils, the two fertilizers released overall more inorganic N and at a faster rate over time compared to the manures. However, CO2 emissions were greater in both soils at the four temperatures, from the manures, compared to the fertilizers. While we found differences in N release and CO2 emissions among amendments, soils, and temperature, future research remains needed to analyze a more diverse set of Florida soils and amendments.

[ANR-3] The Use of Phosphorus Starter Fertilizer in Field Corn Production

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This study investigates the use of starter phosphorus (P) fertilizer on field corn yield in high Mehlich 3 P soils. Starter fertilizers are typically liquid fertilizers applied at planting via the planter to supply nitrogen (N) and P for early season corn growth. Considering the prevalence of high Mehlich 3 P concentrations (exceeding 45 mg/kg) in North Florida soils, and variation in costs between starter liquid fertilizer blends, there is interest in investigating if starter fertilizers need P to optimize crop yield. Three rates of starter P fertilizer (0, 14.72, and 59.42 lbs P2O5/acre) were applied at planting using liquid blends (28-0-0-5, 23-9-0, and 10-34-0), commonly used by field corn growers as starter fertilizers, to achieve desired P rates while maintaining a constant starter N application rate of 42.67 lbs N/acre. Side-dress and fertigation events provided additional N, potassium, and other nutrients based on soil test recommendations**.** Soils were collected and analyzed for Mehlich 1 P, Mehlich 3 P, Haney H3A P, water soluble P, and Iron Oxide P**.** In the first year, no significant differences in yield were observed among the P starter fertilizer treatments. While year one data shows no P starter effect, the study continues for a second year to assess results from multiple field corn growing seasons.

[ANR-4] Preparing to Scale Agroecology - Highlights from Around Florida

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Agroecology is farming that works with nature for production, conservation, and community. The principles of productivity, biodiversity, and resilience are balanced through management of plants and natural resources in agroecosystems. The concept of agroecosystems links agroecological practices to plant production and related features of surrounding natural resources and local communities. Each agroecosystem operates under unique aspects of place, plants, and people from which a unique set of goals drives appropriate agroecological practices. A framework will be presented as a unifying set of features and indicators to guide dialog and evaluation around agroecosystem management. Three unique agroecosystems (demonstration farm, school garden, restoration area) will be presented within the agroecological framework. Each agroecosystem has been mapped and planned for development of plant management and conservation. Developmental goals will be discussed specifically according to the production, conservation, and community context of the agroecological framework. Related agroecological practices to be deployed pertaining to land use and management goals will also be introduced. Commonalities observed across agroecosystems include improvement of soil health through reduced land disturbance and improvement of plant diversity through increased native and cultivated species. Increasing conservation land area and plant species richness are also unifying indicators to track agroecological development across diverse agroecosystems. These common observations and indicators from agroecosystems around Florida may support further adoption of agroecology in principle and practice across diverse scales and contexts.

[ANR-5] Effects of cover cropping on non-irrigated soybean production in Jefferson County, Florida.

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Soybean producers in North Florida are successfully integrating cover crops with reduced tillage on non-irrigated farms. Cover crops have the potential to provide meaningful benefits to cash crops including reducing erosion, scavenging residual soil nitrogen, reducing competition from weeds, and increasing yield, but realized benefits depend on many factors, including inherent site characteristics and crop management. To ascertain short-term benefits of cover crops, researchers from the Precision Sustainable Agriculture network conducted a national large-scale, on-farm research inquiry to characterize the conditions and impacts cover crops have on subsequent dryland row crops. In

Florida, on-farm randomized complete block experiments at six sites over three years were established to evaluate the impact of cover crops verses no cover crops on soybean production. Cover crop biomass, nutrient composition, and decomposition rates along with soybean yield, continuous soil moisture, and weed presence were assessed from each site-year. Winter annual rye (*Secale cereale* 'FL 401') produced a mean yield of 6,671 lb ac^{-1} on a dry weight basis and were grown from early January to late May (~133 d). Soybean (group 7) were grown from early June to late October and yielded an average of 58.7 and 60.8 bu ac^{-1} when planted after cover crops or bare ground, respectively. Tissue and soil composition samples were still being processed at the time of this writing, but an evaluation of yield data analyzed by year demonstrates that soybean yield was not different by cover crop treatment ($p > 0.05$) or site ($p > 0.05$).

[ANR-6] Extension Educational Programs to Promote Biodiversity

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Loss of biodiversity is a problem in both our urban and rural ecosystems. Having a biodiverse environment with many different species of plants and wildlife provides habitat and prevents species from going extinct. Demonstration gardens help to encourage citizens to choose plant species that provide an ecological benefit to pollinators, birds, animals, and other wildlife. Demonstration gardens, educational classes, and social media were used to inspire behavior change and encourage the public to plant more species in their landscapes. In 2023, two educational gardens were initiated at county parks in partnership with UF/IFAS Extension Hillsborough County. For both sites, funding was provided from a Viva Florida grant from the Florida Wildflower Foundation to plant a native garden. Signage was installed to identify the plant names and two classes were taught to educate attendees about Gardening with Native Plants and Butterflies. Social media was also used to educate the public on the ecological benefits of plants, plant/wildlife interactions, and plant species selection. As a result of the two garden projects, we had 230 volunteer hours from Master Gardener Volunteers. We also created partnerships with the Florida Native Plant Society and Hillsborough County Parks. We planted 194 plants of 29 different species labeled with educational signage. Two classes were taught with a total of 70 participants who reported knowledge gained on right plant right place, and techniques to attract wildlife to their yards.

[ANR-7] 2nd Arbor Day Tree Planting Event: Impact of Tree Planting Activities on Environmental Awareness in Young Children

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Environmental awareness is a crucial component of fostering sustainable attitudes and behaviors from an early age. Last year, we planted two small native trees at a youth learning and demonstration garden in an underserved neighborhood. This year, we planted an additional four trees. Like last year's event, we had four objectives. 1. Help the children identify benefits we receive from trees. 2. Teach children how to plant trees. 3. Explain why we are using a native species. 4. Show them how to care for trees. A site assessment was done to determine which native species would be most suited to the location. The young people were provided with a palate of small trees to chose from for the event. On planting day, students were engaged in a 15-minute discussion including a quick overview of the history of Arbor Day and the benefits we receive from trees. After a planting demonstration, the children were allowed to install four small trees on their own. Overall, this event underscores the importance of hands-on environmental education initiatives, such as tree planting, in nurturing environmental awareness and fostering a sense of stewardship among young children. Educators, policymakers, and community organizations need to recognize the effectiveness of hands-on environmental education programs targeting youth.

[ANR-8] East Central Florida CISMA Workdays: Community-Driven Solutions in Action for Invasive Species Removal

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The University of Florida IFAS (UF/IFAS) Extension and the East Central Florida (ECF) Cooperative Invasive Species Management Area (CISMA) task group spearheaded two community-driven workdays targeting education and removal of two important invasive plant species: water primrose (*Ludwigia hexapetala*) and Brazilian peppertree (*Schinus terebinthifolia)*. On the St. Johns River in Brevard County, airboats were deployed to survey for and remove water primrose, a regional priority early detection/rapid response (EDRR) species. More than 200 lbs. were removed, highlighting the efficacy of workday efforts. Brazilian peppertrees were targeted in Volusia County along the Halifax River in Holly Hill. Diverse CISMA partners participated, demonstrating proper removal strategies, and emphasizing the significance of collaborative engagement in invasive species management. Workdays encompassed three key components: targeting priority species, involving partners in removal techniques and species identification, and engaging the broader community in invasive species removal for educational purposes. Initiatives contributed to the overall ECF CISMA mission of managing and surveying invasive species, particularly priority control of EDRR species. By involving both UF/IFAS Extension and CISMA partners and the public, we achieved tangible results in removing invasive species and fostered a sense of environmental stewardship. Hands-on experiences in removal techniques and species identification enhance public awareness and empower communities to actively participate in protecting their local ecosystems. These community-driven efforts play a crucial role in preventing and managing invasive species and safeguarding the ecological balance and biodiversity of the East Central Florida region and beyond.

[ANR-9] Lettuce Phosphorus Fertilizer Recommendation on Organic Soils of Florida

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Florida ranks third in lettuce production within the United States. Approximately 90% of current commercial lettuce varieties are cultivated on organic soils of South Florida which require phosphorus (P) inputs to sustain economically viable production. The P recommendation for lettuce needs to be updated, as the last recommendation dates back to the 1990's. Additionally, soil pH has increased due to the presence of underlying limestone, leading to a decrease in P availability. The study objectives were to determine the optimal P fertilizer rates for different lettuce cultivars to revise phosphorus fertilizer recommendations. The experiment was conducted in a single trial field at the Everglades Research and Education Center. Employing a split-plot experimental design with four replicates where the main plot was fertilizer rate (0 (control), 48, 97, 150, 195, and 210 lbs. of P_2O_5 $acre^{-1}$), while lettuce cultivars (8 cultivars) were assigned to the subplot. Soil total P (TP), Mehlich-3 P, and water-extractable P were measured prior to planting, midseason), and post-harvest, and leaf tissue samples were measured for TP at mid-season and post-harvest. We hypothesize that (i) increasing fertilizer rates will result in higher lettuce head weights; (ii) positive correlations between soil P and plant tissue P concentrations; and (iii) lettuce grown under low P rates will have a reduced shelf-life. These findings will help establish new P fertilizer recommendations aimed at optimizing yield production while minimizing environmental impacts.

Citrus Section

Presiding: **John Chater**

[C-1] Impact of cover cropping on soil and tree parameters in citrus groves affected by citrus greening: a field study in the Indian River regions of Florida.

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Citrus greening, or Huanglongbing (HLB), poses a significant threat to Florida's citrus industry, with devastating effects on tree health and yield. As a result of the lack of an effective cure, growers' resort to various management strategies to mitigate its impact. Among these strategies, the application of increased nutrients to affected trees has gained popularity. However, in regions like the Indian River District (IRD), characterized by low organic matter and soil fertility, nutrient retention poses a challenge. Consequently, there is growing interest in employing cover crops as a management approach, as this is known to enhance soil fertility. Despite this interest, there is a lack of published data regarding the efficacy of cover cropping on citrus soil parameters in the IRD. To address this gap, a collaborative study was initiated in Fort Pierce, Florida, involving a commercial grower and the University of Florida. A three-year field trial, organized into a randomized complete block design with four blocks, comprising 'Star Ruby' grapefruit trees grafted on 'US-942' rootstock, 'Bearss' lemon trees grafted on 'Sour Orange' rootstock, and 'OLL' sweet orange trees grafted on 'US-942' rootstock. Two treatments were applied: conventional (no cover crops) and experimental (cover crops). Cover crops were planted bi-annually (winter and summer), allowed to grow, and then terminated at each season's end. Soil nutrient content, organic matter, moisture, and temperature, as well as tree growth parameters were assessed seasonally in winter and summer. After 3 years of cover cropping, analysis revealed significant trends in soil nutrient content and organic matter between the conventional and experimental treatments, indicating potential impacts of cover crops on soil characteristics, but not on tree growth or physiology. This study is still ongoing and aims to offer a comprehensive understanding of the long-term effects of cover cropping on soil parameters in HLB-affected citrus groves, thereby informing sustainable management practices in citrus cultivation.

[C-2] The impact of Irrigation rate on the fate of root morphology and life span of sweet oranges at varying tree densities in commercial groves

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Agricultural expansion and intensification are expected to meet 70% of the increase in food demands by 2050, exacerbating the negative impacts on water resources. Increased nitrate concentrations and eutrophication of water resources, nitrogen, and phosphorus leaching is a global water quality challenge. The objective of the current study was to determine the fate of root morphology and root life span in response to varying irrigation levels at selected tree densities in grower citrus groves on Florida sandy soils. The experiment was conducted in a commercial citrus grove near Immokalee, FL, USA. Thirteen-year-old 'Valencia' (*Citrus sinensis*) citrus trees grafted on Carrizo planted in two rows of 360 and 485, and three-row trees of US-897 (*Citrus reticulata* Blanco x *Poncirus trifoliata* (L.) Raf.) citrus rootstock with 920 trees ha^{-1}. Significant root length, volume, and area were recorded in the three-row and two-row experiments with a partial deficit (50%-crop evapotranspiration, ETc) and medium (78%-ETc) irrigation regimes, respectively. Significant water relations were also detected when the trees received medium irrigation in the low and moderate tree densities than the highest tree density indicating significant water flow in response to improved root development and lifespan. Results indicated that irrigation management improved water availability and root development in response to varying irrigation rates.

[C-3] Influence of the application of Zn and Mn obtained from black mass on young citrus plant growth.

Ana Isabel Escudero[1], Patricia Arizo-García[1]*, Rubén Simeón[1], Miguel Angel Naranjo[2], Marcos Caballero[2], Feliz Antonio López[3], María Isabel Martín[3], Alberto San Bautista[1]

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The reuse of industrial waste is essential to reduce environmental impact and promote more sustainable development. Therefore, the need arises for new methods that do not rely on the consumption of limited resources. In response to this need, a new fertilizer, known as a black mass, was developed from the recycling of alkaline batteries, where the raw material is utilized and transformed into a useful product rich in manganese and zinc. The aim is to use industrial wastes to develop a new environmentally safe fertilizer. An experiment was carried out in young citrus plants (*Navelina* cutivar and *Carrizo* rootstock) grown in pots filled with coconut fiber under greenhouses at Valencia (Spain). A total of one hundred plants were divided in four experimental groups (Ncontrol, Pcontrol, BMS, BMLS), all irrigated with Hoagland nutrient solution. NControl nutrient solution didn't have Mn and Zn. PControl nutrient solution was prepared with sulfates. BMS nutrient solution was prepared with Mn and Zn from Black Mass. BMLS nutrient solution was prepared with black mass lignosulphates. Plants were irrigated according ETc and monitored for various monthly parameters (height, stem diameter, CIEL*a*b*, number of leaves, and SPAD) and quarterly parameters (LAI, biomass, foliar content of elements, and chlorophyll). The results showed that there were no significant differences between nutritive solutions, which guarantees the absence of harmful substances and, therefore, the health of the plants. In consequence, no toxic effect was found in the young citrus plants treated with nutrient solutions prepared with Mn and Zn received from the black mass.

[C-4] The Historical Utility and Research of Entomopathogenic Fungi in Floridian Citriculture, 1885-2024

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Sustainable horticulture promotes the use of environmentally friendly and compatible agrochemicals and biopesticides. Microorganisms that have the least impact on the environment and have been applied since the 19th century are the entomopathogenic fungi (EPF). These are a group of microorganisms which form colonies visible to the naked eye after they infect a host. Two of the most widely utilized species of EPF in agriculture are *Metarhizium* spp. and *Beauveria bassiana*, and Florida boasts of an array of endemic EPF including genera such as *Aschersonia*, *Cordyceps*, *Lecanicillium* and *Hirsutella*. The state's humid climate and low seasonal variability compared to other parts of the country facilitate the continuous growth of EPF and interactions with host organisms, including citrus. Observations of EPF infecting citrus pests were made as early as the 1880s, and the 20th century coincided with greater initiatives to study these microorganisms and incorporate them into commercial applications. Abundant research involving the use of EPF on citrus arthropod pests was conducted by Dr. Clay W. McCoy, during his long tenure at the UF/IFAS Citrus Research and Education Center. Ongoing studies aim to evaluate how effective EPF could be at mitigating the insect vector associated with citrus greening (huanglongbing) disease. This presentation will include past, present and future perspectives of using EPF-based products for the management of citrus arthropod pests in Florida sub-tropical climate.

[C-5] Grove-First: A Novel Approach to Field Testing Molecules for the Treatment of Citrus Greening

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There is an urgent need to provide relief from citrus greening and restore profitable citrus production. Trunk injections with oxytetracycline are the only approved antibiotic treatment in Florida. To broaden treatment options, a framework based on the principles of design-of-experiments was developed to efficiently screen large number of molecules in citrus groves. Eighty-eight molecules were injected into 8-year-old 'Valencia' sweet orange trees grafted on 'US-812' rootstock over a six-week period. The injections were divided into nine sets, with varying numbers of molecules injected in each set (12, 10, or 6). Visual assessments of tree health index and canopy density were collected to evaluate changes in horticultural traits. Ratings were recorded before injections and at 90- and 180-days post-injections. In addition to health index and canopy density, a series of seven pictures were taken per tree on the injection day and subsequently at 30, 60, 90, and 180 days after injections. Pre-harvest fruit drops were measured by counting and removing any fruits on the ground beneath each tree. Yield, fruit, and juice quality were assessed at harvest. Trees injected with oxytetracycline served as a positive control to indicate enhancement in tree health. Results from the tree health index obtained at 90 and 180 days after injection showed that 17 molecules performed similarly or better than the oxytetracycline-treated positive control. We are partnering with regulatory consultants to identify those that are safe and affordable. New molecules for injection will require regulatory labeling.

[C-6] Brassinosteroids improve yield and plant defense in different citrus varieties.

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Huanglongbing (HLB), or citrus greening disease, severely threatens citrus production worldwide, leading to significant yield losses and economic costs. Brassinosteroids (BRs) are phytohormones known for their fundamental role in plant growth, development, and stress responses, and hold promise in combating HLB in citrus. In this study, two mandarin cultivars, Tango and Sugar Belle (SB), on two different rootstocks, Sour Orange (SO) and US-942, were monthly sprayed with BRs. The application was conducted on trees previously covered or non-covered for 3 years, with individual protective covers (IPCs). In addition to rootstock and scion diameter, canopy volume, yield, and internal fruit quality, expression of defense-related genes in the salicylic acid biosynthetic pathway and downstream PR genes was studied. BRs application significantly improved canopy volume in Tango irrespective of the rootstock, after 6 months, and this effect continued for at least one year. Likewise, treatment increased yield by 2.5-fold. Sugar Belle behaved differently, as BRs significantly enhanced the yield of non-covered Sugar Belle on SO or US-942 rootstocks, however BRs did not influence fruit production for the uncovered trees. Gene expression analyses showed that BRs treatment on uncovered Tango trees induced expression of defense-related genes; Together, this work shows a role for BRs in modulating plant immunity while improving growth and suggests that BRs are a promising tool for sustainable citrus management in HLB endemic areas.

[C-7] Exploring the Effect of Brassinosteroids Application Timing on the Internal Fruit Quality in Mature Citrus Trees

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Florida has significantly lost citrus yield in the past few years. The yield has declined from 169.1 million boxes in 2004-05 to 15.8 million in 2022-23. The major reason behind the yield loss is Huanglongbing (HLB). In Florida, HLB is associated with the bacteria *Candidatus* Liberibactor asiaticus. One of the main effects of HLB is poor fruit quality in terms of a decrease in Brix and altered Brix to acid ratio. A class of plant steroidal hormones, brassinosteroids (Brs), has shown some positive results in maintaining fruit quality after post-harvest application in blood oranges. However, the preharvest application effect of Brs on fruit quality has not been explored. We hypothesized that applying Brs at the right maturation stage would help reduce physiological changes induced by HLB and maintain improved fruit quality. Starting in September, foliar application of Brs was performed in Hamlin oranges continuously every 15 days or just once at 15d intervals to identify the right window of hormone efficacy. Fruit quality was determined two weeks after each treatment, including size, color, and brix-to-acid ratio. The results showed an increase in brix and brix: acid

ratio as well as in color development with the Brs treatment performed at a later maturation stage and close to the harvesting time (November).

[C-8] Key components of grapefruit quality affecting pack-out and fruit revenue in CUPS

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In the high-investment Citrus Under Protective Screens (CUPS) grapefruit production system, understanding the critical factors influencing net fruit revenue is essential for fine-tuning the enterprise to be profitable. After 10 years of successful HLB-free grapefruit production in the CREC CUPS, we explored the effects of fruit yield, fruit drop, fruit size, internal quality, and defects such as undersize fruit, discolored and misshapen fruit, scars, rind breakdown and decay on the pack-out and net revenue per box returned to the grower. Using sensitivity analysis, the key determinants of profitability could therefore be identified. Yield and fruit size emerged as primary influencers of revenue, while rind blemishes significantly impacted marketability and thus returns. Although market prices critically influence net fruit revenue, they are often beyond the direct control of production practices. Spider mites, greasy spot and melanose diseases are the primary contributors to rind blemishes of grapefruit grown in central Florida CUPS. Other fruit disorders encountered include “sheep-nosing”, citrus scab disease and insufficient color break. Color break can be artificially induced with ethylene application at the packing house, and a well-designed fertilizer program minimizes sheep-nosed fruit. Significantly, CUPS virtually eliminates citrus canker, highlighting a major advantage of this system in a subtropical climate. A sensitivity analysis underscores the elasticity of profitability to these factors, offering a strategic roadmap for optimizing production practices and sustainability in CUPS.

[C-9] TO UNDERSTAND THE CAUSE AND MECHANISM OF POOR FRUIT ATTRIBUTES IN HLB-SYMPTOMATIC SWEET ORANGE FRUIT

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The Florida citrus industry has faced significant economic losses for decades due to the citrus disease, Huanglongbing (HLB), which affects both the citrus trees' health and fruit development and quality. Small fruit increased pre-harvest fruit drop, and low yield are common in HLB-affected trees, which is a major concern for the industry. HLB-affected trees produce a significant proportion of symptomatic fruit, lopsidedness (the central core may be curved) is a defect of symptomatic fruit that are known to have poor quality. Although previous research has compared asymptomatic and symptomatic fruit, no studies have investigated the cause of defects in HLB-symptomatic lopsided fruit, making it an important gap in our understanding. This study aims to understand the mechanism leading to the development of lopsided fruit in HLB-affected sweet orange. Understanding the cause of symptomatic fruit development can lead to the development of new strategies to mitigate this kind of defect to improve citrus fruit quality and benefit the citrus industry. In the current study, Valencia 15-year-old trees were used, and asymptomatic and symptomatic individual fruit were tagged in June. Fruit growth rates and other growth characteristics were monitored monthly from June to February (individual fruit n=40). Asymptomatic and symptomatic fruit were destructively sampled multiple times (every 2-3 months), and samples were stored at -80°C for further analysis. Preliminary findings indicate that symptomatic fruit were present as early as June. Asymptomatic fruit had more fruit size (60.5 mm vs. 53 mm, respectively), peduncle diameter and size-to-peduncle ratio than symptomatic fruit consistently from June to February. The fruit growth rate was lower in symptomatic fruit, and fruit halted in September as compared to asymptomatic in November. During the rapid fruit growth period, asymptomatic fruit had 40% more leaves with more leaf area and leaf mass per unit area (18% and 9.5%, respectively). Symptomatic fruit exhibited early, and higher rates of pre-harvest fruit drop as compared to asymptomatic fruit (65% vs. 37.5%, respectively). Fruit size and leaves were positively correlated, whereas fruit drop was inversely correlated with leaves. A higher fruit-to-peduncle ratio suggests a balanced growth in asymptomatic fruit, and number of leaves close to fruit influences the fruit size and pre-harvest fruit drop. The early growth cessation in symptomatic fruit suggests developmental constraints in fruit growth.

Hormonal, enzymatic, and biochemical profiles of stored leaves, stem, fruit peels and pulp will be analyzed, which may provide insights relevant to the proposed hypothesis.

[C-10] Optimizing Oxytetracycline Injection in Citrus Trees: Concentration and Dosage Effects

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Florida citrus industry began applying oxytetracycline by trunk injection to manage the disease huanglongbing (HLB). This study aims to assess the effects of different rates of oxytetracycline (OTC), different injection volumes and different numbers of injection sites, on tree health and productivity. A field trial was conducted in a commercial citrus grove in southwest Florida. The trial was composed of 8-year-old 'Valencia' sweet orange (*Citrus sinensis*) trees grafted on Kuharske (*C. sinensis* × *Poncirus trifoliata*) rootstock. The experimental design was completely randomized with two factors (OTC dose, and number of injection sites) and six blocks. Trees were injected in May 2022 and in June 2023 with a formulation of OTC (ArborBioticTM, MGF Scientific, 39.6% oxytetracycline hydrochloride) and using Chemjet tree injectors (Logical Result LLC). The doses were 0.59 g, 0.79 g, and 0.99 g of OTC per tree and were delivered using one, two, or three injectors. Each injector holds a volume of 20 ml, and the OTC was dissolved and delivered in 20 ml, 40 ml, and 60 ml of deionized water for each dose, respectively. Preliminary results show significant differences among injected and non-injected trees. Fruit yield of injected trees increased by 38%, fruit weight increased by 9%, and the ratio of TSS to acidity increased by 10%. Overall, injection with three syringes produced the largest amount of TSS, regardless of the OTC rate. This study provides valuable insights for citrus growers, contributing to the ongoing efforts to combat HLB and sustain the health of Florida's citrus industry.

[C-11] Efficacy of Propionic Acid in Reducing Pre-harvest Fruit Drop in 'Hamlin' Sweet Oranges Under Huanglongbing (HLB) Stress

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Pre-harvest fruit drop significantly undermines the yield and economic viability of citrus orchards, especially those affected by Huanglongbing (HLB). This is a critical issue in Florida's citrus production. This study investigated the efficacy of propionic acid in mitigating fruit drop in 'Hamlin' sweet oranges. Utilizing a randomized block design, the experiment applied three monthly doses of propionic acid — 40 ml/ac (Low), 162 ml/ac (Mid), and 324 ml/ac (High) — to trees, with an untreated group serving as the control. The primary aim was to assess the impact on fruit drop rates, yield, and fruit quality, with a specific focus on the weight and Brix values of the oranges.
Results indicated that the mid dose of propionic acid was most effective in controlling fruit drop, significantly reducing losses by 30% as compared to the control; notably, this treatment also enhanced the average weight of the oranges; these two facts, together, led to a higher yield. Low and high doses also reduced fruit drop, but to a lesser extent.
These findings suggest a promising avenue for reducing pre-harvest fruit drop and enhancing the profitability of citrus cultivation amidst challenges like HLB. Future research should explore propionic acid's long-term effects and optimal application protocols to maximize its benefits for citrus production. This study contributes to the growing body of knowledge aimed at sustaining and enhancing citrus yield through innovative agricultural practices in a scenario of endemic HLB.

[C-12] Therapeutic Impacts of Molybdenum on Young Huanglongbing-Affected Citrus Trees

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In the last two decades, citrus production in Florida has steadily declined due to citrus greening disease also called Huanglongbing. The disease disrupts citrus tree growth, resulting in reduced yield, fruit size, and juice quality. Nutrients are vital for enhancing tree resilience against biotic and abiotic stresses. Research indicates that optimal ratios of elevated macronutrients and micronutrients may mitigate adverse effects of HLB, particularly root loss. Nonetheless, some micronutrients such as molybdenum (Mo) application rates for young and mature HLB-affected citrus trees in Florida remain to be determined for trees impacted by HLB. To address this, a study is being conducted to evaluate the effect of varying rates of Mo on citrus tree growth and biomass accumulation of 2-year-old HLB-affected and HLB-free Valencia (*Citrus sinensis* L. Obserk) on Swingle citrumelo rootstock under greenhouse conditions. Preliminary results show that different Mo rates impact tree growth. In HLB-affected trees, 4.48 $kg \cdot ha^{-1}$ (4×-standard rate) Mo treatment resulted in the lowest height, probably due to toxicity, while 2.24 $kg \cdot ha^{-1}$ (2×-standard rate) resulted in the lowest height among unaffected trees. No significant differences in trunk diameter were observed among HLB-affected trees, whereas those subjected to 4.48 $kg \cdot ha^{-1}$ (4×-standard rate) showed the smallest trunk diameter among unaffected trees. Our findings suggest that applying 4.48 $kg \cdot ha^{-1}$ (4× UF/IFAS current standard rate) adversely impacts key plant growth parameters.

[C-13] Foliar spray of macronutrients influences leaf nutrient status and citrus fruit qualities of Sugar Belle® grown in Florida sandy soil

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Sugar Belle® mandarin is the most Huanglongbing (HLB)-tolerant citrus variety, but fruit qualities (peel thickness, texture, total soluble solids (TSS), titratable acid (TA)) and plant nutrient balance are still compromised due to HLB. Soil fertilization is the easiest way to supply required nutrients, however nutrient uptake could be ineffective and inhibited due to poor root systems in HLB-affected trees. The experiment was conducted during 2022-2023 at the University of Florida, Citrus Research and Education Center in a five-year-old Sugar Belle® mandarin grove to assess the effect of foliar application of macronutrients to increase peel thickness and fruit qualities. The experiment consisted of eight treatments which includes foliar application timings of Potassium Nitrate (KN), Dipotassium phosphate (DKP), KN with sodium borate (Boron), and Gibberellic acid (GA). Results showed that foliar KN application either in May or July resulted in significantly thicker peel of 2.42 mm on the bottom section (stylar end) during 2023 which is almost 20% 23% and 28% more than control (no spray), GA and DKP respectively. TSS and fruit diameter were not significantly different with foliar application of nutrients, however, GA spray resulted in significantly low. Leaf nutrient concentration was not affected with foliar application nutrients except leaf K concentration during year 2023 where KN application during May and July with B resulted in significantly higher concentrations. Based on these findings, one-time foliar application of KN during either May or July is helpful for improving peel thickness which need large scale field experiment before recommendation.

[C-14] Response of Grapefruit Trees to Reclaimed Water as Alternative to Groundwater Irrigation in Florida

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Coastal agriculture frequently depends on surface water for irrigation. However, in Florida's agricultural landscape, surface water availability can become limited, particularly during the dry season. Consequently, growers often switch to groundwater which has lower water quality characteristics. Groundwater in coastal areas typically carries high salt concentrations that can negatively affect crop production. Citrus species are sensitive to these salinity concentrations and are also one of the most produced crops in the state. Alternative water sources, such as reclaimed water, must be evaluated for sustainable irrigation during the dry season. The objective of this study was to evaluate grapefruit tree responses to different water sources and salinity concentrations. One-year-old grapefruit trees (Ray Ruby) grafted on US-942 were grown under controlled greenhouse conditions. Four different types of water were applied: surface (0.3 dS/m), reclaimed (1.1 dS/m), blended (2 dS/m) and groundwater (3.5 dS/m). Dry weight, chlorophyll contents, and electrolyte leakage were measured at the end of the experiment. Soil water and electrical conductivity (EC) values

were continuously recorded using soil moisture sensors. Plants treated with reclaimed water showed a reduced physiological stress, higher chlorophyll content and lower electrolyte leakage, compared to those irrigated with groundwater. Higher root biomass was found in plants irrigated with reclaimed water. Soil EC increased up to 1.8 dS/m across the experiment, crossing the grapefruit tree salinity tolerance threshold for the groundwater treatment. Overall, reclaimed water enhanced physiological plant performance and resulted in lower salt accumulation compared to groundwater, establishing it as a viable alternative water source.

[C-15] Does variable macronutrient application impact the performance of huanglongbing (HLB)-affected sweet oranges?

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Huanglongbing (HLB) is a disease that has been affecting the citrus industry in Florida since 2005, causing fruit quality issues and making citrus trees unproductive. Currently, there is no cure for this disease, prompting scientists to explore potential solutions to revive the Florida citrus industry, which historically produced around 80% of the national citrus fruits. In the pursuit of a remedy, research has identified decreased fibrous root density as the prominent symptom of HLB-affected citrus trees which leads to hampered nutrient uptake. Research has identified decreased fibrous root density as a prominent symptom of HLB-affected citrus trees, leading to hampered nutrient uptake. Standard recommended rates of nitrogen and phosphorus may no longer be applicable, requiring new site-specific nutrient management guidelines. A study was initiated on 11-year-old 'Valencia' sweet orange trees in central Florida to assess the impact of nitrogen and phosphorus fertilization on the growth and yield of HLB-affected citrus trees. The study aims to determine the optimal nitrogen and phosphorus fertilization rates, with the hypothesis that varying application rates can alleviate losses due to HLB, potentially enhancing citrus canopy growth and improving overall nutrient uptake. Treatments receiving additional fertilization beyond current recommendations are expected to have higher canopy measurements and nutrient content, resulting in optimal tree performance.

[C-16] Impact of Huanglongbing (HLB) on Source-Sink Dynamics and Photosynthesis in Citrus

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Understanding how sink organs and photosynthesis respond to huanglongbing (HLB) can aid the development of effective disease management strategies. Healthy plants dynamically co-regulate photosynthesis and sink demand for carbon, mediated by phloem translocation. HLB alters carbon availability leading to sugar hyperaccumulation in the source and along phloem pathway. We hypothesized that HLB would limit sink activity coordination and photosynthesis. To assess the impact of HLB on source-sink dynamics, we used HLB-affected and -unaffected 'W. Murcott' trees grown under protective screens. To assess the impact of source-sink dynamics, we manipulated source-sink dynamics by girdling and defoliating at 0%, 50% or 75% per one fruit on each branch and control treatment (no defoliation or girdling). Using gas exchange methods, we quantify the maximum rate of carboxylation and electron transport in carbon fixation and assess sink carbon demand by measuring carbon accumulation and utilization in the fruit. Varying source:sink ratio did not significantly affect photosynthetic activity in both HLB-affected and unaffected trees. HLB-affected trees had reduced fruit growth, defoliation reduced fruit growth in healthy trees, and only impacted HLB-affected trees at extreme defoliation rate (75%). Thus, HLB impacts sink activity and source-sink transport more than photosynthesis. Although HLB impacts sink growth, it limits the effect of source:sink variation on sinks as sink carbon demand remains relatively stable. Suggesting that this might be due to buffering effect of sugar hyper-accumulation in the stem phloem. Summarily, HLB does not dramatically affect photosynthesis but reduces fruit growth and interrupts carbon fixation coordination and consumption by fruits.

[C-17] Evaluation of Different Container Types on Root Architecture and Performance of Nursery-Grown Citrus Plants

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Establishing a healthy tree is imperative for sustained citrus production. Poor tree establishment after transplant to the field might be hampered by malformed roots developed during the nursery stage. Containerized citrus production in enclosed nurseries restricts root growth and can produce pot-bound, intertwined roots. In addition, the container type in which the trees are grown, can significantly affect the root architecture. Containers with root-pruning properties like chemical pruning or air pruning can produce better root systems and healthier trees by reducing root circling and other malformations. This study evaluates the effects of three different nursery containers: chemical pruning (CP) containers, air pruning (AP) containers, and standard nursery containers (SC) on root physiological and morphological traits and plant performance. Two rootstocks US-812 and US-942 grafted on 'Valencia' orange scion were used. Chemical root pruning using a commercial formulation of copper paint (10% Cu) positively influenced tree height, shoot mass, leaf area, rootstock trunk diameter, and non-fibrous root biomass. No differences among container types were observed for the fibrous root biomass. Most of the leaf-nutrients were lower in content in trees grown in CP containers compared to trees grown in standard containers. Copper root pruning also produced a higher specific root length and fibrous root respiration rate. Trees grown in AP containers were not significantly different in growth than trees grown in the other containers. Overall, the results suggest that copper root pruning improves citrus nursery growth, which may facilitate tree establishment after field transplant.

[C-18] Cover Crops for the Indian River Citrus District: Selection of Leguminosae Species Based on Biomass and Root Nodulation

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Cover crops have reemerged as an increasingly common soil management strategy for citrus production in the Indian River District (IRD) due to their potential to enhance soil nutrient content and organic matter. Often, Leguminosae species are incorporated into cover crop mixtures for their ability to fix atmospheric nitrogen and increase soil fertility; however, there is a lack of research regarding which species are best suited for the IRD. In response, a field trial that compared the biomass and root nodulation of different Leguminosae species was conducted in the IRD. Six different treatments, consisting of five species monocultures and one fallow plot (control), were organized into a completely randomized design. Each treatment was replicated five times, resulting in a total of thirty experimental plots. The species chosen were hairy indigo (*Indigofera hirsuta*), sunn hemp (*Crotalaria juncea*), cowpea (*Vigna unguiculata*), alfalfa (*Medicago sativa*), and aeschynomene (*Aeschynomene americana*). Leguminosae species were planted in summer and winter 2023 and both terminated after six months. Soil nutrients, moisture, temperature, organic matter, as well as plant biomass, root nodulation, and nodule activity were collected at three and six months after planting for each season. Overall, aeschynomene exhibited significantly higher nodule density, and differences were observed in biomass between the Leguminosae species. Seasonality significantly affected plant biomass and establishment with summer resulting in higher performances in nearly all the tested species. The identification of an optimal legume for inclusion in a winter cover crop mix for the IRD is ongoing, and this study contributed to this effort.

[C-19] Rootstock responses to oxytetracycline trunk injections for managing huanglongbing (HLB) in Florida citrus.

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Trunk injection is a promising and environmentally friendly pesticide delivery method for treatment of Huanglongbing (HLB) in citrus trees. It involves the targeted delivery of pesticides, such as oxytetracycline (OTC), into the vasculature, from where it is distributed systemically throughout the tree. The current label for OTC injections

recommends injecting into the rootstock, but it is unclear whether injecting into the scion would be equally effective, and if different rootstocks respond differently. To address these questions, a large-scale study was conducted at a commercial production site in Florida. The study used 9-year-old 'Valencia' orange trees grafted onto five different rootstocks planted in a randomized block design. Three treatments were applied: 1) no injection (control), 2) OTC injection into the scion, and OTC injection into the rootstock. The injections were carried out in April 2023 using FlexInject injectors and a commercial formulation of OTC at a rate of 1.1 g (a.i.) per tree. Scion injections resulted in more external wound damage in terms of wound closure, wound size, and bark cracking than rootstock injections. Three months after injection, CLas titers were reduced in all injected trees. Yield and juice brix measured in March 2024 were increased by 58% and 10%, respectively, regardless of the injection site, but different rootstocks responded differently. The best performing rootstock in this study was US-812 and the worst was sour orange. In summary, the delivery of OTC through trunk injection demonstrates potential for short-term mitigation of HLB but the efficacy can be influenced by the rootstock.

[C-20] Field evaluation of different rates of oxytetracycline delivered by trunk injection in mature 'Hamlin' sweet orange trees

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Huanglongbing (HLB) is an endemic disease of citrus in Florida causing major economic losses. The systemic delivery of oxytetracycline (OTC) by trunk injection has been adopted as a viable strategy for managing HLB by targeting the associated pathogen *Candidatus* Liberibacter asiaticus. The main objective of this study was to determine the optimal OTC rate to improve the health and productivity of HLB-affected mature sweet orange trees. A trial was established in a commercial citrus production site in Polk County, Florida. The trees were 18-year-old 'Hamlin' orange (*Citrus sinensis*) grafted on Carrizo (*C. sinensis* × *Poncirus trifoliata*) rootstock. In June 2023, trees were injected with OTC at four different rates (0.55g, 0.85g, 1.1g, and 1.65 g active ingredient per tree) and compared against non-injected trees. A registered formulation of OTC (Rectify) was used and administered with one FlexInject injector in a volume of 100 mL, except for the highest rate, which was administered with two injectors on opposite sides of the trunk using 75 mL per injector. All injections were performed in the scion. The experimental design was a randomized block design with 10 replications, and each replication consisted of three linear trees. Fruits were harvested in December 2023, and fruit quality and yield were determined. On average, injected trees produced 26% more fruit, and juice brix was 7% higher. The best results were obtained with the highest OTC rate administered with two injectors. This research provides important insights into the best practices for managing HLB using trunk injection of OTC.

[C-21] Utilizing drones for high-throughput phenotyping of citrus tree health to identify HLB tolerant individuals for breeding and selection

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Citrus has been decimated by huanglongbing (HLB), a devastating disease caused by a phloem-limited bacterium and vectored by the Asian Citrus Psyllid. Most citrus cultivars are susceptible to HLB, which causes tree decline and death, among other symptoms. Sweet orange trees that are affected by HLB produce lower yields with low quality, smaller fruit with low total soluble solids and high acidity, which greatly affects juice quality and greatly reduces profitability for growers. There are some advanced selections in the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) citrus breeding program that appear to be tolerant to HLB. Growers, processors, and other stakeholders desired to have all UF/IFAS citrus material evaluated via drone in December of 2022 and again, to a lesser degree, in December 2023. Quantitative data gathered included tree count (number of existing and missing trees), measurements of canopy area and volume, normalized difference vegetation index (NDVI), and normalized difference red edge index (NDRE). Commercial groves not affected by HLB were used to develop comparator metrics for plant health. Results indicated that there are significant differences among citrus cultivars and among sites in general. There was significant plasticity in terms of tree health for various cultivars that are believed to be tolerant to

HLB. However, some trees were missed by the drone metrics, which required in-person ground truthing to verify. More research is needed to increase the accuracy of drones when used to identity possible candidate cultivars for growers and breeders.

[C-22] Understanding of molecular mechanism of newly identified natural bud sport from the 'Flame' Grapefruit

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Natural bud sport occurs due to spontaneous genetic mutation in a plant which can result in the emergence of plants showcasing distinctive phenotypic trait, including changes in color, size, or disease resistance. Such genetic mutation leads to a distinct branch or shoot that exhibit unique characteristics to the rest of the plant and identifying and studying these sports which positively impact the phenotypic traits can contribute to crop improvement. This report investigates the biochemical and transcriptomic changes of natural bud sport found in the 'Flame' Grapefruit variety in comparison with its wildtype phenotype in response to Huanglongbing (HLB; Citrus greening) disease. Biochemical analysis revealed a quantitative difference in chlorophyll and starch content between the wildtype and mutant phenotype, while the phenolic content showed no significant difference. Starch accumulation was higher in the leaves of wildtype compared to the mutant, serving as one of the markers for HLB infection. Transcriptomic analysis revealed differential expression of transcripts belonging to leucine rich repeats, phloem proteins, phytohormones like jasmonic acid and gibberellic acid. The DEGs related to callose depositions were downregulated and phloem proteins were significantly expressed in mutant compared to wildtype, suggesting that flame might be modulating phloem genes in response to CLas without callose excessive deposition. Lower level of phloem disruption and greater phloem regeneration capacity are responsible for the HLB tolerance. Over expression of WRKY factors involved in PR genes like NIM1 expression along with negative regulators of PR gene suggesting activation of PR defense as well as balancing to avoid excessive and prolonged activation observed in this study. Downregulation of carbohydrate metabolism and major transporter gene might be a part of resource allocation strategies to limit bacterial spread. Altered expression of some of the key genes and pathways in mutant producing a better phenotype than wildtype against HLB infection, suggesting that the plant is evolving against the pathogen through the natural mutation.

[C-23] Molecular Analysis of Pummelo-Finger Lime Hybrids following Huanglongbing (HLB) infection

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Huanglongbing (HLB), is a devastating bacterial disease caused by the bacterium *Candidatus* Liberibacter asiaticus (*Ca*Las) and affects citrus trees worldwide. The current study investigates the performance of two F1 pummelo X finger lime sibling hybrids in response to *Ca*Las infection. The hybrids were identified primarily using leaf morphology assessment and were selected for further studies based on the differential *Ca*Las titer in leaf petioles. HLB infected budwood from the selected hybrids, (PF2-61 and PF1-11) were grafted onto Swingle rootstock along with the two parents for further evaluation. Two years post grafting, PFL 2-61 had low *Ca*Las titer and increased chlorophyll content when compared to PF1-11. Subsequently, we conducted a detailed investigation of these two siblings by conducting transcriptome analysis. Out of 21,532 DEGs identified, 1,413 were downregulated in PF2-61 compared to PF 1-11, while 325 exhibited upregulation. Several pathways were activated such as cell wall-related genes, redox homeostasis, biotic stress response, phytohormone transcription factors, and secondary metabolism pathways, suggesting activation of defense mechanism. The expression of genes included several involved in redox homeostasis (*TTL1*, *FSD2*, *APX3*, *ATH7*), and biotic stress response (*PR5*, *TLP1*, trypsin and protease inhibitors). Several phytohormone related (*ABF3*, *PIN6*, *DFL1*, *AILP1*, *LOX2)* and secondary metabolite synthesis-related genes (*PAL1*, *DXR – 1*, *LAC5*, *LAC11*, *LAC17*, *DFR*, and several others) were also upregulated. Development of HLB tolerant hybrids by breeding with the finger lime can be a practical approach to rapidly develop HLB tolerant rootstock

and our data sheds some light on the mechanism of HLB tolerance in hybrids developed using the finger lime as a parent.

[C-24] Rootstock Effects on Yield and Juice Quality of HLB-affected 'Ray Ruby' Grapefruit and 'Glenn Navel' Sweet Oranges

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The Florida citrus industry has diminished in size and production over the past fifteen years due to HLB, also known as citrus greening. The Indian River Region is internationally known for its prime grapefruit; however, the scion is highly susceptible to the bacteria that putatively causes HLB—*Candidatus* Liberibacter asiaticus (*C*Las). The best management of the several scion and rootstock varieties commercially available and yet-to-be-released materials is crucial for an informed decision by citrus growers. Although an HLB-resistant plant is the utmost target to a whole industry recovery, a fine tune between best rootstock for the appropriate scion is still to be accomplished in the current HLB epidemic scenario. Our study aims to examine the rootstocks' effect on the yield and juice quality performance of 'Ray Ruby' and 'Glenn Navel' sweet orange scions. We evaluated over 30 rootstocks in two distinct scions in the 2023-24 harvest season for yield, juice weight, and quality. Raw data and graphs were analyzed in RStudio. Grapefruit and sweet orange scions require specific rootstock characteristics for optimal yield and juice quality. 'Ray Ruby' grafted onto 'UFR-15' yielded nearly 50% more than the second-best rootstock variety. 'Glenn Navel' had several best-yield-performing rootstocks, with 'US-942' and 'UFR-17' as the top two. Juice brix showed no distinct differences between scion/rootstock combinations; however, a dwarfing rootstock, 2247x6070-02-2, performed best for both scions regarding juice quality.

[C-25] Consumer Preferences for Finger Limes

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Finger limes are a relatively new fruit crop also known as citrus caviar due to its shape, desirability, and high price. The fruit has the potential to diversify citrus production as it is tolerant to citrus greening, a devastating citrus disease now endemic in Florida. Researchers at the UF Citrus and Research Education Center have recently released new improved red pulp finger lime cultivars, which have excellent sensory attributes. In particular, the SunLime cultivar seems promising based on preliminary industry and consumer feedback. To assess market opportunities for the SunLime cultivar, we conducted research at the consumer level to understand consumer preferences including their willingness to pay (WTP) for it. During the first half of 2023, we participated in different consumer shows and festivals to access a very diverse consumer base. A total of 573 consumers tasted the fruit and completed a survey. In the survey, consumers were asked their perceptions about the fruit's sensory attributes, potential pairing options, and their WTP for the SunLime cultivar. Consumers participating in the survey indicated that this cultivar has great potential to be used in cocktails, salads, and with seafood. In terms of pricing, it was found that on average consumers are willing to pay $4.86 for 1.4 oz (40 gr.) of the SunLime cultivar. These results will help citrus growers and agricultural entrepreneurs to better understand market opportunities for this new cultivar.

Handling & Processing

Presiding: **Adrian Berry**

[HP-1] Comparative analysis of lemon juice quality: A study of ten hybrids and commercial cultivars in Florida

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With HLB devastating over 90% of Florida's orange and grapefruit crops, lemons, which exhibit relative tolerance to HLB, could become a viable alternative. Although Florida doesn`t have a dedicated lemon industry, this study assessed juice quality of eight lemon hybrids (9E Lemon Seedling, 'Des 4 Saisons', 'Ichang', Lemon 62.67, 'Malta', 'Monachello', 'Vangasay', 'Villafranca') and two commercial cultivars ('Bears' and 'Eureka'), all collected from the USDA-ARS-HRL in Fort Pierce, FL. The key quality attributes analyzed included juice yield, soluble solids content (SSC), titratable acidity (TA), SSC/TA ratio, limonoids, and volatile organic compounds (VOC). 'Malta' and 9E Lemon Seedling led the group with juice yields exceeding 50%, followed by Lemon 62.67 and 'Des 4 Saisons'. SSC ranged from 5.8-10.1%, and TA 1.8-5.8%. Hybrids like 9E Lemon Seedling, 'Des 4 Saisons', 'Malta', 'Villafranca', and 'Bears' had well balanced SSC and TA contents. Limonin, which indicates bitterness, ranged from 7.26-14.58 ppm, with Lemon 62.67, 9E Lemon Seedling, 'Malta', and 'Vangasay' exhibiting the highest concentrations. The study identified 34 VOCs with limonene, γ-terpinene, β-myrcene, 3-carene, and terpinolene being the most prevalent. 'Monachello', 9E Lemon Seedling, and Lemon 62.67 had lower VOC emissions compared to the commercial cultivars. Overall, hybrids like 'Des 4 Saisons', 'Malta', 'Monachello', and 'Villafranca' demonstrated juice quality comparable to commercial cultivars, while others lagged in aspects of juice yield, TA, VOCs, or exhibited high limonoid levels, perhaps because they were not harvested at their optimum maturity level. This study offers preliminary insights for selecting lemon hybrids suitable for juice production in Florida.

[HP-2] Postharvest Performance of UF Selection 914 – A Red-fleshed Grapefruit-like Hybrid

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Selection 914 is a seedless, red-fleshed, grapefruit-like hybrid with low furanocoumarin content that was released by the University of Florida in 2012 through the New Varieties Development and Management Corporation FAST TRACK program. Reported here is postharvest fruit quality, degreening performance, and shelf-life results from 17 harvests, spanning 9 noncontiguous seasons, starting in 2012 and including this past season. Not all tests were conducted with each harvest. Fruit availability was limited before the 2021-22 season, with an average of 12 fruit per harvest. Afterward, each harvest comprised 60 or more fruit. After harvest, fruit external color, weight, total soluble solids (TSS), titratable acidity (TA), and storage quality were evaluated. Degreening exposed fruit to 5 ppm ethylene at 85ºF with 95% relative humidity. Fruit were stored at 50°F. Overall, fruit TSS averaged 9.48%, TA 0.63%, and with a ratio of 15.77. During storage at 50ºF, little decay (<8%) usually developed even after 8 weeks. Exceptions occurred with harvests in 2012 and 2013 with 20% and 30% decay, respectively, and in 2018, when 60% decay developed after 7 weeks. The fruit usually developed acceptable peel color by January or February, but also responded well to degreening. When fruit had bags placed over the developing fruit and grown under CUPS (Citrus Under Protective Screen), bagged fruit developed better peel color at harvest but also resulted in about 20% heavier fruit but with about 15% thicker peels. Bagging did not significantly affect juice volume, TSS, TA, or ratio.

[HP-3] Postharvest changes in finger lime fruit (*Citrus australasica*, F. Muell.) during storage at chilling or non-chilling temperatures

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Finger lime (*Citrus australasica*), also promoted by the name citrus caviar, is an emergent fruit in Florida, with current research focused on its cultivation and its pulp and peel nutritional values. In this study, we investigated the responses of 'UF SunLime' finger lime fruit to postharvest chilling and non-chilling temperature storage in terms of chilling injury symptoms and senescence. We also evaluated the effectiveness of fruit coatings in delaying development of postharvest chilling injury and senescence symptoms. Commercially mature 'UF SunLime' fruit were harvested at Lake Alfred, FL and transported to the postharvest lab at Gainesville, FL. After overnight storage at 10 °C/95% relative humidity (RH), the fruit were manually coated by brushing with water (control), coconut oil, or a commercial coating (Akorn Technologies) and stored either at 10 °C for 3 weeks followed by 1 week at 20 °C for shelf life evaluation or for 2 weeks at 4 °C followed by 1 week at 10 °C and an additional week at 20 °C for shelf life evaluation, all with 95% RH. Green areas on peel of fruit stored at 10 °C yellowed by the end of the study. Fruit stored at 4 °C developed small pits at the stomata within 7 days, which became larger over time. The stem end of some fruit stored at 4 °C or 10 °C collapsed or discolored with prolonged storage durations, rendering the fruit unmarketable. Coatings did not reduce fruit pitting or stem end collapse. Coconut oil reduced water loss of fruit stored at either 4 °C or 10 °C compared to the control treatment and thus potentially extended fruit shelf-life.

[HP-4] *Escherichia coli* transfer onto and internalization into strawberries dropped on plastic mulch.

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The US FDA Produce Safety Rule prohibits the distribution of dropped-covered produce due to the risk of contamination from the ground and the internalization of pathogen. This study aimed to assess *Escherichia coli* transfer onto and internalization into strawberries dropped onto plastic mulch from different heights. Unwashed strawberries (n=192), randomly selected and weighed, were dropped new and used plastic mulch inoculated with ~8 Log CFU gfp-tagged *E. coli* using PVC pipes from 15.24, 30.48, 60.96, 121.96 cm. Bacterial transfer (BT) to fruit surfaces was assessed via plate count. To measure bacterial internalization (BI), fruit surfaces were sterilized, prior to homogenization and plate counts followed by enrichment to identify the presence of *E. coli*. ANOVA showed significant differences ($p>0.05$) among scenarios; linear regressions explored correlations between BT/BI and fruit weight. *E. coli* survived significantly better during drying on new plastic mulch (7.6 ± 0.25 Log CFU/mulch) than used mulch (6.9 ± 0.58 Log CFU/mulch) ($p<0.05$). BT was significantly elevated ($p<0.05$) from new mulch (5.2 ± 2.1 to 5.5 ± 1.0 Log CFU/strawberry) compared to used mulch (2.2 ± 1.2 to 3.7 ± 1.8 Log CFU/strawberry). Internalized *E. coli* was detected in strawberries dropped onto new mulch from heights of 15.24, 30.48, and 121.96 cm, and onto used mulch from heights of 15.21 and 121.92 cm. No correlation was observed between with BT or BI and weight. Higher bacterial survival following inoculation and transfer to strawberries was seen from new plastic mulch, emphasizing the importance of not harvesting dropped strawberries.

[HP-5] Ethylene Degreening Enhances Peel Coloration in Georgia-Grown Satsuma (*Citrus reticulata*) Citrus Fruit

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In recent years, the production of Satsuma oranges (*Citrus reticulata*) in Georgia has increased significantly. Satsumas are known to produce a bright orange peel color fruit when the air temperature decreases below 12 °C. In Georgia, due to the subtropical climate, fruit usually fails to turn orange naturally, even after reaching physiological maturity. Degreening, a postharvest treatment using ethylene (C_2H_4) gas, was investigated to enhance color development in four Satsuma cultivars ('Brown Select', 'Owari', 'Miho', and 'Xie Shan'). Fruit samples at physiological maturity with green peel color were exposed to <1 ppm C_2H_4 gas for up to four days at 21°C and 95% relative humidity conditions. Control samples were stored without C_2H_4. Ethylene degreening resulted in higher respiration rates, weight loss, and reduced firmness on day four. However, it did not affect internal quality, including total soluble solids and titratable acidity.

Notably, degreening effectively removed chlorophyll and increased anthocyanin synthesis, producing orange/yellow colors in all cultivars after four days. There was no decay incidence observed in any of the treated and untreated samples. This study demonstrates the potential of C_2H_4 degreening to improve peel color development in early-season Satsuma citrus. By enhancing their visual appeal, this technique can increase fruit marketability, benefiting both consumers and the industry. Further research will be carried out to examine the effects of ethylene degreening on different Satsuma cultivars, their long-term storage, and consumer acceptability.

[HP-6] *Salmonella* cross-contamination risks between tomatoes and brush rollers during postharvest activities

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Tomatoes have been associated with salmonellosis outbreaks. The purpose of this study was to evaluate *Salmonella*'s transfer potential from contaminated tomatoes to adjacent tomatoes, brush rollers, and wastewater during washing on a brush bed under a spray bar using different concentrations of chlorine (pH 6.5) and peracetic acid. A bench-top brush washing system which included two roller brushes beneath overhead sprayers. Tomatoes were spot inoculated with a *Salmonella* cocktail (10^5) and dried for 1h. Inoculated tomatoes were placed on the brushes with an uninoculated tomato on each side. Wash water was mixed with chlorine or peracetic acid to concentrations of 20-100ppm and 20-80ppm, respectively. Tomatoes were washed for 30sec. *Salmonella* from wastewater, tomatoes, and (swabbed) brushes was enumerated. Enrichments were performed following a modified FDA BAM method because counts fell below the limit-of-detection. Results from 18 samples were reported as %positives and statistical significance was determined by chi-squared tests. A significant ($P \leq 0.05$) decrease in the number of positive enrichments for each enumerated sample was observed as chlorine concentrations increased; at 40, 50, and 70ppm the total number of samples positive was 60, 18 and 0%, respectively. A significant ($P \leq 0.05$) decrease of the %positive samples was observed as PAA concentrations increased at 50, 70 and 80ppm, the total number of samples positive was 46, 14, and 0%, respectively. The concentration of chlorine and PAA needed to minimize the potential transfer of *Salmonella* does not exceed the recommended concentration of either sanitizer in postharvest processes.

[HP-7] Biochemical Assays at Harvest Potentially Associated with Shelf-Life in Lettuce Grown in Non-Traditional Areas of Florida

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Stakeholders in Florida show a growing interest for producing lettuce in non-traditional areas throughout the state, including sandy soils. Currently, little information is known regarding the shelf-life of lettuce produced in these locations, which is important to consider due to the potential postharvest losses in this relatively fast-deteriorating leafy vegetable. As a result, experiments have been conducted in plasticulture on sandy soils at the Hastings Agricultural Extension Center to identify lettuce varieties with superior shelf-life. Yield and marketability were recorded at harvest, then plants were transported to the UF/IFAS Postharvest Laboratory in Gainesville. Plants were evaluated for visual quality using a hedonic scale and accelerated shelf-life testing at 10°C. At the same time, lettuce was transported to the Everglades Research and Education Center and evaluated using antioxidant-related assays to determine whether an early indicator could help estimate shelf-life performance. Preliminary results of this testing in sandy soils have demonstrated a genotype × environment interaction, with an overall decrease in shelf-life when tested in warmer plantings. Furthermore, preliminary data have indicated higher chlorophyll content could be associated with lettuce exhibiting longer shelf-life in these tests. Additional experiments are being conducted to supplement these findings, which could help identify lettuce cultivars with extended shelf-life when grown during warmer and cooler plantings in sandy soils. Eventually, and early detection method at harvest could be developed to estimate the potential shelf-life of lettuce for more efficient evaluations within breeding programs.

[HP-8] Fruit characteristics of six mandarin hybrids tolerant to HLB

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This study assessed the fruit characteristics of six new mandarin hybrids tolerant to HLB (FF-1-35-25, FF-1-21-30, FF-1-21-124, FF-1-35-96, FF-1-35-72, and FF-1-26-131), along with two commercial cultivars, US. Early Pride and Sugar Belle®. The assessed traits included size and shape, color, mechanical properties, seedlessness, ease of peeling, sugar-acid content, and sensory evaluation. Among these hybrids, FF-1-21-30 had the largest fruits, and all the hybrids exhibited flat shape. FF-1-21-30 excelled in terms of hardness, puncture, resilience, and deformation, closely followed by Sugar Belle® and Early Pride. In terms of color, FF-1-21-30 and FF-1-21-124 displayed a deep red/orange hue, while FF-1-26-131, FF-1-35-96, and FF-1-35-25 exhibited a more yellowish tint. Seedlessness varied among the hybrids; four of them (FF-1-21-30, FF-1-35-96, FF-1-35-72 and FF-1-26-131) were seedless, whereas the others, including Sugar Belle®, contained more than five seeds per fruit. Peelability also varied: three hybrids were easy to peel, two comparable to Early Pride, and the remaining one, along with Sugar Belle®, fell in between. Sugar and acid content varied as well, with three hybrids showing more than 13% soluble solids content (SSC) and differing titratable acidities (TA), and SSC/TA ratios. FF-1-21-30 emerged as a standout, high-quality hybrid, characterized by its large size, dark color, damage tolerance, seedlessness, high SSC, and balanced sugar-acid ratio. FF-1-26-131 and FF-1-35-25 also demonstrated comprehensive quality, particularly noted for their high SSC. These findings offer valuable insights for mandarin hybrid selection in Florida, emphasizing aspects such as size, color, seed number, peelability, susceptibility to physical damage, and sweet-sour profile.

[HP-9] Tracking Postharvest Quality of Melons (*Cucumis melo*) Imported from Central America

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Transporting melons from Central America to the US is a daunting challenge. The melons must be harvested at optimal maturity to maintain quality during the two-week journey across land and sea. For this study, the quality of nine imported honeydew and cantaloupe (*Cucumis melo*) varieties was tracked during simulated commercial storage. Four separate storage tests were conducted between November 2022 and March 2023. All melons were harvested from a commercial operation in Guatemala and shipped by marine container to a receiver in Pompano, FL then transported by refrigerated truck to the University of Florida postharvest lab in Gainesville, FL. Depending on the melon variety, fruit were placed in cold storage at either 4, 8 or 10 °C and 90% relative humidity for 14 days. Upon arrival at the lab, melon firmness ranged from 7 to 22 N and decreased up to 55% during storage. The flavor profile, as measured by the brix:acid ratio at the start of the storage, was lower for honeydew melons (35) compared to cantaloupe melons (140); however by the end of storage the ratio increased for honeydew (65) and decreased for cantaloupe (120). The results from these tests demonstrate that uniform maturity at harvest is critical for maximum quality and shelf life. Other than the development of brown spots on certain varieties, the melons maintained salable quality for up to 28 days after harvest.

[HP-10] Postharvest changes in bioactive compounds and antioxidant activity in muscadine grape cultivars during cold storage

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Muscadines (*Muscadinia rotundifolia* Michx) are native to the southeastern United States, with almost 100 improved cultivars. They have been cultivated for over 400 years for fresh consumption, juice, wine, and various processed products. Currently, there are approximately 5,000 acres of muscadines in commercial production in the southeastern United States. Due to the distinct pomological, physiological, and biochemical characteristics of muscadine grape cultivars, variations in storability and postharvest physiological behavior are possible. Furthermore, changes in bioactive compounds and antioxidant activity of muscadines offer valuable insights for determining optimal storage

periods and preservation methods to attain the highest quality for each cultivar in the market. Such insights can also yield valuable information concerning market demand and human health. In this study, six commercial muscadine cultivars (three purple: 'Alachua', 'Paulk', and 'Supreme'; and three bronze: 'Granny Val', 'Hall', and 'Triumph'), were harvested when fully colored and ripe from a research plot located in Citra, Florida, USA. All cultivars were grown under the same conditions and cultural practices. Immediately after harvest, the muscadine fruit were transported to the Postharvest Horticulture Laboratory at the University of Florida, Gainesville. The fruit were divided into sets of four replicates, each consisting of 20 fruit, and placed in clear, vented clamshell containers, then stored for 42 days at 4 °C with 90% relative humidity. The total anthocyanin concentration (TAC), total phenolic content (TPC), and total antioxidant activity (TAA) were assessed in the whole fruit, as well as separately in the peel and flesh of each cultivar at harvest and after 14, 28, and 42 days of cold storage. The purple cultivars had higher TAC, TPC, and TAA than the bronze cultivars, and the peel had higher levels of those bioactive compounds than the flesh. During cold storage, TAC, TPC, and TAA decreased in both the peel and the flesh, but more so in the peel. Two of the three purple cultivars ('Supreme' and 'Alachua') maintained more TAC, TPC, and TAA in the peel than the three bronze cultivars. Based on our results, the purple muscadine cultivar 'Supreme', followed by purple 'Paulk' and 'Alachua', exhibited better storability than the bronze cultivars in terms of maintaining their quality factors closest to the initial values. Overall, the order of storability of muscadine cultivars was 'Supreme'>'Paulk'>'Alachua'>>>'Granny Val'>'Triumph'>'Hall'.

[HP-11] Evaluation of postharvest treatments to extend the shelf life of mature breadfruit (*Artocarpus* altilis) fruit by restricting gas exchange.

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Breadfruit (*Artocarpus altilis* [Parks.] Fosb.) is a tropical fruit that may have export potential to North American and Europe from the Caribbean, but its extreme perishability limits its export potential considerably. Previous research has shown that the unripe fruit can be stored for 14 days at its chilling threshold of 13 °C. Traditionally, breadfruit have been stored underwater in homes to extend their shelf life and prevent softening and ripening. The aim of this study was to replicate the conditions of underwater storage using fruit coating and MAP packaging with the aim of facilitating export by marine transport. Mature-green, ~800-g 'Ma'Afala' breadfruit were stored at 13 °C, uncoated or coated with coconut oil, under water, or in sealed Ziploc freezer bags. Measurements were made after 4, 7, and 14 days for weight loss, firmness (compression and puncture force), and internal CO_2 and ethylene concentrations. Weight loss was best controlled by water submersion and bagging. There were no treatment differences for firmness after 7 days, but coated and bagged fruit were less firm after 14 days. Both submersion and bagging resulted in hugely increased, injurious CO_2 concentrations (30-50%), and internal ethylene increased to >2 ppm in the bagging treatment. The results indicate that adjustments will be needed in future fruit coating and MAP experiments to extend breadfruit shelf life while avoiding injurious CO_2 concentrations.

[HP-12] Studies with Open Field-Grown Purple Passionfruit: Comparison of Harvest Stage on Storage Quality

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Passionfruit (*Passiflora edulis*) harvest is typically passive, in which growers pick the ripe fruit after it abscises and falls to the ground. However, some growers clip the fruit before full ripe stage. Although the peel color is used as a harvest index there is limited research on how harvest maturity correlates to pulp quality for Florida-grown crops. Several tests were conducted to compare quality during simulated commercial storage of passionfruit harvested at two ripeness stages (clipped from the plant or after falling on the ground). Passionfruit were harvested from a commercial farm in the Homestead area transported to Gainesville and stored for three weeks at 10 °C/90% relative humidity. The following quality parameters were measured weekly: external color, weight loss, visual rating, pulp yield, soluble solids content (SSC), total titratable acidity (TTA), and pH. Results showed that fruit harvested from the ground had

a lower, initial hue* angle (28°), indicating a deeper purple compared to fruit harvested from the vine (45°). Weight loss was similar for ground and vine-harvested fruit averaging 2% after 7 d and 7% after 21 d however shriveling symptoms were higher for fruit harvested from the ground which usually developed after 14 d. Pulp volume was consistent during storage averaging 53% for ground-harvested fruit and 48% for vine-harvested fruit. The SSC at harvest was 15 °brix regardless of harvest stage and remained similar throughout storage. Fruit harvested from the ground had lower TTA (3.8%) compared to the vine (5%) which resulted in a higher SSC/TTA ratio (4.0).

[HP-13] Examining preharvest genetic and morphological factors contributing to lettuce (*Lactuca sativa* L.) shelf-life

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Lettuce is a highly perishable horticultural crop with a relatively short shelf-life that limits its commercial value and contributes to food waste. Postharvest senescence varies with influences of both environmental and genetic factors. From a larger pool of romaine lettuce genotypes, we identified three genotypes with variable shelf lives and evaluated their leaf morphology characteristics and transcriptomic profiles at preharvest to predict postharvest quality. Breeding line 60184 had the shortest shelf-life (SSL), cultivar 'Manatee' had an intermediate shelf-life (ISL), and 'Okeechobee' had the longest shelf-life (LSL). We observed significantly larger leaf lamina thickness and higher stomatal index in the SSL genotypes relative to the LSL cultivar. To identify molecular indicators of shelf-life, we used a transcriptional approach between two of the contrasting genotypes, breeding line 60184 and cultivar 'Okeechobee' at preharvest. We identified 552 upregulated and 315 downregulated differentially expressed genes between the genotypes, from which 27 % of them had an *Arabidopsis thaliana* ortholog previously characterized as senescence associated genes (SAGs). Notably, we identified several SAGs including several related to jasmonate ZIM-domain jasmonic acid signaling, chlorophyll a-b binding, and cell wall modification including pectate lyases and expansins. This study presented an innovative approach for identifying preharvest molecular factors linked to postharvest traits for prolonged shelf.

[HP-14] Freeze-dried muscadine fruit: potential for a year-round snack

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Muscadine (*Muscadinia rotundifolia* Michx) originating from the southeastern region of the United States, boast nearly 100 enhanced varieties and there are currently about 5000 acres are under commercial cultivation in the Southeast. Muscadines have been grown for more than four centuries for fresh consumption, juice, wine, and processed products. Muscadines are a rich source of bioactive compounds, including flavonoids, polyphenols, and tannins associated with numerous health benefits due to their antioxidant activity, plus vitamins, dietary fiber, and glycosides. However, the fruit's thick peel may pose a challenge to wider public acceptance, despite being a rich source of health-enhancing phytochemicals, including resveratrol, anthocyanins, and ellagic acid. To make muscadine peel more palatable and enhance its health appeal, the innovative approach of freeze-drying technology was studied. Freeze-drying, also known as lyophilization, is a highly advantageous technique for preserving muscadine fruit. It offers year-round availability by removing much of the fruit's moisture content, practically eliminating the risk of decay, reducing waste, and significantly extending the shelf life compared to fresh fruit. Furthermore, unlike traditional drying methods, freeze-drying preserves many of the same characteristics as fresh muscadine fruit, including shape, appearance, color, and flavor. In addition, freeze-dried muscadines present numerous benefits such as allowing convenient storage and transportation at ambient temperature. Freeze-drying muscadines also allows the peel to be easily consumed as it is no longer tough but retains the important phytochemicals and antioxidant properties present in fresh muscadine fruit. The potential benefits of freeze-drying muscadine fruit make it an area of interest for

both researchers and industry professionals. However, the high initial investment and potentially high operational costs associated with freeze-drying remain to be studied for economic feasibility.

[HP-15] Extending the Postharvest Storage Life of Caladium Tubers, a Signature Florida Specialty Crop for the World

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Caladium is a signature specialty crop and one of the most valuable floriculture/nursery crops in Florida. Florida caladium growers produce and supply all the caladium tubers used by greenhouse growers, nurseries, and landscapers in the state, across the United States, and in the world. In recent years, two new markets for Florida caladium tubers have emerged: Producing potted plants for major holidays in November and December and international customers from the southern hemisphere. Generally, growers store cured caladium tubers in ambient warehouses where temperature and relative humidity are barely controlled. Under these conditions, by early June the stored tubers begin to rapidly lose weight, and by early fall, tuber rot becomes severe, and tubers rapidly lose the ability to produce quality plants in containers or in the landscape. Because of these issues, growers also lose many millions of stored tubers each year. In response to industry needs and with support from the Specialty Crop Block Grant Program, we began in 2023 to evaluate storage conditions and chemical or physical treatments to extend the storage life of caladium tubers and screen caladium cultivars for these new market opportunities. Results from our first-year experiments have shown lower storage temperatures, fungicide, and/or coating treatment could reduce tuber rot incidences and store caladium tubers to October or later. A number of caladium cultivars exhibited a longer postharvest storage life. These cultivars are better suited for these new markets and offer the potential for development of new cultivars with a longer postharvest storage life.

[HP-16] Different storage responses of blueberries and blackberries to modified humidity and controlled released thymol.

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Blueberries and blackberries, both highly valued and in-demand fruits, face challenges like water loss, shriveling, softening, and vulnerability to post-harvest phytopathogens. All of these factors impact their storage life and marketability, and thus, postharvest quality preservation is a crucial area of interest for the industry. In this study, blackberries and blueberries were packed in modified humidity clamshells (named as LV, for low-vented), with an opening ratio 6.43 times lower than that in commercially available clamshells (named as COM). Also, the controlled-release of the essential oil thymol, microencapsulated within a pectin-alginate matrix, was evaluated as a means to reduce decay. Relative humidity within LV clamshells remained higher and less variable than in COM clamshells, which led to significantly lower weight loss in both crops. Blueberry firmness, shriveling, and marketability were positively impacted by storage in LV clamshells and the inclusion of a microencapsulated thymol sachet successfully reduced postharvest decay. Therefore, these two tools promise to extend blueberry's shelf life, and their combination yields the most optimal results. However, the same strategies were ineffective for blackberry quality maintenance. After exposure to thymol, more decay was observed, whereas firmness, shrivel, and marketability were not affected by either the clamshell vent area or the thymol treatment. This highlights the importance of tailoring storage conditions, packaging design, and handling methods to each specific fruit type.

[HP-17] Prediction of Citrus-infused and Non-infused Kombucha Bioactivity using Metabolomics and a Statistical Method, Orthogonal Partial Least Squares-Discriminant Analysis

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Kombucha is a fermented tea product made with brewed black or green tea in combination with sucrose as a substrate. The market size of kombucha has been growing due to its known health benefits. Among various types of kombucha, kombucha that uses citrus juice and flavor has increased in popularity because of its refreshing qualities. However, more information is needed about the metabolite profile and bioactivity changes during the fermentation of citrus-infused kombucha. In this study, we conducted targeted and untargeted metabolomics in regular and citrus-infused kombuchas (Hamlin and Sugar Belle) during the fermentation process by varying the source of sugars and their levels, along with four bioactivity tests, including cell protective effect, antioxidant effect with DPPH and ABTS, and reducing power. The identification and quantification of metabolites in kombucha were done using quantitative Liquid Chromatography tandem Mass Spectrometry (quantitative LC-MS/MS), High-resolution LC-Orbitrap-MS, and Gas Chromatography-Mass Spectrometry/Olfactometry (GC-MS/O). Correlation analyses were performed using chemical analysis outcomes between compounds and their corresponding bioactivity levels using Orthogonal Partial Least Squares-Discriminant Analysis (OPLS-DA). Nine compounds distinguishing regular and citrus-infused kombucha showed significant correlations with bioactivity test results. Single-compound level bioactivity assays were conducted to confirm the significant correlation of individual compounds on bioactivity observed from OPLS-DA. This highlights the predictive power of OPLS-DA in identifying bioactive compounds without requiring extensive single-compound level bioactivity tests.

[HP-18] Evaluation of Propiconazole and Natamycin for Postharvest Diplodia Stem-end Rot Control on Grapefruit in Florida

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Diplodia stem-end rot (D-SER) caused by *Lasiodiplodia theobromae* is one of the most important postharvest decays on fresh citrus in Florida. Propiconazole and natamycin are relatively new fungicides registered for citrus sour rot control and are also effective against *Penicillium* molds. However, it is unknown if these two fungicides have activity for D-SER control. These two fungicides were evaluated for their activities *in vitro* against fungal growth and *in vivo* efficacy for D-SER control after harvest. *In vitro* antifungal activity was determined by growing fungus on a medium amended with fungicides at various concentrations. For *in vivo* tests, naturally infected grapefruit were dipped for 1 min in fungicide suspensions (1,000 ppm). The fruit were then degreened and incubated at 75ºF for disease development. Thiabendazole (TBZ) was included as a commercial D-SER control. The *in vitro* test results showed that propiconazole, natamycin, and TBZ at 10 ppm reduced *L. theobromae* mycelial growth by 92.0%, 79.7%, and 97.5%, respectively. The EC_{50} values for propiconazole, natamycin, and TBZ were 0.40, 3.73, and 0.33 ppm, respectively. Tests on naturally infected grapefruit showed that propiconazole, natamycin, and TBZ reduced D-SER incidences by 76.2 to 80.9%, 38.5 to 42.9%, and 81.0 to 92.3%, respectively, compared to the untreated control. Propiconazole was more effective than natamycin and close to TBZ for D-SER control. Overall, the study demonstrates that propiconazole could be a good postharvest fungicide for use in Florida citrus for managing not only sour rot and green mold, but also D-SER.

[HP-19] Florida's Extension Programs Prepare Produce Growers for Produce Safety Rule Inspection

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The Food Safety Modernization Act (FSMA) Produce Safety Rule (PSR) was the first legislation to establish minimum standards for growing, harvesting, packing, and holding fresh produce. The new regulation meant Florida produce growers would require education and technical assistance to meet the requirements of the rule. The University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) and the Florida Department of Agriculture and Consumer Services (FDACS) have collaborated, since 2017, to provide education and outreach through Produce Safety Alliance (PSA) Grower Training Courses and On-Farm Readiness Reviews (OFRR) to assist growers in meeting the requirements of the PSR. Pre- and post-tests are given at PSA Grower Trainings (n=1,559) to measure knowledge increase during the class. A follow up survey to determine practices changed or implemented is sent four months post training. Following the completion of each OFRR, surveys (n=72) are completed to evaluate farm readiness for rule implementation, and highlighted areas where more education was needed to meet minimum requirements. Post-test score means (21.66/25), were significantly higher than pre-test score means (18.05/25), indicating an increase in knowledge after participation in the training (t=-10.30, P< 0.05). Follow up surveys indicated the creation or modification of record keeping systems was the most common action taken based on the knowledge gained in the training. OFRR surveys indicated sanitation (36%), pre-harvest water (14%), and worker training (25%) required the most improvements, and that 46% of farms met the PSR requirements, 42% needed minor improvements, and 12% needed significant improvements to meet the FSMA PSR requirements. The results demonstrated improvement of knowledge and practices of Florida farms regarding the FSMA PSR. As inspections continue throughout the state of Florida, education and outreach programs are ongoing to ensure Florida farms are prepared for implementation of the FSMA PSR.

[HP-20] The science behind sustainable packaging: It's all about the functionality

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"In today's society, packaging is ubiquitous and essential. It surrounds, enhances and protects the goods we buy, from processing and manufacturing, through handling and storage, to the final consumer. Without packaging, materials handling would be an inefficient, and costly exercise and modern consumer marketing would be virtually impossible. Good packaging prevents waste and ensures that the food retains its desired quality throughout its shelf life. Despite the important and key role that packaging plays, it is often regarded as an unnecessary cost. Furthermore, in the view of many consumers, packaging is, at best, somewhat superfluous, and, at worst, a serious waste of resources. Such views arise because the functions that packaging has to perform are either unknown or not considered in full. By the time most consumers come into contact with a package, its job, in many cases, is almost over." [1] In order to begin to choose what type of sustainable packaging is optimal for a particular application one must first understand and quantify the functionality of the packaging. Otherwise, the packaging choice may have unintended contradictory ecological repercussions. What may be the most sustainable solution for one product or particular market might not be the same elsewhere. The greater the packaging functionality the greater the challenge of providing an alternative option.

Krome Memorial

Presiding: **Muhammad Shahid**

[K-1] 'C1-12-2', An Early Ripening Muscadine Grape Selection with High Fresh Market Potentials

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'C1-12-2' is a very early ripening muscadine breeding line obtained by the grape breeding program, Florida A&M University, with the cross of 'O28-12-2' ('Supreme' open pollination') x 'Nesbitt', its fruits ripen in the later July, with about 10 day harvesting window that ends in the early August in Tallahassee, FL. This ripening date could be the earliest muscadine grape observed and is about 1 month earlier than most muscadine grapes there. Together with the vine's self-fertile flowers of industry preferred, satisfactory productivity, uniform in both fruit ripening and fruit size, and pleasant taste, make this breeding line highly potential as an early ripening muscadine table grape for the industry.

[K-2] Application of gene-editing technology for the production of large berry seedless muscadine

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Muscadine (*Muscadinia rotundifolia*) grapes are grown and well-adapted in the southeastern region of the United States. Muscadines have enhanced disease resistance capacity and the berries display enormous nutraceutical qualities. However, producing berries with large seeds and leathery thick skin is the main hindrance to utilizing full commercial potential. CRISPR/Cas genome editing is a smart opportunity to be used for muscadine improvement. Here we are reporting multiplex genome editing (targeting *MrAGL11*) aiming to check the usability of this technology in muscadine and gaining seedlessness trait subsequently. Pre-embryonic mass (PEM) produced from petiole/internode culture was used as a delivery system. After 10-14 weeks of culture, the PEM development was ~22.3%. In total four gRNAs (two from *exon*-1 and two from *exon*-7) were selected. Golden gate cloning strategy was adopted to clone the gRNAs and other CRISPR/Cas modules into the level 2 CRISPR backbone. The final CRISPR plasmid was packed into *Agrobacterium* and allowed to infect the PEM by co-culture. After 6-8 weeks of culturing the transformed PEMs on *Basta*-supplemented germination media, we recovered 61 potential transformed plants. Among them, the PCR screening confirmed 43 true transformed plants. The PCR product sequencing and sequence data analysis revealed 14 different indels in the target region of 39 plants. The outcome of this research is proof of the usability of CRISPR/Cas-based multiplex editing technology for the genetic improvement of the muscadine grape.

[K-3] The Anticancer Effects of Muscadine Grape Extracts on Racially Different Prostate Cancer Cells

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The current trend in food consumption demands liability in the development of innovative foods with superior nutritional qualities to increase consumer acceptance and market value for sustaining production. Muscadine grapes are known to possess enhanced health-promoting molecules due to the synthesis of unique phytochemicals context that distinguish them from other grape species. In this study, the cytotoxicity of the Caucasian (C42B; CB) and African American (MDA PCa 2b; MDA) prostate cancer cell lines was assessed using berry skin extract of muscadine grape population composed of 356 individuals. Further, the role of their total phenolic (TPC), total flavonoid (TFC), and

total anthocyanin (TAC) contents in exerting these properties was investigated. Finally, the association between cytotoxicity and antioxidant capacity (DPPH) was evaluated. The average cytotoxicity levels among the population was 22.1%±1.2 and 8.6%±0.4 for CB and MDA cells, respectively. Muscadine skin cytotoxicity exhibited a wide range among the population, estimated at 100% (from 0 – 100%) for CB cells, while showed moderate range of 29.7% (from 0 – 29.7%) for MDA cells. The correlation coefficient analysis revealed that CB cytotoxicity levels was significantly correlated with the TPC, TFC, TAC, and DPPH; however, no significant correlation was detected with the MDA cytotoxicity levels. Our research outcomes have a direct influence on developing Next–Generation Muscadine cultivars with superior health properties, which should enrich the marketability of viticulture entrepreneurship in the SE region, complement the national efforts to enhance the overall supply of value-added grape products, and increase the viability and global competitiveness of national grape industry.

[K-4] Leaf nutrient analysis levels for tropical and subtropical fruit crops in Florida

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Commercial tropical fruits are grown on an estimated 14,115 acres in 17 Florida counties, with the leading counties being Miami-Dade, Palm Beach, Lee, Hendry, and Martin. The main tropical fruit crops include avocado, mango, longan, guava, dragonfruit, lychee, papaya, sapodilla, banana, mamey sapote, carambola, passionfruit, and sugar apple. Minor crops include jackfruit, guanabana, *Spondias* spp., and caimito. An estimate of the value of these crops exceeds $75 million. The oolitic shallow rocky soils of Miami-Dade County and the sandy soils in all of the other counties where these crops are grown are highly permeable, often with high water tables, allowing nutrients to easily leach out of the root zone and into groundwater. While Florida avocado and mango leaf standard nutrient levels have been investigated during the 1960s-1970s no science-based levels have been determined for the other tropical fruits. This poses a nutrient management challenge to tropical fruit producers from an economic standpoint i.e., the cost-benefit and from an environmental standpoint (i.e., degrading soil conditions and contaminating the aquifer).
The lack of funding to develop leaf nutrient levels for minor crops is an issue and as environmental oversight of nutrient programs for agricultural crops increases may lead to over regulation to the detriment of the socioeconomic status of the producers. A potential interim solution is to use leaf nutrient standards developed in other production areas. This paper will outline and discuss the pros- and cons- of using this strategy.

[K-5] Future scope and challenges of growing passionfruit in central Florida.

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Fresh passionfruit is an emerging fruit crop in Florida because of its potential economic returns, unique flavor and increasing consumer interest. It is mainly grown in south Florida due to the tropical climate. Central Florida may be a region where a good quality of fruit is produced but certain challenges need to be further investigated. The major threat to production in central Florida is plant mortality caused by freezing temperatures and frost. Growing passionfruit under high tunnels may be a viable option but needs further investigation regarding fruit production and quality. Additionally, there is a need to find strategies that can protect passionfruit in open fields. Therefore, field trials are on-going to evaluate the plant growth and fruit quality of 'Possum Purple' passionfruit grown under a high tunnel with a mist system for freeze protection. In the open field, preliminary trials are in progress for frost or freeze protection of three cultivars, 'Possum Purple', 'Panama Red' and 'Bounty' through covering the vine trunks with wheat straw, extruded polystyrene foam and plastic sheets. The plant growth, health, production, and quality of fruit are currently being evaluated. During initial observations, we found no freeze damage inside the high tunnel as it maintained a minimum temperature of 34.6 ºC as compared to open field where we recorded 31.69 ºC with symptoms of freeze damage on leaves. Further investigations are in progress, which will be shared after collection of field data and analysis.

[K-6] Preliminary Investigations into Measuring Cold Hardiness of Passiflora Hybrids

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Measuring cold hardiness of Passionfruit (*Passiflora* spp.) is an area of significant interest, especially in new regions where the crop is expanding. However, few studies have explored it in a controlled manner. A previous study by Quesada (1992) revealed that lethal temperatures (LT50) for *P. edulis* f. *flavicarpa* were -9 to -10.5°C and -10 to -12.5°C for *P. edulis* f. *edulis*. Another species, *P. incarnata*, was also tested and found to have a cold hardiness level of -11.1 to -13.5°C. In the present study, differential thermal analysis was used on roots of *P. incarnata* selections from different states (Oklahoma and Florida), intraspecific hybrids between those selections, a hybrid selection of *P. edulis* f. *flavicarpa* and *P. incarnata* Oklahoma (21R23), and a *P. edulis* f. *edulis* x *P. edulis* f. *flavicarpa* hybrid (Big BB). Preliminary testing showed that potential differences exist within *P. incarnata*, with the Oklahoma selection being hardier than the FL selection (-14.5 vs -8.3°C). Hybrids of these two had an intermediate cold hardiness of -10.5°C. These were similar to the values from Quesada, however, the cold hardiness of Big BB diverged from results for *P. edulis* types. Big BB had an LT50 of -3.6°C, which is more consistent with visual estimates of *P. edulis* cold hardiness in other literature. The hybrid 21R23 had a hardiness level of -9.5°C, a result that shows offspring of crosses involving *P. edulis* and *P. incarnata* can have dramatically improved cold hardiness over the *P. edulis* parent.

[K-7] Sensory Evaluation of Fresh Passion Fruit and Buyer Interest

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Grower adoption of passion fruit (*Passiflora edulis*) is affected by the lack of marketing research that indicates consumer interest in this crop. To gauge potential consumer interest in passion fruit, a sensory evaluation of passion fruit was conducted in Marion County, FL at the Ocala Downtown Market. A total of 111 participants completed the anonymous online survey. The survey collected information about gender, race, and ethnicity. The evaluation provided participants with a sample of freshly cut fruit and a juice product (10% passion fruit juice). Participants were asked if they had previously consumed fresh passion fruit. Participants responded 54% (n=60) "no" they had not, while 46% (n=51) responded "yes" they had. Participants were then asked if they had consumed *any* kind of passion fruit product. Participants responded 66% (n=73) "yes" they had, while 34% (n=38) responded "no" they had not. A likability rating scale of 1 to 9 was used for the survey. Participants provided the following ratings: aroma of 7.43, flavor of 7.92, and overall liking of 8.03. The survey concluded with a question about whether or not they would buy fresh passion fruit grown in Florida if it was available. Participants responded with 93% (n=102) "yes" and 7% (n=8) "no". This sensory evaluation provides essential marketing information to current and prospective growers about consumer awareness of passion fruit, key consumer preferences, and interest in buying Florida-grown passion fruit. Future evaluations aim to compare different varieties of passion fruit.

[K-8] Innovation management in avocado production units in Morelos, Mexico

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Mexico leads the world in avocado production, consumption, and exports, with the state of Morelos standing out for its tradition and potential in this industry. However, its position has declined from second to fifth place between 2000

and 2023 due to low productivity and various factors affecting its competitiveness. These include deficiencies in infrastructure, training, association, access to international markets, reliable financing, and resource management. The study was conducted in the avocado-growing region of Morelos using data from the State Plant Health Committee. Over 11,000 records were filtered according to year, variety (Hass), and size of the production unit, resulting in a sample of 81 producers through stratified probabilistic sampling. The survey consisted of three sections: characterization of the producer and the unit, dynamics of innovation, and analysis of social and technical networks. The results indicate that 71.05% of the orchards are growing, mainly due to increasing planting density or switching from previous crops such as corn and beans to avocado. More than 70% consider this activity as a priority in their income. The adoption of innovations is lower in administration, financing, organization, harvest, marketing, and irrigation. The major bottleneck identified is irrigation, due to water scarcity. The least adopted innovations include organized sales (6.57%), organized acquisition of inputs (11.84%), fertigation (13.15%), harvest scheduling (17.10%), and financing (18.42%), reflecting the lack of organization and technological understanding among producers. Yield is positively related to administration, financing, organization, harvest, marketing, and irrigation. The adoption of innovations varies from 26.98% to 95.94%, with an average of 48.69%, indicating that half of the producers adopt approximately 50% of the available innovations. In summary, the avocado sector in Morelos faces challenges in productivity, competitiveness, and technological adoption. Improvements in infrastructure, access to specialized financing, organization of producers, and resource management are required to boost the industry and maintain Mexico's leadership position in the global avocado market.

[K-9] Canopy architecture effects on photosynthetic light interception in southern highbush blueberry

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Canopy architecture influences light interception, photosynthetic rates, and dry matter accumulation. Southern highbush blueberry (*Vaccinium corymbosum* interspecific hybrids) cultivars exhibit diverse canopy architectures. However, the relationship between canopy architecture and light interception in this crop is still poorly understood. In this field study, we evaluated 29 southern highbush blueberry cultivars grown under commercial conditions in Citra, FL. We used photogrammetry to measure five different plant architecture phenes (leaf area index, canopy density, base angle, plant width, and plant height) in four plants per cultivar. Additionally, we measured the intensity of photosynthetically active radiation (PAR) above the plant and below the canopy (10 cm away from the soil). We found that cultivars differed in all measured phenes, with up to 10-fold differences between commercial varieties. Varieties did not cluster into architecture types according to principal component analysis. Leaf area index was strongly correlated with intercepted PAR. Other phenes were not strongly correlated. These results suggest that the total area of unobstructed leaves in the southern highbush blueberry canopy plays a critical role in light interception. Future research should address the relationship between light interception and whole plant photosynthesis.

[K-10] Effect of Cold Storage Temperature on Various Blackberry Cultivars Grown in North Florida

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Blackberry (Rubus spp.) is a highly perishable fruit crop that limits its postharvest life and causes substantial economic challenges for growers. The present study examined the cold storage performance of four blackberry cultivars, Osage, Traveler, Freedom, and Pompka, cultivated in North Florida. Following the harvest, the blackberry fruit was stored at 1 °C and 85-90 % relative humidity for 7, 14, and 21 days. The response of various blackberry cultivars to post-harvest quality was measured across different quality variables, including color coordinates, fruit weight loss, firmness, respiration rate, soluble solid content (SSC), titratable acidity (TA), SSC/TA, leakage, mycelium, red drupelet reversion (RDR) and marketability index (MI). The effect was significant between the cultivars and storage duration for all the above-mentioned quality attributes. Among all the blackberry cultivars, Osage performed better in maintaining the fruit color, with the highest L* and lowest a* color coordinate value. Furthermore, respiration rates

were significantly lower in Osage among all the cultivars. Fruit firmness, SSC, and SSC/TA were also recorded highest in Osage. Likewise, Osage also exhibited reduced leakage, mycelium, and red drupelet reversion. In conclusion, Osage retained the fruit color in cold storage and exhibited increased firmness, SSC, SSC/TA and decreased weight loss, respiration rates, leakage, mycelium presence and RDR compared to the other blackberry cultivars. These results indicate that Osage among all the cultivars performed better at 1°C for all storage durations by sustaining fruit color along with reduced fruit weight loss, respiration rate, leakage, mycelium, red drupelet reversion and exhibited increased firmness, SSC, and SSC/TA.

[K-11] Chitosan Emulsion and Silicon: a Sustainable Approach to Extend the Shelf Life of Blackberry Fruit

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Blackberry is an emerging crop in North Florida. In this study, the efficacy of pre-harvest application of chitosan emulsion, and/or silicon on color coordinates, fruit weight loss, firmness, respiration rate, red drupelet reversion (RDR), mycelium, leakage, and postharvest quality soluble solid content (SSC), titratable acidity (TA) and SSC/TA of blackberries have been evaluated. Following the harvest, the blackberry fruit was stored at 1°C and 85–90% relative humidity for 7, 14, and 21 days. Blackberries sprayed with chitosan emulsion alone, and in combination with silicon showed improved quality attributes compared to the untreated ones. Additionally, different storage durations also significantly affected the fruit quality characteristics. It was observed that fruit treated with the combination of chitosan and silicon expressed lower respiration rates, with higher SSC and TA. In addition, all the spray applications significantly reduced leakage, mycelium growth, red drupelet reversion (RDR), fruit weight loss, and enhanced fruit firmness and marketability index (MI). In conclusion, chitosan emulsion, silicon, and a combination of both applied two days before the anticipated harvest was found to be effective in reducing leakage, mycelium growth, RDR, fruit weight loss, or respiration rates while it did not affect fruit color at all tested storage durations. It is presumed that chitosan and silicon are highly effective edible coatings and can be considered potential tools for effectively controlling postharvest diseases and enhancing the shelf-life of blackberries.

[K-12] Performance of Juvenile Low-chill 'UFSun' Peach Scions grafted on Low-, Medium-, and High-chill Requirement Rootstocks in Central Florida

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Low-chill peach cultivars are recommended for commercial orchards in Florida and several low-chill scion alternatives are available. However, the only rootstock resistant to root-knot nematodes, which has a low chill requirement, currently recommended in the state is 'Flordaguard'. Considering that rootstocks can affect flowering phenology, growth habit, water uptake capacity, among other characteristics, this study aimed to assess the physiological performance of juvenile low-chill scions grafted on rootstocks of varied chilling requirements in Central Florida. Gas exchange, SPAD Index, stem water potential, and chlorophyll fluorescence parameters were recorded in 2021 and 2022 during spring, summer, and fall from a juvenile orchard (3-year-old) in Fort Pierce, FL. The scion 'UFSun' was grafted on low- ('Flordaguard'), medium- ('P-22'), and high- ('MP-29', 'Nemaguard', and 'Guardian') chill requirement *Prunus* rootstocks. The photosynthetic rate increased continuously from spring to fall, although the SPAD Index decreased in the same period. Stomatal conductance, intercellular CO_2 concentration, and transpiration rate remained similar from spring to summer but increased towards fall. Although stem water potential showed no seasonal changes, trees grafted on 'Flordaguard' rootstocks showed lower water potentials than those grafted on 'P-22', 'Nemaguard', and 'Guardian'. All chlorophyll fluorescence parameters fluctuated throughout the growing season. Increasing gas exchange parameters towards the end of the growing season suggested that juvenile peaches in Central Florida go through a prolonged growing season. Additionally, our results suggested that rootstocks can affect the water uptake capacity of low-chill scions growing under subtropical climates.

[K-13] Influence of boron, calcium and silicon on quality fruit production of apple cultivars in swat valley

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In this study, apple plants were treated with five different combinations of boron, calcium and silicon as T0= 0 mg/l, 0 ml/l and 0 ml/l respectively, T1= 0.75 mg/l, 4.50 ml/l and 6.00 ml/l T2 = 1.5 mg/l, 9.00 ml/l and 12.00 ml/l T3 = 2.25 mg/l, 13.50 ml/l and 18.00 ml/l T4 = 3.00 mg/l, 18.00 ml/l and 24.00 ml/l on apple cultivars: Royal Gala, Mondial Gala and Treco Gala and evaluated for various quality parameters. The maximum number of flowers per plant, fruit set, TSS, fruit boron contents, fruit calcium, fruit silicon were observed in T4. Maximum leaf chlorophyll, number of fruits per plants, yield per tree leaf area, fruits moisture contents, fruit firmness, ash contents, fruit fiber content fruit phenolic contents fruit fat contents in fruit NFE and ascorbic acid were resulted by T3. Maximum fruit DDPH maximum total sugar and reducing sugar in T2. As per evaluation of cultivars the maximum values for fruit drop, scab infestation, cracked fruits, bitter pit, deformed fruits, titratable acidity and non-reducing sugar were found in treco gala while least fruit drop, scab infested fruits, cracked fruit, bitter pit, deformed fruits and titratable acidity in Royal Gala. The maximum number of flowers per plant, fruit set, leaf chlorophyll, leaf area, number of fruits per plants, yield per tree, fruit fiber content, fruits moisture contents, fruit NFE, fruit DDPH, TSS, total sugar, reducing sugar in, ascorbic acid, fruit boron contents, fruit calcium, fruit silicon were observed in Royal Gala cultivar.

[K-14] Optimizing Nitrogen Management for Blackberry Production in Florida

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The cultivation of blackberries holds significant promise as a viable option for fruit growers in subtropical regions like Florida. Nitrogen (N) plays a pivotal role in blackberry cultivation, but the ideal fertilizer quantity varies based on climatic and soil conditions. In this experiment employing a factorial design, we assessed the performance of two commercially available thornless cultivars, 'Prime-Ark® Freedom' (primocane fruiting) and 'Sweet-Ark™ Ponca' (floricane fruiting), under five different nitrogen treatment conditions (0, 10, 20, 30, and 40 g/plant N) with or without hydrogel to enhance nitrogen use efficiency in sandy soil. Over six months, we evaluated the growth response of 'Prime-Ark® Freedom' and 'Sweet-Ark™ Ponca' to varying nitrogen levels, focusing on plant height, cane diameter, and leaf greenness. Results showed that Freedom treated with 40 g/plant N with hydrogel exhibited the tallest growth, while Ponca treated with 10 g/plant N with hydrogel displayed comparable height. The largest cane diameters were observed in both cultivars treated with 20 g/plant N with hydrogel. Moreover, Ponca and Freedom demonstrated the highest levels of leaf greenness when provided with 20 and 40 g/plant N, respectively. This study highlights the importance of optimizing nitrogen management practices to maximize blackberry production in Florida's subtropical environment. Further research is warranted to understand the nuanced interactions between nitrogen levels, cultivar responses, and environmental factors, enabling the development of tailored management strategies for blackberry cultivation in the region.

[K-15] Effect of mycorrhizal inoculation in southern highbush blueberry 'Snowchaser' establishment in rhizoboxes

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Mycorrhizal fungi form symbiotic relationships where they help plants get nutrients and water in exchange of carbohydrates from photosynthesis. For example, *Glomus iranicum* var. *tenuihypharum* has been shown to increase root biomass improving plant water and nutrient uptake. The objective of this study is to assess the impact of a bioinoculant product, MycoUp 360, in southern highbush blueberry ´Snowchaser´ establishment. This experiment consisted of four treatments: 1) 20 plants grown in a pine bark:sand mix (soil cultivation system in Florida) inoculated with MycoUp 360 and 2) 20 plants grown in coco coir inoculated with MycoUp 360, 3) 20 control plants grown in a pine bark:sand mix that were not inoculated, and 4) 20 control plants grown in coco coir that were not inoculated. MycoUp 360 was delivered in a rate of 2.5 lbs/acre, following label recommendation. Water use efficiency was measured starting in week 16 after the rhizoboxes were sealed to prevent evaporation and weighted every day for 18 days to assess transpiration. Photosynthetic rates and stomatal conductance were measured with infrared gas analyzer on the same schedule. Root growth was measured prior to inoculation and six and 15-weeks post-inoculation using a root scanner and RhizoVision. Canopy growth was measured using ImageJ. Uninoculated controls in soil and coco coir exhibited higher transpiration than inoculated plants. Dry weight of canes, leaves and roots exhibited no differences. Results suggest mycorrhizal inoculation could help in the establishment of young blueberry plants.

[K-16] Enhancing Blackberry Cultivation in Florida: Assessing the Impact of the White and Black Groundcover on Plant Growth and Weed Prevention

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Cultivating blackberries offers considerable promise for fruit growers in subtropical regions like Florida. Traditionally, blackberries are grown on beds covered with black groundcovers to suppress weed growth and improve moisture retention. This study aimed to evaluate the effects of the color of ground coverings, white and black, on blackberry plant growth and crop production using 'Prime-Ark® Freedom' cultivar and the BL6 breeding line. White groundcover is known to reflect light intensity and maintain lower temperatures, potentially benefiting plant growth. Soil temperature data collected over the past six months from June to November revealed an average temperature of 27.8°C in the ground beds under white covers, contrasting with 30.8°C under black covers. Blackberry plants grown with white covers exhibited significantly greater growth rates compared to those with black covers. Cultivating blackberries in subtropical regions presents challenges due to high temperatures. However, incorporating white groundcovers into the growing system shows promise in enhancing growth. Nonetheless, additional data are necessary to fully understand the comparative influence of white and black groundcovers on blackberry cultivation. This study sheds light on the potential benefits of white groundcover as an alternative to black groundcover optimizing blackberry production in Florida's subtropical climate.

[K-17] Superabsorbent Polymers as a Soil Amendment for Increasing Water Retention in Mango Trees

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Superabsorbent polymers (SAPs) have emerged as promising materials for water and nutrient management in horticultural crops, addressing challenges related to water scarcity and inefficient nutrient utilization. This abstract delves into the efficacy of SAPs in enhancing water and nutrient retention in soil, thereby optimizing growth conditions for horticultural crops. SAPs possess unique water-absorbing properties, allowing them to absorb and retain large quantities of water, forming hydrogels that can gradually release moisture to plant roots. This project has two main objectives: 1) evaluate how the application of hydrogel improves water retention and increases agricultural productivity; and 2) develop research and extension programs for the implementation of agricultural BMPs and the translation of data to irrigation decision-making. We used four levels of hydrogel (0, 50, 100, and 150 g) on "Pickering" mango. We applied dry hydrogel to the subsoil by mixing it with the sandy soil to a depth of about 6–10

inches, and then wet it for swelling before planting trees. Using a handheld moisture meter, we measured soil moisture and temperature. We measured tree growth characteristics such as canopy height and width, stem diameter, and inflorescence length. **Results:** Soil temperature was significantly lower on treated soils compared to the control. There was no significant difference in growth characteristics. During the dry season, we observed drought stress (wilted leaves) on controlled trees but not on treated trees.

Ornamental, Garden and Landscaping

Presiding: **David Austin.**

[OGL-1] Characterization of genes associated with purple petiole color in ornamental papaya through transcriptomics and QTL-Seq analysis

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Anthocyanins are responsible for the red, purple, and blue hues observed in various plant tissues. In papaya (*Carica papaya* L.), the petiole color can manifest either 'green' or 'purple', which is considered a valuable ornamental trait in papaya. Here, the inheritance manner of purple pigmentation was discovered to be controlled by a monogenetic dominant gene by studying a segregation population of 280 F2 papaya plants, which were generated by selfing an F1 breeding line created from crossing PR-2043 with green petiole and T5-2562 with purple petiole. QTL-Seq analysis suggested that the key genes contributing to the purple pigmentation in papaya were in chromosome 1 from 0.01 Mb to 5.96 Mb. In addition, RNA-Seq analysis of mature papaya plants with purple and green petioles further identified 4 candidate genes locating in target genetic region linked to anthocyanin biosynthesis mediating the purple pigment. *CHS* was verified to be the key gene regulating anthocyanins accumulation by qPCR method, which was observed to highly express in purple petioles rather than green petioles. The findings of this study facilitate the future efforts of enhancing papaya ornamental value through molecular breeding.

[OGL-2] A Review of Diseases on Ornamental Crops Submitted to Plant Diagnostic Clinic Over 10 Years in Miami-Dade County

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Ornamental crop production contributes more than 80% to the total values of agricultural products in Miami-Dade County. Due to its local climate conditions favorable to the disease development, plant disease is a major limiting factor to ornamental production in the area. It is often difficult for nursery growers and their management personnel to identify a disease without extensive training, and growers rely on the disease identification service provided by the Plant Clinic at UF TREC in Homestead before they can make a sound decision in selecting effective products for disease control. From 2012 to 2022, a total of 6040 plant samples over 70 ornamental crops were submitted to the Plant Clinic for disease identification. The top 10 ornamental crops with the most samples submitted were palms (1831), *Dipladenia* spp. (518), *Hibiscus* spp. (373), *Ficus* spp. (314), *Dracaena* spp. (148), *Gardenia* spp. (104), *Cordyline* spp. (98), *Clusia* spp. (98), and *Privet* spp. (94). Causal agents have been identified for 61.5% of the samples (3712), in which 86.5% were fungal pathogens, and bacterial and viral pathogens were only 12.7% and 0.8%, respectively. Major fungal pathogens were *Phytophthora* spp. (19.5%), *Colletotrichum* spp. (11.9%) and *Fusarium* spp. (4.3%). *Xanthomonas* spp. was the predominant bacterial pathogen, with a 5.7% incidence among all samples. Such information helps us to design future training materials regarding disease identification of ornamental crops.

[OGL-3] Most Common Diseases and Pests that are Affecting the Landscape in Recent Years

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Miami-Dade and Palm Beach counties are geographically located in the subtropics and southeastern Florida. Their combined population is almost 4.2 million people of different origins and cultures. Much of these counties feature lush vegetation with exotic landscape plants associated with this type of climate, such as the cities of Coral Gables and Boca Raton. However, the warm, humid subtropical climate plus the influx of millions of travelers and cargo through seaports and airports create optimal conditions for the introduction of possibly destructive invasive pests.
To learn how to identify and manage invasive pests, extension agents, with the help and support of UF/IFAS and USDA-ARS specialists, created a series of webinars. Each webinar typically lasts two hours and covers topics such as Tuttle mealybug on zoysia grass (ZM), lethal viral necrosis (LVN), ficus whitefly (FW), phantasma scale (PS), and lethal bronzing (LB). Participation in the webinars was good, with a total number of 398 and an average knowledge gain and expected practice change of 4.3 (1=not at all and 5=many things) and 3.2 (1=no changes and 5=many changes), respectively. To measure the importance of the topics, we distributed a survey to 267 landscaping and pest control companies who participated in the webinars and asked them to rank a series of landscape pests from not important (1) to extremely important (5). The results of 46 respondents show that the most important pests are LVN and LB, with average scores of 3.61, and the least important, ZM, with an average score of 2.88.

[OGL-4] Removing Bacterial Galls from Crapemyrtle Trees in Production

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Crapemyrtles are ubiquitous in the nursery industry in Florida and set a standard for summer flowering trees. Unfortunately, due to pruning practices and production cultural techniques bacterial infections can flare up and spread. One of these being *Agrobacterium tumefaciens* or crown gall. Crown gall can be spread naturally from soil and water movement as well as human movement of pruning tools and materials. An attempt to remove large gall infections of crapemyrtles was conducted on a commercial tree farm. Initial removal and normal growth of the tree succeeded; however subsequent gall growth formed in different areas.

[OGL-6] Rice Hulls as a Container Weed Preemergent Weed Mulch

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Weed control in woody ornamental container production is one of the most expensive inputs in production. Preemergent herbicides, mulches and hand labor are all methods of delaying, impeding, or removing weeds that will negatively impact the growth and aesthetics of the produced container plant. One method to reduce weed competition that is growing in popularity in the west-central area of Florida is the use of rice hulls (RH) as a mulch. Effective mulches will reduce the amount of weed competition plants face. Rice hulls are a byproduct from the rice industry and deemed as a disposed waste. Woody container growers are applying RH as a mulch on the surface of containers directly after potting. The belief is that this will reduce weed seedlings at potting and eliminate weeds in early growth of the liners. This research investigates the cost of RH, hand application, and benefit of RH mulch in terms of weed growth.

[OGL-6] *Viburnum suspensum* Growth in a Nursery Using Plastic and Fabric Containers

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The amount of time to produce a container plant is an important consideration when targeting specific markets and reducing production costs. A previous investigation by the first author revealed that *Viburnum suspensum* plants grown

for six months with fabric containers were larger than plants grown with conventional plastic containers. Thus, the objectives of our investigation were to determine if fabric containers are a viable production strategy that reduces the amount of time to grow marketable *Viburnum suspensum* in the nursery and concomitantly reduces plant production costs. *Viburnum suspensum* liners were planted with a pine bark-based substrate in trade 3-gallon conventional plastic containers or fabric containers at Hibernia Nursery, Webster, Florida. Plants in both container types were placed on a polypropylene production surface and grown under overhead sprinkler irrigation using standard protocols, except that plants in fabric containers received approximately 1.8 times more irrigation to compensate for evaporation from the fabric. After six months, plants in fabric containers achieved marketable size (heights and widths) so plants grown with both container types were transplanted to trade 7-gallon conventional plastic containers and grown with similar protocols. Two months after transplanting, plants originally grown with fabric containers were marketable, while plants originally grown with conventional plastic containers were marketable five months after transplanting. Thus, the initial production of plants in fabric containers resulted in marketable plants three months earlier. The earlier marketing of plants in trade 7-gallon containers will save approximately $1.00 per plant in production costs and open production space for another crop.

[OGL-7] Recommendations for Production of *Calathea rufibarba* Grown in a Central Florida Greenhouse

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Calathea rufibarba plugs are commonly available to Florida foliage growers. Only general production guidelines are available for calatheas. Tissue-culture plugs (Sunshine Horticulture) were potted in black or white 15.24cm standard pots using a conventional peat/perlite soilless mix amended with dolomite, STEM, and three rates of Haifa Chemicals Ltd. Multicote™ (8) 15-7-15+2MgO fertilizer in September 2023. Pots were transferred to the FSC greenhouses and placed in randomized blocks within a split-plot design with two light levels. The fertilizer (CRF) was formulated to release evenly over 5-6 months at medium temperatures of about 30°C. Temperatures were measured using Onset HOBO MX2202 Bluetooth Data loggers buried in several pots; light levels and humidity at plant height were measured using additional data loggers. Plants were produced under 50% shade (aluminet) or 80% shade. Electrical conductivity (EC) and pH for all pots were measured using the pour-through method to evaluate the overall fertilizer levels available; sample solutions from all pots were collected and evaluated in the FGCU lab for nitrate-nitrogen levels. In the greenhouse, all pots received the same automated irrigation treatment. Fertilizer was exhausted by 120 days after potting date and was reapplied as a top dress to pots at the same rates. DLI for both light levels were calculated, based on data from the data loggers. A plant quality evaluation survey conducted after 180 production days determined that plants produced in black pots in 50% shade with the highest rate of fertilizer applied were superior to plants grown under any other treatment combination.

[OGL-8] Selecting Porterweeds for Florida Gardens: Findings from Recent Research and Ploidy Manipulation

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Porterweed (*Stachytarpheta*), a member of the verbena family, is a common garden plant in Florida because of its attractive flower spikes and attraction of butterflies. A number of porterweed species have been identified in Florida, including the native jamaican porterweed (*S. jamaicensis*) and introduced species, nettleleaf porterweed (*S. cayennensis*) and coral porterweed (*S. mutabilis*). A number of interspecific porterweed hybrids also exist in Florida, including 'Naples Lilac' porterweed (*S. cayennensis* × *S. mutabilis* 'Violacea'). Our recent studies have shown that these species and hybrids are different in plant growth habit, leaf morphology, and flower color, as well as in chromosome number, ploidy level, pollen morphology, and pollen stainability or viability. Nettleleaf porterweed and coral porterweed produce viable seeds under natural conditions, and they can pollinate native porterweed. The Florida Invasive Species Council has listed nettleleaf porterweed as a Category II invasive species, and the UF/IFAS

Assessment has recommended "Caution" for producing and using this porterweed species in Florida. To reduce the invasive potential of porterweeds and protect Florida's native species, we have manipulated the ploidy levels of porterweeds to develop sterile triploid cultivars. Toward this goal, we identified a diploid porterweed and crossed it with nettleleaf porterweed (tetraploid). New triploid selections exhibited much improvement in plant growth and flower color and showed complete male and female sterility when tested in central and north Florida. In addition, we have converted a red diploid porterweed into a tetraploid and crossed it with other tetraploid porterweeds to produce new triploids.

[OGL-9] Pollinator Sustainability Efforts Expand with a Train-the-Trainer "Pollinator Ambassador Academy" Approach

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Insects are responsible for pollinating over 85% of the world's flowering plants, including over 125 global crop species. Studies continuously find pollinator populations are decreasing, primarily due to factors like urbanization and climate change. There's a growing interest from the public in pollinator gardening, which could help combat pollinator decline. At least 75% of participants will increase their knowledge in pollinator and bee gardening, Florida-Friendly Landscaping™ (FFL), and Integrated Pest & Pollinator Management (IPPM). At least 60% will increase their likeliness to advocate for pollinators to individuals, 50% to small groups, and 40% to large groups. Social media was used to invite pollinator enthusiasts to participate in a day-long advanced training on becoming a "Pollinator Ambassador". Topics discussed included pollinator and bee gardening, FFL, IPPM, working with homeowner's associations (HOAs), and Using the Power of Our Voice. 91% (*n = 44)* of participants increased knowledge of pollinator gardening, 93% increased knowledge of bee gardening, 82% increased knowledge of incorporating FFL principles in pollinator landscapes, and 100% increased knowledge in IPPM. 91% increased their likelihood of advocating pollinator sustainability to individuals, 95% to small groups, and 86% to large groups. The majority of participants not only increased knowledge in all major topics of the program, but also increased their likelihood to advocate for pollinator sustainability and gardening to individuals, small, and large groups. Provided the results of this program, it could serve as a valuable tool in counties across the state to sustain pollinator populations.

[OGL-10] Disaster Preparation for the Green Industry

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Climate change impacts to Florida's economy are projected to reach more than $345B by 2100, and hurricanes alone have caused approximately $526B in damage since 1900. Green industry professionals seek guidance in managing for extreme weather and other climate change impacts (unpublished, Roberts et al. 2023). Extension can help the green industry build resilience. UF/IFAS Extension Agents from Miami-Dade and Martin Counties presented at Florida Turfgrass Association Regional Seminars in south Florida, to increase knowledge of resiliency practices and effect practice adoption. At each seminar's conclusion, Agents distributed surveys of knowledge gain and behavior change. The 2023 program (162 participants) focused on landscaping practices to adapt, mitigate, and build resiliency against climate change impacts. In 2024, the program focused on preparedness for hurricanes and other disasters (130 participants). Across climate change topics taught, 89% of respondents indicated they gained knowledge. Knowledge gains were quantified at an average of 21% for the disaster preparedness topics taught, using Likert-scale reflective pre-/post-questions. More than half of 2024 respondents indicated they adopted or increased their practice of climate-smart measures shared the prior year. Landscape professionals learned ways to build resiliency in their operations. They shared information with their customers and examined their own operations for improvements.

[OGL-11] Understanding Resident Perspectives on Fertilizer Usage and Fertilizer Ordinances: A Case Study of Hernando County, Florida

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In Florida, urban landscape fertilizer ordinances have been established in over 100 counties and municipalities. This study is focused on Hernando County, where recent amendments to the existing ordinance expanded seasonal restrictions. Our project aims to delve into the fertilizer usage behaviors and attitudes of residents towards the current fertilizer ordinances. Tailored survey instruments were developed to assess residents' knowledge of lawn care, familiarity with the county fertilizer ordinances, landscape conditions, and fertilizer application practices. These surveys are currently being disseminated through various channels including social media platforms, Hernando Extension networks, and Hernando County Utilities Department customers. Additional, qualitative insights will be gathered through upcoming focus group interviews. By collecting and analyzing both quantitative and qualitative data, we seek to gain a comprehensive understanding of current fertilizer application practices, community sentiments, and the underlying factors influencing these attitudes and behaviors in Hernando County. Furthermore, this project aims to identify residents' concerns and barriers related to the fertilizer ordinances. Findings of this project will play a crucial role in shaping the development of relevant educational materials. These materials will be designed to address community concerns, dispel misconceptions, and offer guidance on responsible fertilizer usage, thereby fostering sustainable landscape management practices in Hernando County and beyond.

[OGL-12] Investigating Homeowners' Preferences for Stormwater Pond Maintenance Attributes

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This research utilizes a discrete choice experiment to estimate homeowners' willingness to pay for key ecosystem services (nitrogen removal efficiency and flood control) and landscape attributes (planting diversity and planting patterns) provided by stormwater ponds in Florida. With the state experiencing continuous urbanization and real estate development, these valuations are necessary to optimize green infrastructure investments and shape landscape planning policies for the development of new stormwater ponds. The findings can help improve municipal codes and homeowner association (HOA) rules that promote ecologically functional pond landscaping that aligns with community preferences. Additionally, this study tests prospect theory by examining whether loss-framed messages are more impactful than gain-framed messages in shifting homeowner preferences toward more diversified pond plantings. This latter contribution has several implications. For one, demonstrating that economic messaging shifts homeowners' preferences towards more diverse plantings could lead to public education policies that frame the benefits of pond vegetation in terms of property value protection and loss avoidance. Second, if loss framing is more impactful than gain framing, it could shape how outreach materials are designed to encourage specific pond management practices. Appeals highlighting potential losses may motivate homeowners to adopt sustainable behaviors. These insights can help to refine public outreach strategies.

[OGL-13] Plant This, Not That: Encouraging Florida Friendly Over Invasive

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Some invasive plants are listed as "prohibited for sale" on the Florida Department of Agriculture and Consumer Services Noxious Weed List, however many invasive plants are commercially available. *Plant This, Not That: A Guide to Avoiding Invasive Plant Species in Florida* is a laminated, ring-bound-flipbook written to provide safe alternatives to commonly sold invasive ornamental plants. Perfect for the resident or professionals visiting or running a nursery, this revolutionary resource includes 22 invasive plants that are commonly available for sale along with alternatives. Over 1,350 copies have been sold or distributed, bringing in $14,234. Concepts from the book have been integrated

into classes for landscape professionals, industry nursery owners, master gardeners and the general public. Results show:

- 367/376 or 97.6% increased their knowledge about the impact invasive species have in Florida
- 371/373 or 99.4% intend to use the information from the class to choose plants that are not invasive
- 323/344 or 93.9% of participants felt more confident they could identify invasive plant species

Follow up surveys indicated participants used hand pulling to remove invasives (85% or 51/60), avoided invasives from the book (76% or 45/59) and educated others about invasive species (75% or 44/59). Notable publicity included The Tampa Bay Times, Brevard Business News, Central Florida Agriculture News, Florida Currents Magazine, LIFE Magazines, Orlando Sentinel, The Invading Sea, Interviews about the book on First Coast Connect (local National Public Radio NPR) and Better Lawns & Gardens Radio.

Vegetables

Presiding: **Alejandro Bolques**

[V-1] Analysis of Surface Water Treatment Efficacy Protocol using Calcium hypochlorite and PAA against STEC in Open Florida Waters

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Surface water has been implicated as a source of microbiological contamination for produce. Growers are under market-driven and regulatory pressure to treat surface water before use that contacts produce. This study evaluated the FDA's water treatment efficacy protocol using Florida agricultural water. Agricultural waters from a Florida pond and canal were collected, and quality characteristics measured. Samples (98ml) were inoculated with 1ml of a 9 Rifampicin-resistant STEC cocktail (ca. 9 log). Water (99ml) was equilibrated at 12 or 32°C for ≥30min. Calcium hypochlorite (Cl) or PAA was mixed with PBDW to create a stock solution, from which 1ml was added to the 99ml to achieve high and low concentrations of each sanitizer (Cl, 2-4 and 10-12 ppm; PAA, 6 and 10) ppm. Following sanitizer addition, STEC populations were determined at 1, 5, and 10 min by serial dilutions in sodium metabisulfite (28 g/L), plating onto Brain Heart Infusion Agar with rifampicin, and incubating at 35±2°C for 24±2h. Colonies were counted by hand and expressed as log CFU/ml; student t-tests and ANOVA were performed (n=9). Cl stock solution treatment concentrations ranged from 380-1800 and 600-2800 ppm in pond and canal water, respectively; PAA stock solution treatment concentrations were 500 or 800 ppm consistently in both waters. Low-range Cl treatment in pond water did not achieve a ≥3 log reduction in pond water at any contact time but did in canal water after 1min. High-range Cl treatment showed significant (p<0.01) reductions in pond and canal water after 1min. Both PAA treatments achieved a ≥3 log reduction in pond and canal water within 5min. Reductions may have been impacted by water quality characteristics; population rebounds were observed during longer treatments in both waters. Cl and PAA are effective for surface water treatment of STEC for ponds and canals in Florida.

[V-2] Marking Corn Silk Flies with Fluorescent Dyes for Improved Management

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Picture-winged flies (Diptera: Ulidiidae) known as corn silk flies (CSF) pose a severe threat to sweet corn production in Florida. Conventional control methods targeting adults have proven ineffective under high pest pressure, necessitating the exploration of alternative strategies. This research focuses on understanding CSF adult movement to develop an integrated pest management approach with reduced insecticide use. The study of insect movement can be accomplished using a mark-release-recapture strategy, but a marking method for CSF has not been developed. The objective of this study was to evaluate three marking methods, DayGlo fluorescent pigment application to pupae, DayGlo fluorescent pigment application to adults, and food coloring addition to adult diet. Results indicate that neither DayGlo pigment marking method significantly impacts walking and flying behavior. Pupal marking was only able to yield 75% marking at the highest concentration, whereas external marking yielded 100% marking in the top three highest concentrations. For internal marking, preliminary results suggest that the ingestion of food coloring does not impact fly behavior. However, although 100% marking was observed at the highest concentrations of dye, the mark usually degraded after cessation of feeding on colored diet. This research contributes to the development of an effective marking method to be used in a mark-release-recapture study so that the behavior of CSF adults can be understood and later manipulated to reduce the population numbers and damage in sweet corn fields.

[V-3] Understanding the Effects Space Irradiation on Selected Crops

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The Growing Beyond Earth (GBE) program is a collaboration between National Aeronautic Space Administration (NASA) and Fairchild Tropical Botanic Garden (FTBG), to increase crop yield for supplementing astronaut diet for long term space flight. This study focuses on five cultivars with seeds exposed to neutron radiation, provided by NASA, and the effect on their morphological changes. The chosen cultivars we tested *Brassica rapa subsp. chinensis* (pak choi), *Brassica rapa var. nipposinica* (Mizuna), *Brassica juncea* (Scarlet Frills Mustard), *Lactuca sativa (*Red Romian Lettuce "Outredgeous Lettuce), and *Raphanus sativus* ("Radish" Red Rambo). The crop was grown in a growth chamber simulating the growth on the International Space Station (ISS). Growth parameters, anthocyanin and chlorophyll were evaluated from select cultivars across multiple 28-day grow outs. Preliminary results indicate that irradiated seeds grow taller and provide more biomass on average than non-irradiated seeds. Pigmentation results are still pending. Naturally occurring radiation from space might have a boosting effect on the biomass content of certain cultivars at harvest.

[V-4] Nitrogen Fertilization Rate and Timing Effects on Strawberry Growth, Yield, and Soil-Plant Nitrogen Dynamics Vary Among Cultivars Grown in Florida.

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Nitrogen (N) is crucial for strawberry (*Fragaria ×ananassa* Duch.) plant growth and yield. However, the effect can vary depending on the application rate, timing, and cultivar. Furthermore, it is important to understand soil-plant nitrogen dynamics for optimizing N management to enhance nitrogen availability for plant growth while minimizing losses. The objective of this study is to determine the optimal N fertilizer application rate for strawberry plants at different growth stages and to understand the variation in soil-plant N dynamics among cultivars. This study was conducted at the University of Florida, Gulf Coast Research and Education Center from October 16, 2023, to February 26, 2024. Four strawberry cultivars ('Brilliance', 'Medallion', 'Pearl', and 'Pearl 66') were subjected to five different N rates (0, 0.56, 1.12, 2.24, and 3.36 kg/ha/day) at three growth stages (early, middle, and late), separately. The early, middle, and late stages were defined as 3-8, 9-14, and 15-20 weeks after planting, respectively. Harvest was performed 14 times throughout the season. The results showed that yield increased with increasing N rate during the early-stage application, irrespective of the cultivar, while middle and late applications showed some fluctuations in yield depending on the N rate and cultivar. 'Brilliance' and 'Medallion' recorded the highest yield from the plants treated with 3.36 kg/ha/day in the early stage, while 'Pearl' and 'Pearl 66' achieved the highest yield from the plants treated with 1.12 kg/ha/day in the late stage. This result indicates that plant response to N highly depends on the cultivar. Results of other parameters will be presented at the conference.

[V-5] Effects of biodegradable plastic mulches with different colors and compositions on microenvironments and productivity of annual winter strawberry in Florida

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The use of polyethylene (PE) mulches in agriculture can cause environmental pollution when inadequate removal results in contamination of mulch fragments in ecosystems. Soil-biodegradable plastic mulches (BDMs) are designed to be tilled into the soil after use to eliminate pollution risks, labor, and costs associated with plastic mulch removal.

Color and composition of BDMs affect their integrity and thermal and radiation properties. The objective of this study was to examine the effects of BDMs with different colors and compositions on microenvironments and productivity of annual winter strawberry in Florida. We conducted a field experiment in the 2023–2024 winter season in West Central Florida. The experiment consisted of five treatments: black PE mulch (control), black starch-based BDM (Mater-Bi®), black resin-based BDM (Ecovio®), white starch-based BDM (Mater-Bi®), and white resin-based BDM (Ecovio®). The test cultivar was 'Florida Brilliance' short-day strawberry, and data collected included bed surface light reflection, under-canopy light changes, bed and plant tissue thermal imagery, number of runners, flower number, and marketable fruit yield. Compared to black PE and BDMs, white BDMs significantly increased light reflection and light interception by the canopy, while decreasing root zone temperature. Although total marketable yield was unaffected by the treatments, White BDMs had significantly higher flower number than the control buthad lower runner production. Treatments did not significantly affect canopy area and fruit yield. In conclusion, our study suggests that there may be potential effects of plastic mulch colors and compositions on strawberry growth parameters, potentially altering their thermal and radiation environments. However, further research is needed to conclusively determine the extent of these effects and whether they are statistically significant.

[V-6] Exploring Interspecific and Intraspecific Competition in *Brassica rapa (*pak choi "extra dwarf") and *Brassica campestris var. narinosa* (misome)

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The Growing Beyond Earth Program ® (GBE) is a project of Fairchild Tropical Botanic Garden (FTBG) in partnership with the National Aeronautic Space Administration (NASA) aiming to find growth methods to optimize crop yield on the International Space Station (ISS) and long-term space exploration. In this study, we analyzed interspecific and intraspecific growth relationships between high producing and fast-growing crops. Two 28 day grow outs were run comparing the three treatments of Misome v. Misome, Pak Choi v. Pak Choi, Misome v. Pak Choi, and plants grown separately in small growth chambers simulating those on the ISS. Preliminary results suggest that Misome grows at a faster rate and on average yields a higher amount of fresh and dry biomass than Pak Choi. Misome outcompetes Pak Choi in intraspecific competition. Further results are pending.

[V-7] Evaluation of a Newly Developed Chile Pepper Cultivar for Root-knot Nematode Resistance under a Pesticide-free and Organic Field Production Systems in Florida

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Enhancing crop management to address food security involves prioritizing resistant cultivars to reduce pesticide use. Pepper is an economically important vegetable crop facing limitation in productivity due to the southern root-knot nematode (RKN). Our objective was to evaluate a newly developed pepper cultivar ('Ruby') for root-knot nematode resistance under organic field conditions in Florida, USA. Using a split-plot design with one plot receiving chemical fertilizer and the other chicken manure, 'Ruby' was compared with two resistant and three susceptible pepper varieties across three blocks. The assessment included root-knot nematode reproduction, overall plant-parasitic nematode soil population composition and density, and total fruit yield per plant. Whereas soil treatment showed significant variation only for total fruit yield per plant, the variety showed significant variation across all data collected. 'Ruby' showed high levels of resistance under organic field conditions, but there were instances in which few 'Ruby' plants enabled high levels of root-knot nematode reproduction in the main plot treated with chicken manure. Additionally, although the pepper variety 'Jimmy Nardello Italian' showed high levels of RKN infection, its fruit yield was comparable to resistant varieties. Results of this study have implications for optimizing deployment of resistant pepper cultivars.

[V-8] Exploring Plant-Available Nitrogen Dynamics Under Integrated Organic Nutrient Management

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Integrating nutrient management practices including organic fertilizers, cover crops, and composts can affect nitrogen (N) mineralization patterns, potentially enhancing N use-efficiency and reducing N losses in organic vegetable systems. Two field trials were conducted during Nov-Feb 2022-2023 (Y1) and 2023-2024 (Y2) in Citra, FL assessing how cover crop residues and composts affect soil N dynamics. The split plot design included sunn hemp residues (SH) vs. weedy fallow (WF) in whole plots, with yardwaste compost (Yard; 22.4 mt/ha), vermicompost (Vermi; 11.2 mt/ha), and no-compost (Control) in subplots. A compost mixture (Mixed; Yard 11.2 mt/ha + 11.2 mt/ha Vermi) was added in Y2. Lab soil incubation studies ran concomitantly, reflecting field soil temperatures. Soil plant-available N (PAN; NO_3-N + NH_4-N) was determined throughout 13 weeks under incubation (WUI). Across years, SH released more PAN than WF, beginning 0 (Y1) and 1 WUI (Y2). In Y1, Yard reduced PAN relative to Vermi (1, 2, 4,10 WUI) and Control (1, 2 WUI). At 13 WUI, there was no difference among composts in WF, though Vermi had higher PAN than Yard and Control in SH. In Y2, all composts increased PAN vs. Control in SH at 1 WUI. There was no impact of compost beyond 3 WUI, suggesting synergies with cover crop decomposition and N cycling at an early stage. Likely, higher C:N ratios in Yard in Y1 (33:1) vs. Y2 (23:1) increased N immobilization. In-depth examination of interactions between cover crop residues and composts on soil N dynamics will help optimize organic nutrient management.

[V-9] Changes in acid and essential oil profiles in 'Cascade' hop (*Humulus lupulus* L.) cones during maturation under subtropical climatic conditions

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Hop (*Humulus lupulus* L.) cultivation has traditionally been limited to temperate regions between 35-55°N latitude. Recent research shows it's possible to grow hops in subtropical environments like Florida by using techniques such as supplemental lighting for double cropping in spring and fall. As hop cultivation expands to non-traditional regions, it's crucial to understand how subtropical climates impact hop cone maturation and critical quality parameters like alpha acids, beta acids, and essential oils, which determine beer's bitterness, flavor, and aroma. This study examined changes in acid and essential oil compositions of the 'Cascade' hop variety throughout maturation in Florida. 'Cascade' hops were grown on a 5.5 m V-trellis system at the Gulf Coast Research and Education Center. Sampling occurred twice weekly for three weeks before harvest, totaling six sessions per season. Composite samples were manually collected from upper, middle, and lower trellis sections across four plots. Chemical analysis quantified alpha, beta acids, cohumulone, colupulone using HPLC, and essential oils via steam distillation. Peak alpha acid levels generally met commercial targets in both seasons. The alpha:beta ratio declined from 2.0-2.2 three weeks pre-harvest to 1.6-1.9 at harvest. Essential oils fluctuated but peaked 0.25-1.6 mL/100g in later maturity. While enabling viable 'Cascade' alpha acid production through double cropping, Florida's subtropical conditions distinctively impacted beta acid development, alpha:beta ratios, and essential oil profiles compared to temperate regions. Thoroughly characterizing these effects is key for optimizing harvest timing and developing tailored management strategies.

[V-10] Roles of root viability and morphology in establishment of strawberry bare-root transplants

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Strawberry bare-root transplants are uprooted and then severely desiccated through exposure during long-distance transportation and storage, but even simple baseline measurements have not been done to characterize these issues. In order to optimize strawberry bare-root transplant production and management, it is helpful to understand these issues, and what initial transplant characteristics lead to successful establishment. We conducted a greenhouse experiment using a scanner-based rhizotron system to characterize initial growth dynamics and morphology of two common Florida cultivars ('Florida Brilliance' and Florida Medallion™ 'FL 16.30-128'). Each rhizotron had 2655 cm^3 of soil at field bulk density with a 23×30 cm scannable window on each side. Plants were grown over 35 days in the rhizotrons with biweekly root scans and canopy images. Four plants for each cultivar were also destructively sampled three times—prior to planting and 24 and 35 days after planting. Rhizotron root scans yielded root surface area and architecture data for original and emerged roots, and canopy images yielded canopy projected area and fruit/flower data. Destructive sampling resulted in biomass data (fresh and dry weight for old and new leaves and roots; number of crowns, leaves, and roots; and green leaf area), nitrogen nutrient analysis of biomass, individual root architecture data (branch number, length, and surface area by diameter), and individual root viability data (live vs. dead root area). Cultivars were compared using SAS and initial measurements were correlated with growth data using R to determine which traits resulted in the greatest growth. Results will be presented.

[V-11] Potential sources of resistance to powdery mildew in the USDA *Cucurbita pepo* core collection

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Summer squash (*Cucurbita pepo*), valued at over $216 million annually in the U.S., is threatened by powdery mildew (*Podosphaera xanthii*), a significant global issue. Despite some cultivars having partial resistance (*PM0*) from *C. okechobeensis*, fungicides are predominantly used for management. This research aimed to identify novel genetic resistances in *C. pepo* to expand the repertoire of resistance alleles available for breeding programs, assessing the USDA core collection (n = 207) across Florida (greenhouse, 2023), New York (greenhouse, 2022) and Michigan (field, 2022). Utilizing an RCBD with three replications, 'Success PM' and 'Early Prolific Straightneck' served as resistant and susceptible checks respectively. Inoculum was derived from naturally infected plants, and symptom severity was assessed at 6th true-leaf stage on a 0-100% scale based on visible pathogen sporulation on the surface of top 4th leaf, bottom 4th leaf, stem above 4th leaf, stem below 4th leaf, and whole plant. For NY and FL, the overall mean disease severity was highest in top 4th leaf (88.5% & 90.9%), followed by stem below 4th leaf (22.3%, 74.4%). For MI, the bottom 4th leaf had the highest disease severity (40%). 'Success PM' (R) showed consistent resistance across replicates, with a mean disease severity of 2.5% in the stem below 4th leaf. Accession 189 showed consistent resistance across all three locations, with a mean disease severity of 7% in the stem below the 4th leaf. The data will be used to conduct GWAS to identify novel resistance alleles for summer squash breeding.

[V-12] Non-destructive assessment of tomato fruit firmness and nutritional composition

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Round tomato plants were grown at SW Florida during Fall 2023 following usual agricultural practices. Fruit were harvested 14 weeks after planting, were grouped into mature green (MG), turning (T), pink (P), and red (R) ripe and were placed on benches in a room under 25ºC simulating shelf-life conditions during disposal in the market. Color, compression firmness, and spectral reflectance were captured on each fruit per ripening stage in 4 replications on the day of harvest and after 4, 8, and 12 days for T, P, and R, and after 4, 8, and 16 days for MG fruit. The fruit were frozen for 1 week for nutritional composition analysis, such as soluble solids content (SSC), pH, and titratable acidity (TA). A blended filtrate was used for SSC measurement and 6 g of that for pH and TA. According to the results, regression analysis coefficients between color (hue angle) and pH and SSC/TA were 0.747 and 0.708, respectively

whereas between compression and pH and SSC/TA were better (0.804 and 0.799, respectively). However, pH and SSC/TA correlated best with Vis-NIR spectroscopy (340-2500 nm) measurements. Partial least square regression analysis between external fruit Vis-NIR reflectance and pH and SSC/TA ratio revealed a strong correlation (0.863 and 0.847, respectively). The above results imply that internal composition in tomato fruit is not strongly associated with external color but can be reliably predicted using proper non-destructive methods and adequate data proceeding techniques such as Vis-NIR spectroscopy and partial least square regression analysis algorithms.

[V-13] Nitrogen use efficiency using controlled release urea and soluble urea under drip-irrigated tomatoes in conventional and compact bed geometries

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Nitrogen (N) is an essential macronutrient for plant growth, where intensive production of vegetables, may lead to inefficient nutrient use. The one-time pre-plant application of controlled-release fertilizers (CRF) could be beneficial in terms of saving time, energy, and labor when compared to multiple fertigation applications of soluble N sources. CRF have emerged as a potential solution over soluble N sources by retaining nutrients in the soil for a longer period and releasing them according to the plant's needs addressing problems associated with low N use efficiency and environmental concerns. Compared to wide conventional beds, the taller and narrower compact beds can reduce seasonal production costs through reductions in nutrient application rates, water, pesticides, and plastics, and reduce leaching. In this study, we studied the effectiveness of pre-plant application of CRF and split application of soluble fertilizer on nitrogen use efficiency under conventional and compact beds. A replicated field study was conducted at the Plant Science Research and Education Unit in Citra, Florida, comparing polymer-coated controlled-release urea and soluble urea for tomatoes (var. HM 1823) grown in sandy soils under two plastic-mulched bed geometry systems (conventional and compact) during the fall of 2021. Data from the fall tomato were analyzed for TC, TN, NO_3-N, and NH_4-N. The findings of this research provide valuable insights for optimizing nutrient management practices in tomato cultivation.

[V-14] Maximizing Vegetable Production: Unleashing the Potential of Oxygen Fertilization in Florida

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Oxygen fertilizers, available in both liquid and solid forms such as hydrogen peroxide, calcium peroxide, and magnesium peroxide, offer a promising avenue for enhancing agricultural productivity across a variety of crops, including basil, snap beans, corn, etc. By delivering oxygen directly to plant roots, these fertilizers aim to optimize nutrient uptake, promote robust root development, and ultimately increase crop yields. Whether employed in traditional soil-based farming or modern hydroponic systems, oxygen fertilizers can improve agricultural environments by enhancing soil aeration, facilitating nutrient absorption, and mitigating stress factors to bolster overall plant health and productivity. In the face of global challenges such as flooding, which annually damages millions of acres of agricultural land and poses significant economic losses, the adoption of oxygen fertilization techniques presents a resilient strategy to sustainably enhance agricultural productivity and ensure food security. Particularly in Florida, where flooding risks are prevalent, oxygen fertilizers could mitigate adverse effects on crop yields and strengthen the resilience of the agricultural sector. Recognized for their cost-effectiveness and environmental sustainability, oxygen fertilizers are increasingly valued by future-oriented commercial growers seeking to sustainably optimize crop performance. Continued research and innovation in this field promises to further refine oxygen fertilizer applications, advancing commercial production methods and contributing to the resilience and efficiency of global food systems.

[V-15] Interactive Effects of Hydrogel and Different Forms of Nitrogen Fertilizer on Growth, Photosynthesis, and Nutrient Accumulation in Bok Choy (*Brassica rapa* var. *chinensis*)

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The application of hydrogel in sandy soil holds significant promise for enhancing crop production and mitigating challenges associated with water and fertilizer efficiency. Nevertheless, the limited documentation regarding hydrogel and its compatibility with nitrogen fertilizers presents obstacles to its widespread adoption in agricultural practices. To bridge this knowledge gap, our study delves into the interactive dynamics between hydrogel application and various forms of nitrogen fertilizers on bok choy production. Implemented as a pot experiment, our study incorporates three different nitrogen forms, with and without hydrogel application, utilizing a completely randomized design with three replications. Our results unveil a noteworthy enhancement in bok choy growth parameters due to hydrogel application, manifesting in heightened plant height, increased fresh and dry weight, as well as augmented nutrient uptake. Additionally, hydrogel application demonstrates a positive impact on photosynthetic parameters and brings about notable alterations in soil physicochemical properties. Interestingly, the synergistic effects of hydrogel vary across different nitrogen forms, with ammonium nitrogen (NH_4^+–N) exhibiting the greatest efficiency in enhancing bok choy production. Pearson correlation analysis reaffirms the close interrelationships between bok choy growth parameters, photosynthesis, nutrient accumulation, and soil properties. Further insights from Principal Component Analysis (PCA) underscore the substantial influence of hydrogel and NH_4^+–N on bok choy growth parameters, attributing the stimulated growth to enhanced nutrient uptake, photosynthesis, and soil properties. These findings illuminate the potential of hydrogel in bolstering nutrient use efficiency and crop production in sandy soil environments, thereby contributing significantly to the optimization of sustainable agricultural practices.

[V-16] Improving Green Bean (*Phaseolus vulgaris* L.) Growth, Yield, and Nutrient Uptake with Solid Oxygen Fertilizer: A Two-Year Field Study

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Snap bean yields can be significantly boosted by applying oxygen and phosphate fertilizers, vital for addressing the crop's susceptibility to hypoxic stress and phosphorus deficiency. In our two-year field study, we aimed to assess the impact of oxygen and phosphorus fertilization on plant growth, pod yield, and nutrient uptake. Using a Randomized Complete Block Design with four replications, we evaluated two oxygen fertilizer rates (0 and 45 kg/ha of solid oxygen fertilizer as calcium peroxide, CaO_2) and five phosphorus rates (ranging from 0 to 179 kg/ha of phosphorus pentoxide, P_2O_5, as triple superphosphate). Through monitoring changes in plant growth, nutrient uptake, pod yield, and soil properties, we aimed to determine the efficacy of oxygen and phosphorus fertilization in enhancing plant growth and soil quality. Our findings revealed significant improvements in plant growth and pod yield with the application of oxygen and phosphate fertilizers. Specifically, the greatest pod yield was observed with a combined application of 45 kg/ha of solid oxygen fertilizer and 135 kg/ha of phosphorus pentoxide. Pearson correlation analysis highlighted the close relationships between plant growth, pod yield, nutrient accumulation, and soil physicochemical properties. Furthermore, Principal Component Analysis demonstrated the substantial influence of oxygen and phosphorus fertilization on various growth parameters and pod yield in snap bean cultivation. Overall, our study underscores the potential of oxygen-containing compounds to alleviate hypoxic soil conditions, enhance phosphorus use efficiency, and improve crop productivity in snap bean cultivation, offering insights into cost-effective soil amendments for enhancing snap bean crop growth.

[V-17] Optimization of carbon and nitrogen inputs for adapting anaerobic soil disinfestation to organic strawberry production in Florida.

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A two-year field experiment was conducted on certified organic land in Citra, FL to assess anaerobic soil disinfestation (ASD) treatments of varying application rates of carbon (C) and nitrogen (N) inputs for improving organic strawberry production. Twenty-five combinations of five C rates (blackstrap molasses at 0, 3.5, 6.9, 10.4, and 13.9 m^3/ha) and five N rates (Everlizer, a heat-processed chicken litter product, at 0, 4.75, 9.5, 14.25, and 19 Mg/ha) were examined in a split plot design with 4 replications. Sunn hemp cover crop was seeded in July as a rotational crop with strawberry. ASD treatments were set up after 7 days of sunn hemp incorporation and lasted for 21 days before 'Florida Brilliance' strawberry was planted in early October. Cumulative redox potential (ORP) was recorded during ASD period. Weed populations, plant biometrics, strawberry yield, and fruit quality were assessed throughout the strawberry season. In both years, ORP significantly increased with the increasing application rates of molasses. At the end of ASD period in the first year, higher molasses (10.4 and 13.9 m^3/ha) and Everlizer (14.25 and 19 Mg/ha) application rates resulted in significantly lower numbers of nutsedges. However, inconsistent results were found in the second year. Plant aboveground biomass increased as the application rate of Everlizer increased in both years. The first year highest accumulative strawberry marketable yield (412.7 g/plant) was observed with molasses and Everlizer applied at 13.9 m^3/ha and 9.5 Mg/ha, respectively. No negative effects of ASD were observed in strawberry fruit quality attributes.

[V-18] Florida Statute 576.045: Analysis of Economic Impacts on Florida's Tomato Growers

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In 2019, tomatoes ranked as the second most-consumed vegetable in the U.S. The national production of fresh market tomatoes in 2021 totaled 10.49 million tons. Florida is the second-largest producer within the U.S., contributing around 3% to the total output, commanding 48% of the fresh market with approximately 315,000 tons. Central and South Florida boast a substantial tomato cultivation area of 23,000 acres with a crop value of $323 million. Florida statute "576.045 Nitrogen and phosphorus" aims to optimize fertilization management practices and nutrient rate applications. However, the variability in soil conditions across different locations challenges achieving site-specific recommendations. The term refers to determining the precise and adequate nutrient amounts tailored to specific locations, considering soil characteristics and geographical factors. Besides soil quality, proximity to water bodies significantly influences nutrient management due to leaching, especially in Florida's predominantly sandy soils, making them prone to nutrient loss and drought susceptibility. In this analysis we aim to provide a better understanding of the multiple economic impacts of this statute that may affect Florida tomato growers. As a result, we conclude that restricting phosphorus input poses challenges for tomato farmers, particularly small-scale growers, who rely on timing windows for optimal prices. Larger producers may benefit from stability and gaining negotiating power, while smaller ones may struggle to remain competitive. Farmers near water bodies face more challenges due to their potential impact on eutrophication and algae blooms, yet enforcing the law needs more clarity. We also evaluate how unintended consequences may result in an increased market penetration of imported tomatoes from Mexico, leading to lower domestic market prices and decreased crop value.

[V-19] A Risk Analysis for Florida Fresh Snap Bean: Using Enterprise Budgets to Assess Profitability of Management Decisions

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Florida snap bean (*Phaseolus vulgaris L.*) is an economically important vegetable crop, with a total of 31,607 harvested acres destined for the fresh market (2022 USDA-NASS Census of Agriculture). Grown statewide, Miami-Dade County is ranked second in US acres dedicated to snap bean production (Zhang et al., 2022). Florida growers face warm and wet weather conditions to produce fresh market beans to meet the demands of winter/early spring market windows of Thanksgiving and Easter.

Snap bean growers continue to face new pest pressures, such as the 2020 arrival of the *Megalurothrips usitatus* legume pest which originated from the Asian tropics. (Ivey et al., 2024). Extension specialists and crop consultants provide up-to-the-minute pest and disease monitoring and reporting, while researchers work to identify successful preventative and treatment options to mitigate crop losses. Yet there is a need to provide growers with economic tools to make informed decisions on how and when to select and implement these management practices. It is the intent of this study to demonstrate a Florida snap bean enterprise budget to establish a baseline estimate of revenues and costs on a per acre, per bushel basis that can be used by growers to make informed production and harvesting decisions specific to their operations. Additionally, enterprise budgets are useful to evaluate the impact of potential changes in recommended input prices or availability using breakeven analysis. We conduct partial budgeting analysis to reflect how recommended management practices may affect the annual cost of production and overall enterprise profitability. We provide a sensitivity analysis of expected returns over total costs of production allows for a detailed examination of varying input and yield scenarios.

[V-20] Water Productivity for Drip Irrigated Tomatoes Produced in Conventional and Compact Bed Geometries

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Tomato (*Solanum lycopersicum L.*) cultivation covers approximately 8,903 hectares in Florida, yielding an average of 45,193 kg ha-1 and generating an annual value of $322 million. Given the economic significance of this crop, the optimization of water and nutrient management practices become imperative. In the southeastern region of the United States, where prevalent soils feature sandy soils characterized by low organic matter content and limited water-holding capacity, tomato cultivation is predominantly produced on raised plastic mulched beds. Variation in bed geometry have the potential to significantly influence important soil physical characteristics, including bulk density, porosity, water retention, and penetration resistance. These factors in turn impact water productivity and yield. Previous research in southwest Florida showed that compact beds require less fertigation input compared to their conventional counterparts without compromising crop yields. A field study using tomato (*var*. HM 1823) was conducted in north Florida, assessing two raised plastic mulch bed geometries: conventional (0.76 x 0.15 x 0.76 m) and compact (0.61 x 0.25 x 0.61 m) during spring and fall. Preliminary findings indicate higher water productivity and yield in the compact beds during spring, whereas the trend reversed in fall. This suggests a direct influence of ambient and soil temperatures on water efficiencies and yield, with higher productivity during the warmer spring conditions.

[V-21] Effect of biostimulant application in tomato plant yield and fruit quality in relation to nitrogen application

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Round tomato plants were grown on plastic mulched sandy soil in Immokalee during the Fall season of 2023 following the usual agricultural practices. Four rates of liquid fertilizer (7-2-7) were supplied to the plants through fertigation (75, 100, 125 and 150% of the recommended UF/IFAS rate) and 3 aminoacid-based biostimulant products were tested in weekly drench applications. Fertilization rate significantly affected only mean weight of X-large fruit, whereas biostimulant application affected both the number and the average total production of X-large fruit, as well as total number of marketable fruit and fruit yield per plant. When plants were supplied with 200 lb/A of nitrogen (100% recommended rate of fertilizer), the number of X-large fruit and their mean weigh was 24.7 fruit and 6 kg per plant respectively with 29.5 total marketable number of fruit and 6.8 kg yield per plant. The reduced fertilization by 25% didn't affect the total plant marketable number of fruit and plant yield. However, the application of 50% extra than the recommended rate resulted in significantly lower number of X-large fruit per plant, as well as total marketable yield per plant (6.1 kg), in comparison to the application of 175 lb/A. In the case of biostimulant applications, the use of 2 products resulted in greater number of X-large fruit number and consequently greater total marketable fruit

number (32.0-32.6) and yield (7.1-7.2 kg) per plant, in comparison to untreated plants. The unmarketable yield and above ground biomass were unaffected by the fertilizer rate or the biostimulant application.

[V-22] Artichoke Nutrient Management - Comparing Yield in CRFs vs Fertigation.

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The globe artichoke (*Cynara cardunculus*) is a large thistle plant native to the Mediterranean and belonging to the Asteraceae family. This crop was introduced at UF/IFAS Hastings to provide an alternative demonstration for potato and cabbage growers looking for a new plant family rotation for diversification. Artichokes have not been a traditional crop in the state of Florida, even as a garden variety. Therefore, this study is the evaluation of nutrient demands of a potential new commodity for Florida growers. The artichoke trials transitioned from variety demonstrations to nutrient management options: controlled-release fertilizers (CRFs) compared to fertigation. With CRFs slowly releasing the fertilizer over time, depending on the coating, ideally, it should mimic a fertigation program as nutrients are being injected in increments over the growing season. The objectives were to (1) compare the yield of 'Green Queen' artichokes by USDA size class, and (2) select the preferred nutrient source for future rate studies. The half-acre bed on Alfisol soils was divided into two treatments with nine replicates, and all plots receiving 200 lbs of Nitrogen, 75 lbs of P_2O_5 and 138 lbs K_2O. Treatment 1 included water-soluble fertilizers for injection while Treatment 2 included a 5-6 month-release blend of 16-6-11 (including minors) from Harrell's Fertilizer, and both planted with plasticulture and double-line drip irrigation in November. The results showed a significant difference in the yield and even an increased quantity by weight of one globe size class when using the CRFs, but fertigation is still practical as well.

[V-23] To understand the potential of CRF in maintaining carrot quality and production goals while reducing nitrate leaching

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Fertilizers are often used by farmers to enhance the production and quality of carrots. The present study region is the Suwannee River Basin, dominated by sandy soils that are highly susceptible to nutrient loss, particularly nitrate leaching. The leaching of nitrogen (N) may drain into the Upper Floridan Aquifer (UFA) and contaminate water. So, it becomes a paramount to use a fertilizer and application timing that provides nutrients in synchrony with the sequential needs of plants for nutrients to enhance the crop yield and reduce the leaching. The objective of the study was to understand the potential of control release fertilizer (CRF) in maintaining carrot quality and production by reducing nitrate leaching in North Florida. To reach the goal a field experiment was carried out with six treatments in 2022 and eight treatments in 2023 involving different combinations of CRF application rate/time and conventional fertilizers. The different parameters such as soil nitrate-nitrogen at different depths, leaf tissue N, and carrot yield were collected throughout the growing season. The result of the study in the consecutive years revealed that all the treatments were within the range of 2.55 to 3.6 % leaf tissue N, which is well below the target range of 1.8-2.5% N. The study also showed that the CRF effectively retained the same amount of nitrogen across all depths (0-12, 12-24, and 24-36 inches) compared to conventional application methods. The application of 100 lbs/ac of CRF N (15-0-20) preplant, and an additional 100 lbs/ac of CRF N (43-0-0) in-season, resulted in the highest yield compared to the conventional application of 200 lbs/ac, yielding 27.70 tons/acre and 20.49 tons/acre respectively. The available nitrogen in biomass was consistent across treatments, T6(75 lbs N CRF preplanting,125 lbs CRF in season) showed higher plant nitrogen uptake efficiency than the conventional method. Total available nitrogen in the biomass was also similar for all the treatments throughout the growing season. Plant nitrogen uptake efficiency was also significantly higher in T6 as compared to the conventional.

[V-24] Convincing Growers we have them Covered with Cover Crops

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Cover cropping is not a new concept, but cover crops are gaining new traction. The use of cover crops can reduce fertilizer and herbicide use, improve soil health, prevent soil erosion while conserving soil moisture, protecting water quality, and potentially improving crop yield in future years. These benefits have a positive impact on our natural resources. UF/IFAS Extension wants fruit and vegetable producers to learn the motives for utilizing cover crops, to understand the short and long-term benefits to farm ecology, facilitate field demonstration days, and discuss with other producers the types and cultivation methods for several cover crop species. Three farms agreed to experiment with the use of four thriving cover crop species, for our region, to reduce crop pests like weeds and nematodes. They also agreed to host field day demonstrations to teach others what they learned. By Year 3, all three farms (total of 343 acres with cover crops experimentation) noticed subtle changes in the soil strata, a reduction in weeds and nematode pressure where cover crops were planted, and the ability to reduce their fertilizer and pesticide applications. Some cover crop species failed to perform. Preliminary data will be shared of the successes and the challenges of using cover crops. Producers were reluctant to try cover crops due to the financial burden. After three years of data, they are noticing an increase in soil organic matter; a suppression of soil pests like nematodes; they have reduced the summer herbicide treatment and the soil nutrient levels are slowly building in the soil. During the field day, new producers were ready to try cover crops based on impacts shared. The potential economic benefit is currently being calculated by the farms for their acreage by the reduction of herbicide and pesticide applications.

[V-25] Seed Planting and Nutrition Workshop for Taylor County

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About 12.9% of Taylor County residents live in poverty. That equates to nearly 2,749 people struggle to provide or eat proper food on the table. Most do not have the information to choose healthier foods nor can afford to buy thus rely on fast foods. Three Rivers Regional Library System acquired a grant and purchased certified organic vegetable seeds to distribute free within the County regions, Dixie, Gilchrist, Lafayette, and Taylor. To increase the availability of fresh fruits and vegetables, planting your own seeds has multiple benefits. Improves health by having access to fresh produce, saves money on groceries in long run and having a peace of mind knowing where your food is coming from, and the physical activity that gardening requires, can provide exercise, and relieve stress. Two presentations were delivered to (26) participants. The first demonstrated how to, when, planning, fertilizer soil test, and harvesting tips. UF/IFAS Florida Vegetable Gardening Guide publication was provided and interpreted along with the presentation. The second presentation introduced participants to the health benefits of gardening, including the physical, mental, social, environmental, and nutritional benefits. A recipe was shared, that featured foods of the seeds that were distributed. Following the presentations, the participants were allowed (5) free seed packets of their choice and each an individual sample of a pre-prepared recipe using some of the produce discussed in the earlier presentations. According to surveys, when the participants could see, hear, and engage in a taste sample, provided a better understanding of the connectiveness by growing their own produce, how to use in preparations and all the health and economic benefits. As a result of connectiveness, there is a high likelihood the participants will perform a soil test and start their garden from the seeds.

[V-26] Developing a winter artichoke production guide in Florida

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Artichoke (*Cynara cardunculus* var. scolymus) belongs to the sunflower family and is cultivated for its flower buds. Artichoke is adapted to Mediterranean climates, requiring adequate winter chill for flower bud induction and yet being susceptible to freeze damage. Because of these climatic requirements, nearly 100% of artichoke production in the United States currently comes from California. Insufficient winter chill is among the major environmental constraints for artichoke production in subtropical and tropical climates. We started this study in 2015 with the goal of developing artichoke as a new winter crop in Florida. First, we developed a protocol for artificial flower bud induction using a plant hormone, gibberellic acid (GA_3). With the optimum rate and timing, GA_3 application is highly effective in inducing bud formation, irrespective of winter chilling. Second, we evaluated eight cultivars based on earliness of bud formation, yield, and bud quality. Our results suggest that 'Imperial Star' and 'Green Queen' are the most promising cultivars in Florida, with the maximum yields of 17.3 and 11.8 t ha^{-1}, respectively. The current artichoke production guide provides recommendations on GA_3 application, cultivars, planting configurations, plastic mulch, and basic pest management. In 2023, artichoke was grown on about 12 hectares in Florida using the production guide we developed. We are currently testing additional hybrid cultivars and assessing nutritional values and postharvest quality to enhance the viability of artichoke as Florida's new winter crop.

[V-27] The Potential of Purple Sweetpotato for Florida Horticulture

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Florida's summers are characterized by hot temperatures and frequent rainfalls, and this season can be specifically utilized to grow certain heat stress tolerant and value-added vegetables. We propose that purple sweetpotato will best suit this season and generate value for its antioxidant qualities, nutritional value and natural colors. During May to Oct 2023 three purple sweetpotato varieties (NCPS, WMVQ and SPL) were cultivated along with one orange-fleshed sweetpotato (BGD) in a randomized block design. Plants were planted using 4 ft between-row and 1.5 ft within row spacing in a field in Gainesville and managed with overhead irrigation and granular fertilizer applications. The mean tuber yield per plant in pounds were 2.5 + 0.6, 5.7 + 0.5, 6.5 + 1, and 6.3+1.2 for BGD, NCPS, WMVQ and SPL respectively. Data on the use of a standard curing protocol and estimation of anthocyanins in purple sweetpotato varieties will be presented.

[V-28] Plant-parasitic nematodes infecting alternative crops in Florida

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Alternative crops are crops that are not commercially grown in Florida on a large scale but are being investigated for their suitability for Florida production. They can help growers to diversify their operations and help create new markets. Presently, they include crops with potentially high market value and nutritional benefits such as artichoke, blackberry, hemp, hops, and pomegranate. However, the cultivation of these crops poses several challenges owing to unconventional climate and soil conditions as well as the prevalence of diseases and pests. Plant-parasitic nematodes are one of the main biological constraints for crop production in Florida. Especially in sandy soils, root-knot (*Meloidogyne* spp.) and sting (*Belonolaimus* spp.) nematodes are very widespread and capable of causing considerable crop damage to many fruit and vegetable crops. It is therefore very important to assess how these nematodes could impact new crops that are introduced to Florida fields. Our findings revealed that artichokes, hemp, hops, and pomegranate are good hosts to root-knot nematodes. No obvious above- or belowground damage was observed on pomegranate, but artichoke plants at the GCREC showed aboveground yellowing and large coalesced root galls towards the end of the season, Hops similarly showed yellowing and stunting associated with numerous discrete root galls. Hop cultivars showed significant differences in susceptibility to root knot with cvs Chinook and Centennial being highly susceptible and cvs Cascade and Magnum less susceptible. A variety of hemp cultivars, consisting of different fiber, oil, and cannabinoid cultivars, showed only limited variation in root-knot host status with all cultivars allowing high root-knot nematode reproduction. Sting nematode did not appear to be a problem on hops and hemp, but high populations of sting nematodes were found associated with declining blackberry bushes at the GCREC

research farm. With both root-knot and sting nematodes being very prevalent in Florida's sandy soils, it will be important to develop practical nematode management strategies to support successful production of alternative crops.

[V-29] Can hydrolyzed corn protein baits be used for sweet corn insect pest management in Florida?

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The corn silk flies (Diptera: Ulidiidae), *Euxesta eluta*, *Euxesta stigmatias*, and *Chaetopsis massyla*, are the most damaging insect pests attacking sweet corn in Florida. Larvae feeding on silks and kernels, as well as pupae found in the soil, are not exposed to insecticides. Thus, management with insecticides targets adults to prevent egg deposition. However, adults in habitats surrounding sweet corn fields quickly infest these fields following insecticide applications, contributing to poor control levels when corn silk fly populations are high. UF/IFAS entomologists have initiated the study of potential adult attractants and repellents to determine whether these compounds could be used to minimize corn silk fly adult movement into sweet corn fields. Laboratory experiments determined the preference of *E. eluta* and *E. stigmatias* adults for two hydrolyzed corn protein baits and 1,4-dimethoxybenzene (a floral volatile), alone and in combination. *Euxesta* spp. adults exhibited a preference for NuLure and GF-120 relative to a water control; however, preference for sweet corn kernels relative to a water control was greater. A follow-up field experiment determined the number of corn silk fly adults in sugarcane plots following applications of the bait treatments. The number of *C. massyla* adults in plots treated with NuLure were greater than in control plots treated with water. However, differences in *Euxesta* spp. adult numbers were not observed. These results suggest that hydrolyzed corn protein baits should be further studied for use in corn silk fly management.

[V-30] Extension and research efforts focusing on *Thrips parvispinus*, a new invasive species impacting pepper production in South Florida

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Agriculture in Florida is continuously threatened by newly introduced invasive pests. In 2020, *Thrips parvispinus*, an invasive polyphagous thrips species, was first detected in the continental U.S. on ornamental plants in a greenhouse in Orange County, Florida. In early 2022, the insect was observed on Gardenia plants in Miami-Dade County, and later in Palm Beach County. In November 2022, it was reported in commercial pepper fields for the first time in Palm Beach County. All life stages can feed and cause damage on all parts of pepper plants including flowers and fruits. On young plants, thrips feeding can cause significant leaf and bud damage. The distorted leaves and flower buds resemble injury caused by broad mites. In 2023, thrips population monitoring and on-farm insecticide evaluations were initiated in collaboration with pepper growers. In addition, the South Florida Pest and Disease Hotline Newsletter was a crucial tool to the UF/IFAS Palm Beach County Extension program to communicate the spread and population dynamics of this important pest with vegetable production stakeholders. Constant communication, field visits, and on-farm trials with growers and crop consultants have been a pillar of the response for the management of *T. parvispinus.*

[V-31] Allelic variations in the candidate gene for hull-less seed trait in pumpkin

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Pumpkin seed is a popular snack that contains healthy fats as well as other beneficial nutrients for human health. A single recessive gene, designated *n*, confers the hull-less characteristic in pumpkin seed. However, the phenotypic variation observed in seeds carrying the *n* gene are suggestive of allelic variations and or additional modifiers. The *n* locus was recently mapped to chromosome 12 of the *Cucurbita pepo* genome and a candidate gene (*Cp4.1LG12g04350*) encoding a NAC domain-containing protein involved in lignin biosynthesis was identified. In the current study, comparative sequence analysis of *Cp4.1LG12g04350* gene was conducted in a panel of *C. pepo* cultivars and accessions, as well as several bridge (*C. pepo* x *C. moschata*) lines. Several single nucleotide polymorphisms and indel markers were identified in the sequenced panel of cultivars/ accessions, including those previously mapped through independent studies. These new genomic resources will facilitate marker-assisted selection for the hull-less seed trait in pumpkin.

[V-32] Analyzing Consumer Preferences and Willingness to Pay for Florida-Grown Fresh Blueberries

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Blueberry farmers in Florida gain extra advantages from participating in the state-branded agricultural marketing program and using the *Fresh From Florida* logo on their product packaging. However, the Florida blueberry market has faced challenges due to the influx of imported berries. To enhance the visibility of the promotional program and local blueberry consumption, it is essential to boost consumers' awareness and understanding of the benefits associated with locally grown fresh blueberries. The objective of this paper is to provide a better understanding of consumers' preferences and underlying reasons for purchasing fresh blueberries with the state label, *Fresh From Florida*. In this paper, we first investigate whether, and the extent to which, consumers are willing to pay a price premium for the state-branded logo, *Fresh From Florida*. Second, we examine whether providing information impacts consumers' willingness to pay (WTP) for fresh blueberries marketed with the state logo. We determine which type of information is most important in affecting consumers' choices. Lastly, we segment consumers based on their self-reported attitudes towards state identity, healthy diet, and pro-environmental behavior. The outcomes of this study will offer valuable perspectives for promoting locally grown products among local retailers, agricultural producers, and policy decision-makers.

[V-33] Challenges and Possible Solutions in Vegetable Production of Miami-Dade County

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The winter fresh market vegetable production has a long history, and it is an important agricultural industry in Miami-Dade County. However, the acreage and production have declined significantly in recent years. Vegetable growers are facing a lot of challenges, namely the land value pressure, residential development with urban expansion, pest control and pest management, labor shortage, market competition from overseas, costs of labor and materials. For instance, a pre-construction house on ¼ acre of lot starts from $720,000 in Redland, Homestead, which is a dominant agricultural area; the outbreak of plant pests, such as tomato chlorotic spot virus (TCSV) since a few years ago impacts all the tomato growers; and during the pandemic of Covid-19 from 2020 to 2022, some growers were unable to get enough labors to pick and pack the produce. Some vegetables imported from overseas are cheaper than what produced here. To mitigate such challenges, vegetable growers probably need to improve their feasibility by growing high quality and more productive varieties or cultivars adapted to the unique environment of Miami-Dade County; reduce labor costs by implementing new technologies, such as automation, drone, and artificial intelligence (AI); and apply space-efficient technologies, such as vertical culture with hydroponics or aeroponics. UF/IFAS extension and research is a resource to provide a strong support and collaboration with growers to succeed.

[V-34] How New Mexico's Specialty Crops Growers Perceive and adapt to Climate

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Every year, climate change causes $73 million in loss to New Mexico's agriculture (Niemi, 2009), and despite the numerous incentivizing conservation programs, the state remains one with the lowest adoption rates in the nation (Wade et al., 2015). Thus, understanding specialty crop growers' perceptions of climate change is a crucial element to develop mitigation strategies that will ensure resiliency of the state's agriculture. Thus, in this study, we use survey data of 300 farmers from New Mexico to: (a) determine how they perceive climate change; (b) assess their awareness of incentivizing conservation programs; and (c) elicit their willingness and how they would adapt their agricultural practices (e.g. adoption of reduced tillage, cover crops, nitrogen management) to climate change. Three main hypotheses are tested in this study: (H1): Climate change perceptions are equally influenced by demographic characteristics and peer-counseling; (H2): Farmers lack literacy regarding climate change incentivizing programs. And, (H3): Farmers who perceive climate change are more likely to adapt. Descriptive statistics are used to test (H1), while for H2 and H3, a sample selection (Heckprobit) model is used to study adaptation willingness among climate change believers. Preliminary estimations show that growers who perceive climate change are more likely to adopt conservation practices to accommodate climate change. Understanding conservation practices adoption preferences in the state will help improving the design of adaptation policies to better fit climatic conditions and growers' needs.

[V-35] Prediction of tomato yield by image processing and crop canopy calculations

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[Abstract is missing]

Best Management Practices (Special Section)

Coordinators: Sanjay Shukla and Thomas Obreza

[BMP-1] A two-year on-farm study to evaluate the effectiveness of phosphorus fertilization for tomato in Central Florida

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The objective of this study was to investigate the effectiveness of P fertilization for tomato production in Central Florida. Four field experiments were conducted on commercial farms with Mehlich-3 soil P exceeding the critical level (45 ppm). In Year 1 Fall, we evaluated four phosphate (P_2O_5) rates (0, 50, 75, and 100 lb/acre) in one experiment. At planting (0–6" depth), Mehlich-1 soil P showed a linear increase with P_2O_5 rates, whereas Mehlich-3 soil P showed no significant correlation. Plant P uptake and total marketable yield (TMY) increased linearly with P_2O_5 rates by up to 74% and 23%, respectively. In Year 1 Spring, we evaluated four P_2O_5 rates (0, 50, 100, and 150 lb/acre) in two experiments. In the first experiment, both Mehlich-3 and Mehlich-1 soil P at planting showed linear increases with P_2O_5 rates. Plant P uptake and TMY increased linearly with P_2O_5 rates by up to 104% and 21%, respectively. In the second experiment, although Mehlich-3, Mehlich-1 soil P, and plant P uptake increased linearly with P_2O_5 rates, TMY showed no significant response to P_2O_5 rates. In Year 2 Fall, we evaluated six P_2O_5 rates (0, 50, 75, 100, 150, and 200 lb/acre) in one experiment. Although neither Mehlich-3 nor Mehlich-1 soil P showed significant correlation with P_2O_5 rates, plant P uptake and TMY increased linearly with P_2O_5 rates by up to 84% and 22%, respectively. These results suggest the need to revise the current P recommendation for tomato in Florida.

[BMP-2] On-farm evaluation of phosphorus fertilization for potato in Central Florida

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Phosphorus (P) is essential for crop production, but its excessive application can lead to environmental pollution. The Florida government mandates the use of best management practices to minimize the risks of environmental pollution while improving fertilizer use efficiency and sustaining crop productivity. Our objective was to assess soil–plant phosphorus dynamics, growth, and yield responses of potato to P fertilization in potato (*Solanum tuberosum*) grown on sandy soils in Central Florida. Field experiments were conducted at commercial farms using chip ('Atlantic') and table-stock potato ('Red LaSoda') cultivars. Treatments included six phosphate (P_2O_5) application rates (0, 45, 90, 135, 180 and 225 lb/acre), arranged in a complete block design with four blocks. In both experiments, background

soil P levels determined by Mehlich-3 extraction (107–260 ppm) were much higher than 45 ppm, above which no P fertilization is necessary according to the current recommendation. The relationship between leaf P concentration and P_2O_5 application rate was best described as quadratic or exponential plateau functions for 'Atlantic' but as a linear function for 'Red LaSoda'. Although plant biomass and P uptake increased with increasing P_2O_5 application rate, marketable yield showed no significant response. In the table-stock potato experiment, tuber quality improved with P_2O_5 application rate. We are currently conducting additional experiments to evaluate the potential interaction between P_2O_5 application rate and season.

[BMP-3] On-farm evaluation of phosphorus fertilization for green beans in Central Florida

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Optimum phosphorus (P) fertilization is critical for achieving high crop productivity and minimizing environmental concerns. Although sandy soils in Florida commonly show high soil test P availability, it has been reported that green bean yields can still respond to P fertilization. Our study aimed to examine soil–plant P dynamics, growth, and yield responses of green beans to P fertilization in a sandy soil with high background P availability. Field experiments were conducted at a commercial farm in Central Florida over two consecutive years. Treatments included four phosphate (P_2O_5) application rates (0, 40, 80, and 120 lb/acre), arranged in a complete block design with four blocks. Leaf samples were collected bi-weekly for tissue nutrient analysis once plants were established, and whole plants were sampled immediately before harvesting to determine P uptake and partitioning. Background Mehlich-3 extractable P levels in the surface soil (0–6 inch) (128–154 ppm in Year 1) were much higher than 45 ppm, above which no P fertilization is necessary according to the current recommendation. Throughout plant development, leaf P concentration increased proportionally to P_2O_5 application rate. Although plant biomass accumulation also increased with P_2O_5 application rate, biomass partitioning was unaffected. Marketable yield increased with P_2O_5 application rate, maximizing at 80 for Year 1. These results indicate the need to revise the current P recommendation for green beans in Florida.

[BMP-4] Evaluating Phosphorus Recommendations for Fresh-market Tomato Production in Florida

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Phosphorus (P) is an essential nutrient for production of crops, but excessive P fertilizer application can adversely impact natural ecosystems. Florida is the largest producer of fresh tomato in the USA. The Clean Waterways Act of Florida requires implementation of state's agricultural best management practices (BMPs), including soil test-based P fertilizer application for tomato, to minimize the excessive P losses to the environment. The main P BMP involves

adjusting the P fertilizer application rate based on the Mehlich-3 P (M3P) levels (Low: < 25 ppm, medium: 25-45 ppm, high: > 45 ppm) in soil, and dictates no application of P for soils with "high" M3P values. This recommendation was mainly based on decades old research conducted mainly on small plots, which the industry perceives to be inadequate for the high pH soils of Florida. A state-wide study, funded by the state and conducted on commercial farms in partnership with the industry, was initiated in 2021 to reassess the current recommendations. The experiments considered yield responses from four to six P_2O_5 application rates (0 to 200 lb/ac) at farms with different irrigation systems (seepage and drip) and soil M3P values (22 to 145 ppm). Plant, soil, weather, and hydrologic data including yield, soil and plant tissue P concentrations were collected for a system wide analysis. Results from the first two years (2021-2023, six seasons) of the study in South Florida showed statistically significant ($p < 0.05$) increase (up to 40%) in yield when P_2O_5 was applied even with "high" soil M3P (> 45 ppm). Preliminary analyses indicate that the critical soil M3P concentration at which no additional fertilizer is required may be more than double of the current threshold value of 45 ppm. Results also confirmed observations from an earlier study which showed that yields from ditch rows (DR), that are adjacent to an irrigation ditch, differed significantly from non-ditch rows (NDR), that are further away from a ditch. This result can help develop site-specific recommendation with DR and NDR receiving different fertilizer P inputs. The study is ongoing for the third year (2023-2024), and if the preliminary results are confirmed, the current fertilizer P recommendations and interpretation of the soil test will likely be revised. The revised recommendations are likely to keep Florida's tomato industry competitive by maintaining yields and economic viability while minimizing losses to the ecosystem.

[BMP-5] Large-scale Re-assessment of Phosphorus Fertilizer Recommendations for Potatoes on Commercial Farms in South Florida

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Florida is a top winter/spring producer of potatoes in the U.S. and accounts for one-third of the national production. It is essential to apply phosphorous (P) on the sandy, low water-holding capacity soils of the state to maintain economically viable potato yields. However, careful P fertilizer management is needed to avoid the risk of losses to waterbodies. The challenge of incorporating both the concern for positive economic outcomes and the mitigation of risk to the environment is addressed by the adoption of the states' fertilizer P best management practice (BMP). The P BMP dictated using the Mehlich-3 soil P (M3P) test to determine the level of P fertilizer input; with 45 ppm being the critical value above which no P fertilizer is to be applied. However, the initial research upon which the P fertilizer recommendations are based may not be representative or applicable for the state's various soil types, hydrologic conditions, and production systems. A study was initiated in North, Central, and South FL in 2021 with funding by the state and conducted in cooperation with the growers on their farms to assess the P fertilizer BMP. Results for the large-scale south FL study, which tested the yield of table stock potato (Red Lasoda) response to six P fertilizer rates (0, 46, 92,138, 184, and 230 lbs/acre P_2O_5) under varying levels of pre-plant M3P (74 to 208 ppm) will be presented. An eclectic set of plant, soil, weather and hydrologic data including yield and soil and tissue P concentrations was collected. Initial results showed a statistically significant increase in tuber yield in response to P fertilizer application at soil M3P concentrations greater than the 45 ppm (BMP). In 2022, a provisional suspension of the P fertilizer recommendation was granted in consideration of the interim results from the study. Pending data from the third year of this study, a revision of P recommendations, that use the M3P test with 45 ppm as a cutoff, is likely needed to sustain the economic outcomes of producers while minimizing losses to the environment.

[BMP-6] Evaluating phosphorus recommendations for snap bean production in South Florida

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Phosphorus (P) is an essential nutrient for producing fresh vegetables including snap bean. Florida ranks first nationally in the fresh market snap bean production. Sustainable crop production calls for efficient phosphorus (P) management to maximize productivity while minimizing environmental losses. Florida's Clean Waterways Act requires growers to implement Best Management Practices (BMP) including soil test based P fertilizer application. The current P recommendation for snap bean uses soil Mehlich-3 (M3) P values to determine how much P-fertilizer to apply: up to 100 lb/ac P2O5 for M3P ≤ 25 ppm (low), up to 80 lb/ac P2O5 when M3P is 26-45 ppm (medium) and no P-fertilizer when M3P is > 45 ppm (high). These recommendations are, however, based mainly on research from small-scale experiments that may not be representative of commercial production system for all Florida soils. A study was initiated in North, Central, and South FL in 2022 with funding from the state and conducted in cooperation with the bean growers, to assess the P fertilizer BMP. Results for two experiments conducted in 2022-2023 in southwest and southeast Florida will be presented. Dry P-fertilizer rates of 0, 40, 80, and 120 lb/ac of P2O5 and a grower standard rate (80 to 113 lb/ac P2O5; dry plus liquid) were tested. The experiments were conducted on large fields (10-45 ac) on commercial farms with a randomized complete block design. Soil and plant nutrient concentrations, yield, weather, and hydrologic data were collected for two growing seasons. Pre-plant M3P levels varied from 49 ppm to 106 ppm. Preliminary findings indicated a statistically significant increase in yield to fertilizer P even when M3P was above the threshold value of 45 ppm (high). Yield increases of up to 50% were observed compared to the control treatment (0 lb/ac P2O5). Positive yield response for soils with high pre-plant soil M3P values suggests that the current recommendations are likely to be insufficient for maintaining snap bean yields in South Florida and need to be revised. The study is ongoing for two more years (2024-2025) and results are likely to help improve P recommendations to maintain current production while reducing excess P losses to the environment.

[BMP-7] Phosphorus fertilizer rate trials for potato yield response in Northeast Florida

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An adequate soil phosphorus (P) supply is essential to maintain potato (*Solanum tuberosum*) plant P status and tuber yield. Soil P testing remains the most common method to determine soil available P to the crop, but it requires regional studies to establish the critical soil P level and to provide site-specific P-fertilizer recommendations. Since 2010, Mehlich-3 (M3) has replaced Mehlich-1 (M1) for phosphorus (P) recommendations in soil testing. Despite this shift, M3 testing often reveals high P levels in potato-growing regions, resulting in a recommended P-fertilizer application rate of zero despite observed yield responses. This study aimed to determine potato yield and tuber-specific gravity in response to increasing rates of P-fertilizer with varying pre-planting soil extractable P concentrations. Six production areas were selected, with Mehlich-3 (M3) extractable soil P concentrations of 73, 148, 196, 287, 351, and 648 mg/kg. Pre-planting P-fertilizer rates (0, 45, 90, 135, 180, 225 lb/ac of P_2O_5) were applied in large plots in a randomized complete block design with four replications. Data collection occurred over two consecutive years for the cv. 'Atlantic', with measurements taken at specified stages throughout the growing season. The average total tuber yield for zero P-fertilized treatments ranged from 214 to 430 cwt/ac. There was a significant linear response of total tuber yield to increasing rates of P-fertilizer for all sites. Total yield increased linearly with increasing P-fertilizer rates for sites with

soil P values < 179 mg/kg (coefficients between 27 and 33) prior to fertilizer application, while sites with initial M3 soil P between 180-348 mg/kg showed coefficients between 2 and 21. One site with M3 soil P of 648 mg/kg prior to fertilizer application had a coefficient of -9, indicating a decrease in yield with increasing P-fertilizer rates. There was no significant effect of P-fertilizer rates on tuber-specific gravity, averaging 1.084±0.003 and 1.082±0.007 in seasons 1 and 2, respectively. The findings of this study suggest that current interpretations of soil P concentration using M3, with the critical level at 45 mg/kg, require adjustment to accurately predict tuber yield response to added P-fertilizer for potatoes in northeast Florida sandy soils.

[BMP-8] An Update on Optimizing Phosphorus Application Rates for Snap Bean Production in North Florida

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In our comprehensive two-year field study, we sought to understand the effects of dry granular phosphorus fertilization on snap bean yields, a critical consideration given the crop's vulnerability to phosphorus deficiency. Employing the 'Caprice' snap bean variety as our test subject, we implemented a rigorous Randomized Complete Block Design (RCBD) with four replications. Across five phosphorus rates, ranging from 0 to 179 kg/ha of phosphorus pentoxide (P_2O_5) sourced from triple superphosphate (TSP), we meticulously assessed plant growth, nutrient uptake, pod yield, and soil properties to gauge the impact of phosphorus fertilization on both crop productivity and soil health. Our findings revealed compelling evidence of the positive influence of phosphate fertilizers on snap bean cultivation. Notably, we observed significant improvements in both plant growth and pod yield with the application of phosphate fertilizers, particularly at rates exceeding 160 lbs/acre P_2O_5, especially in soils characterized by high aluminum and iron contents. These outcomes underscore the critical role of phosphorus supplementation in enhancing snap bean yields and mitigating the risks associated with phosphorus deficiency. However, our study also highlights the need for further optimization of phosphorus fertilizer application methods to maximize the benefits for snap bean cultivation. By fine-tuning application strategies and considering soil-specific factors such as nutrient availability and soil composition, growers can potentially unlock even greater gains in snap bean productivity and soil fertility. Overall, our research contributes valuable insights into the importance of phosphorus management in sustainable snap bean production, providing a foundation for future advancements in agricultural practices aimed at enhancing snap bean yields and soil sustainability.

[BMP-9] Snap Beans Response to Different Phosphorus Rates and Irrigation Scheduling

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The application of nutrients such as phosphorus (P), in crop cultivation aims to enhance productivity and economic returns. Nevertheless, overapplication and inappropriate techniques can lead to nutrient leaching into groundwater and surface water bodies. Moreover, the overuse of water for irrigation purposes further facilitates runoff and the leaching of nutrients out of plant root zones, consequently affecting groundwater resources. Thus, the implementation of a balanced and rational approach to fertilizer management and irrigation emerges as a requisite for the conservation of water resources and the sustainable cultivation of snap beans. This necessitates a critical reevaluation of established practices about both irrigation and nutrient application. The determination of optimal irrigation and fertilizer rates assumes paramount importance in optimizing the overall productivity of snap bean crops. This situation is more serious within the context of South Florida, characterized by unpredictable rainfall patterns and soil exhibiting high permeability. Hence at the Tropical Research and Education Center, University of Florida, we conducted a phosphorus and irrigation optimization study for three years on an experimental field and a commercial bean grower's field. The study includes five levels of P2O5 application rates (0, 40, 80, 120, and 160 lbs./ac) and two irrigation treatments (based on crop water requirement (CWR) and based on common growers' practices of 1 inch of irrigation per week). Moreover, during the study on the commercial grower field an additional rate of phosphorous, which we called grower practice, was added. This presentation will highlight the lessons learned, challenges encountered, and essential factors to be integrated into forthcoming investigations on optimizing fertilizer rates.

[BMP-10] Florida irrigated corn and nitrogen rate recommendations: insights and future perspectives

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Corn (*Zea mays* L.) ranks first in production and third in consumption among grain crops in the world. However, ensuring food security of a growing population requires proper management of fertilizers, especially those that contain nitrogen (N), to mitigate potential environmental and health risks. The current N rate recommendation (269 kg ha^{-1}) for irrigated corn in Florida dates back to more than 30 years ago, hence a potential update of such rate needs to be assessed. The yield response of a new corn hybrid, 'Pioneer 1870', to six N rates was evaluated in two fields (short-term cultivated and long-term cultivated) at the North Florida Research and Education Center – Suwannee Valley in Live Oak, Florida, in 2022 and 2023. The N rates ranged from 0 to 392 kg ha^{-1}, with 78.5 kg ha^{-1} increments. A total of 24 small plots were established in each field under a randomized complete block design. In addition, N budgets were calculated to determine the primary N environmental loss pathway. A linear-plateau response curve best described the complete dataset (N rate at plateau equal to 275.18 kg ha^{-1}), however some individual field-years showed quadratic curves (N rate at highest yield close to or above 393 kg ha^{-1}). The N budgets showed that leaching was the primary environmental loss, and it was positively linearly correlated with the increase in N rates. In addition, best management practices applied to this study (i.e., split application of urea and sensor-based irrigation) might have helped in mitigating N leaching. These results reinforce the need of reassessing the optimum N rate for irrigated corn in Florida, with potential field- or year-specific N management.

[BMP-11] Site-specific Nitrogen and Phosphorus BMPs of HLB-affected sweet orange

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Nutrient management is imperative on Florida sandy soils, where significant rainfall is prevalent, and where severely impacted huanglongbing (HLB)-affected citrus tree root systems. Nutrient management based on crop demand has been considered a best management practice in recent years for sustainable crop production. Huanglongbing (HLB, citrus greening) has caused tree root densities to decline severely and has decreased citrus acreage, fruit yield, and quality. When a citrus tree becomes affected by HLB, approximately half of its root density and mass decline before symptoms of HLB become visible on the tree canopy. The objective of this study is to determine the impact of varying fertilization rates of nitrogen (N) and phosphorus (P) on soil, leaf nutrient content, tree growth, fruit yield, and juice quality of HLB-affected citrus trees with emphasis on the best management practices (BMP). Nitrogen (N) rates (100, 150, 200, 250, and 300 lb/acre) and phosphorus (P) (0, 10, 20, 40, and 80 lb/acre) rates were applied on 'Valencia' and 'Hamlin' *Citrus sinensis* trees in three splits each year following the tree leaf flushes at the three study sites (Lake Wales, Arcadia, and Clewiston). Soil samples were collected at 0–6 and 6–12-inch depths, while data on canopy volume, trunk cross-sectional area (TSCA), and leaf and soil nutrient concentrations data were collected every six months in spring and summer seasons and fruit yield and fruit yield and postharvest fruit quality were also analyzed each year. Baseline and first-year data of soil, leaf nutrient concentration, canopy volume, TSCA, fruit yield, and postharvest fruit quality parameters have been analyzed. Results indicated that not only N but also calcium (Ca), manganese (Mn), and zinc (Zn) were deficient in both the Clewiston and Arcadia sites. Meanwhile, iron (Fe) was deficient in the Lake Wales and Clewiston sites. Potassium (K) was deficient in Lake Wales and Clewiston sites. Results of canopy volume and trunk cross-sectional area of 'Hamlin' and 'Valencia' citrus trees did not show variation among each of the study plots.

Mango Summit

Organizer: Nathalia Tello and Muhammad A. Shahid

[M-1] Efficacy of Thyme Guard®, Timorex ACT®, and Kocide®-2000-O for controlling fruit diseases in 'Valencia Pride' mango and 'Tower 2' avocado under south Florida grove conditions

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The efficacy of organically certified Thyme Guard®, Timorex ACT®, and Kocide®-2000-O for controlling of fruit diseases in organic 'Valencia Pride' mango and 'Tower 2' avocado groves in Homestead, Florida was investigated. During the 2022 production season treatments compared were: Thyme Guard® (TG) and Timorex ACT® (TI) each at low and high rates, a water-treated control, and a non-treated control. In 2023, the treatments were: TG and TI only at the highest labelled rate (based on the 2022 results), Kocide®-2000-O (Cu-O) at the highest labelled rate, Cu-O+TG at the highest labelled rate, and a non-treated control (NTC). In 2022, treatments were applied to mango trees every seven days (20 applications) and in 2023 every seven to 14 days (17 applications) from panicle emergence to harvest. Avocado trees were treated six times from fruit set to harvest at 20- to 22-day intervals during both years. Phytotoxicity of leaves and fruit, and postharvest efficacy data were collected during both seasons. Avocado and mango yield were recorded in 2023. No significant phytotoxicity in leaves, panicles, or fruit was observed for any treatment in either year. There was no significant difference in disease suppression and incidence among TG and TI treated avocado fruit in both years. In contrast, application of Cu-O better controlled pre- and postharvest disease of mango fruit than treatment with TG or TI. For avocado, there was no significant difference in disease suppression and incidence or fruit production among treatments. In contrast, for mango, treatment with Cu-O or Cu-O+TG significantly increased fruit set. Also, mango trees treated with Cu-O and Cu-O+TG produced significantly more fruit than NTC and TG treated trees but Cu-O+TG and TI yields were similar and Cu-O+TG, TI and NTC were lower but not significantly different.

[M-2] Use of Microtensiometers for Mango Irrigation Management: A Farmer's Perspective

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The introduction and improvements in soil moisture monitoring probes have been a significant advancement in irrigation technology. These devices provide data that agriculture producers use to improve crop production, increase water use efficiency, reduce operational costs, and limit growing risks. One difficulty with soil moisture sensing is extrapolating the soil/water availability information to the actual stress level imparted to the plants. Recent developments of probes devices that provide direct, real-time readings of water stress in woody plants has improved the ability of producers to make better irrigation decisions by providing direct tree water status conditions. This presentation is a brief discussion of the experiences of using microtensiometers for precision irrigation control on a Mango farm in the extreme heat environment of the Southern California Desert.

[M-3] Optimization of fresh cut mango packaging

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In order to optimize the quality of fresh cut mango, even before we get to the mechanical processing operations, equipment, and packaging,. there are a number of postharvest steps and treatments required to ensure that the whole fruit is in an optimal state. If the whole mango is not in its optimal state, then even with the best fresh cut equipment and packaging, quality will not be optimized. The most important steps of the process include proper application of

pretreatments including 1-MCP, firming, and anti-browning, washing in sanitized water, peeling and slicing, then modified atmosphere packaging. Sustainable packaging should also be a part of the design process. Proper peeling and subdermal removal are VITAL to the shelf-life extension of fresh cut mango. There is a wide selection of existing processing, packaging equipment available, and packaging to choose from. Modified atmosphere packaging improves shelf-life outcomes but is not a complete solve for fresh cut mango. Moderate atmospheres (<10% CO2 is most important) to improve texture, flavor and aroma. Low residual O2 (<5%) had mixed results in our testing. Fresh cut mango does not seem to have a high tolerance to low O2 and can develop ethanol off flavors and aromas. It is critical to understand your process, distribution channel and retail outlet in order to choose the optimal equipment and packaging.

[M-4] Perspectives and Challenges of Mexican Mango

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Mango (Mangifera indica L.) holds a significant position in global horticultural trade, with Mexico emerging as a leading producer and the main exporter. This paper explores the multifaceted perspectives and challenges inherent in the Mexican mango industry, highlighting its socio-economic, environmental, and technological dimensions. From a socio-economic standpoint, Mexican mango cultivation is a vital source of income for numerous smallholder farmers, contributing to rural livelihoods and national economic growth. However, challenges such as limited access to market information, uneven distribution of profits along the value chain, and labor rights issues persist, necessitating attention for sustainable development. Environmental considerations are critical in the discourse on Mexican mango production. The expansion of orchards often encroaches upon ecologically sensitive areas, threatening biodiversity, and water resources. Additionally, the intensive use of agrochemicals raises concerns about soil health, water contamination, and the long-term sustainability of farming practices. Technological advancements offer promising solutions to these challenges. Innovations in irrigation techniques, pest management, and post-harvest handling have the potential to enhance productivity while minimizing environmental impacts. Furthermore, the adoption of digital platforms for market access and traceability can empower farmers and improve supply chain efficiency. However, the realization of these opportunities faces several obstacles. Limited financial resources, inadequate infrastructure, and a lack of technical expertise impede the adoption of modern agricultural practices among small-scale mango producers. Additionally, volatile market dynamics and trade regulations create uncertainties for exporters, necessitating adaptive strategies and policy interventions.

[M-5] A guide to pruning and training young mango trees

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Commercial mango trees in Florida were traditionally planted and left to grow with abandon. There was no formal tree training of young trees to shape the tree and control its height. Letting trees grow to 35 feet or more without pruning presented a number of problems for the farmer. Trees were more susceptible to wind-storm damage, harder to spray, there were less trees per acre, picking was more difficult, branching was not complex, trees were less open to air and light, and trees would often shade each other out resulting in a decline in fruit production as the fruit would only be present on the tops of the trees. This publication will explain how to prune and train young mango trees. Training young mango trees through pruning is essential to creating a mature tree that has complex branching, is

potentially more productive, and is small enough to make the farmer's job easier.

[M-6] The Mango Loa Project: A Comparison of Two High Density Orchard Management Systems for Mango Production.

Umi Martin

Umi's Farm Kauai, Hawaii

The agricultural sector constantly seeks innovative practices to increase productivity, sustainability, and resilience against environmental challenges. This paper examines two distinct yet transformative methods in the realm of tropical fruit orchard management: The Ultra High Density Plantation (UHDP) technique and the open Tatura trellis system for mango production. The Mango Loa Project, launched in 2017, aimed to improve Hawaii's mango industry by implementing and assessing two high-density orchard management systems designed to increase production while reducing the demand on labor. The UHDP and trellis systems have demonstrated success in other regions, offering innovative agricultural practices that are reshaping tropical fruit production by enhancing yield, labor efficiency, sustainability, and climate resiliency.

[M-7] Twenty Years of Field Experience: A Review of Specialty Mango Cultivars for Florida

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Over the past couple of decades, Florida has developed a local mango industry based on new cultivars with superior, unique flavors; novel genetics; and modern horticultural traits. This industry offers considerable economic potential for growth throughout the state based on its adaptability to novel and efficient horticulture, production, and sales strategies, such as on-farm sales and direct consumer marketing. Florida has selected hundreds of mango cultivars – many of which have gone on to have widespread commercial success in the world export market, but the current and continued success of this local industry is based on new cultivars that are adapted to innovative horticultural practices and local environmental conditions, while offering diverse, exceptional flavor profiles. 'Angie', 'Bolt', 'Carioca', 'CeciLove', 'Diamond', 'Equinox', 'King Lion', 'Lil Gem', 'Mallika', 'Nam Doc Mai', 'Ruby', 'Sunny', 'Sweet Tart' and 'Venus' are cultivars that have proven themselves successful for this new Florida mango industry based on their production, horticulturally effective tree size, disease tolerance, flavor, and marketability. These cultivars have consistently produced commercially viable harvests over 20 years of management and evaluation at MangoMenHomestead, LLC orchard in Homestead, FL. There are in addition to these cultivars, many newer selections, both mangos (*Mangifera indica* L.) and interspecific hybrids between *M. indica* and other *Mangifera* species that have shown considerable potential for Florida, but need more evaluation.