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J.B. Edmund Undergraduate Student Paper Competition

Drying Danger: Evaluating Microbial Safety of Freeze-Dried vs. Conventionally Dried Strawberries (Fragaria ananassa).

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The global dried fruit market is projected to reach $15.6 billion by 2031, driven by consumer demand for shelf-stable and nutritious snacks. However, limited data exist on the safety of dried strawberries, particularly regarding the survival of *Salmonella Typhimurium*, a pathogen commonly associated with low-moisture foods. This study evaluates the impact of conventional and freeze-drying methods on the microbial safety and physicochemical properties of strawberries. Fresh strawberries inoculated with *S. Typhimurium* were subjected to freeze-drying or conventional drying at 130°F, 140°F, 150°F, and 160°F. Moisture loss, water activity (aw, ww), color parameters (L*, a*, b*), and pathogen reduction were assessed. Results showed that while both drying methods achieved sufficient moisture loss and shelf-stable aw_ww values, freeze-drying did not meet the regulatory requirement for a 5-log reduction in *S. Typhimurium*. Only conventional drying at 160°F achieved this benchmark. Furthermore, freeze-dried strawberries demonstrated rapid humidity absorption during storage, potentially compromising safety and quality. These findings underscore the need for rigorous food safety practices, including Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP), from farm to processing. The study highlights the limitations of freeze-drying as a standalone microbial inactivation strategy for strawberries, emphasizing the importance of integrating safety protocols to protect public health.

Effects of Different Stem Colors on the Plant Growth, Nutrient Uptake, and Vitamin A Content of Hydroponically Grown Swiss Chard

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Swiss chard is a nutritious leafy vegetable eaten raw or cooked and is grown year-round in greenhouses using hydroponics, but little is known growth and vitamin A differences among cultivars. Swiss chard ‘Fordhook Giant’, ‘Oriole’, ‘Peppermint’, ‘Rhubarb’, ‘Heart of Gold’, ‘Cardinal’, ‘Sea Foam’, ‘Bright Yellow’, ‘Silverbeet’, and ‘Bright Lights’ were grown using the nutrient film technique. Data was collected on plant growth and vitamin A content. ‘Heart of Gold’ had the greatest SPAD content. ‘Peppermint’ had the greatest root dry weight. ‘Peppermint’, ‘Sea Foam’, and ‘Bright Yellow’ had the greatest shoot dry weight, but were not significantly different from ‘Bright Lights’. ‘Peppermint’ had the greatest number of leaves, but was not significantly different from ‘Fordhook Giant’, ‘Cardinal’, and ‘Silverbeet’. The leaves of ‘Oriole’, ‘Cardinal’, and ‘Sea Foam’ had the lowest vitamin A content, but were not significantly different from ‘Peppermint’ and ‘Rhubarb’. In general, vitamin A content was greater in stems than leaves.

Effects of Fungicide on Mycorrhizal Root Colonization and Soil Health

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Grasslands provide numerous ecological services acting as carbon sink hotspots, supporting fertile soils, and hosting a rich diversity of plants and animals. Grassland plant communities are in part regulated by fungal pathogens but most plant species are also involved in mutualistic relationships with arbuscular mycorrhizal fungi. These symbionts help form soil structure by producing glomalin which can glue soil particles together forming water stable aggregates. Soil structure is very important for agriculture which stores more carbon as it is locked away in the aggregates and it allows water to infiltrate the soil and increase water holding capacity building drought

resilience. To protect our crops from fungal pathogens such the *Puccinia* genus over a million tons of fungicide are applied to agricultural fields every year. While the aim of these fungicides is to kill the pathogens, the next question is, do these fungicides hurt the beneficial mycorrhizae fungi and does this have a negative effect on the soil structure and soil infiltration? To test these hypotheses root samples were taken from the Mcpherson preserve (Stillwater, Oklahoma) where thiophanate methyl was applied four time over the growing season and control areas received water for two years. With the root samples collected we estimated percent fungal root colonization to determine if the fungicide did have an effect on the mycorrhizal fungi. We found that the thiophanate significantly decreased root colonization but did not impact soil aggregate stability. However, soil infiltration was significantly decreased by root colonization and more so in the treatment plots. Similarly, soil infiltration was significantly decreased by soil aggregate stability. In conclusion thiophanate reduces mycorrhizal root colonization, but its impact on soil aggregate stability is negligible. Soil infiltration decreases with increased root colonization and Percent Aggregate Destruction (PDA). Enhancing soil aggregate stability emerges as a key strategy for improving soil infiltration and building disturbance resilience.

Evaluating Efficiency and Accuracy of Three Texture Analysis Methods for Blackberry Fruit

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A major objective of the University of Arkansas System Division of Agriculture (UADA) Fruit Breeding program is to improve blackberry (Rubus subgenus Rubus Watson) texture. Blackberry varieties with improved fruit firmness transport and store well and may maintain superior quality under challenging postharvest conditions than softer varieties. Increased firmness may also make cultivars less susceptible to red drupelet reversion (RDR); a postharvest disorder of blackberries in which fully black drupelets revert to red after harvest. This research project aims to assess the efficiency and accuracy of three methods applied in evaluating blackberry firmness. The study compares instrumental analysis using the TA.XT Plus Texture Analyzer and the newly introduced FruitFirm® 1000 and subjective firmness ratings that have been used in the program for over a decade. Significant differences in firmness were found among the 10 UADA blackberry breeding selections included in the study using all three texture analysis methods across two years. The results of the FruitFirm® 1000 were strongly correlated in year one ($r = 0.72$) and year two ($r = 0.94$) with the TA.XT Plus results, and the FruitFirm® 1000 was able to process fruit ten times faster in year one, and twenty times faster in year two, than the TA.XT Plus. These results suggest that the FruitFirm® 1000 has strong potential for use in large-scale analysis of blackberry texture. The findings aim to accelerate high-quality, commercially competitive public releases from the UADA Fruit Breeding Program by optimizing selection for improved commercial shipping blackberry cultivars.

Evaluating Nursery Production of Coastal Grass Propagated in Recycled Glass Medium

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Louisiana has made significant investments in coastal protection and restoration projects, including propagating and planting native vegetation and adding sediment. The volume of sediment needed to maintain the existing coastline exceeds the available amount that could be locally extracted, and state officials have since identified this lack of sustainable sediment resources as a limitation for future restoration projects. One proposed solution is using recycled crushed glass cullet (RCGC), a sand-like material that is made by grinding recycled glass into particle sizes comparable to native sands. However, additional research is necessary to evaluate the suitability of RCGC for use in coastal restoration. The aim of this study is to assess the growth of the native dune grass called bitter panicum (*Panicum amarum*) when it is propagated in mixtures of RCGC. We created five soil mixtures using varying amounts of RCGC to mason sand as the control (0%, 25%, 40%, 65%, and 80%) and added 20% peat moss by volume in all treatments. In March 2024, we planted bitter panicum cuttings in containers with these mixtures (45 plants per treatment) and arranged into a complete randomized block design in an outdoor irrigated plant

nursery. From late March to early August, we measured plant height weekly, then assessed dry biomass for a subset of plants in August. The results indicate that bitter panicum can be successfully propagated directly into mixtures containing RCGC. In treatments containing up to 80% RCGC, there were no negative effects on height (cm) or biomass (g). Additionally, there was evidence suggesting a positive effect on growth parameters with higher amounts of RCGC. These findings support the viability of using RCGC as an alternative material for plant propagation or coastal restoration. By leveraging post-consumer recycled materials, this work addresses multiple sustainability goals: reducing dependence on finite sources of natural sediment, diverting glass waste from landfills through local recycling, and producing restoration plants.

Examining Various Eastern Red Cedar Biochar Particle Sizes and Incorporation Rates to Produce Potted Begonias

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The use of biochar in soilless media mixes is becoming increasingly popular due to environmental concerns with peatmoss extraction such as the ecosystem destruction and carbon emissions. Alternatively, Eastern Red Cedar is causing a decrease in the growth of native prairie grasses due to nitrogen immobilization and lower light penetration. A greenhouse experiment was conducted in Stillwater, Oklahoma from May to July 2024 to evaluate the effect of various particle sizes and incorporation rates of Eastern Red Cedar biochar on container grown begonias. Treatments included four particle sizes- 2mm, 4mm, 8mm and >8mm of Eastern Red Cedar biochar at four incorporation rates- 15%, 30%, 45%, and 60% and 100% soilless media control. Results showed that smaller the particle size and supplementation rate increased plant growth and flower development. Additionally, the use of 15% supplementation rate with any particle size resulted in increased plant growth and flower development. The use of 30% supplementation rate with the 2mm particle size also resulted in increased plant growth, flower development, and ability to hold soil moisture compared to the control. In contrast, Particle sizes greater than 2mm reduced the water holding capacity. Finally, biochar has the potential to become a substitute for peat moss in soilless media mixes, however the feedstock used to produce biochar, particle sizes, and supplementation rates need to be further examined.

Impact of Different Soilless Media on Kale Microgreens Growth and Quality

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Microgreens are increasingly recognized for their high nutrient concentration and potential health benefits. Traditionally, peat-based media have been widely used for microgreens production; however, due to environmental concerns, there is a growing interest in sustainable and alternative substrates. This study evaluates the effects of four different growing media—coconut coir, hemp fiber, biochar mixed with soilless media, and a soilless media (control) on the yield and nutritional quality of kale microgreens. Results showed that there were significant differences among trials for fresh weight ($p<0.0001$) with greater average fresh weight in trial 1 than trial 2. In trial 1, fresh weight varied between treatments (0.0017) and greatest fresh weight was seen in control and biochar treatments followed by hemp fiber and coconut coir. In trial 2, coconut coir and hemp fiber had the greatest fresh weight than biochar and control treatments ($p<0.0001$). However, trial 1 and 2 did not different significantly in terms of % dry matter ($p=0.99$) and % Moisture content ($p=0.99$). Additionally, there were significant differences in microgreen quality in terms of chlorophyll a and b content. Chlorophyll a was greater in soilless media only and coconut coir grown microgreens and chlorophyll b was greater in biochar grown microgreens. These findings suggest substrates determine the yield and nutritional quality of microgreens. In conclusion, evaluating alternative substrates for microgreens production can improve microgreen cultivation practices, promoting sustainability without compromising yield or quality.

The Influence of Commercial Mycorrhizae Products on Basil Growth in Controlled Environments

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Arbuscular Mycorrhizal Fungi (AMF) products are increasingly marketed for their potential to enhance plant growth, particularly in container systems where naturally occurring mycorrhizal associations are absent. This study aimed to evaluate the effects of three commercially available AMF products on the growth performance of container grown basil (Ocimum basilicum) using soilless medium. Treatments included three commercially available mycorrhizae added at the transplant stage and a soilless media control with no mycorrhizae. Data on yield parameters including fresh and dry biomass and quality parameters like chlorophylls, carotenoids and mineral content was collected to assess impact of mycorrhizae on yield and physiological quality. Results indicated no statistically significant differences in yield or pigment concentration between the mycorrhizae-treated plants and the control (P>0.05). These findings suggest that the use of commercial mycorrhizae products may not provide any benefits for short-term crops like basil under soilless conditions. Further research needs to conducted to assess the viability of mycorrhizae products in long-term crops to understand their role on crop production.

Norman F Childers MS Graduate Student Paper Competition

Assessing the Impact of Plant Hormone on *Osmanthus fragrans* Cuttings Propagation

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Osmanthus fragrans is an evergreen shrub or small tree in the *Oleaceae* family with small but fragrant flowers. Stem cutting is the most commonly used asexual method for *O. fragrans* propagation. However, *O. fragrans* hardwood cuttings respond differently to different types and rates of plant growth hormones in regard to propagation success. This study evaluated 1,000 mg/L, 3,000 mg/L, and 8,000 mg/L of Potassium Indole-3-butyric acid (K-IBA) solution, 1,000 mg/L, 3,000 mg/L, and 8,000 mg/L of Indole-3-butyric acid (IBA) powder, 3,100 mg/L IBA rooting gel, and water effects on *Osmanthus fragrans* 'Beni Kin Mokusei' hardwood cuttings. The study measured survival rate (%), callus rate (%), rooting rate (%), number of roots per cutting, total root length (cm), longest root length (cm), average root length (cm), root index, and cutting biomass (g). The results showed that the cuttings treated with 3,100 mg/L IBA rooting gel had the highest survival rate and rooting rate, the most roots per cutting, the longest total root length and single root length, as well as the highest root index and biomass value. The treatment significantly affected survival rate, callus rate, rooting rate, number of roots per cutting, total root length, longest root length, average root length, root index, and cutting biomass, while the block did not significantly affect any parameter. The interaction between treatment and block only significantly affected the callus rate. In conclusion, 3,100 mg/L IBA rooting gel is the best hormone for promoting *O. fragrans* hardwood stem cutting propagation success from August in the nursery industry.

Assessment of New Perfect-flowered Muscadine Grape (*Vitis rotundifolia* Michx.) Cultivars Under Alabama Conditions

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The muscadine grape is a native fruit crop of the Southeastern U.S., known for its resiliency, high nutritional value, and relatively low input cost in comparison to bunch grapes. Within the last fifteen years period (2007 to 2022), there has been a 38% increase in the total area under grape production in Alabama, evidencing the expanded industry interest in grape cultivation. The recent release of newly developed perfect-flowered muscadine grape cultivars can considerably sustain the growth of the industry, but information is lacking on cultivar performance in Alabama environment. An experimental plot was established at the Chilton Research and Extension Center, Clanton, AL, in 2019, to evaluate the overall performance of newly released perfect-flowered muscadine grape cultivars 'Hall', 'Lane', 'Paulk', 'RazzMatazz', and 'Southern Home'; pistillate cultivar 'Eudora' and compare to the standard pistillate cultivar 'Supreme'. The experiment was designed as a RCB with four single vine replications as experimental units. The 2024 results suggest 'Hall', 'Lane' and

'RazzMatazz' ripened early in the season, whereas 'Paulk' and 'Supreme' had mid-season ripening. 'Eudora' and 'Southern Home' were late season cultivars. Pistillate cultivars 'Supreme' and 'Eudora' produced the highest yield of 49.6 kg/vine and 38.6 kg/vine respectively with 'Hall' and 'Paulk' producing a yield of 38.0 kg/vine and 30.8 kg/vine in 2024. 'Paulk' had the largest berry size of 12.3 g and was similar to 'Supreme' (11.8 g). 'Eudora' produced the softest berries with the highest percent berries with wet stem scar. 'Paulk' had the highest TSS:TA ratio of 32.3 whereas the TSS measured 13.5^0 Brix. Study findings can provide valuable insights for cultivar selection to support sustainable muscadine grape production in Alabama and the Southeast.

Bed Architecture and Fumigation Strategies for Tomatoes in Eastern NC

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Tomato and strawberry growers have faced significant challenges in managing nematodes, diseases, and weeds since the prohibition of methyl bromide (MBr) in 2005. This project evaluates alternative fumigation strategies and bed architectures for tomatoes and strawberries. For tomatoes, compact beds (16 inches wide by 12 inches tall) were compared to traditional beds (24 inches wide by 12 inches tall). For strawberries, compact beds (24 inches wide by 12 inches tall) were compared to traditional beds (30 inches wide by 6 inches tall). Both bed designs were tested with shank and drip-applied fumigants (Pic-Clor 60 and Pic-Clor 60 EC, respectively), with and without the inclusion of a soil surfactant (Escort) for the drip fumigation treatments. Field trials for tomatoes were conducted at the Horticultural Research Station in Clinton, NC, while strawberry trials are currently being conducted at the Clinton and Castle Hayne Research Stations. Variables measured include plant performance, volumetric water content, plant-parasitic nematodes (PPNs), weed pressure, and yield. For tomatoes, results demonstrated that compact beds with drip-applied fumigants achieved comparable control of PPNs and weed pressure to traditional beds with shank fumigation. Post-treatment PPN counts and yield suggest that compact bed architectures are a sustainable alternative to conventional production methods. For strawberries, as the study is ongoing, preliminary results have shown similar reductions in PPN counts two weeks after transplant.

Canary Melon Yield and Exterior and Internal Quality Results, 2024

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Canary melon (*Cucumis melo* (*Inodorus group*)) is an oblong, yellow-rind melon with an ivory-green flesh and distinct sweet taste. Canary melon is mostly grown in Brazil, Algeria, Spain, and Morocco with some acreage in the U.S.; predominantly in California and Arizona. In 2024, yield, quality, and sensory evaluations were taken on 20 canary melons cultivars from 10 participating seed companies to assess their adaptability to North Carolina growing conditions. The entries were grown on black plastic mulch with drip irrigation in 20 ft long plots with 10 plants in a randomized complete block design with 4 replications. Yield data were collected over 14 harvests and quality measurements (flesh firmness, soluble solids) were taken on 3 fruit per plot. Core samples were also taken from the 3 fruits for analysis using high-performance liquid chromatography (HPLC). Additional fruit were saved from each plot to develop a sensory lexicon. The highest yielding cultivars in pounds per acre (lb/ac) were UASM 16160 at 48,686 lb/ac, Halo at 47,780 lb/ac, and Rugoso di Cosenza at 45,052 lb/ac. A difference in yield was observed between the highest yielding cultivar, USAM 16160, and the lowest yielding cultivar, 91164. The average yield was 38,061 lb/ac. Cultivars 91121, Crispy Pear, and Y636 had the firmest flesh at 1.68, 1.65, and 1.65 pounds of pressure, respectively. The average flesh firmness was 1.55 pounds. The cultivars with highest Brix (% soluble solids) ratings from the HPLC analysis were Brilliant at 13.40, 91164 at 13.14, and 20MWY5069 at 13.08. The average Brix rating was 11.78. From the sensory lexicon development panel, 797 unique descriptors were generated for the sensory categories aroma, flavor, and texture. From those unique descriptors, 189 common terms were curated to develop the lexicon. The prior results and additional quality measurements are being analyzed to select the 6 most adapted cultivars for further study in 2025.

Comparison of Rabbiteye to Southern Highbush Blueberry Quality, Flavor, and Sensory Analysis

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Blueberries (*Vaccinium spp.*) are valued for their flavor and phytonutrient content. Common species grown include rabbiteye (*V. virgatum A.*) (RE) and southern highbush (*V. corymbosum L.*) (SHB), with. minimal postharvest data reported on RE genotypes. The objective of this study was to assess the postharvest quality and visual indices of 16 RE and 3 SHB genotypes. Blueberries were harvested in 2024 from the EV Smith Research Center (Tallassee, AL) and stored at 4°C and 85% relative humidity for 42 days, with sampling at day 0, 14, 28, and 42. Colorimeter data (L*, a*, b*, c*, hue angle), soluble solids content (SSC, °Brix), titratable acidity (TA), and pH was measured. Total anthocyanins (mg/g), phenolics (mg/100 g), and antioxidant activity (mM/100 g) were quantified using UV-VIS spectrophotometry. Cultivar differences were found in L*, a*, and b* CIELAB units. 'Legacy' and 'Alapaha' had the lowest L* (27.9 and 28.0), while 'New Hanover' and 'NC5303' had the highest a* (1.3 and 1.2). 'Overtime' and 'Vernon' had the lowest b* (-4.0 and -3.9). SSC did not vary with storage, but TA increased from day 0 (0.41) to day 42 (0.51). 'Brightwell' (16.5 °Brix) and 'Ochlocknee' (16.0 °Brix) had the highest SSC, while 'New Hanover' (12.1 °Brix) and 'T-3075' (12.2 °Brix) were the lowest. 'Vernon' (0.60) and 'Climax' (0.61) had the highest TA, compared to 'Alapaha' (0.36). Phytonutrient analysis showed interaction effects of cultivar*timepoint for phenolics and antioxidants, with little change in anthocyanins. 'Alapaha' (309.8 mg/g and 22.7 mg/100 g) and 'Brightwell' (326.7 mg/g and 23.3 mg/100 g) had high phenolics and antioxidants. Principal component analysis (PCA) and hierarchical cluster (HCA) analysis were run to identify genotypes with enhanced characteristics. PCA showed SHB correlated positively with b*, a*, and pH. HCA indicated MS selections had enhanced phytonutrients but suppressed SSC and TA; 'Brightwell', and 'Ochlocknee' had enhanced SSC, TA, anthocyanins, phenolics, and antioxidants and 'New Hanover' and 'Legacy' had enhanced general composition but suppressed phytonutrients. Six genotypes 'Titan', 'Brightwell', 'T-3072', 'T-3075' (RE), 'Legacy', and 'New Hanover' (SHB) were selected for sensory and electronic sensing analysis. Identifying fruit quality and flavor differences will help improve RE germplasm, selecting high-quality genotypes for consumer acceptance and marketability.

Cultivating Sustainability: Plasticulture Mulch Management for Increased Profitability in Vegetable Production.

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Plasticulture is a widely implemented system for vegetable producers due to the benefits this system provides such as weed control and the ability to extend growing seasons due to altering soil temperature. In an effort to minimize the negative impacts from plasticulture systems, two plastic and two biodegradable plastic films were used for multiple consecutive growing seasons. Mulch durability, plant yield, and surface-level economics were used to evaluate the soundness of reusing mulch films for multiple growing seasons. Conventional polyethylene mulch had an average tensile strength of 4.56 N at the end of the first growing season, whereas Film Organic biodegradable mulch had an average tensile strength of 2.91 N and Bio360 biodegradable mulch had an average tensile strength of 2.02 N. Both biodegradable plastics exhibited more than 50% bare ground at the end of the first growing season while the Solar Shrink and conventional plastics both exhibited less than 10% bare ground. Despite the drastic difference in durability, there were not significant differences between mulch types for total yield. At the time of purchasing, conventional plastic was the least expensive at $55/1,000 ft and Solar Shrink plastic was the most expensive at $105/1,000 ft. The Bio360 biodegradable plastic and Film Organic biodegradable plastic were the same price at $90/1,000ft. Subsequent growing seasons have yet to be completed and analyzed, but preliminary results from season one suggest that biodegradable plastic films may not be a sound option for use over multiple seasons due to their low tensile strength and percentage of bare ground on the beds. Further research is needed to determine the best management practices for increased profitability and sustainability in plastic mulched vegetable systems.

Cutting Edge Technologies: Assessing ROI and Safety of Autonomous Mowers

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The landscape industry is facing increasing labor shortages and rising operational costs, leading to a growing interest in automation. Autonomous mowing technology has the potential to address these challenges by reducing labor dependency and increasing efficiency. However, there is limited research evaluating the return on investment (ROI) and performance of these mowers in real-world conditions. One of the primary concerns for landscape professionals is whether autonomous mowers can operate effectively across various terrains and obstacle-heavy environments while maintaining efficiency and safety standards. This study assessed the performance of autonomous and manual mowers by measuring mowing time, energy consumption, and adaptability across different landscapes. Two mower types were tested: a manual battery-powered mower and an autonomous gas-powered mower. Testing was conducted on two landscape designs—a simple square plot and a complex plot with obstacles—to analyze variations in efficiency, along with two turf types. There was no significant difference in either mower's performance on bermuda or ryegrass. Preliminary results indicate that manual mowers perform significantly faster than autonomous mowers, and the autonomous mowing time increases significantly in complex landscapes. The energy consumption of the gas autonomous mower is higher than that of manual battery-powered mowers. Factors such as sensor reliability and obstacle detection remain areas of concern. The collected data provides insight into the operational efficiency of autonomous mowers and their potential impact on the landscape industry. Future research will focus on calculating ROI values by incorporating cost analysis and industry data, as well as investigating safety protocols related to obstacle detection and avoidance to enhance autonomous mowing technology for commercial use.

Effect of biochar on the growth and development of Basil (*Ocimum basilicum)* under saline conditions.

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Increasing salt stress and scarcity in water usage has necessitates researches on salinity tolerance on plants. This study aimed to investigate the effect of biochar on growth and development of basil (*Ocimum basilicum)* amended in comercial substrate mixes treated with three rates of biochar (0%, 15% and 25% v/v), and levels of salinity (control, medium at 3 $dS \cdot m^{-1}$, high at 8 $dS \cdot m^{-1}$). The study measured physical properties including particle sizes, container capacity, total porosity, bulk density, air spaces, and chemical properties including pH and electric conductivity (EC). Plant growth parameters including growth index (GI) and leave greenness (indicated with SPAD), biomass, and number of flowers were measured biweekly. Plants physiological responses including net photosynthesis rate, transpiration rate and stomatal conductance rate were measured at 3, 5, and 7 WAT. No significant differences in physical properties were observed. Electric conductivity was bulit up overall time across all treatments, and pH was within recommended range. Both 15% and 25% biochar were effective at medium (3 $dS \cdot m^{-1}$) and high (8 $dS \cdot m^{-1}$) salinity levels in improving GI and maintaining similar SPAD, biomass, flower production, and physiological rates as the control. These findings suggest that 15% and 25% biochar can help mitigate some salinity damages on plants growth and development of basil plants.

Enhancing Bell Pepper Production: Exploring the Effects of AMF Application Methods on Bell Pepper Performance

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Arbuscular mycorrhizal fungi (AMF) are a widespread and naturally-occurring soil microorganism that form symbiotic relationships with the roots of terrestrial plants. However, their soil populations are greatly affected by disruptive agricultural practices. These fungi have been credited with numerous host plant benefits such as increased nutrient and water acquisition. Bell peppers are heavy nutrient feeders and extremely vulnerable to water stress, so the integration of AMF could potentially help fortify this crop against its common stressors. Nevertheless, research around AMF integration into vegetable systems is inconclusive and often inconsistent when compared across locations and production methods. One of the most important aspects to consider during the integration of AMF into a system is the application method, as it will dictate the effectiveness of colonization. Hence, the goal of this study was to identify the most adequate method to integrate AMF into a bell pepper cropping system. A greenhouse trial was established in 2024 at Raleigh, North Carolina. 'Red Knight' F1 hybrid bell pepper plants were inoculated with a commercially available AMF spore product, *Mycoapply Ultrafine Endomycorrhizae formulation by Valent Biosciences*, using three application methods. The AMF product was

integrated either at the seedling or transplant stage via the following methods: seed coat or planting hole treatment, mixed into the planting media, mixed with the irrigation water and applied once post seeding/transplant. We also had a sub-treatment of two different nitrogen fertilizer rates: 120 lbs/ac and 180 lbs/ac. We assessed root colonization rates, above- and below-ground biomass, plant height, and fruit yield as key performance indicators. The results showed no significant differences between the AMF application method or the timing of application (seeding/transplant) on the measured performance indicators. Longer and repeated studies are needed to establish a recommendation on AMF for both greenhouse and open field settings.

Evaluating Blended Bioreactor Media for Nutrient Remediation and Seedling Establishment

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Bioreactors are a promising water treatment technology to address the problems posed by nitrogen (N) and phosphorus (P) in runoff water. Bioreactors are reservoirs or trenches filled with a carbon source (typically woodchips (WC)) that retain runoff water for a period of time (hydraulic retention time; HRT) sufficient to support desired biologically mediated reactions. Bioreactors can remove nitrates through denitrification, whereas phosphate removal may be supported through adsorptive and biological processes. Bioreactor medias comprised of combinations of WC and sugarcane bagasse (SB, an abundant byproduct of sugarcane production in Louisiana) were evaluated, investigating the potential of SB as a carbon source in bioreactor applications. The WC/SB carbon blends were also evaluated with or without incorporation of expanded shale (ES) serving as a P-sorbing amendment. Six unique blends were assessed for N and P remediation, with subsequent evaluation of used bioreactor media as a seedling establishment substrate for potential use in raingarden applications. Bioreactor units were comprised of a two-container system in which the substrates were saturated with simulated runoff (containing N and P) for a HRT of 48 h before being drained, sampled, and analyzed to assess residual N and P content. Following the nutrient remediation study, medias were homogenized by treatment and moved to seedling trays for the seedling study. The bioreactor medias were investigated with and without stratification methods (pine bark/peatmoss/perlite potting soil for the surface 2.54 cm), with a hypothesis of stratification enhancing plant germination. All bioreactor medias were effective at removing N (>98% removal), while ES medias were more successful in P removal. Wildflowers seeded within expanded shale medias experienced noticeably lusher growth, and *Hibiscus moscheutos* 'Luna' achieved significantly (1.5 to 6 times) greater growth in stratified bioreactor medias.

Evaluating Spray Efficiency and Quality of Agricultural Sprayer Drones on Tomato Crop

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Effective pest management in dense-canopy crops like tomatoes requires precision in pesticide application, where conventional methods often fall short. Unmanned aerial application systems (UAAS) offer a potential solution, enhancing spray coverage and reducing drift. This study aims to assess the efficacy of UAAS in tomato cultivation by evaluating spray coverage, droplet density, and dye deposition across canopy layers using three distinct treatments: high-quality fine (HQF), high-quality medium (HQM), and high efficiency coarse (HEC). Experimental trials were conducted in Alabama using a DJI Agras T40 drone. Results indicate that HQF and HQM treatments achieved higher spray coverage and droplet density, particularly in the upper canopy, compared to HEC. Canopy position and application timing significantly affected spray metrics, with higher values recorded in the upper canopy and early growth stages. HQF exhibited optimal depositions in lower canopy regions, while HQM showed consistent deposition across swath positions. The findings underscore the importance of adjusting UAAS parameters – flight speed, droplet size, and application timing – to maximize spray precision and penetration in dense canopy crops, presenting valuable insights for sustainable pesticide management in agriculture.

Evaluating the Weeding Performance of an Unmanned Ground Vehicle on Direct Seeded Sweetcorn (*Zea mays* L.)

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Precision agriculture and robotics have the potential to reduce inputs like labor, fertilizers, and pesticides while maintaining yields. Novel technologies have been developed for large-scale crop systems, where extensive acreage offers greater market incentives for industry. This research investigated the utility of an unmanned ground vehicle (UGV) with real-time kinematic global positioning systems (RTK-GPS) technology for direct seeding and weeding using mechanical cultivation tools in small-scale vegetable production. Sweetcorn (*Zea mays* L.) was chosen as a model crop due to its upright growth habit. Field trials were conducted in 2024 in three locations: Fayetteville, AR, Kibler, AR, and Bridgeton, NJ, to determine optimum weeding strategies of the UGV. Weed management strategies included UGV operation at 1 wk and 2 wk intervals, a preemergence herbicide (*S*-metolachlor), *S*-metolachlor followed by UGV operation 30 days after application (DAA) at 1 wk intervals, *S*-metolachlor followed by a postemergence herbicide (atrazine + tembotrione) 30 DAA, and weedy all-season and weed-free treatments (hand-weeded) were included as controls. There were no significant differences in weed management strategies with between-row green cover image analysis ratings three weeks after planting (WAP) in Fayetteville, AR and Bridgeton, NJ locations. At the Kibler, AR site, green cover image analysis represented 21% in UGV-only plots while herbicide-treated plots were <3%. At 10 WAP, both Arkansas locations weedy plots had the highest weed biomass (6,200 to 13,200 kg ha^{-1}), followed by UGV-only treatments (1,900 to 3,300 kg ha^{-1}), and the herbicide-treated plots (4 to 800 kg ha^{-1}; $p<0.0001$). At the Bridgeton, NJ site, weed biomass did not differ between treatments. In all locations, weed-free plots produced the highest sweetcorn yields, and weedy plots had the lowest. Herbicide-treated plots produced higher yields than the UGV treatments in all locations. Therefore, UGV treatments reduce weed biomass, but conventional herbicide treatments were more effective at controlling weeds and consistently resulted in higher sweetcorn yield.

Evaluation of Narrowband Supplemental Lighting and Nitrogen Concentrations on Physiology, Growth, and Yield of Hydroponic Lettuce

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Supplemental lighting can be used to maintain an optimal daily light integral (DLI) in greenhouse production of leafy greens such as lettuce (*Lactuca sativa* L.) during cooler seasons when the solar radiation transmitted through the glazing material is low. Maintaining optimal nutrient solution concentrations, especially nitrogen is also essential for enhancing lettuce growth traits. Research is needed to better understand the extent to which optimal N concentration for hydroponic lettuce production can be reduced with supplemental lighting treatment in the greenhouse environmental conditions. The objective of this study was to determine the interaction effects of narrowband supplemental lighting treatments with nitrogen concentrations on the growth, yield, and physiological traits of lettuce cultivars in a hydroponic system. Three lettuce cultivars (cvs. Nancy, Salvius, and Thurinus) were grown in the fall of 2024 under three light treatments including supplemental 80% red and 20% blue light (80R/20B); 80R, 10B, and 10% far red light (80R/10B/10FR); non-supplemental natural light (control) and two nitrogen concentrations (100 and 200 ppm N). Both light treatments supplemented 6 $mol.m^{-2}.d^{-1}$ of DLI. Supplemental lighting treatments had limited effects on the weekly net assimilation rate ranging from 6.704 – 18.593 $\mu mol.m^{-2}.s^{-1}$ while the natural light treatment ranged from 8.261 – 17.102 $\mu mol.m^{-2}.s^{-1}$. With 200 ppm N, the 80R/20B and 80R/10B/10FR light treatments significantly increased the fresh yield by 90% and 45% respectively when compared to the natural light treatment. For the leaf area index (LAI), these increases were 19% and 35% for the 80R/10B/10FR and 80R/20B treatments respectively. In contrast in 100 ppm N, the average yield for the 80R/10B/10FR treatment was only 3% higher than that of the natural light treatment, while the average yield for the 80R/20B treatment was 15% lower than the natural light treatment. A similar decrease was also observed in the LAI in both light treatments with 100 ppm N. Overall supplemental lighting, especially the 80R/20B ratio, significantly increased growth and yield traits when combined with the higher nitrogen at 200 ppm.

Evaluation of Sweetpotato Transplant Orientation Methods and their Effects on Yield and Root Shape

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With some new innovations, plant orientation of sweetpotato transplants became a renewed interest of NC sweetpotato growers in the 2018 growing season. Growers were interested in investigating the use of longer plants with more nodes being planted in the soil to increase yields. A fabricated planter that allowed plants to be placed at a horizontal orientation within the row was one planting method evaluated. Another method was the use of a sleeve adaptor which could be easily attached to current commercial transplant equipment. The hypothesis was that the sleeve would bend some of the transplant stem to a horizontal orientation when planting them into the soil resulting in increased yields. A third method is the standard commercial planter which orients the transplants vertically. Research studies were conducted in 2020 and 2022 to help evaluate the potential benefits of these planting methods. Treatments in 2020 included plant lengths of 6, 10, 12 and 18 inches, in-row spacings of 10 and 14 inches, and orientations of vertical and sleeve. Treatments in 2022 were plant lengths of 10 and 15 inches; vertical, sleeve and use of horizontal planters; two planting timings; and two harvest timings for each planting. Results from the 2020 study showed no differences when solely comparing planting methods of sleeve vs. vertical. Differences were found among plant lengths, with 14 inch yielding more US#1 roots/acre than the 6 and 18 inch plants and higher total marketable yields than the 6 inch plants. The 18 inch plants produced canner yields greater than all other plant lengths. In the 2022 study the 15 inch plants yielded more than 10 inch plants in US#1, canner and total marketable yields. Orientation differences were not consistent in both studies but plant length did show positive yield results of US#1 and total marketable at the 14-15 inch range.

Horticulture Extension Use and Preferences of Midwestern United States Landscape Professionals

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Little research has been conducted on Cooperative Extension resource use and consideration among horticultural professionals. A multi-state survey was created in Qualtrics and shared through 12 university Extension programs, at in-person Extension events (i.e., field days, conferences, and workshops) to attain a better understanding of how horticultural industry practitioners (e.g., golf course superintendents, sports field managers, lawn and landscape contractors, nursery and greenhouse growers, tree care, and retailers) are using Cooperative Extension resources. A secondary objective was understanding their challenges with current Extension learning resources and investigating promising future learning tools. Business details and current practices were also collected to better understand the respondents. Most respondents (~74%) were aware of Cooperative Extension resources for horticultural plants and practices and indicated that it was either their primary (~23%) or secondary (~16%) source of plant health-related information. Practitioners suggested that resources being easy to find and updated in the past five years were the two most important considerations for future use. Industry professionals prefer the current style of online Extension publications and in-person events. They would also be more likely to use video resources and emailed newsletters than other educational tools. Updating and creating new resources in mediums that practitioners prefer to use can help increase Cooperative Extension use and awareness.

Impact of Location on Yield and Fruit Quality of Aronia Berry in Georgia

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Global interest in health and wellness has led to an increased demand for nutraceutical foods that provide health benefits beyond basic nutrition. Aronia Berry can satisfy this demand because of their high antioxidants, higher than those found in other small berries such as blueberries, blackberries, and cranberries. The genus, native to the eastern United States, has three main species: black (A. melanocarpa), red (A. arbutifolia), and purple (A. melanocarpa x A. arbutifolia). The most widely grown cultivar, Aronia mitschurinii' Viking,' an intergeneric hybrid between A. melanocarpa and Sorubus aucuparia (mountain ash), is used for commercial production, as fresh berries and processed berries. Most of aronia production occurs in the north and central US, and little information exists on aronia berry performance in southern locales. We have established replicated plantings in Georgia. During the 2024 growing season, Viking's yield and fruit quality were assessed at two locations: Griffin (USDA Zone 8a, Piedmont region) and Blairsville (USDA Zone 7a, Blue Ridge region). The berries were harvested in August, weighed, and frozen for further processing. The following parameters were evaluated: growth index, stem diameter, yield, berry size and weight, dry weight, total

soluble solids (°Brix), pH, and total titratable acidity. Plants in Blairsville outperformed plants in Griffin in all parameters -growth index, stem diameter, average berry weight, size and dry weight. The sugar content, acidity, and total acid content were significantly lower in Griffin compared to Blairsville. These findings indicate that berries produced in more northern locales in Georgia are of higher quality than those produced in southern locales. Berries are sweeter and have a better tart flavor. Based on these results, we conclude that northern areas are more suitable for aronia berry production in Georgia.

Influence of Shade on Blackberry Cultivar Performance

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Blackberry, the official state fruit of Alabama, has great potential for production in the state. Nineteen blackberry cultivars were planted in 2023 March at the Chilton County Research and Extension Center (central Alabama). This study was arranged in a randomized complete block design (n = 8) under a 30% aluminet shade cloth and an uncovered (full sun) field plot. Environmental data, yield, and fruit quality attributes were recorded from the 2024 harvest season. The shaded plot had greater yield and fruit size compared to the open field plot. Soluble solids content of the berries was higher, and titratable acidity was lower in the open field plot. Fruit pH was lower under shade. White drupelet disorder, a physiological disorder whose cause is not fully understood, had a lower recorded incidence under the shaded plot. This supports previous studies evidence for improvements in yield and white drupelet disorder in blackberries grown under shade. These results are likely influenced by differences in environmental conditions between treatments. PAR light intensity and soil temperature were lower under shade structures, and overall average temperatures were highest in the field. Preliminary results from this first year of harvest support the potential for improved production under shade, however the study will repeat data collection for the 2025 harvest to further evaluate and determine cultivar recommendations.

Inventory of Pawpaw (*Asimina triloba*) Pollinators

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Pawpaw (*Asimina triloba*) is a temperate, deciduous fruit tree native to North America and a member of the custard apple family (Annonaceae). It produces unique, flavorful fruit with a taste resembling mango, banana, and pineapple, making it valuable for various value-added products such as jams, bread, ice cream, and brandy. Pawpaw fruits are also rich in nutrients and antioxidants, contributing to their increasing commercial potential. However, fruit sets in some cultivars may be limited due to the protogynous and self-incompatible nature of pawpaw flowers, which require external pollinators for successful fertilization. Unlike many fruit-bearing species, pawpaw has been thought to be pollinated by beetles and flies rather than bees. However, their abundance and role in pollination remain understudied. This study aims to identify and quantify insect visitors to flowering and non-flowering branches of two pawpaw cultivars, ‘Sunflower’ and ‘Susquehanna’. Ten trees of each cultivar were selected, and a completely randomized design was implemented using 40 wire cage traps coated with tangle-trap adhesive on both flowering and non-flowering branches. After an 18-day flowering period, the traps were collected, and captured insects were identified to the order level and their abundance recorded. In 2024, an additional 20 traps were placed at control sites (roadsides and fields), and nine days of direct observations were conducted to document insect activity during male and female flower stages. Data were analyzed using RStudio v.2023.09.1 (Posit, PBC, Boston, MA) and subjected to a three-way ANOVA, with flowers, cultivars, and years as treatment factors, followed by Least Significant Difference (LSD) means separation. Results from 2023 indicate a significantly higher abundance (p-value: 2.548e-14 ***) of Coleopteran insects on both flowering and non-flowering branches of ‘Sunflower’ and ‘Susquehanna’ compared to 2024. This study provides valuable insights into the pollination ecology of pawpaw, aiding in the development of strategies to enhance fruit sets and improve commercial production.

Plant Growth Regulator Influence on Sweetpotato Slip Propagation

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The production of sweetpotatoes encompasses several phases, each presenting distinct challenges, particularly during the transplanting process. Sweetpotato slips, or vine cuttings, exhibit non-uniform characteristics that complicate transplanting. Furthermore, the transition from greenhouse to field conditions introduces various

environmental stresses, often diminishing transplant survival rates. The high mortality rate poses significant challenges for producers. Research has shown that plant growth regulators (PGRs) can induce lignification of cell walls, which can alleviate transplant stresses in several crops; however, their effects on sweetpotato slips remain largely unexplored. A study conducted at Mississippi State University aimed to evaluate the impact of several types of PGRs on sweetpotato slips. The study comprised two greenhouse trials designed to identify the most effective types and rates of PGRs on sweetpotato slips. A randomized complete block design assessed four different PGR types across thirteen concentrations with three replications, featuring 38 subsamples per treatment per replication. Comprehensive data on plant height, stem diameter, node count, chlorophyll content, leaf area, and both dry and fresh weights of slips and roots were collected to analyze the influence of PGRs on plant development. The findings revealed that sweetpotatoes are more sensitive to repeated applications than larger single applications when reducing height. In contrast, all chemicals, at most rates, increased chlorophyll content. However, the other parameters were not positively affected at any application, including external stem diameter, which decreased. Several measured parameters, such as node count, fresh and dry weight of slips and roots, and leaf area, remained unaffected.

Stratifying Biochar Derived from Sugarcane Bagasse Can Improve Substrate Nutrient Retention and Fertilizer Efficiency in Container-grown Petunia

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Peatmoss use as a substrate has been scrutinized due to concerns with long-term sustainability, as it is considered by some a non-renewable resource. Moreover, peat harvesting can be weather limited, leading to supply chain-related issues and inconsistent availability. Thus, researchers search for alternative materials that can complement peat in a substrate. Due to the organic-nature, many of these alternative materials have issues associated with rapid decomposition. Biochar, the product of heating biomass in an oxygen-limited environment, has the potential to stabilize these components and serve as a peat alternative in container production. These biochar products present several additional benefits including increased nutrient retention, higher porosity, and is regionally available being created from local biomass. In this study, sugarcane bagasse biochar was analyzed for increased nutrient retention in different locations within the container in standard and stratified substrate systems. Petunia plugs were planted into 3.8 L containers filled with one of eight different substrate treatments, four stratified treatments (peatlite over aged pine bark) and four non-stratified treatments (peatlite). Each of these treatments received 10% (by vol.) sugarcane biochar in the container, either 1) throughout the whole container, 2) at higher concentration (20% by vol.) only the upper strata, 3) at higher concentration (20% by vol.) only in the lower strata, or 4) no biochar (control). It was found that biochar did increase growth and overall nutrient retention in container grown petunias regardless of location within the container. However, the fine texture of the biochar led to increased moisture retention, when incorporated at 20% in the lower strata, which limiting root growth. These results confirm biochar does have the potential to improve fertilizer use and efficiency in container grown crops by increasing overall nutrient retention, and that benefit can be improved with strategic positioning within the container.

Target genotyping using Capture-Seq technology to characterize the population structure and phylogenetic relationships of peaches from Australia and other parts of the world.

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Peach *(Prunus persica)* is one of the world's most widely produced temperate fruit tree crops. In addition, it is considered a model organism for fruit tree research by virtue of its small and relatively simple genome. Currently, genetic studies of *P. persica* are facilitated by 9k and 16k SNP chip arrays, which can be expensive and inflexible. Having only 16k SNP markers available is limiting, considering that other crops like maize have had over 50k arrays available for more than ten years. One goal of this project is to develop a panel of 50k SNP markers for use in peach and related species. These can be used for genetic diversity analysis, genomic selection, QTL analysis, and more. Another goal of our project is to characterize the relatedness and diversity of worldwide peach populations,

to assess their potential as sources of breeding material to improve American peach varieties. We began by acquiring tissue samples from 250 unique peach genotypes from the University of Georgia's Dempsey Farm, USDA-GRIN, and collaborators in Australia. The samples represented 28 different countries and 17 *Prunus* species and interspecific hybrids. Tissue samples were sent to Rapid Genomics for DNA extraction and Capture-Seq analysis. Capture-Seq was carried out using 50k genetic probes, which were based on known SNPs from the 16k SNP array, as well as SSR markers and exonic regions. After processing, over 7 million variants were identified, 134,424 of which were biallelic SNPs with a read depth between 10 and 100, minor allele frequency of 10% or more, and linkage disequilibrium r^2 less than 0.2. This panel of 134k SNP markers was used to run a principal component analysis, which revealed separation between North American and Australian populations, marking Australian peaches as a potential source of novel germplasm for American breeding programs. In the future, these SNPs will be further filtered to create a panel of informative markers. These markers will be used to investigate the diversity of Australian peach populations.

Validation of Diagnostic Markers for Seedlessness and Flower Sex in Diverse *Muscadinia* and *Vitis* Grape

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Muscadine grapes (*Muscadinia rotundifolia*), native to the southeastern United States, are cultivated commercially for fresh consumption, wine, and juice production. Among the most sought-after traits in fresh market muscadine cultivars are stenospermocarpic seedlessness and perfect flowers. However, the genetic divergence and chromosome number disparity between *Vitis* (38 chromosomes) and *Muscadinia* (40 chromosomes) have posed significant challenges in introducing stenospermocarpy from *V. vinifera* to *M. rotundifolia*. Stenospermocarpic seedlessness has been successfully introgressed into *M. rotundifolia* through conventional breeding, but molecular markers associated with this trait remain unvalidated in muscadines. A flower sex marker complements the stenospermocarpy marker by enhancing the development of seedless muscadines, streamlining the breeding process, and eliminating the need for embryo rescue. The flower sex marker targets male sterility to identify female flowers, without distinguishing between male and perfect flowered plants. Recently, Kompetitive Allele Specific PCR (KASP) markers targeting candidate genes for male sterility (*VviINP1*) and stenospermocarpy (*VviAGL11*) were developed. These markers, named seedless_Arg197Leu_site56.fas and female_INP_indel_site56.fas, were evaluated for their potential across various species within *Vitis* and *Muscadinia* through sequence alignments with published *M. rotundifolia* genomes. This study assessed the predictive ability of these markers using a validation panel from the University of Arkansas Division of Agriculture Fruit Breeding program, which included 918 *Vitis* x *Muscadinia* hybrids and a range of diverse *Vitis* and *Muscadinia* accessions, encompassing cultivars, selections, and wild material. In total, 209 accessions were accessed with the seedless marker, and 320 accessions were evaluated with the flower sex marker. The evaluation for seedlessness and flower sex took place over 2023 and 2024. Excluding incomplete phenotype and genotype data, the stenospermocarpic marker (seedless_Arg197Leu_site56.fas) accurately predicted seedlessness in 921 of 924 entries. Additionally, 148 out of 203 seedlings that did not produce fruit in both growing seasons were predicted to be stenospermocarpic. A t-test comparing vine girth between seeded and seedless material ($p=0.04$) indicates a potential link between the lack of fruit production in seedless hybrids and cold hardiness issues. The flower sex marker (female_INP_indel_site56.fas) correctly predicted flower sex in 1,137 of 1,138 entries. Overall, the KASP markers showed outstanding predictive performance, achieving accuracy rates of 99.91% for flower sex and 99.68% for seedlessness across *Vitis*, *Muscadinia*, and hybrid germplasm.

Yield Response of Three Sweetpotato Clones to Variable Nitrogen Rates

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Sweetpotato is a critical crop for North Carolina in both domestic and international export markets, with North Carolina producing 60% of total US sweetpotato production and accounting for 70% of all sweetpotato exports. For many years, the Sweetpotato Cultural Management team at NCSU has collaborated with the NCSU Sweetpotato Breeding Program to evaluate advanced clones for fertility requirements, in-row spacing, and postharvest durability. This study evaluated two advanced sweetpotato clones near-release (NC09-1105

and NC15-0728) as well as ‘Covington’, the current industry standard, in a nitrogen (N) rate study to optimize a nitrogen rate before their release. The study was conducted in two locations, one on-farm near Nashville, NC and one at the Horticultural Crops Research Station (HCRS) in Clinton, NC. At the on-farm location, yields were good but there were no differences between nitrogen rates within clones. However, ‘Covington’ had a greater marketable yield compared to ‘NC09-1105’. At the HCRS location all yields were low by commercial standards, but there was statistical separation among treatments. ‘Covington’ and ‘NC15-0728’ had no differences between rates, but both demonstrated a numerical increase in marketable yield with increasing nitrogen rate. ‘NC09-1105’ had the greatest marketable yields at the HCRS location and had significant differences between the 0 lb N/ac rate which yielded 5,549 lb/ac and the 120 lb N/ac rate which yielded 19,493 lb/ac. Due to the late planting time and substantial fluctuations in moisture conditions due to weather throughout the production season, we are planning to repeat both studies in 2025.

Warren S. Barham PhD Graduate Student Competition

Assessing Postharvest Texture Variations in Rabbiteye and Southern Highbush Blueberries Grown in Alabama

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Blueberry (*Vaccinium* spp.) firmness is a critical parameter influencing shelf-life and fruit quality. Variations in firmness have been extensively studied on southern highbush (SHB; *Vaccinium corymbosum L.*) genotypes, with little reported on rabbiteye (RE; *Vaccinium virgatum*) genotypes. The research objective was to evaluate weight loss, fruit firmness, and berry diameter on 14 RE and 3 SHB genotypes through storage. Blueberries were harvested in 2024, and then stored at 4 °C and 85% relative humidity. Four postharvest timepoints were followed: days 0, 14, 28, and 42 in storage. Firmness and fruit size were measured using a FruitFirm 1000 texture analyzer, and weight loss was recorded using a digital scale. Significant changes in weight loss, firmness, and fruit size during storage were found, with trends varying by cultivar. On day 42, RE genotypes of ‘T-3081’, ‘Vernon’, and ‘T-3075’ exhibited the lowest weight loss at 7.2%, 7.8%, and 7.9%, respectively. Conversely, ‘MS1228R’ (18.3%), ‘MS1110R’(13.6%), and ‘Titan’ (13.2%) (RE genotypes) and ‘Newhanover’ (14.9%) (SHB genotypes) had the highest weight loss. At harvest (day 0), ‘Titan’ (RE) had the highest firmness (287 $g.mm^{-1}$), while ‘MS1110R’ (RE) had the lowest (152 $g.mm^{-1}$). After 6 weeks storage (day 42), RE genotypes of ‘Titan’, ‘Vernon’, ‘T-3075’, and SHB ‘Legacy’ maintained high firmness (>200 gmm^{-1}), while ‘Alapaha’ (RE), ‘NewHanover’(SHB), and ‘MS1110R’ (RE) were lowest (<150 gmm^{-1}). During storage, most cultivars decreased in berry diameter. RE genotypes ‘Titan’, ‘T-3081’, and ‘T-3075’ had the largest diameter (24.9, 24.1, and 26.1 mm, respectively) at harvest, and retained fruit diameter through storage (23.7, 23.4, and 26.1 mm, respectively). Principal Component Analysis (PCA) and Hierarchical Cluster Analysis (HCA) identified three distinct firmness clusters, categorizing cultivars into enhanced (‘Titan’, ‘T-3075’), moderate (‘Legacy’, ‘Overtime’, and ‘T-3081’), and suppressed firmness (‘Alapaha’, ‘Krewer’, ‘Brightwell’, and ‘MS1110R’). HCA was crucial in selecting 10 genotypes (7 RE and 3 SHB) for future cell wall and texture analysis. This study provided valuable data for growers to select RE cultivars with maintained firmness and shelf-life. This data will aid blueberry breeders in selecting high-quality and competitive RE genotypes.

Associations Between Early Berry Color and Final Anthocyanin Content in Blackberry

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Anthocyanins are the compounds responsible for the characteristic dark purple/black color of blackberry fruit. These compounds have nutraceutical properties and their degradation during harvest and cold storage is associated with the red drupelet reversion postharvest disorder. Significant genotypic variation in total anthocyanin content and composition of specific anthocyanins has been previously documented in University of Arkansas System Division of Agriculture (UA) blackberry breeding germplasm; however, all cultivars appear fully black at harvest and it is impossible to discern anthocyanin content in the field based on visual observation. Interestingly, field observations have shown that blackberry genotypes have

strikingly different flower color and berry color early during the fruit development period. The goal of this study was to assess whether there is a relationship between berry color early in development and total anthocyanin content or the composition of individual anthocyanins in blackberry. Significant genotype x year interactions were discovered for total anthocyanins and cyanidin-3-glucoside. However, Von, A-2845TN, and APF-448T consistently exhibited the lowest total anthocyanin content across both years, while A-2687T had consistently high anthocyanin content. Immature berry color at 28 days after flowering was modestly correlated with final anthocyanin content. Darkness (L*) values were correlated with total anthocyanins (r = -0.339) and cyanidin-3-glucoside values (r = -0.412). While early berry color showed some indicative trends, the correlations were not robust enough to reliably use developing berry color as a proxy for selecting for higher anthocyanin concentrations. Still, the results of this study show that anthocyanin content varies widely in UA breeding germplasm and that breeders may be able to improve anthocyanin content.

Changes in Color and Phenolics During Storage of Wines Produced from Co-fermentation of Noble (*Vitis rotundifolia*) and Merlot (*Vitis vinifera*) Grapes

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Muscadine grapes (*Vitis rotundifolia* Michx) used for wine production can have issues with
color and phenolic stability, especially compared to *V. vinifera* grapes predominantly used for wine production. Co-fermentation, two or more grape varieties fermented together, can enhance quality attributes of wine. In 2023, Noble (*V. muscadinia*) and Merlot (*V. vinifera*) grapes were harvested, randomized into five co-fermentation treatments in duplicate (100% Noble, 75% Noble+25% Merlot, 50% Noble+50% Merlot, 25% Noble+75% Merlot, and 100% Merlot), processed, and fermented. At bottling, sulfur dioxide (SO_2) was added to each co-fermentation treatment at different molecular levels (0.0, 0.8, and 1.5 mg/L). Composition, color, and phenolic attributes of wines were evaluated at bottling and during storage (0-,6-, and 12-months) at 15°C. At bottling, pH (3.24-3.67), titratable acidity (0.60-0.80%), free SO_2 (18.53-42.43 mg/L), and ethanol (10.35-13.64%) varied for each co-fermentation treatment. From 0- to 12-months storage, red color and color density decreased in wines with ≥ 25% Noble. However, at 12-months storage, both attributes were higher in blends with ≥ 25% Noble (2.67 red color and 5.23 color density) compared to 100% Merlot blends (2.21 red color and 4.12 color density). Red color decreased in wines without SO_2 at all storage times. However, moderate and high SO_2 levels protected against red color loss in wine blends up to 6 months. Phenolic content of the wines increased from 0 to 6 months across all co-fermentation treatments but declined by 12 months. Monomeric anthocyanins consistently decreased during storage, except in 100% Merlot wines. Wines with more Noble contained mostly 3,5-diglucosides anthocyanins, while wines with 100% Merlot contained only monoglucoside anthocyanins, namely malvidin-3-glucoside and petunidin-3- glucoside. These monoglucoside anthocyanins positively correlated ($r^2 \geq 0.74$) to L*, showing blends with more Merlot were lighter, regardless of SO_2 concentration. Co-fermenting with ≥25% Noble produced darker, redder wines. Furthermore, increased Noble content enhanced phenolic and monomeric anthocyanin levels in the wines at all storage times, highlighting the beneficial impact of Noble grapes on wine blend quality.

Comparative Yield Analysis of 8 Hop Cultivars (*Humulus lupulus* L.) in North Central Oklahoma After Three Growing Seasons

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Hops, a key ingredient in beer brewing, are predominantly grown in the Pacific Northwest, which accounts for 95% of U.S. production (Fandino et al., 2015). Regional hop-growing isolation contrasts with the expansion of the beer brewing industry, and has limited access to hops for growers and brewers in other regions. This study evaluates the yield performance of eight hop cultivars grown in Oklahoma over three growing seasons (2022–2024) to assess their regional viability. The trial, conducted in Perkins, OK (35.9739°N, 97.0336°W) on sandy loam soil (pH 6.2), used a V-style trellis with drip irrigation. Yield data, expressed in pounds per acre (lbs/acre), were collected annually for Cascade, Chinook, Comet, Mt. Rainier, Newport, Sterling (which failed to establish), Tahoma, Willamette, and Zeus. In the establishment year (2022), Zeus (90.56 lbs/acre), Chinook (75.47 lbs/acre), and Cascade (65.36 lbs/acre) yielded the highest amounts, while Mt. Rainier, Tahoma, and Willamette produced no harvestable cones. In 2023, Cascade yielded 536.63 lbs/acre, a 721% increase from 2022. Zeus, Chinook, and Comet (introduced in 2023 to replace Sterling) also improved, with yields of 352.81 lbs/acre, 133.28 lbs/acre, and 143.9 lbs/acre, respectively. By 2024, Cascade

reached 754.19 lbs/acre (a 40% increase from 2023), Zeus increased to 679.72 lbs/acre (93% increase), Comet to 442.23 lbs/acre (207% increase), and Chinook to 297.83 lbs/acre (124% increase). Mt. Rainier, Tahoma, Newport, and Willamette showed little improvement, with Willamette failing to produce harvestable cones in 2024. Results indicate that Cascade, Zeus, Comet, and Chinook consistently improved yields across seasons. Future research should focus on increasing yield by exploring supplemental lighting, alternative trellis heights, and plant genetics for southern-adapted hops.

Differential Responses of Specialty Pepper Genotypes to Microbial Inoculant and Water Stress

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Specialty Peppers grown in Southwest United States face significant limitations due to water stress, a major abiotic constraint in this region. Tolerant genotypes and plant growth-promoting rhizobacteria (PGPR) are effective strategies for mitigating the stress effects. Genotypic variations and PGPR can enhance water uptake, nutrient availability, and stress adaptation through different mechanisms. This study evaluated the interaction between different pepper genotypes and PGPR (Spectrum DS, a commercial microbial inoculant) under water stress (30 % field capacity). Among the three genotypes tested, ‘Jal46,’ a Jalapeno-type breeding line, exhibited superior drought tolerance compared to ‘Mama Mia Giallo’ (an Italian frying-type hybrid) and ‘Corne di Toro’ (an Italian frying-type heirloom). ‘Jal46’ had lower electrolyte leakage, a higher root-to-shoot ratio, greater relative height growth rate, and photosynthetic capacity. Inoculation with Spectrum DS further enhanced ‘Jal46’s’ stomatal conductance, transpiration rate, photosynthetic activity, and root system development. ‘Corne di Toro’ was the most susceptible genotype to water stress, exhibiting high electrolyte leakage, low antioxidant activity, and poor root and shoot growth. However, PGPR inoculation improved its root length, root surface area, and relative water content, mitigating some stress symptoms. Overall, PGPR inoculation benefited all genotypes, primarily by enhancing root architecture and gas exchange, demonstrating its potential to mitigate water stress in pepper production.

Response of Three Parthenocarpic Zucchini Cultivars to Different Substrates in Greenhouse Conditions

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Controlled Environment Agriculture (CEA) is rapidly expanding as a sustainable and efficient approach in modern agriculture for crop production in high tunnels, greenhouses, and indoor vertical farms. However, the range of crops successfully cultivated in CEA systems remains limited. Zucchini (*Cucurbita pepo* subsp. *pepo*) has potential for high yields and adaptability to greenhouses. Parthenocarpy is a desirable trait for CEA grown crops, ensuring consistent yields even without natural pollinators. Given the limited knowledge regarding optimal zucchini cultivation in greenhouses, this study aimed to evaluate the performance of three parthenocarpic zucchini in different substrates. We tested three cultivars: ‘Dunja,’ ‘Golden Glory,’ and ‘Noche’ grown in three different substrates: coconut coir and wood fiber blend (Coco), phenolic foam slabs (Oasis), and a peat-based blend (Promix). The experiment was conducted in a greenhouse at the University of Georgia in Athens and used a two-factor randomized complete block design with three replications. The experimental unit was a set of four plants. Data recorded included female flower production, flower abortion rate, fruit weight, and marketable yield. Of the three cultivars tested, ‘Golden Glory’ produced the largest total fruit weight. Plants grown in peat-based blend produced more female flowers than those grown in coconut coir and wood fiber blend or phenolic foam. ‘Noche’ produced more female flowers than ‘Dunja’ or ‘Golden Glory.’ ‘Golden Glory’ had the lowest flower abortion rate and the highest percentage of marketable yield. However, substrate type and cultivar interacted to affect marketable harvest. This was due to an extremely low percentage of marketable ‘Dunja’ fruit grown in coconut coir and wood fiber blend. The study also highlighted challenges with disease management, as even powdery mildew tolerant cultivars showed signs of powdery mildew and symptoms of virus infection. In conclusion, ‘Golden Glory’ proved to be the most productive cultivar. However, the findings emphasize the need for further breeding improvements to enhance parthenocarpic fruit set and development, increase percentage of marketable fruits, and improve disease resistance for higher productivity in greenhouse environments. In our experiment, uniform irrigation frequency and timing were applied across all treatments. This may have influenced substrate performance as the three substrates differ in their water holding capacities. Future studies could deploy soil moisture sensors to

manage irrigation automatically based on the substrate water holding capacity.

Field Performance of Commercial Cucumber Cultivars Under Whitefly and Virus Pressure in Southern Georgia

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Whitefly and whitefly-transmitted viruses (WTV) account for 30-50% yield losses on average every year and challenge cucurbit production during fall in Georgia. Cucurbit leaf crumple virus (CuLCrV), cucurbit yellow stunting disorder virus (CYSDV), and cucurbit chlorotic yellows virus (CCYV) are the common WTV in Georgia. In the fall of 2023, we evaluated ten commercial cucumber cultivars to study whitefly preference, identify cultivars resistant/tolerant to WTV, and determine high-yielding cultivars in Tifton, Georgia. Eight of the cultivars selected for the study were field-grown slicing types (Brickyard, Bristol, Cobra, Diamondback, Dasher II, Python, Raceway, and Speedway), one was a field-grown pickling type (Supremo), and one was a greenhouse-grown slicing-type (Tasty Green). We observed whitefly infestation and symptoms of CYSDV and CCYV mixed infection in the research field. We found significant differences in whitefly counts, area under disease progression curve (AUDPC) for virus incidence, virus severity ratings, and yield. We found the lowest number of whitefly adults per leaf in 'Supremo'. The cultivars Brickyard, Bristol, Diamondback, and Raceway had a significantly higher numbers of whitefly adults per leaf than Supremo. 'Bristol' exhibited the lowest AUDPC, followed by 'Supremo'. In contrast, Tasty Green, Speedway, Python, Dasher II, and Diamondback cultivars had highest AUDPC. Furthermore, 'Tasty Green' and 'Speedway' had the most severe virus symptoms. The marketable fruit number per hectare was greatest for Supremo. Moreover, alongside supremo the marketable fruit weight per hectare was highest for Bristol, Dasher II, and Diamondback. Unlike other cucurbits, cucumber had no visual symptoms of silver leaf disorder and CuLCrV. Overall, 'Bristol' outperformed exhibiting the lowest AUDPC and top marketable fruit weight. Although having the smallest average fruit weight by type, 'Supremo' yielded the best along with the lowest whitefly infestation and AUDPC. Although cultivars Dasher II and Diamondback had moderate to high whitefly infestations and AUDPC, they had marketable fruit weights similar to Supremo and Bristol. Hence, based on this experiment, we suggest cultivars Bristol, Supremo, Dasher II and Diamondback for fall-season cucumber production in South Georgia.

Hydraulic Properties of a Coarse-Textured Soil Treated with Biochar

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Sandy soils, with low water-holding capacity, poor nutrient retention, high leaching potential, and erosion susceptibility, hinder crop growth, reduce agricultural yields, and challenge food security. This study investigates the potential of commercially available biochar to improve the hydraulic properties of these coarse-textured soils. While previous research has focused mainly on laboratory-produced, small-scale biochar, this study aims to bridge the gap between laboratory findings and practical, commercial applications. A two-by-twelve completely randomized factorial design with four replications was employed to evaluate eight commercially available and three laboratory-made biochar treatments, differing in feedstock, particle size, and production process, along with a control, at 5% and 10% (v:v) application rates. Loamy sand soil was mixed with biochar and packed into 100 cm^3 stainless steel rings. After saturation, soil columns were subjected to repeated drying and wetting cycles. Water retention curves were developed using a tension table at various suction levels (10, 30, 50, 75, and 100 hPa) and a WP4C PotentiaMeter for higher suction measurements. Results indicated that biochar amendments significantly enhanced water retention and improved pore structure. The 10% biochar application rate yielded the greatest soil porosity and water availability improvements. Specifically, biochar application at 5% and 10% increased total porosity by 5% and 10%, microporosity (<10 µm) by 3% and 6%, mesoporosity (10-1000 µm) by 6% and 11%, and macroporosity (>1000 µm) by 9% and 14%, respectively. These findings suggest that commercially available biochar products can effectively improve the hydraulic limitations of sandy soils, offering practical solutions for farmers.

Leaf sap analysis as a nutrient management tool in a mature peach orchard.

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Current fertilization recommendations for mature peach orchards rely on spring soil sampling and postharvest leaf analysis. While soil sampling assesses nutrient status at the soil level, leaf analysis information is useful only for the next crop cycle, limiting in-season adjustments. This study evaluated preharvest leaf sap analysis to monitor macro- and micronutrients. Conducted in a nine-year-old peach orchard using a split-plot design with three replicates, the experiment compared two irrigation systems, micro-sprinkler and drip, as whole plots and leaf, old vs. new, as subunits. Trees received 3 lb/tree of 10-10-10 and 2 lb/tree of calcium nitrate during the season and water was supplied based on the Peach Smart Irrigation App recommendations. Leaves, including petioles, were sampled between 8 and 11 h at 40, 72, 86, and 100 days after full bloom (DAFB). Leaf sap analysis showed N (mainly as NH_4) and Mg were within sufficiency ranges, P and K were excessive, and Ca, S, and all micronutrients were deficient. P likely limited Zn and Fe uptake, B deficiency may have impaired sugar, N, and P loading and transport to sink tissues, and Mo (<0.05 ppm) could have restricted nitrate reduction. Nutrient levels fluctuated over time, and irrigation system interacted with Al, Mg, and S. In contrast, conventional tissue analysis showed that all macro- and micronutrients fell within sufficiency ranges for 2023 and 2024. Overall, leaf sap analysis revealed nutrient imbalances during fruit growth stages that may impact fruit quality.

Optimizing hydroponic spinach cultivation in warm climate: effects of root zone cooling on growth and biochemical properties

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Root zone cooling in hydroponic systems enhances productivity, reduces oxidative stress, and maintains physiological integrity in spinach, ensuring optimal year-round production, even during hot summer months. This study aimed to quantify cultivar-specific responses to root zone cooling by characterizing growth and biochemical properties of four spinach cultivars (Lakeside, Hammerhead, Mandolin, and SV2157) grown in deep water culture hydroponic systems in a greenhouse during the summer season. The cultivars were exposed to three root zone temperature (RZT) treatments through root zone cooling: Control (ambient temperature, no cooling), root zone cooling to 24 °C or to 21 °C (RZT24, RZT21). Results revealed that root zone cooling significantly increased shoot fresh and dry weight in both RZT treatments, except for SV2157. For SV2157, there were no differences in growth parameters, phytochemical traits or stress indicators among the three treatments. Therefore, SV2157 was the heat-tolerant of the four cultivars. For Mandolin, shoot dry weight increased by 87% and 94% in RZT24 and RZT21, respectively, compared to control. For Lakeside and Hammerhead, there were no significant differences in growth parameters among the treatments; however, root zone cooling reduced heat stress as indicated by lower H_2O_2, MDA, cell leakage and mortality rate. A similar trend was observed for total phenolics across the cultivars: highest in control and lowest in RZT21. In contrast, other phytochemicals, such as total chlorophyll and carotenoids, did not show any significant differences across the treatments, regardless of cultivar. Based on electricity consumption (1.23 kW-h/day in RZT24 vs. 2.67 kW-h/day in RZT21), growth, and phytochemical properties, cooling to 24 °C is recommended.

Photoregulation of bioactive compounds in greenhouse-grown tomatoes

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Tomato is a functional fruit rich in health-promoting compounds like carotenoids, amino acids, ascorbic acid, and phenolics. The presence of these compounds contributes to tomato flavor and overall fruit quality. However, environmental factors, including light, can influence the synthesis and accumulation of such bioactive compounds and affect the quality of tomato fruit. Therefore, the current study investigated the effect of supplemental growth light on the levels of amino acids (AAs), ascorbic acid (AsA), and hydroxycinnamic acids (HCAs) in greenhouse-grown tomato fruits. This study was conducted with two tomato varieties (Plum Regal and TAM Hot-Ty) exposed to supplemental blue (238 µmol m^{-2} s^{-1} at 40 cm from plants for 8 h), UV-B light (5 µmol m^{-2} s^{-1} at 46 cm from plants for 4 h), a combination of blue and UV-B (B+UV-B), and control (no supplemental lighting). Our findings revealed that B+UV-B conditions consistently led to a higher accumulation of HCAs, and UV-B led to an overall increase in AsA in both varieties. Similarly, important AAs like γ-amino butyric acid (GABA) and glutamine were enhanced significantly by B+UV-B. Therefore, supplemental blue and UV-B light could be employed to improve nutritional value by augmenting the abundance of bioactive compounds in tomato fruits grown under controlled environment conditions. This work was partially supported by USDA-

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Potential of Brewer's Spent Grain and Cannabis Ash as a Source of Organic Nutrient for Potted Plants.

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Synthetic fertilizers have been serving as a nutrient source for the plant grown in the greenhouse environment. However, due to concerns regarding environmental sustainability and energy crisis use of organic nutrient as an alternative has been getting recognized. Brewer's spent grain (BSG), a byproduct produced from the brewing process is known to contain a notable percentage of nitrogen. This study aimed to evaluate Brewer's spent grain *(BSG) as a substitute of a synthetic nitrogen source, and cannabis plant ash as a phosphorous* source for the geranium 'Patriot Bright Red' plant. Three different rates of BSG as nitrogen source (50g, 100g, and 150g) and four different rates of ash as phosphorous source (2g, 4g, 6g, and 8g) were mixed with the soilless media. The 100% soilless media with control release fertilizer was considered as a control treatment. This study showed that the control produced the greatest plant height (20.93 cm), width (24.12 cm), SPAD (53.90), and flower diameter (4.75 cm). Whereas root and shoot dry weight, along with water use efficiency (WUE) were observed greatest at control and treatment with 50 gm BSG and 4 gm ash. Days required for flowering were found to be increased while, the number of umbels and flowers were found to decreased with an increased in BSG rate. In general control outperforms the higher rate of BSG, however, the lower rates of BSG showed a significantly similar effect as the control. Meanwhile, plant growth parameters were not affected by the application of the different ash rates. This study suggests that BSG at 50 gm can be used as the replacement of synthetic fertilizer and peatmoss for the greenhouse production of geranium plants.

Probiotic-Derived Exopolysaccharide as a Natural Emulsifier for Limonene: Enhanced Stability and Antimicrobial Applications

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Volatile compounds such as limonene are widely used in food and pharmaceutical applications for their bioactive properties, but their stability is often compromised by environmental factors, including temperature, pH, and salinity. Conventional synthetic stabilizers can improve their stability but pose safety and environmental concerns. This highlights the critical need for effective, natural alternatives, to enhance food safety and antimicrobial efficacy. In this study, exopolysaccharide (EPS) derived from *Lactobacillus* (LAB) was evaluated as a natural emulsifier for encapsulating limonene enantiomers (S-limonene and D-limonene). The study investigated the physicochemical and rheological properties of EPS and its role in stabilizing oil-in-water emulsions, along with antimicrobial efficacy against foodborne pathogens. The EPS was extracted with a yield of 1.1 g/L under optimized conditions (5% carbon source, pH 6.1) and characterized using Fourier transform infrared spectroscopy (FTIR), scanning electron microscopy, and thermo-gravimetric analysis. A 2% EPS concentration in a 60:40 oil: water emulsion achieved the desired particle size and polydispersity index. The emulsions demonstrated exceptional stability across varying conditions, including temperatures (-20 to 60°C), pH (2–9), and salinity levels. FTIR analysis confirmed the presence of functional groups from both EPS and encapsulated limonene. Notably, LAB-derived EPS improved limonene stability and exhibited superior antimicrobial activity against *Escherichia coli* and *Listeria monocytogenes* compared to unencapsulated oils. This study highlights LAB-derived EPS as a promising natural stabilizer for volatile compounds, offering significant potential to enhance food safety and quality. This work was partially supported by USDA-NIFA-2024-51181-43464, USDA-NIFA-AFRI 2023-67013-39616 through the Vegetable and Fruit Improvement Center and Institute for Advancing Health Through Agriculture of the Texas A&M University.

Screening Tomato Genotypes for Thermotolerance Using Physiological Traits

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The tomato production in Texas has been insufficient under high-temperature conditions. This study aimed to evaluate the thermotolerance of eight commercial and thirteen Texas A&M-developed tomato genotypes in Uvalde, TX. Five-week-old seedlings were transplanted into an open field with clay loam soil (pH 7.8) on March 28, and fruits were harvested at the 'red' stage until July 17,

2024. The average daily maximum temperature during the growth period was 32.8 °C. Among cherry-type tomatoes, 'TAM-C6' and 'TAM-C9' produced significantly higher yields than 'Super Sweet 100', while 'TAM-FLW2' and 'TAM-FLW3' outperformed 'Celebrity' among slicer-type tomatoes. 'TAM-FLW2' and 'TAM-FLW3' also showed the highest pollen viability among all genotypes. However, all TAM genotypes had lower total soluble solids and titratable acidity levels than 'Super Sweet 100' and 'Celebrity' within their respective tomato types. In contrast, 'Amish Paste' showed the highest lipid peroxidation, and 'Cherokee Purple' showed the lowest leaf transpiration rate, both contributing to their lowest yields among plum and slicer-type tomatoes, respectively. In conclusion, TAM tomato genotypes demonstrated promising performance in Uvalde, TX, while 'Amish Paste' and 'Cherokee Purple' are not recommended for hot climates.

Time-Series Phenotyping and 3D Modelling of Peach Tree Architecture Over Five Years by Utilizing TLS Technology

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Tree architecture is a complex trait of growing importance for horticultural production of fruit trees and for future automation. Several architectural traits were collected and analyzed from 3D quantitative structural models (QSMs) of 36 peach trees over 5 years spanning Winter 2019 to Winter 2023 (labelled here as 2020-2024). Traits that were evaluated included average number of branches, tree height, branch length, and crown volume. Each tree across 5 years was modelled 50 times utilizing the *TreeQSM* modelling pipeline method modified to suit peach trees grown in an open vase training system. Data collected from these 50 in-silico replicates were averaged and then analyzed to observe the potential environmental and genetic impacts on the overall tree architectural phenotypes in a time-series study. Spearman's rank correlation was performed for each trait for every year vs. year combination. For number of branches, the greatest Spearman rank-order correlation coefficient (ρ) among trees across all year comparisons was $\rho = 0.64$ and p-value ≤ 0.001 (year 2020 vs. 2021). For branch length, the greatest correlation coefficient across all years was $\rho = 0.60$ and p-value $= 0.0001$ (2021 vs. 2022). Tree height across all years, the greatest correlation coefficient was $\rho = 0.620$ and p-value ≤ 0.001 (2020 vs. 2021). Canopy volume across all years, the greatest correlation coefficient was $\rho = 0.836$ and p-value ≤ 0.001 (2022 vs. 2023). Across all 5 years, tree 17b, 'Durbin', was the most heavily branched tree with an average of 1109 branches. Tree 4a, 'Reliance' had the greatest average total branch length at 460.17 m. Tree 6a, 'Chui Lum Tao' had the greatest average tree height at 4.17 m across the 5 years. Finally, the tree with the greatest average canopy volume was tree 8a,'Redhaven', at 60.81 m^3.

Towards the identification of genes controlling flowering time and intensity in blackberries.

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Flowering is one of the most complex processes in plants, both at molecular and physiological levels. Understanding the genetic regulation of flowering in perennial crops like blackberries has gained significant interest due to the impact of climate change on fruit production and the necessity to develop new varieties with flowering times adapted to specific growing areas. To identify genomic regions regulating flowering time, a population of tetraploid blackberry genotypes from the University of Arkansas System Division of Agriculture breeding program was evaluated through a genome-wide association study approach. The 10% flowering time of floricanes was recorded for a set of 254 blackberry selections and cultivars during the spring seasons of 2022, 2023, and 2024. In addition, flowering time of primocanes was evaluated in a set of 104 primocane-fruiting genotypes during summer. A set of 80,000 SNP markers distributed throughout the genome was used for the association analysis. The phenotypic data were analyzed by fitting a linear mixed model and calculating the Best Linear Unbiased Predictors. The R package 'GWASpoly' was used to identify SNPs significantly associated with flowering time. Two genomic regions were detected on chromosomes one and five, explaining 10.7% and 11.3% of the flowering time variation in floricanes, respectively. Notably, genes coding for *VERNALIZATION 1* are annotated in the genomic region of chromosome 1, suggesting a significant role of these genes in regulating flowering time in blackberries. Additionally, one genomic region located on chromosome four was identified for flowering time of primocanes, explaining 21.4% of the phenotypic variation. Flowering intensity is another essential trait for crop improvement given its association

with fruit yield. Given the need to have an accurate methodology, we are implementing image-based phenotyping to identify genes associated with bloom intensity. Images of every selection plot were captured weekly during the spring season with an unmanned aerial vehicle and are being processed to estimate the number of flowers. These results contribute to obtaining a better understanding of the genetic basis of flowering time and intensity to develop molecular tools for implementation in the blackberry breeding program.

Two-year evaluation of morphological and floral characteristics of wild and cultivated *Ratibida* Raf. in Central Texas

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A field study of *Ratibida columnifera* (Nutt.) Wooton & Standl., a native North American perennial wildflower, revealed valuable phenotypic traits supporting its viability as a candidate for breeding programs in the South-Central United States. Open-pollinated seeds from wild and cultivated populations across Oklahoma, New Mexico, and Texas were collected from 2019 to 2022, in addition to accessions from Nebraska, and commercial suppliers in Michigan and North Carolina. Thirty accessions were established in June 2023 (Burleson County, Texas, USA) in a randomized complete block design, with three replicates in each of the three blocks. Sixteen vegetative or floral traits were measured for each plant. Data was collected in July, September, and November 2023, and in May, July, September, and November 2024. A majority of traits differed significantly (P<0.0001) in 2023 and 2024 among accessions, and seasonally, however, traits measured in 2024 had a lesser degree of variation among most accessions. A variance components analysis attributed most phenotypic variance to seasonal variation in 2023 (50-60%+). In 2024, phenotypic variation was attributed to the interaction of environment and accession. Accession variation accounted for 40% of the phenotypic variance for plant height in 2023. Phenotypically, plants for several accessions appear to be interspecific hybrids. Northern ecotypes died during early 2023, while most southern ecotypes survived as perennials in 2024. Overall, these results yield unique candidates for ornamental and cut-flower applications in the South-Central United States, illustrating the influence of local adaptation and highlighting phenotypes that could yield promising traits for future cultivar development.

Education Section

Insights Into Student Topical Interests in Horticulture in a General Survey Course and the Application to Curriculum Improvement

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Plants, People, and You is a freshman level survey course that is designated as a university level general elective satisfying a cultural requirement for the university's student learning outcome goals. This course is taught in the fall and spring semesters each year. Enrollment is from all the academic colleges on campus with the Bumpers College of Agriculture and Life Sciences contributing to the largest number of students followed by the Fulbright College of Arts and Sciences, and the Walton College of Business. Since its establishment in 1978, the class has evolved over the years in both size and content. The course originally emphasized home horticulture, and the content was delivered exclusively by horticulture faculty. In 2015 the course title was changed from Plants in the Home Environment to Plants, People, and You to reflect a change in emphasis towards global horticulture, plant-human interaction, and horticultural production systems. Presenters now include academic faculty, extension faculty, and industry representatives. The average enrollment from 2021 to 2025 was 155 students each semester. Starting in 2021, data was collected to measure student interest in the topics being presented by students' ranking topics from not interested to very interested. Top ranked topics involved experiential learning, hands-on activities or active class engagement. While topics of lesser interest are still considered necessary to meet course objectives, student interests and learning effectiveness can be incorporated into existing horticulture curriculum to keep content relevant to students and useful for recruitment.

Student-Led Discussions to Foster Students in In-Depth Learning in Advanced Horticultural Courses

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Lecture-based teaching methods focusing primarily on course content though valuable, often fall short in promoting active learning and critical thinking and have relatively less student engagement. Fostering deep and meaningful learning experiences has become essential in ever evolving and specialized fields like horticulture. One of the effective ways to achieve substantial student engagement is through student-led discussions. By placing students at the center of the discussion, this class activity will encourage a deeper understanding of concepts in horticulture. Hence, students-led discussion activity was incorporated in two advanced-level (3000-level) undergraduate courses; Hydroponics and soilless crop production and commercial vegetable production, taught in-person during the spring and fall semesters of 2024, respectively. Students were provided with a rubric for discussion leaders during the first week of classes. Key areas of grading such as understanding of the topic, preparation, engagement, communication, and time management. Each student was required to read the scientific paper, fact sheet, or relevant article provided by the instructor on the chosen topic and develop at least five discussion questions and lead a 15-minute discussion. Students selected a topic of interest within the course material by the second week to lead discussions. Students used Microsoft PowerPoint presentations to display their questions. Participation was mandatory, with each student expected to contribute at least once by offering insights or asking questions during the discussion about the reading material. However, many students participated several times, suggesting their interest in specific topics. In conclusion, having ownership over their learning and contributing to the shared knowledge in the classroom, allowed students to engage with their peers and promote critical thinking and active learning.

Using PlayPosit to Teach Calculations in an Asynchronous Online Plant Nutrition Course

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Quantitative exercises are rare but essential in horticulture education. For example, calculating fertilizer application rates is a common student learning outcome for plant nutrition courses. Teaching quantitative skills to horticulture students can present challenges, including student math anxiety, limited quantitative background, and lack of practice. These challenges are amplified in online courses, where students have less access to instructor feedback. Web tool PlayPosit can be used to incorporate interactive feedback in lecture videos for online courses. Here, I report on using PlayPosit in an asynchronous online plant nutrition course at the University of Florida. HOS6307 – Nutrition of Horticultural Crops is a graduate course that enrolls students in horticulture and related graduate programs. This course is taught using pre-recorded lectures that range between 8 and 45 minutes in duration. During the spring 2024 semester, PlayPosit was incorporated in three quantitative exercises where students learn to calculate fertilizer application rates for row crops, hydroponic crops, and fertigated crops. Four to six interactive activities were used per video. All feedback provided was formative, but PlayPosit can also be used for graded assignments. The impact of using PlayPosit on student learning outcomes and student experiences will be assessed in coming semesters.

Horticultural Career and Professional Development: A collaboration between curriculum and college and Offices of Career Connections to prepare students

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In the late 1990s a survey of Horticulture Department alumni and employers was conducted that led to several curricular changes among them being the development of a required internship experience, an internship capstone course, and a preparatory course in Horticultural Careers and Professional Development. The “careers” course is a one semester credit hour course taught in a seminar format with both classroom lectures and guest speakers. The class meets once weekly for 75 minutes. The course uses Blackboard as the learning management system. Content includes exploring horticultural careers, professional behaviors, personal branding, communication skills, and considerations for graduate school. Alumni speak about their career journeys from college to their current employment whether in or out of the career field. Partnerships have been established with the College and University Offices of Career Connections to incorporate discipline expertise in creating positive and professional social media presence, internship and job-hunting skills and resources, navigating career and trade fairs, writing cover letters, resumes and curricula vitae, interview skills, and small business and entrepreneurship skills. The partnerships have led to consistency in messaging for

communications, cover letters and resumes and have reduced workload of the horticultural instructor. Class evaluations showed student felt most appreciative of information on internships and job search strategies, cover letters, resumes and professional communications, financial literacy, and alumni presentations. Difficulties identified with the course are a lack of appreciation by students since it is not a horticultural-topic course, there is no strong supporting textbook, and it is difficult to have a course only once per week. Partnerships across campus have led to reduced workload for the primary instructor and consistency in information across campus, and increased use by students of campus resources. The course contributes to institutional strategic initiatives and goals for student success and career readiness.

Extension Section

Creating a Viticulture and Wine Science Professional Certificate

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The Texas A&M Viticulture & Enology Program developed a Viticulture and Wine Science Professional Certificate in 2024 to meet a growing demand for continuing education in grape and wine production. The Viticulture and Wine Science Certificates each consist of five courses that are delivered through online instruction. Students also have the option of choosing two or three hands-on courses for the Wine Science and Viticulture tracks, respectively. Courses include: VIT ENOL 100 You and the Texas Wine Grape Industry: Past, Present, and Future; VIT 101 Viticulture Basics for Viticulturists and Enologists; VIT 102 Getting Started: Vineyards from the Ground Up; VIT 103 Installing and Managing the Vineyard Through the Fourth Leaf; VIT 104 The Mature Vineyard; VIT 105 Viticulture Hands-on Component; ENOL 101 Enology Basics for Viticulturists and Enologists; ENOL 102 Wine Chemistry, ENOL 103 Wine Making; ENOL 104 Sensory Evaluation and Wine Faults: Causes, Prevention, and Treatments; ENOL 105 Winery Lab Procedures, Tests, Equipment Hands-On.

Creative Writing to Engage Consumer Audiences

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Reaching a range of audiences is a critical consideration in the evolving world of agriculture extension. This presentation highlighted principles and practices that can be employed to engage audiences of varying aptitudes and attitudes via extension writing and workshops. Delivering materials that are clear, concise, and entertaining can be accomplished through honing in on timely topics, actionable advice, and relatable references to help readers digest difficult topics. Integrating interests external to agriculture can further the reach of resources, allowing a wider array of individuals to engage with content. Examples in this presentation include excerpts from the award winning "Puns N' Roses" article series, which intertwines well-known songs and artists with ornamental horticulture tips and combining two distinct topics to help commit management practices to memory. Regional and seasonal activities, such as events, holidays and sports, can further serve as sources of inspiration for creative content generation. Beyond exploring how unrelated topics can be woven together, the use of a variety of writing elements has been shown to enhance knowledge retention. Alliterative applications add an appreciable asset to acquiring attention, and studies have shown that rhyming, puns, and wordplay can enhance retention. This presentation provided the framework for extension personnel to explore new methods of engaging audiences in outreach endeavors.

Getting the Best of Pests Webinars Meet Green Industry Needs and Bolster County Programming

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Continuing education is critical for professionals in the green industry and structural pest control sectors to maintain certification and stay informed on best practices.

The *Getting the Best of Pests* (GTBOP) webinar series, initiated in 2017, is a bi-monthly, CEU-granting program designed to provide accessible, high-quality training for commercial and private pesticide applicators. Delivered in a synchronous, computer-based format, GTBOP webinars have been recognized as face-to-face training by the Georgia Department of Agriculture, ensuring compliance with state requirements. Over an eight-year period (2017–2024), GTBOP hosted 48 webinars, serving 3,762 attendees and granting 5,247 CEUs across multiple states. Attendees included golf course managers, botanical gardens, municipal parks departments, and regulatory agencies such as the EPA and CDC. Additionally, the program generated over $37,000 in revenue while maintaining an average annual operational cost of approximately $10,300. To expand reach and accessibility, GTBOP introduced asynchronous, on-demand CEU programs, housed in the GREEN webinar archive. These recordings, available through county extension offices, support last-minute certification needs, structured county programming, and educational curricula. Future program developments include the launch of a structured certificate program, hybrid access models to increase industry engagement, and expanded marketing strategies. By Q4 2025, GTBOP aims to increase average attendance to 100+ participants per session and establish 3–5 specialized certification tracks from its webinar archives. GTBOP's innovative approach to professional education demonstrates the efficacy of hybrid learning models in horticulture and pest management, ensuring continued industry advancement through accessible, high-quality training.

Production of Carrot BBQ Sauce, From Harvest to Marketing; A Value-added Food Product from Surplus Produce

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Northwest Arkansas boasts dynamic farmers' markets, yet growers face challenges such as weather unpredictability, limited shelf life of produce, and difficulty selling imperfect produce. Addressing these issues, the University of Arkansas System Division of Agriculture (UA System) launched the Expanding Farmers' Opportunity in Northwest Arkansas program, funded by a three-year USDA-Agriculture Marketing Service grant. This initiative, a collaboration between the UA System Food Science Department, Brightwater: A Center for the Study of Food, and the UA Sam Walton College of Business, focuses on transforming surplus and imperfect produce into value-added, shelf-stable products. Key goals include reducing on-farm waste, supporting growers with product development and business strategies, and maximizing the use of existing food system infrastructure. In 2024, the project team collaborated with a farm in Rogers, Arkansas, that sells directly to customers at farmers' markets and incorporates its crops into award-winning dishes served at its restaurant. Since the farm has an issue with surplus carrots, a recipe for "Carrot BBQ Sauce" was developed. Then, 300 lbs. (136 kg) of surplus carrots were used to produce 500 jars of this sauce at the Arkansas Food Innovation Center. The production cost of the sauce was $2,505 with potential total sales of $4,000 (suggested retail price of $8 per 16 oz/453 g jar), highlighting the potential for local food processing to enhance farm profitability and sustainability. By demonstrating the economic and logistical benefits of food innovation, the program aims to strengthen the regional food system and offer a replicable model for other communities.

Improving Garden Production in Coastal Environments Using Raised Garden Beds

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Food insecurity is particularly prevalent in coastal areas where sodic soils can make it difficult to successfully produce home gardens that supplement dietary needs of low-income gardeners. The objective of this study was to evaluate raised bed substrate depth needed to successfully produce several ornamental and garden species not typically adapted to a coastal environment. Raised beds of 12", 17", and 32" depth filled with an amended substrate successfully increased tomato and Irish potato yields. Tomato fruit count, yield and plant biomass were also increased by at least 2.8-fold compared to growing in the indigenous soil. Similarly, Irish potato count and yield were increased by 2.4-fold and plant biomass by as much as 3.5 times. Basil and rosemary harvest was increased by at least 2.5 times greater than the control. Sunflower and

petunia count data was at least 3 times greater for 17” and 32” raised beds. Sweet potato ‘Murasaki’ yields were increased 2 to 3 times yield when grown in 17” and 32” raised beds. Basil and rosemary harvest was increased by at least 2.5 times greater than the control. Raised beds can provide a substantial cost savings and improved nutrition in diets of low-income families.

Performance of Olive (*Olea europaea* L.) Cultivars in Texas

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The modern interest in olive cultivation in Texas began in the 1990s. Many of the first orchards planted in the state failed due to poor cultivar selection or were planted too far north and quickly killed by freezes. For surviving orchards success was mostly elusive, as there were no Texas-based recommendations for suitable cultivars or management practices. Fruit yields were variable and low – no more than 4,500 kg/ha^{-1} – and damaging freezes and Cotton Root Rot disease (*Phymatotrichopsis omnivorum* (Duggar) Hennebert) threatened orchard survival. Growers began requesting assistance from Extension to provide an unbiased evaluation of the sustainability of this crop and to conduct studies aimed at answering basic agronomic questions regarding olive cultivation in Texas. Cultivar trials were established at 12 diverse locations across the state to identify productive cultivars and to evaluate the suitability of different regions/climates. Findings indicate that cultivars ‘Arbequina,’ ‘Aglandau,’ ‘Lecciana,’ ‘Picual,’ and ‘Chiquitita’ show the greatest freeze tolerance, while ‘Arbequina,’ ‘Koroneiki,’ ‘Oliana,’ ‘Arbosana,’ ‘Picual,’ and ‘Chiquitita’ show the greatest fruiting potential. It was also discovered that the area between San Antonio, Del Rio, and Laredo (southwest region of Texas) seems the most suitable for olive production due a lower frequency of damaging freezes and more consistent fruit production. Winter Storm Uri in February 2021 brought a major setback to the industry, causing the complete above-ground death of more than half of Texas’ olive orchards. Surveys indicate that 20% of growers decided to stop growing olives after the historic freeze event. Others replanted or rehabilitated orchards and interest in planting new orchards decreased only moderately. Observations made in grower orchards suggest that winter drought-stressed olive trees withstand freezing temperatures better than well-watered trees. In 2024 most Texas olive growers harvested fruit for the first time since 2020, bolstering waning morale. Extension research and outreach efforts provided a fair-minded presence and continuity that had been lacking in the evaluation of this experimental crop. Sharing the findings of this work has allowed current and prospective growers to make informed decisions regarding their investment in this unproven crop. Currently, olive production in Texas is likely not profitable and is recommended for home and hobby orchard plantings only.

Understanding the Needs of Horticultural and Specialty Crop Industry in Texas

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The horticultural sector is worth over $70B to Texas' economy. The producers of horticultural and specialty crops face several challenges due to extremes of weather conditions, socioeconomic factors and availability of labor. This research project aims to enhance the understanding of the needs of Texas horticultural and specialty crop producers by surveying 5000 of these producers and analyzing the data obtained from this survey. The data collection instrument consists of an 18-question survey that was developed in collaboration with the Texas Department of Agriculture and the Washington State University Social & Economic Sciences Research Center. This survey will gather data from participants concerning the types and dollar values of crops produced or planned to be produced in the future, the nature of their crop production operation, the methods used to sell their crops, and the degree to which their operation requires employees possessing a four-year degree in horticulture, among other areas of concern related to the Texas horticultural and specialty crop industry. Additionally, participants will have the option to provide input into the curriculum of a four-year degree in horticulture. Responses gathered from this survey will be used to inform the current and future producers of support programs offered by the Texas Department of Agriculture and also guide future modifications in undergraduate curriculum to prepare citizens with excellent skills for their professional growth in this sector.

Survey Assessment of Production Practices, Marketing Perspectives, Education,

Research, and Extension Needs of the Texas Pecan Industry

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Farm production of pecans in Texas evolved greatly in three decades (1950 to 1980) from an industry comprised largely of native tree groves to one predominated by planted orchards of improved cultivars. Orchard management strategies employed today resulted from collaborative exchange between land grant research and Extension entities, USDA-ARS, and the Texas Pecan Growers Association (formed in 1920). Post-Covid period concerns over USDA Census of Agriculture-reported acreage decline and decreased grower morale prompted a grant-funded investigation into grower practices, marketing strategies, and perceptions of industry sustainability. Two formal electronic quantitative surveys and one series of qualitative listening sessions were undertaken in 2023 and 2024 with a collective participation of 287 Texas pecan growers. Pecan production acreage represented in the town hall listening sessions, crop cycle survey, and industry perspectives survey was 13,200, 16,284, and 22,080 acres, respectively. Seventy percent of survey respondents were sole proprietors who own and manage their orchards themselves. A similar percentage (71%) are retirement age (61) and older. While a strong majority of growers (69%) expressed plans to continue growing pecans for at least the next four years, only 20% have a continuation plan aimed at keeping the land in pecans. The current pricing depression of the wholesale pecan market and rising land prices in Texas were cited as influencing factors that could cause further acreage decline in the state. “The economy”, “crop protection”, and “the pecan market” emerged as the greatest problems facing the industry. Participants identified “fertilizer”, “pest management” and “human nutrition of pecans” as the highest priority subjects for current research investment. Despite a high percent (77.5%) agreement that knowledge of how to grow pecans successfully is available, Texas pecan growers voiced a desire to know more about pecan growing (66% Agreement), have better understanding of certain topics (68%), and are interested in advanced grower training (61%). Growers utilize fellow growers, popular press/trade association publications, grower association conferences, the internet, and Extension specialists/university faculty (both inside and outside Texas) for assistance.

Using the Arkansas Quality Wine Program to Expand Consumer Knowledge on Wine Sensory and the Arkansas Grape and Wine Industry

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The grape and wine industry is a vital component of Arkansas’s agritourism and economy. However, its growth is challenged by variability in wine quality and limited consumer awareness of Arkansas wines. A project team from the University of Arkansas System Division of Agriculture received Arkansas Department of Agriculture Specialty Crop Block grants to establish the Arkansas Quality Wine (AQW) in 2020 and expand AQW in 2022. In 2021 and 2022, the impact of the AQW Program on quality of commercially produced Arkansas wines and consumers’ perception of wines was evaluated by implementing an online consumer survey, hosting annual AQW wine competitions for wines made in Arkansas with 90% Arkansas-grown grapes, analyzing sensory, composition, and color of select medal-earning wines from the competition, and hosting public outreach events across Arkansas. In 2020 and 2021, the online survey showed that 50% of respondents thought it was important to purchase locally-produced wines and 70% were likely to purchase an Arkansas-made wine, 75 wines were entered into the AQW competition with 75% of wines receiving medals, and through virtual workshops and wine education/tasting events, the AQW program reached over 1,200 individuals. In 2023 and 2024, the fourth and fifth annual wine competitions were held with 57 wines entered into the AQW competition with 93% of wines receiving medals. The wine competition was expanded to include any wine made in Arkansas and other fruits in addition to grapes. In 2023, a winemaking blog and factsheet was published and

grape and wine industry trainings and AQW tastings were delivered to 570 participants. In 2024, two virtual and eight in-person grape and wine industry trainings and AQW tastings were delivered to 364 participants. For 2025, a wine competition, a wine sensory factsheet, and more tasting events with sensory training are planned. The AQW program was launched to establish quality and sensory standards for commercial wines and increase consumer awareness of the Arkansas grape and wine industry, and the expansion of the program will continue with the final goal to have a self-sustainable AQW program.

Floriculture, Ornamentals and Turf Section

The Effect Substrate Packing Density and Particle Size has on Root Morphological Development

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Ornamental operations have heavily relied on soilless substrates to produce containerized crops since the 1950's. This is primarily due to the engineered substrate physiochemical and biological properties when compared to mineral soils (i.e., air:water storage balances and reduced pathogen pressures). In this time frame, most rootzone management research has heavily focused on shoot development, irrigation and fertilizer efficiency, or substrate physiochemical characteristics. Despite the root systems' critical importance and ultimate influence on plant quality, their development in soilless substrates is seldom studied beyond simple biomass measures. Two important substrate properties, packing density and particle size, can severely influence plant development as the former can result in result in non-uniformity of growth across greenhouse plants and the latter can modify nursery irrigation and fertility practices. However, little is known how the root system is influenced. With regards to substrate packing density, increasing packing density on a continuum from 0.08 g cm^{-3} (lightly tapping- no overhead compression) to 0.14 g cm^{-3} (heavy overhead compression), shoot growth was not significantly influenced. Numerically, petunias grown in mild overhead compressed substrates (0.12 g cm^{-3}) had greater flower count and a more 'compact' appearance; though, all plants were considered salable. Regarding root morphology, there were quadratic relationships with total root length, surface area, volume, and average root diameter, where roots were thinner as packing density increased. These greater root metrics were hypothesized to be due to increased root-substrate contact and decreased air-filled porosity to stimulate lateral and fine root development. Regarding bark particle size, plants grown in finer particle substrates contained longer root systems with more fine root length, also attributed to increasing substrate-root contact and stimulating growth. In all, these studies begin to highlight how manipulating soilless substrates can extend beyond augmenting substrate physiochemical properties, but rather engineering container root systems.

Influence of Stratification Treatments on Germination of *Acer skutchii* Seed from Seven Different Genotypes

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Acer skutchii (Mexico mountain sugar maple) is a deciduous maple species native to Guatemala and the states of Tamaulipas and Chiapas in Mexico. When grown in the U.S. the species has exhibited heat, drought and alkalinity tolerance, though this has been scarcely documented in the literature. Successful propagation of *A. skutchii* has been done by stem cuttings and seed, however, few results have been published. Reports of their fruiting structures (samaroid schizocarps), which are comprised of two winged achenes, often having one or both seed undeveloped or aborted are common. Objectives of the current research were to observe the influence of genotype on seed fill percentage and the influence of genotype and stratification treatment on germination percentage and rate of *A. skutchii* seed. Seed from seven genotypes (H1, H2, T1, T2, T3, T4 and T5) were randomly assigned to a stratification treatment (control, GA_3, 13 d, 26 d or 39 d cold stratification). On 13 Nov 2023, seed were sown 20 per container with three replicates of each treatment arranged in a CRD. Significant differences ($P \leq 0.001$) in the mean number of viable seed per schizocarp were observed among the seven genotypes, with T1 producing a mean of 1.74 and H1 and H2 producing 0.74 and 0.80, respectively. An interaction among genotype and

stratification treatment ($P \leq 0.001$) was observed for mean germination percentage. Seed from the genotype H2 that were cold stratified for 26 d germinated at 70% while most seed in the control and GA_3 treatments did not germinate or germinated at near 0%. Germination rates (d to initial germination and d to 50% germination) followed a similar significant pattern (P=0.0173 and 0.0253, respectively) as germination percentage, with the genotypes T1, T2 and H2 that had been stratified for at least 13 d germinating before other treatments and genotypes. A main effect of stratification treatment ($P \leq 0.001$) was significant for the measurement of d to final germination percentage with the cold stratification treatments yielding their maximum germination percentages 10 d before those in the control and GA_3 treatments. Overall, genetic differences were observed in seed fill percentages, germination percentages and germination rates. A short cold stratification treatment also increased the germination percentages and rates observed in this study.

Moving Beyond Peat: Extending Substrate Supply with Low-Input Materials

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Peatmoss has defined the expansion of specialty crops into soilless culture for more than sixty years. Peat has become one of the most critical resources for growing operations, ultimately serving as the primary substrate component used globally. This is due to its favorable physiochemical properties, relative availability, and optimal storage conditions for soilless operations. To ensure sustainability and continued applications, the harvest of peatmoss is becoming more strictly regulated. With growing demand for substrates, the next paradigm in soilless culture will require fabrication of new materials to extend the peat supply and ensure that the growing industry has satisfactory supplies of substrate materials. Thus, the industry must move beyond peat in order to maintain current expansion and progress. To accomplish this, researchers have evaluated many regionally available biomass materials, with efforts to identify ag-fibers that can be used in place of peat. Recent advancements with sugarcane bagasse and pine bark, two low input and relatively available materials, have shown promise of serving as peat reducers. The use of finely screened bark and aged sugarcane bagasse can offset peat in commercial mixes by 20% of the container volume with little production adjustments required. Research exploring the use of these materials in greenhouse floriculture has shown the potential for implementing these materials into production seamlessly, with opportunities for greater inclusion rates if growers are willing to adjust production practices slightly. However, further work is necessary to pinpoint the specific adjustments that need will allow these transitions.

Ecological Niche and Phenotypic Differences Among Two Alpine *Rhododendron* Species and Their Natural Hybrids in A Shared Landscape

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Species living in a shared environment face similar selective pressures and often evolve adaptive divergence to avoid competition. Quantifying ecological niche and phenotypic traits among sympatric species is crucial for understanding ecologically moderated biodiversity. We integrate ecological and phenotypic datasets to investigate the extent to which three sympatric alpine *Rhododendron* species in the mountainous southwest of China (parents: *Rhododendron delavayi* and *Rhododendron irroratum*; natural hybrid: *Rhododendron agastum*) differed in their adaptations to co-exist in a shared environment. We utilized principal component analysis, one-way analysis of variance, and niche-identity tests to summarize and compare environmental and phenotypic divergence. Leaf phenotypic traits related to structure, morphology, biomass, and physiology were analyzed, as they were key indicators of niche and phenotypic differences, crucial for the co-existence of sympatric *Rhododendron* species. We employed nested linear models, and phenotypic differentiation coefficients to assess inter- and intraspecific phenotypic variation. Pearson's correlation analysis and Mantel tests identified key environmental factors influencing leaf phenotypic variation. The results indicate that the three Rhododendron species exhibit different preferences for environmental factors such as annual mean temperature, temperature seasonality, annual precipitation, water vapor pressure, and soil organic matter. These distinct ecological preferences may represent specific ecological adaptations that facilitate their coexistence in sympatry. Leaf area, leaf length, leaf thickness, and leaf tissue density emerged as key indicators for distinguishing the leaf phenotypes of the three *Rhododendron* species. Elevation, temperature, and

precipitation-related factors are significantly correlated with leaf phenotypic variation. The observed ecological niche and phenotypic differences observed likely resulted either causal effects or indirect consequences of ecologically mediated changes. Our study offered novel insights into the mechanisms underlying evolutionary versatility and ecological success among sympatric species.

Petunia (*Petunia* x *hybrida*) Growth Characteristics in Response to a Novel Poultry-Derived Fertilizer

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Multiple manufacturing processes have been developed to reduce the negative effects of raw poultry litter application by altering the physical and chemical nature of the raw substrate into a more suitable plant nutrient product. This investigation focused on a novel aerobic digestion process utilizing Cleaned & Green's (C&G) proprietary method to extend the nutrient release time of fertilizer while eliminating potential pathogens. Chemical and physical characteristics were assessed on C&G fertilizer by conducting plant assays and physical testing. *Petunia* 'Supertunia Bubblegum' was grown in Auburn, AL, and Mobile, AL to evaluate plant growth responses using C&G, and a synthetic blend of fertilizer. Substrate pH and electrical conductivity (EC) were evaluated, and plant growth index, dry weight, and foliar analysis were recorded. Increasing rates of fertilizer application resulted in increased EC rates and decreased plant growth two weeks after planting. Auburn C&G electrical conductivity two weeks after planting was 0.33, 1.43, 3.18, and 5.20 $mS \cdot cm^{-1}$ for 0 kg N· m^{-3}, 0.44 kg N· m^{-3}, 0.89 kg N· m^{-3}, and 1.78 kg N· m^{-3}. Mobile plants followed a similar trend. Growth indices indicated the control group had the lowest biomass while C&G and the synthetic blend at 0.44 kg N· m^{-3} had the greatest biomass. Results of this study suggests C&G fertilizer acts as a quick-release fertilizer and potentially used as a starter charge in greenhouse containerized production without the environmental limitations imposed by raw poultry litter applications.

Sooty Mold Alterations in Photosynthesis and Leaf Chlorophyll in 'Natchez' Crepe Myrtle (*Lagerstroemia indica* × *fauriei* 'Natchez') Infested with Crepe Myrtle Bark Scale (*Acanthococcus lagerstroemiae*) Infestation.

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Crepe myrtle bark scale (CMBS) (*Acanthococcus lagerstroemiae*) is an important pest of crepe myrtle (CM), and infestation causes growth of sooty mold (SM), reduced flowering, and stunted growth. To assess the impact of sooty mold on photosynthesis, an experiment was conducted at the East Texas A&M University Crepe Myrtle Research Garden (CMRG) and a local crepe myrtle planting. The CMRG includes 24 'Natchez' crepe myrtle (*Lagerstroemia* × *fauriei* 'Natchez') divided equally across four blocks. The local planting included approximately 12 'Natchez' trees, all CMBS free. At the CMRG, six trees were selected, based on the presence of sooty mold covered leaves (SM) and new leaf growth free of sooty mold (New). Six trees were selected at the local planting with mature leaves, also sooty mold free (Mature). We used an LI-600 fluorometer/porometer to measure stomatal conductance (g_{sw}), leaf vapor pressure deficit (VPDleaf), quantum yield (ϕPSII), and electron transport rate (ETR) on five leaves from each tree, and an LI-6800 was used to measure net photosynthesis (A_{net}) on five leaves from each tree. A light response curve was measured on one leaf per tree. A SPAD meter was used to estimate leaf chlorophyll content. Across all trees, A_{net} was higher for both new (11.6 µmol m^{-2} s^{-1}) and mature leaves (10.1 µmol m^{-2} s^{-1}) when compared to SM leaves (6.9 µmol m^{-2} s^{-1}), and A_{net} increased at all light levels above 300 µmol m^{-2} s^{-1}. New leaves had lower SPAD readings (35.7), while Mature and SM leaves were higher, 51.3 and 54.0, respectively. Using the LI-600, ϕPSII was highest in SM leaves (0.66), followed by New (0.57), and lowest in mature (0.31). However, these values did not differ using the LI-6800. Photosynthetic efficiency and net production appear to be negatively affected by sooty mold, but we consider these results preliminary, and we will collect season-long observations in 2025.

Assessing Pre-Plant Root Modifications of Crape Myrtle (*Lagerstroemia indica x fauriei*

‘Natchez’) to Enhance Establishment in the Landscape

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Installing ornamental trees and shrubs in the landscape involves a range of practices to support successful establishment. Proper hole size, planting depth, and continuing care are common considerations with generally accepted practices; however, pre-planting modification of root systems is an area that has opinions and anecdotal beliefs as to what practices are best. Existing literature highlights the variability in treatment response between ornamental species, site and soil conditions, regions, and a host of other considerations. This project sought to contribute to the knowledge base by observing the effects of three common pre-plant root manipulation practices on the establishment of *Lagerstroemia indica x fauriei* ‘Natchez’ in the Louisiana landscape. Common practices were solicited from horticulture stakeholders and homeowners alike, where scoring the rootball with a knife, severing the base of the rootball with a shovel, and manually butterflying the roots represented common pre-planting root modifications of increasing effort levels. Research conducted at the LSU AgCenter Hammond Research station included observing the growth of 20 replicates (n=5 for each treatment listed above plus an unamended control treatment) from April of 2023 to October of 2024, measuring growth as a function of growth index (GI: average of perpendicular widths and height of the plant) and stem caliper (of the largest stem). Results indicated no significant differences in GI and nearly no differences in stem caliper between treatments. Destructive harvest and excavation of root systems provided a qualitative assessment of root morphology, where unamended root systems displayed signs of continued circling in the landscape. While all replicates were successful in establishment, more research into a wider array of taxa and/or soil types, as well as longer-term observations, must be considered.

Evaluating soil sensors and imaging systems to monitor container basil and sage growth under varied irrigation and fertilization schedules

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Soil sensor monitored substrate moisture and nutrient status, while imaging system detected plant canopy growth and RGB color changes. However, studies on the soil sensor and imaging system to monitor containerized plant growth and nutrient status are insufficient. A greenhouse study was conducted to test the effectiveness of using soil sensor and imaging system to monitor containerized basil and sage plant growth under different irrigation (0%, 20%, 40%, 60% and 80%) and fertilization (0%, 25%, 50%, 75%, and 100%) schedules. The results showed that increased irrigation significantly increased basil and sage growth index and biomass accumulation, while increased fertilization additionally increased plant chlorophyll contents (SPAD). Basil plant died after extremely low irrigation scheduling after 3 weeks, while sage can hold until 4 weeks. For both plants, 0% fertilization and 0% irrigation had the lowest growth index and canopy area throughout the experiment. 0% irrigation had the lowest RGB while 0% fertilization had the highest RGB at the end of the experiment. 0% fertilization and 80% irrigation had the lowest SPAD at the beginning of the experiment. Increasing irrigation and fertilization rates increased plant biomass. In conclusion, soil sensor and imaging system could detect different irrigation and fertilization schedule for containerized basil and plant growth.

A New Era for Ornamental Rhizome Perennial Peanut (*Arachis glabrata*).

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Perennial Peanut is an umbrella term used to describe a group of *Arachis* species used as a hay crop in tropical and subtropical climates. With a high protein content, drought tolerance/resistance depending on the species, and low disease and insect incidences, perennial peanut species produce high-quality hay. Perennial peanut has also been used an ornamental, especially as turf replacements and “utility grass” in right of ways, or street medians due to its attractive leaf color and shape, low maintenance needs, attractive flowers, and low mowing requirements (2-4 times a year). There are two species of perennial peanut, rhizome types (*A. glabrata*) and stoloniferous (*A. pintoi*).

Although both types fix nitrogen into the soil, attract pollinators, and have low disease and insect incidences, only rhizome types are drought resistant. 'EcoTurf' is the most common and popular ornamental cultivar of ornamental rhizome perennial peanut (ORPP) due to its short height (14 cm). The University of Florida Ornamental Perennial Peanut Breeding Program is releasing four new and improved ORPP varieties. These new varieties have been developed during the last 10 years, purified from single rhizome descend, and tested for uniformity, stability, and purity. UF-RP-89 has the largest flower size of any available variety of ORPP in the market; Orange flowers and 9-10 cm height. UF-RP-23 has a long flowering period; Orange-yellow flowers and 9-10 cm height. UF-RP-90 has lustrous leaves; the only ORPP variety with yellow flowers in the market and 10-11 cm height. And UF-RP-01 has Dense and compact growing habit; orange flowers, 9-10 cm height. The new varieties will be trial in the southeast US for ornamental performance.

Kansas Homeowner Preferences for Naturalistic Landscape Styles

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Residential lawns cover a large portion of managed landscapes in the United States. Some consumers consider traditional manicured lawns resource-intensive, requiring water, fertilizer, pesticides, and maintenance using carbon-emitting equipment. Traditional lawns (composed of one turfgrass species only, free from weeds and pests, continuously green, and mowed regularly to an even height) may contribute to reduced wildlife habitat and lack of biodiversity. Naturalistic landscapes, characterized by mixed grasses and other herbaceous species allowed to grow and assume natural forms/habits, are alternatives to traditional lawns. However, there is resistance to the widespread adoption of naturalistic landscapes. The objective of this study was to understand consumer perceptions of and barriers to the adoption of naturalistic landscapes in Kansas. An online survey tool (Qualtrics, Seattle, WA; Kansas State University IRB-12036) was distributed through the Horticulture e-newsletter, Extension Master Gardener volunteers, and county-based Extension networks (n=~5,000) and was open from Feb 12 to Mar 4, 2024 (21 days). There were 240 complete responses. Participant demographics largely matched those of the state of Kansas and gardening consumers. Respondents were presented with artificial intelligence-created images (Adobe Firefly, Adobe, San Jose, CA) of a home with different variables in the landscape manipulated and asked to select their preferred option. Lawns exhibiting a full extent of planting, no buffer edge, a mix of color and planting groups, and a medium growing height were most preferred. Regarding consumers who did not have naturalistic lawns, the most significant deterring factors and challenges came from installation and establishment challenges, while the most attractive factors were the possibility of increasing pollinator populations and conserving water. Consumers who had installed naturalistic lawns found managing aesthetics with expectations the most difficult challenge and discovered an increase in wildlife to be a positive benefit. Opportunities exist for landscape contractors to help consumers with installation and maintenance, educate homeowner associations, remove invasive species, and provide design services.

Effects of Nursery Container Color and Fertilizer Rates on Growth of *Cestrum corymbosum*

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White containers have been well studied and identified as a potential solution to reduce root zone temperatures in container nursery production. However, the added expense of white containers may be a barrier to adoption. As the primary release mechanism of controlled release fertilizer is temperature dependent, questions have arisen about whether white containers could produce fertilizer savings by reducing root zone temperatures and offset the increased cost of white containers. To investigate this, a trial was conducted to compare the growth of *Cestrum corymbose* 'WNCESCORYEL' USPP 35,457 when grown in black or white containers with varying fertilizer rates. The study was of factorial design with two container colors (black and white) and five fertilizer rates using a 6-month controlled-release fertilizer. These rates included 3.0, 4.5, 5.8, 7, and 8.3 kg/m^3 representing the label rates of low, medium, and high (4.5, 5.8, and 7 kg/m^3, respectively) and

two additional rates representing one increment below low (extra low) and one below high (extra high). For shoot dry weight, a significant interaction between container color and fertilizer rate was observed. White containers produced greater shoot dry weight than black containers with equivalent fertilizer rates. Notably, white containers using the low rate of fertilizer produced plants that were statistically the same in dry weight and growth index as both the medium and high fertilizer rates in black containers, indicating a potential fertilizer savings of 19 to 33%, respectively. White containers reduced time root zones were exposed to temperatures over 35ºC by 28% and over 40ºC by 80% when compared to black containers.

Fruit Crops Section

Regional Survey Recommends Amendments to Southeastern Blackberry Leaf Tissue Nutrient Sufficiency Ranges

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Leaf tissue nutrient sufficiency ranges are a critical tool for growers to make informed decisions around fertility management in many crops. Current southeastern blackberry leaf tissue nutrient sufficiency ranges are not based on a region wide study and have instead been adapted from ranges used in other regions. An additional limitation is that blackberry leaf tissue nutrient sufficiency ranges have only been established for post-harvest samples collected from primocane leaves. This timing does not allow growers to make in-season fertilizer adjustments based on leaf tissue nutrient status. The objectives of this study were to 1) verify nutrient sufficiency ranges for southeastern blackberries through a region wide leaf tissue nutrient survey, 2) investigate leaf tissue nutrient content throughout the season and across physiological stage. To accomplish this, leaf tissue nutrient samples were collected across seven states (Alabama, Arkansas, Georgia, Mississippi, North Carolina, Tennessee, and Virginia) during the 2022 and 2023 seasons. Samples were collected from floricanes at five physiological stages (floricane bloom, primocanes at 15.24 cm, floricane small green fruit, floricane peak harvest, and post-harvest) and primocanes were sampled at four of these physiological stages, excluding floricane bloom. This study found that post-harvest leaf tissue nitrogen (N) in the southeastern United States had a median concentration of 2.18 % with a standard deviation of 0.39 %, which falls slightly below the current N leaf tissue range of 2.5 – 3.5 % recommended for the region in the Southeastern Caneberry Guide. The current recommendation for post-harvest sampling is due to previous literature which observed more nutrient stability at that stage, however in our study variation in leaf tissue nutrient was comparable at other physiological stages for N including, floricane bloom (0.39 % SD) and floricane peak harvest (0.37 % SD). Similar observations for other key plant essential nutrients in primocane leaf tissue, where in-season physiological stages had similar or smaller variation as measured by standard deviation than the post-harvest stage. Floricane leaf tissue N had significant physiological stage by year and location by year interactions where primocanes did not. The findings of this study imply that existing sufficiency ranges should be updated and new in-season primocane leaf tissue nutrient sufficiency ranges can be developed. Results of this study support previous literature that floricane leaf tissue nutrient concentrations were more variable than primocanes. Thus, it is still not recommended to sample leaf tissue nutrients from the floricane.

Preliminary Evaluation of Two Cutting Propagation Methods of Eight Elderberry Cultivars

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In a preliminary study, dormant hardwood cuttings of eight cultivars of elderberry (*Sambucus canadensis*) were tested in two propagation systems with or without rooting

hormone. The eight cultivars were: Adams (A), Ash Grove (ASH), Bob Gordon (BG), East Grove (EG) , Pocahontas (P), Ranch (R) , Wyldewood (W) , and York (Y). The two propagation systems were Ellepot or Tree Pot propagation systems. The two hormone treatments were an untreated control or a basal dip in Hormodin powder (0.8% IBA). The experiment was designed as an 8x2x2 factorial with 5 replicate plants of the factorial treatments. Plant material was received from a commercial nursery in March, and plants were put into the propagation test in May 2024. The experiment was terminated after 70 days. Plant performance was measured with percentage of cuttings rooted, number or emerging shoots, and length of the most terminal or longest emerging shoot. There were no interactions among the factors and only main effects are reported. There were differences in stem diameters among cultivars at the initiation of the study with EG and W having the largest propagule stem diameters and BG Gordon being significantly smaller. Rooting percentage varied with cultivar with EG and ASH having the highest percentage and BG Gordon and Y significantly lower rooting. Rooted cuttings of EG produced the longest new shoots while A and AG had the shortest shoots. There was no difference in rooting percentage between propagation systems due to significant variation, but cuttings in Ellepots produced 15% higher rooting percentage, and significantly longer shoots. Visually, Ellepots produced roots vertically throughout the system while plants rooted in Tree Pots produce mostly basal roots. IBA, at 0.8%, significantly reduced rooting and the length of resulting shoots. Across all cultivars and treatments, there was a positive relationship (R^2=8.1) between rooting and propagation stem diameter implying that basal sections may root more readily although there was not a strong relationship between emerging shoot length and stem diameter due to significant variation.

Golden Kiwifruit in Texas (*Actinidia chinensis* Planch.): Conclusions and Outlook from a Decade of Research

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Several studies were conducted to explore the adaptation and feasibility of golden kiwifruit (*Actinidia chinensis*) production in Texas. In the case of two-year-old field-grown kiwifruit plants in active growth to an early autumn frost event (-4.1 °C) in 2018, green (*A. deliciosa*) plants sustained greater overall damage (P = 0.002), compared to *A. chinensis.* A study of freeze injury in 2021 (-19.1 °C) to dormant four-year-old plants showed a similar trend, with seedlings of *A. deliciosa* 'Hayward' exhibiting 3.46 times greater vascular injury (P = 0.008) and lateral bud mortality (P = 0.03) than to *A. chinensis* Zespri Gold™ seedlings. In response, six different trunk protection materials were studied to guard against cold injury on four-year-old *A. deliciosa* seedling vines in the winters of 2019/'20 and 2020/'21, including polyurethane wrap; tubular foam pipe insulation; pine bark; pine shavings; pine straw; hay. Pine bark showed the greatest air temperature margin (9.4°C), relative to ambient (P < 0.001), although no materials effectively reduced trunk injury over the control. In another study during 2017-2019, dormant fruiting canes of two cultivars were exposed to either continuous chilling (CC) at weekly increments or weekly chilling (7/4 °C) interrupted by three-day periods of warm temperature (WT) conditions (25/17 °C) at weekly increments. For *A. chinensis* 'AU Golden Dragon', WT did not result in reduced floral response, whereas negation of winter chilling by intermittent warm temperatures was evident in *A. deliciosa* 'AU Fitzgerald' with reduced flowering with WT over CC at 5 weeks of chilling over the 2 years (P = 0.05). Finally, the effects of contrasting soil pH (5.2 and 7.6) were studied 2018-2019 in young field-grown plants. Mean chlorosis index was approximately 400% greater at the alkaline soil site in 2019. Leaf tissue concentrations of iron and manganese were 37.1% and 113.8% higher, respectively, over both years at the acid soil site. At the alkaline soil site, *A. chinensis* plants were smaller and exhibited 74.8% greater chlorosis (P = 0.01) than *A. deliciosa*, with symptoms strongly associated with deficiencies in iron, manganese, and copper. As a result, golden kiwifruit should only be considered for small-scale production in Texas at this time, and primarily in the eastern part of the state.

New Clues to Solving the Peach Bronzing Puzzle

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Bronzing is a disorder in the form of brown or discolored, irregular-shaped patches on the peach exocarp. Previous experiments carried out at Clemson University led us to

conclude that bronzing is not caused by pathogens, insect pests, pollution or external contaminants, and that it starts in the field (pre-harvest) even though it is more visible at postharvest. We hypothesized that transient nutrient imbalances coupled with high transpiration demands could cause bronzing. In this study, we i) evaluated the efficacy of foliar applications of an antitranspirant before harvest, ii) assessed the role of relative humidity at harvest, and iii) studied the influence of soil nutrition on the incidence and severity of bronzing. Our results showed i) the antitranspirant we used did not reduce the incidence or severity of bronzing; ii) rainfall before harvest was not needed for bronzing development but there were conditions inducing high transpiration demands at harvest when most bronzing was found; and; iii) orchards with balanced soil nutrition had reduced bronzing incidence and severity.

Genomic Characterization of Mutation-Bred Pears by Long-Read Sequencing

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European pear (*Pyrus communis*) cultivation in the Eastern United States, despite its historic prominence, has been reduced to a vanishingly small proportion of national production. This decline is a response to unresolved issues in pear cultivation: poor tolerance to pests and pathogens in most growing regions, high chilling hour requirements, a lack of vigor controlling rootstock, and ripening characteristics which frustrate effective postharvest management. The most common cultivars in the United States, ‘Bartlett’ and ‘d’Anjou’, were developed in the 18th and 19th Centuries, respectively, underlining the relatively unimproved state of pear genetic resources and pear cultivation. In order to create a competitive pear industry, superior cultivars for commercial production must be developed. Genetic improvement of clonally propagated tree fruit species is often limited by existing breeding stock, and existing pear genetic diversity is notably lacking in traits relevant to improved tree architecture and postharvest management. Mutation breeding, an approach which uses exogenous mutagens such as ionizing radiation to rapidly generate genetic diversity, is one approach which can overcome this limitation on pear genetic improvement. Gamma-irradiated pollen from four commercially relevant pear cultivars (Bartlett’, ‘d’Anjou’, ‘Comice’, and ‘Abate Fetel’) were used for crosses, and a total of 800 seeds were produced. From these seeds, a total of 37 lines germinated and survived, including multiple potential self-crosses in this otherwise self-incompatible species. In order to assess putative mutations and structural variation, all existing lines are undergoing nanopore long-read sequencing to generate whole genome assemblies. So far, 6 draft assemblies have been generated allowing for identification of structural variation and several lines are being micropropagated providing a resource for future trials of these lines across Texas.

Influence of High Tunnel Cultivation on Early-Ripening Blueberry Cultivar Performance in Central Alabama.

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This three-year study was designed to evaluate the performance of early-ripening blueberry cultivars in high tunnel and open field conditions in central Alabama. Thirteen southern highbush (*Vaccinium corymbosum* hybrids) cultivars and 2 rabbiteye (*V. virgatum*) cultivars were established in a randomized complete block design (n = 8) inside a high tunnel and in adjacent open field in 2022 March. Maximum air temperatures were greater in high tunnel compared to field, however, minimum temperatures were similar in high tunnel compared to field during freeze events. Propane heaters were used to enhance frost protection inside high tunnel during spring freeze events in 2023 March. Plant canopy volume was greater in field for year 1 (2022), but plant canopy volume was greater in high tunnel by the end of year 2 (2023). High tunnel conditions did expedite bloom and ripening for most cultivars. Though much less severe in high tunnel, in conjunction with propane heaters, spring frost injury was realized under both field and high tunnel conditions and later blooming cultivars tended to have greater yields in 1st year of harvest (2023). Yield and berry size were greater due to high tunnel even in the absence of a spring frost event in 2024.

Seed Nanopriming with Copper (Cu) Enhances Yield, Quality, and Potential Health-Promoting Attributes in Tomato Fruit

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Seed nanopriming is an emerging agricultural technology that uses nanoscale particles (25–100 nm), including essential metals and minerals, to enhance seed germination, growth, yield, and resistance to biotic and abiotic stresses by stimulating secondary metabolite biosynthesis and promoting plant health. Nanoparticles (NPs) of essential micronutrients, specifically copper (Cu), can be effective seed priming agents. Cu is essential for several metabolism-regulating enzymes, which act as a key prosthetic group in their structure, but their efficacy in crop production and postharvest quality attributes remains largely unexplored. This study investigates the effects of Cu-NPs on the production of tomatoes (*Solanum lycopersicum*), an economically vital crop worldwide. Cu-NPs were synthesized using copper sulfate and onion peel extract as green reducing agents and used to prime seeds of two Texas A&M-developed tomato varieties, TAM-C3 and TAM-C11. The analysis included germination percentage, seedling growth, yield, and bioactive profiling of health-promoting compounds, including vitamin C (AsA), β-carotene, lycopene, and amino acids (AA). Cu-NP seed priming significantly improved seed germination, shoot and root growth, and overall yield, with a 30% higher yield than controls in both tomato cultivars. Cu-NPs priming also increased AsA levels by 1.6 times, enhancing the fruit's antioxidant content and nutritional value. It positively impacted AA profiles, increasing glutamic acid, aspartic acid, and branched-chain AAs, which are key to flavor development and volatile biosynthesis. Elevated proline, histidine, serine, glycine, and threonine levels indicated delayed senescence, prolonged shelf-life, and improved stress tolerance. Additionally, Cu-NPs treatment enhanced carotenoid levels, with lycopene levels 2.2-fold higher in TAM-C3 and 1.3-fold in TAM-C11, while β-carotene levels increased by 1.4-fold in TAM-C11. Asa, lycopene, and β-carotene increase suggest that Cu-NP priming could deliver tomatoes with higher nutritional value and health benefits. This work was partially supported by USDA-NIFA-2024-51181-43464, USDA-NIFA-AFRI 2023-67013-39616 through the Vegetable and Fruit Improvement Center and Institute for Advancing Health Through Agriculture of the Texas A&M University.

Rock and A Hard Place: The Challenges Confronting the West Texas Pecan Industry

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The pecan industry and other fruit and nut crops are vital to West Texas, contributing significantly to the region's economy and cultural heritage. Pecans, in particular, are deeply rooted in the area's history, with Texas being a leader in U.S. pecan production generating millions of dollars annually. However, growers face numerous challenges that threaten the sustainability of these crops. Water availability is one of the most critical issues for West Texas growers. Limited rainfall and declining soil moisture levels hinder tree hydration, leading to heat stress, which damages cell membranes, disrupts metabolic processes, and reduces crop yields. Soil conditions, such as high pH and poor drainage, further complicate water uptake, while nutrient deficiencies, like zinc in pecans, limit tree growth. Additionally, water quality issues such as salinity can hinder tree health and productivity. Heat stress exacerbates these problems, as prolonged high temperatures can reduce nut yields and quality, and particularly damages critical growth stages like pollination and flowering, affecting pollen viability and water-stage fruit split in pecans, leading to nut abortion. Pests, such as aphids, are persistent threats to pecan orchards, damaging leaves and nuts, reducing yields and necessitating costly pest management strategies. Diseases like bacterial leaf scorch and cotton root rot add another layer of complexity. Effective pest and disease management is critical but challenging due to the high variability in pest populations and environmental conditions. While West Texas nut and fruit tree growers play a crucial role in the agricultural economy, they must navigate through these pressures. Addressing these challenges through sustainable practices and innovative solutions is essential for the future of this vital industry.

Introducing a New Research Program: Advancing Sustainability and Quality in Grapes and Other Tree Crops for Texas and Beyond

Lorenzo Rossi

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This research program at Texas A&M University aims to enhance the sustainability and productivity of Texas horticulture by applying plant physiology to address key production challenges. With a focus on high-value crops like grapes, citrus, and other fruit trees, the research program explores how environmental stressors - such as drought, heat, cold, and varying soil conditions – affect plant growth, fruit quality, and overall yield. By studying the physiological responses of plants to these stresses, the program seeks to develop strategies that optimize water and nutrient use, improve soil management, and enhance rootstock and cultivar selection. Field and laboratory studies will investigate how to increase crop resilience through better understanding of the interactions between roots, shoots, and fruits, as well as how to mitigate stress impacts on production. The research program's outputs will directly benefit Texas growers by providing practical recommendations for improving crop quality and sustainability in diverse climates and soils. Collaborative efforts with colleagues at Texas A&M, Texas Tech, and institutions nationwide will enhance the program's ability to deliver practical, science-based solutions to Texas growers, improving crop quality and sustainability across the state's varied climates and soils. Additionally, the laboratory provides hands-on research opportunities for undergraduate and graduate students, fostering the next generation of horticultural scientists. Through industry collaborations, the program will support the long-term success of Texas and American agriculture, helping to ensure a sustainable future for horticultural production.

Evaluating Heat and Drought Stress in Wine Grapes in Texas

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The Texas wine industry has experienced significant growth over the past decade but faces increasing challenges due to extreme heat and drought. These abiotic stressors negatively impact grapevine physiology, leading to reduced yield, compromised fruit quality, and economic losses for growers. To address these challenges, this study synthesizes data from prior research to assess the anticipated physiological and genetic responses of four widely cultivated wine grape cultivars Chardonnay, Riesling, Pinot Noir, and Tempranillo under heat and drought stress conditions. Previous studies have evaluated vine stress using controlled drought treatments, nitrogen application, and a combination of both. The effects of these treatments were assessed through vine water status measurements, carbon isotope composition, and gene expression analysis via RNA sequencing. At harvest, fruit composition parameters, including soluble solids, pH, titratable acidity, and phenolics, were analyzed to determine potential cultivar-specific adaptations. Findings from prior research suggest that heat stress induces greater transcriptomic changes than drought stress, affecting key metabolic pathways related to carbohydrate metabolism, oxidative stress response, and mitochondrial energy production. Riesling demonstrated a heightened sensitivity to drought stress compared to Cabernet Sauvignon, highlighting the importance of cultivar selection in mitigating climate-related stressors. By integrating existing research, this study aims to provide a framework for future vineyard management strategies tailored to the Texas climate. Identifying physiological and genetic markers associated with drought and heat tolerance will inform breeding programs and management practices to enhance sustainability. These insights will contribute to optimizing resource use, improving stress resilience, and ensuring the long-term viability of Texas vineyards in an era of climate change.

Preliminary Investigation of Parboiled Rice Hull Mulch as a Weed Barrier in Containerized Blueberries

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Container-grown highbush blueberries (*Vaccinium* sp.) are a scale-neutral production system that could be adopted by commercial growers, school gardens, or even home gardeners. Unlike the green industry and ornamental plants which are moved and sold on a schedule of weeks or months, container blueberries can remain in place and produce a viable crop for years. Thus, is interest in investigating the utility and persistence of mulches for weed suppression in container blueberry systems. Parboiled hull (PBH) product is a high-quality, processed rice hull product that is widely used for weed suppression in nursery plants. It is desirable because it is low density, OMRI-approved, and has proven effective for suppressing weeds. This study was designed to assess the performance of PBH in containerized blueberries. Plants for this experiment were blueberries (var. 'Duke') were planted in

Fall 2021. Blueberries were planted into 25 gallon containers using a substrate mix of 60% pine bark and 40% peat moss. Treatments were applied to a single container (i.e. experimental unit) and included PBH mulch at 1-inch depth, 2-inch depth or no mulch (weedy check). Treatments were replicated four times and arranged in a randomized complete block design. All containers were hand weeded on May 9, 2024 just prior to applying mulch treatments. Visual ratings of weed suppression and weed counts were conducted weekly for 8 weeks after treatment (WAT). Weed suppression, visually assessed relative to the weedy checks, detected no statistical difference between 1-inch or 2-inch PBH treatments, which suppressed ≥86% and ≥95% of weeds, respectively. Fewer grass and broadleaf weeds were detected in PBH containers, relative to containers with no mulch. These findings indicate PBH product is a suitable short-term mulch material. However, it is not clear whether the PBH material would persist over time and continues to suppress weeds in future growing seasons.

Survey of Northwest Arkansas Specialty Crop Growers' Soil Health Perceptions and Practices

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A survey of 34 specialty crop growers in four Northwest Arkansas counties (Benton, Carroll, Madison, and Washington) found that specialty crop growers are interested in learning more about soil health, believe healthy soils can increase yields, and are taking steps to improve their soil health since soil samples were taken in 2022. The majority of growers have ≤ 5 acres in production (79%) and have been farming for ≤ 10 years (64%). Although their operations are relatively small, the majority of surveyed growers (77%) report growing crops in multiple categories including fruiting vegetables (76%), leafy greens (62%), berries (59%), herbs/greens (59%), cut flowers (41%), and perennial tree fruit (41%). Approximately half of the growers use farming as their primary source of income/occupation (47%) and many producers are selling in multiple markets including farmer's markets (59%), farm stands (44%), food conservancy (41%), community supported agriculture (29%), and U-pick (21%). Cover cropping and crop rotation were not universally adopted among participants. Some growers report planting the same annual crops at the same site year after year (21%) and not planting cover crops between annual crops (35%) due to limited time, space, funding, experience, or difficulties with infrastructure already in place at their operations. Growers report that soil microbial communities are very important for their farm's productivity (76%) and 55% of growers report using beneficial soil inoculants or practices aimed at promoting beneficial microbes, however over a third (35%) do not know the status of soil-borne diseases on their farm. Additional soil health education would benefit Northwest Arkansas-based specialty crop growers, as well as encouraging annual soil tests.

Impact of Different Strains of *Lachancea thermotolerans* Yeast on Acids and Sugars during Wine Fermentation of Arkansas-Grown Chambourcin Grapes.

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Wine is typically produced using *Saccharomyces* yeasts due to their strong fermentation capabilities, ensuring successful fermentation. However, there is increased interest in using non-*Saccharomyces* yeasts to enhance wine complexity, particularly acidity. Since grape acidity, which directly impacts wine quality, varies by region due to climate, non-*Saccharomyces* yeasts, such as *Lachancea thermotolerans*, offer a natural way to modify acidity and other attributes during fermentation. Investigating experimental non-*Saccharomyces* strains alongside commercial strains is key to understanding their effects on wine quality, thus providing winemakers with more fermentation options. In 2023, 252 kg of Arkansas-grown Chambourcin (*Vitis* hybrid) grapes were hand-harvested, randomized into batches, crushed, and destemmed. Five inoculation treatments, each in duplicate, were conducted using *Saccharomyces cerevisiae* (SC), a commercial strain (LAK), and an experimental strain (LT_1) of *L. thermotolerans*. Except for the SC treatment, the *L. thermotolerans* treatments received sequential *S. cerevisiae* inoculations after 24 and 48 hours. At harvest, the grapes had 20.4% soluble solids, pH of 3.77, and 0.61% titratable acidity. Fermentations were conducted at 21°C, with all treatments completing alcoholic fermentation by day 6 (°Brix < 0), though SC wines finished fastest by day 3. By day 4, all wine treatments with *L. thermotolerans* had pH values ranging 3.65–3.70, averaging 3% lower than SC wines (3.79). On day 5, the LT_1-SC-48 wines had 41% higher titratable acidity

(0.84%) compared to SC wines (0.60%). At bottling, pH was highest in SC (4.00) wines compared to most other treatments (3.82-3.87 pH). Lactic acid and total organic acids were highest in LT_1-SC-48 and LT_2-SC-48 wines (0.43–0.46% lactic acid and 0.91–0.92% total organic acids) compared to SC wines (0.25% lactic acid and 0.72% total organic acids). Mixed inoculation with *L. thermotolerans* and *S. cerevisiae* produced Chambourcin wines with lower pH and higher titratable acidity, lactic acid, and total organic acids. Using *L. thermotolerans* offers an alternative fermentation technique to naturally increase acidity and lower pH, thereby addressing challenges faced in warm-climate regions like Arkansas.

Influence of High Tunnel Cultivation on Early-Ripening Bluebery Cultivar Performance in Central Alabama.

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This three-year study was designed to evaluate the performance of early-ripening blueberry cultivars in high tunnel and open field conditions in central Alabama. Thirteen southern highbush (*Vaccinium corymbosum* hybrids) cultivars and 2 rabbiteye (*V. virgatum*) cultivars were established in a randomized complete block design (n = 8) inside a high tunnel and in adjacent open field in 2022 March. Maximum air temperatures were greater in high tunnel compared to field, however, minimum temperatures were similar in high tunnel compared to field during freeze events. Propane heaters were used to enhance frost protection inside high tunnel during spring freeze events in 2023 March. Plant canopy volume was greater in field for year 1 (2022), but plant canopy volume was greater in high tunnel by the end of year 2 (2023). High tunnel conditions did expedite bloom and ripening for most cultivars. Though much less severe in high tunnel, in conjunction with propane heaters, spring frost injury was realized under both field and high tunnel conditions and later blooming cultivars tended to have greater yields in 1st year of harvest (2023). Yield and berry size were greater due to high tunnel even in the absence of a spring frost event in 2024.

An Update on Pawpaw (*Asimina triloba*) Production in the Southeastern Region of the United States

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The North American pawpaw [*Asimina triloba* (L.) Dunal] is a native tree-fruit that is in the early stages of commercial production. The native range of the pawpaw includes the entire Southern Region of the United States. Pawpaw fruit have fresh market appeal for farmers markets and organic markets, as well as processing potential for frozen pulp production. Commercial products produced in the region include pawpaw jam, beer, wine, and brandy. The recently released 2022 Census of Agriculture was the first census to list pawpaw as a reporting option on the survey. The objectives of the study were to 1) examine the 2022 census data to determine the current size of the pawpaw grower base in the Southern Region of the United States and 2) present an update on pawpaw research at Kentucky State University (KSU). An examination of the Ag Census data from the states of the Southern Region showed pawpaw growers in each state. There were between 2 to 28 pawpaw farms in each of the states of South Carolina, Georgia, Arkansas, Mississippi, Florida, Oklahoma, Alabama, Texas, and Louisiana. However, there were between 62 and 97 farms in North Carolina, Kentucky, West Virginia, Virginia, and Tennessee. This data suggests a lower adoption rate by farmers for growing pawpaw in the more southern states in the region. Recent research at KSU has demonstrated that most commercially available pawpaw cultivars only require between 600 to 700 chilling hours and can be grown in most southern states. Additionally, it has been found that flies and lady beetles are important potential pollinators of pawpaw flowers and that at least three pawpaw cultivars should be included in plantings to enhance fruit set due to low selfing rates.

A Non-Buffered UPLC-FLD Gradient Method for Identifying GABA and Essential Amino Acids in Tomatoes

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Food analytics demands precise chromatographic conditions for both qualitative and quantitative phytonutrient analysis. To ensure the comparable separation of metabolites, phytonutrients from certain chemical groups require modified chromatographic settings, which include mobile phase composition, pH levels, column type and size, temperature, absorbance/emission wavelength and a properly designed gradient combination. In this study, a precise ultra-high performance liquid chromatography (UPLC) approach paired with a fluorescence detector (FLD) was developed to quantify 20 essential amino acids and gamma-aminobutyric acid (GABA) using a non-ionic solution as the mobile phase. Buffers have traditionally been utilized for the chromatographic separation of amino acids; however, excessive usage can result in system precipitation and salt production, clogging the column, pump, and injection lines. Furthermore, buffers might induce pH drift due to the high pressure and temperature used in amino acid separation. The current optimized chromatographic conditions address these constraints by providing efficient amino acid separations and quantification under our optimized UPLC conditions. 0.1-0.4% formic acid in water (A) and triethyl amine in acetonitrile (B) were evaluated, with 0.2% performing best in both mobile phase conditions. The greatest separation was seen at 45°C, comprising a temperature range of 25-55°C. The modified gradient did not significantly affect by the injection volume, but 5 µL remained consistent across all situations. FLD excited wavelengths were evaluated at 250-400 nm, using 550 nm as the uniform emission wavelength, and 360 nm was determined to have the greatest detection and peak intensity. Gradient began at a greater level of A (90%), gradually dropped until the 20th minute, and then returned to the starting gradient conditions. Peak tailing occurs at a flow rate of 0.5 mL/min, whereas clear and distinct peaks appear at 1.0 mL/min. Throughout the optimization procedure, pressure was maintained at 1300 psi evenly. All calibration regression R^2 values range between 0.97 to 1.0, demonstrating the method's repeatability and accuracy. Finally, real samples were examined for quantification, and 18 compounds were identified in the detectable range with a larger area under the curve and a 0.01-0.05 change in retention time.

Effects of intermittent warm temperature exposure on progression of chill accumulation during peach floral bud dormancy

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Dormancy is an important strategy in perennial plants such as the tree fruit peach (*Prunus persica*), to protect them from damage during harsh environmental conditions such as winter weather. As day length and temperature decrease in the fall, floral and vegetative buds enter a state of endodormancy where they remain unresponsive to growth promoting environmental signals (Nilsson, 2022). Exposure to cold temperatures (typically ≤ 7° C) during the winter allows for chill accumulation and upon sufficient such chill accumulation, release from endodormancy occurs. This is followed by exposure to warmer temperatures in the spring leading to the end of eco-dormancy and bud break. In the field, low winter temperatures are often interspersed with periods of substantially warm weather thereby interrupting or negating the progression of chill accumulation and affecting bud break in the spring. Understanding responses of peach buds to intermittent warm temperature exposure is needed to mitigate crop loss due to temperature fluctuations. Experiments were conducted to determine the effects of such intermittent warm temperature exposure on chill accumulation in ‘Contender’ peach. Potted trees were maintained at ambient conditions in the field until around 50% of chill requirements (100 % = 1050 chill hours) were met. Following this, trees were subjected to one of three treatments: Control, Chill break I, and Chill break II, with 4 replicates per treatment. The Control group of peach trees were maintained under ambient conditions to reach their chill requirement. Chill break I and Chill break II were exposed to intermittent warm temperatures of continuous 14 °C in a growth chamber for 7 and 13 days, respectively. Following the treatment, trees were returned to ambient conditions. Peach buds were collected from each treatment at three stages and remaining buds were monitored to track floral bud break progression. Additionally, we determined the metabolite and phytohormone concentrations in ‘Contender’ peach buds that naturally accumulated their chilling requirements. Results indicate that as chilling progression increases, starch concentration increases. Concentration of the phytohormone ABA (abscisic) acid appeared to decrease upon completion of endodormancy. Together, these analyses are expected to help us gain a better understanding of dormancy progression in peach.

Fruit Quality and Postharvest Storage of Arkansas Fresh-market Blackberries Grown on a Rotating Cross Arm Trellis

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Fresh-market blackberries (*Rubus* L. subgenus *Rubus Watson*) are commonly grown on T- or V-trellis systems, but the Rotating Cross Arm (RCA) trellis, which allows canes to be positioned parallel or perpendicular to the ground, offers a potential alternative for improving production. This study evaluated the performance of three blackberry cultivars (Ouachita, Sweet-Ark® Caddo, and Sweet-Ark® Ponca) grown on an RCA trellis at a commercial farm in Fayetteville, AR, during the 2023 and 2024 growing seasons. Blackberries were harvested into clamshells in triplicate on three dates per cultivar, with berries evaluated for marketability at harvest and after storage at 2 °C for 0, 7, 14, and 21 days. Marketable berries (fruit without damage or blemishes) were significantly higher in 2022 (92.79%) than in 2023 (83.68%), with unmarketable berries affected by factors such as anthracnose, red drupelet reversion (RDR), bird damage, poor pollination, white drupelet, and rain damage. Cultivar × year interactions were significant for berry weight (5.52–8.60 g), soluble solids (9.37–11.91%), pH (2.96–3.32), and titratable acidity (1.09–1.53%) at harvest. Sweet-Ark® Caddo had the highest soluble solids and pH and lowest acidity in 2022, though year had no consistent impact on composition at harvest for the other cultivars. Storage duration significantly increased leakage and decay of blackberries in clamshells across cultivars, though RDR remained low (<15.1%). At 21 days storage, Sweet-Ark® Caddo showed higher leakage (77.73% in 2022 vs. 10.60% in 2023) and decay (57.28% in 2022 vs. 7.43% in 2023), while Ouachita and Sweet-Ark® Ponca demonstrated greater storage potential with less leakage and decay. This study highlights the potential of the RCA trellis system to produce high-quality, marketable blackberries and provides insights into cultivar selection for optimal postharvest performance.

Through the Grapevine: Developing *Vitis* x *Muscadinia* Wide Hybrids for Enhanced Disease Resistance and Quality

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The genus *Vitis* has two subgenera, *Vitis* (V) and *Muscadinia* (M). While *Vitis* (bunch grapes) are the backbone of the U.S. grape industry (worth $4.8 billion annually), production is associated with high costs and plant/fruit disease risks. Muscadinia grapes, which are grown commercially across the Southeast U.S., are resistant to many pathogens that affect Vitis grapes. Despite their complementary attributes, breeding high quality, disease resistant V × M hybrids have been complicated by their genetic distance and difference in chromosome number. New genomic tools and 'bridge hybrids' with restored fertility enable the discovery and introgression of disease resistance and fruit quality alleles to create V × M hybrids. Our project team led by the University of Arkansas System Division of Agriculture (UA System) was awarded a USDA NIFA Specialty Crop Research Initiative (SCRI) Award #2024-51181-43236 from September 1, 2024 to August 31, 2028. The project is the first national effort leveraging the synergistic potential of interdisciplinary research on disease resistance and fruit quality traits in *Vitis* and *Muscadinia*. Our team will: 1) Determine the cytogenomic basis of V × M wide hybrid success (Genetics), 2) Develop V × M hybrid breeding populations combining quality and disease resistance loci (Breeding), 3) Identify new disease resistance alleles (Pathology), 4) Determine preferred consumer quality attributes in V × M hybrids (Quality), 5) Assess market opportunities for *Muscadinia*-type hybrids (Marketing), and 6) Demonstrate potential for commercial production of *Muscadinia*-type hybrids (Production). Our stakeholder-driven planning process resulted in the development of a diverse, interdisciplinary project team with 33 breeders, geneticists, pathologists, food scientists, agricultural economists, and extension specialists from 12 institutions working at the intersection of the *Vitis* and *Muscadinia* industries. Research and extension efforts will be integrated through collaborations with industry partners including 14 advisory board members and 38 stakeholders. We will translate outcomes from this project to stakeholders, growers, and consumers across the U.S. Our long-term goal is the introduction of disease-resistant

cultivars with enhanced fruit quality through use of *Muscadinia* derived resistance loci, leading to a more resilient U.S. grape industry.

Color Impact of Alternative Packaging on Vignoles (*Vitis* hybrid) White Wine Quality during Storage

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The sustainability of grape (*Vitis* species) wine production is influenced by costs and supply-chain challenges associated with glass packaging. Alternative materials, such as aluminum and plastics, offer more sustainable options but may impact wine quality and consumer perception. This study evaluated the effects of various packaging materials on the composition, color, and phenolics of Vignoles (*Vitis* hybrid) white wine during storage at 15°C. Wines from the 2022 harvest were stored for 0, 6, and 12 months, while those from 2023 were stored for 0 and 6 months. In 2022, eight packaging treatments were evaluated, including three sizes of glass bottles (250 mL, 375 mL, and 750 mL) and five 250-mL alternatives: aluminum (AL), polyethylene terephthalate (PET), high-density polyethylene (HDPE), low-density polyethylene (LDPE), and polypropylene (PP). In 2023, ten treatments were evaluated including three sizes of glass containers (250 mL, 375 mL, and 750 mL), three sizes of aluminum containers (250 mL, 375 mL, and 500 mL), three PET containers (two 250 mL and 750 mL), and one 750-mL flexible pouch. Wine stored in traditional glass bottles (375 mL and 750 mL) demonstrated superior color and phenolic stability throughout storage. Among alternatives, aluminum and PET maintained acceptable wine quality for up to 6 months, while flexible pouches showed greater degradation in color and phenolics. Key wine attributes affected by storage included dissolved oxygen, free sulfur dioxide, color (L*, ΔE, hue angle, chroma, and brown color), and total phenolics. While glass packaging remains the standard for extended wine shelf life, alternative materials such as aluminum and PET show promise for wines intended for consumption within six months of bottling. These findings highlight the potential of alternative packaging to reduce the carbon footprint of wine production, though their limitations in long-term storage should be considered in implementation strategies.

Use of Plastic Reflective Mulch to Shorten the Production Cycle of Six Peach (*Prunus persica*) Cultivars Budded on 'MP-29' rootstock

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Armillaria root rot (ARR) caused by Desarmillaria tabescens is a major disease in the peach industry. The pathogen colonizes and decimates roots, persisting indefinitely in soil through colonized root pieces. Using resistant or tolerant rootstocks is the most sustainable control method. 'MP-29', a peach x plum interspecific hybrid, is the only rootstock exhibiting tolerance. However, its slow growth and low budding success extend the production cycle to two years, increasing costs and reducing nursery interest despite strong demand from growers. Peach farmers may be able to produce their own peach trees on 'MP-29' within one year using common production technologies. A 2024 study at the Chilton Research and Extension Center in Clanton, AL, evaluated methods to accelerate production. Rows (beds) were formed with plastic mulch and drip irrigation installed simultaneously on 6-ft centers. Experimental plots (20-ft long, three rows each) were separated by 20-ft alleys in a randomized complete block design with four replications. The split-plot design tested mulch color (main plot) and scion cultivar (subplot). Each subplot contained approximately 20 trees. Plant height, caliper, and budding success were measured. Means separation (Tukey-Kramer Grouping) and analysis of variance (PROC GLIMMIX, SAS 9.4) were used. Both mulch treatments increased caliper over the bare ground control. White reflective mulch promoted greater scion length. Scion growth varied among cultivars, but differences were minimal. Budding success rates were comparable to nurseries. Silver mulch negatively impacted budding success. A protocol to improve plant growth and reduce cycle time in nurseries or on-farm operations should include white plastic mulch. Cultivar selection may also influence cycle time. Further research is needed to explore other cultivars, confirm budding success rates, and assess economic feasibility.

Postharvest and Biotechnology Section

Texture Comparison of Rabbiteye Blueberry Cultivars Grown in Two Locations

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Rabbiteye (RE) blueberry (*Vaccinium virgatum*) are native to Southeastern U.S. states, including Georgia and Alabama. Alabama growers prefer RE cultivars due to high vigor and heat tolerance. Breeding programs are continuously working to release cultivars with improved fruit quality characteristics, yet fruit firmness through storage remains inadequately studied on RE cultivars. The research objective was to assess percent (%) weight loss, berry diameter, and fruit firmness in five established cultivars produced in two Alabama locations. 'Alapaha', 'Ochlocknee', 'Krewer', 'Titan', and 'Vernon' were harvested in 2024 from E.V. Smith Research Station (EV Smith) and Chilton County Research and Extension Center (CREC) and stored at 4 ℃ and 85% relative humidity. Data collection occurred at four timepoints: days 0, 14, 28, and 42 in storage. Firmness and berry diameter were measured using a FruitFirm 1000, and weight loss was recorded using a precision digital scale. Significant differences were observed between the two locations for % weight loss. Among all cultivars, % weight loss increased from day 14 (1.3-3.3%) to day 42 (6.6-14.3%). 'Titan' and 'Alapaha' had the highest weight loss at 14.3% and 11.2% from CREC and 10.0% and 10.8% from EV Smith, respectively. 'Titan' exhibited the highest firmness on day 0 at 294.9 (CREC) and 293.1 g.mm-1 (EV Smith) and remained the highest on day 42 at 215.1 (CREC) and 209.8 g.mm-1 (EV Smith). Conversely, 'Alapaha' (CREC 184.70 g.mm-1; EV Smith 174.02 g.mm-1) and 'Ochlocknee' (CREC 169.97 g.mm-1; EV Smith 171.92 g.mm-1) exhibited the lowest firmness from day 0 through day 42. Fruit size declined during storage, with minimal differences between the two locations. 'Titan' had the largest fruit diameter (24.6 mm CREC; 24.5 mm EV Smith), and 'Alapaha' (18.3 mm CREC; 17.8 mm EV Smith) was the smallest. Principal Component Analysis revealed positive associations between firmness and berry diameter, with an inverse relationship to % weight loss. RE cultivars grown in two Alabama locations exhibit minimal differences in %weight loss, firmness and fruit size. For both locations, 'Titan' had high firmness and berry diameter, suggesting superior postharvest quality and shelf-life for Alabama growers.

Consumer Sensory Evaluation of Five U.S.-Grown Specialty Black Teas in Comparison to an Imported Brand Name Tea

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Specialty tea made from *Camellia sinensis* has gained popularity in the U.S., with cold brew tea becoming a new trend among consumers. This sensory evaluation was conducted to understand consumer preferences for cold brew U.S.-grown tea. Six cold brew black tea samples were evaluated: five from U.S. growers ('Big Easy', 'Black Magnolia', 'Hawaii Black Assamica', 'Hawaii Black Sinensis', 'Summer Black') and one from Taiwan ('Sun&Moon Lake'). A consumer panel rated the teas on color, aroma, taste, aftertaste, sweetness, bitterness, overall flavor, and overall liking using a 9-point hedonic scale. Willingness to try again was assessed with a yes/no scale, and reasons for rejection were recorded using CATA. Results showed that consumers favored the color and aroma of the teas over taste, aftertaste, sweetness, and bitterness. 'Big Easy' and 'Hawaii Assamica' had the highest "just-about-right" (JAR) ratings for color, while 'Black Magnolia' was often rated as "too light." 'Sun&Moon Lake' had the highest JAR for aroma, and 'Hawaii Assamica' and 'Sun&Moon Lake' exceeded 50% JAR ratings for aftertaste. Both teas performed better overall across most attributes. After tasting, 'Sun&Moon Lake' and 'Hawaii Assamica' had the highest willingness-to-try-again ratings (59% and 52%), which remained high even after consumers knew the teas were cold brewed (54% and 50%). These results provide consumer insights to U.S. specialty tea growers for potential enhancements to maximize the popularity of U.S.-grown specialty tea.

An Efficient Solvent System for the Extraction of Lycopene and its Isomers from Tomato Fruit

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Tomato (*Solanum lycopersicum*) is economically the second most important and widely consumed crop worldwide. It is often acknowledged for its nutritional and

health-promoting properties, mainly attributed to higher abundances of bioactives such as carotenoids, phenolics, vitamin C, and others. Among them, carotenoids such as lutein, lycopene, and □-carotenes are of great importance since they not only give the typical color to the tomato fruit but also provide numerous health benefits. These carotenoids exist in various isomeric forms (trans and cis), with cis isomers being more bioaccessible than trans isomers. However, isolation and quantification of these iso-forms are often complex and tedious, as these compounds are highly sensitive to light and heat. Hence, isolation and quantification of the carotenoid, especially lycopene (trans and cis), β-carotene, and lutein are of utmost importance. The conventional isolation procedures mostly rely on extracting these compounds in a mixture of hexane/chloroform: methanol. The present study explored the possibility of efficient extraction of these compounds from tomato fruit using different combinations of polar (methanol: Met and acetone: Ac), intermediate (ethyl acetate: EA, tetrahydrofuran: THF, and chloroform: Chl), and nonpolar (methyl tert-butyl ether: MTBE and hexane: Hex). Solvent polarity had a significant role in maximizing the yield of cis-/trans- isoforms of lycopene and other carotenoids. Normalized data showed that systems including hexane, as a nonpolar solvent, were the most effective in extracting carotenoids compared to systems containing MTBE. The Hex/Ac/Met solvent system was the most potent combination to maximize extraction yield of studied carotenoids by showing yields of 2.5 to 10 times higher than the MTBE/Ac/Met system. This work was partially supported by USDA-NIFA-2024-51181-43464, USDA-NIFA-AFRI 2023-67013-39616 through the Vegetable and Fruit Improvement Center and Institute for Advancing Health Through Agriculture of the Texas A&M University.

Rabbiteye Blueberry Cultivar Assessment of Postharvest Composition and Phytonutrient Quality Between Two Locations

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Southeastern U.S. states, including Alabama and Georgia, produce rabbiteye (RE) blueberries (*Vaccinium virgatum* A.) due to their high vigor and heat tolerance. Limited postharvest research exists on established RE cultivars grown at different locations within Alabama. The research objective was to evaluate postharvest fruit quality and phytonutrient content in five RE cultivars (‘Alapaha’, ‘Krewer’, ‘Titan’, ‘Ochlocknee’, and ‘Vernon’) grown at two Alabama locations: EV Smith Research Center (EV Smith) and Chilton Research and Extension Center (CREC). Fruit was harvested and stored in clamshells at 4°C and 85% relative humidity for six weeks, and analyzed at 0, 14, 28, and 42 days for color (L*, a*, b*, C*, hue angle), soluble solids content (SSC, °Brix), pH, titratable acidity (TA), and SSC:TA ratio. Crude phytonutrient content, including total anthocyanins (mg/g), phenolics (mg/100 g), and antioxidants (mM/100 g), were assessed using a UV-VIS spectrophotometer. No significant differences by location were observed for SSC, TA, SSC:TA, L*, b*, or C*. Cultivar*location interactions were significant for all traits except TA, pH, a*, and anthocyanins. ‘Alapaha’ (CREC) had the lowest L* (27.12) and highest a* (0.98) CIELAB units, while ‘Ochlocknee’ (CREC) had the lowest b* (-4.53) CIELAB units. Fruit pH was higher at EV Smith (3.41) than CREC (3.27). SSC varied most at EV Smith, with ‘Ochlocknee’ highest (16.0 °Brix) and ‘Vernon’ lowest (12.5 °Brix). TA differed by cultivar, peaking in ‘Titan’ (0.63) and lowest in ‘Alapaha’ (0.39). Phytonutrient content was highest at EV Smith, with anthocyanins (13.9 mg/g), phenolics (273.1 mg/100 g), and antioxidants (19.4 mM/100 g). ‘Alapaha’ and ‘Ochlocknee’ had the highest anthocyanins (16.3 and 16.2 mg/g), phenolics (328.8 and 310.0 mg/100 g), and antioxidants (22.7 and 23.3 mM/100 g) content, respectively. Principal component analysis showed no clear separation among cultivars or locations. Hierarchical cluster analysis identified enhanced SSC, SSC:TA, and all phytonutrients in ‘Ochlocknee’ (EV Smith) and ‘Alapaha’ (EV Smith), with suppression in ‘Alapaha’ (CREC) and ‘Krewer’ (EV Smith). Minimal location effects were observed suggesting quality is consistent across establishd cultivars. Moreover, RE blueberries maintain high phytonutrient contents through storage, emphasizing their nutritional value.

Effect of Microwave Assisted Pasteurized and Sonicated Edible Coatings on the Post-harvest Quality of Blackberries

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Blackberries (*Rubus fructicosus* L.) are categorized as functional foods, as it is rich in bioactive compounds. Due to limited shelf life and susceptibility to postharvest quality deterioration, it is imperative to investigate postharvest interventions that can prolong the fruit's quality. The aim of this research was to develop sonicated, and microwave assisted pasteurized edible coating

containing citrus peel essential oil (CPEO) and investigating the impact of sonicated edible coating on the postharvest quality of blackberry fruit while stored at various temperatures. All treatments were subjected to physico-chemical and antioxidant analysis during storage. Coating effect on maintaining the quality of blackberries during storage was more prominent when it is applied on blanched blackberries. Sonicated edible coating was more effective in delaying loss of total phenolic content, total, flavonoid content, total flavanols, total antioxidant activity and DPPH radical scavenging activity at 4ºC storage for 21 days. Control blackberries indicated more weight loss and decay at elevated temperature. The promising results concluded that sonicated edible coating is an innovative solution for effective postharvest quality during storage. However, additional work needs to be done to analyze the potential of sonicated edible coating with different essential oils on different Horticultural commodities at various storage temperatures.

Comparison of Six Carotenoids in Red and Green Butterhead Lettuce Grown in Different Production Systems

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Lettuce consumption is important due to high levels of carotenoids and other phytonutrients. The type of production system and cultivar choice can influence the carotenoid composition of lettuce. The objective of this experiment was to: 1) quantify six carotenoids in ‘Skyphos’ (red butterhead) lettuce grown in three production systems and 2) quantitate carotenoid differences between a red (‘Skyphos’) and green (‘Nancy’) butterhead lettuce cultivar. Both production experiments were conducted in spring 2023 at Southern Illinois University Carbondale. ‘Skyphos’ was produced in a high tunnel, green roof or field system as a completely randomized design with 4 replications. In the second experiment, ‘Nancy’ and ‘Skyphos’ were cultured in a high tunnel system with 4 replications. Both experiments were harvested 40 days after germination and lower and mid leaves were collected. Samples were shipped to Auburn University then extracted for carotenoids via acetone and 0.5% butylated hydroxy toluene. Carotenoids (ug/g) were analyzed for lutein, zeaxanthin, neoxanthin, violaxanthin, a-carotene and b-carotene via LC-UV-MS. The interaction of production system*leaf location was significant for four carotenoids. Violaxanthin (4.43 ug/g) was highest in the mid leaves of field cultivated ‘Skyphos’, conversely β-carotene (582.4 ug/g) and α-carotene (26.5 ug/g) were highest in the lower leaves. Neoxanthin (26.1 ug/g) was highest in the lower leaves from the green roof. Lutein and zeaxanthin were highest in the lower leaves of ‘Skyphos’ lettuce at 1091.8 and 3.7 ug/g, respectively. In the cultivar experiment, ’Skyphos’ was highest in α-carotene (19.0 ug/g) compared to ‘Nancy’. The lower leaves of both cultivars had the highest lutein (1133.9 ug/g), zeaxanthin (261.5 ug/g), neoxanthin (544.9 ug/g), α-carotene (23.5 ug/g) and β-carotene (544.9 ug/g). ‘Skyphos’ mid leave had highest violaxanthin (6.1 ug/g). Results from this experiment indicate the lower leaves of field and green roof cultivated lettuce have the highest carotenoid content. Growers should remove as few lower leaves as possible to enhance nutritional (e.g., carotenoid) consumption. Both red and green butterhead cultivars have optimal carotenoid performance. However, other phytonutrients such as anthocyanins and phenolics likely differ and are also important to human health.

Postharvest Evaluation of Two Blackberry Cultivars Treated with 1-Methylcyclopropene

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Blackberry is the state fruit of Alabama and variety evaluations are being done to identify the optimum cultivars for local growers. Blackberries have a short shelf-life of 7-10 days limiting their availability. The use of 1-methylcyclopropene (1-MCP) can be used in non-climacteric crops to increase shelf-life and reduce physiological disorders. The objective of this study was to determine the effect of 1-MCP on the postharvest qualities of two blackberry cultivars. ‘Kiowa’ and ‘Natchez’ were grown at the Chilton County Research and Extension Center and harvested physiological maturity. Fruit were sorted into vented clamshells and underwent two storage treatments; control (no 1-MCP) or exposed to a 1-MCP sachet (1-MCP). The experiment was repeated twice as a randomized complete block design with 3 replications. Fruit was stored for 19 days at 4°C and 85% relative humidity. Firmness (N), red drupelet reversion (RDR) count, color (l*, a*, c*, b*and h*), fresh weight and percent weight loss (%weight loss) were collected every 4

to 5 days of storage. No significant interactions were found. The use of 1-MCP had minimal effects on blackberry but timepoint and cultivar differences were evident across the dependent variables. The %weight loss increased through storage and was highest after 19 days of storage (6.0%). The use of 1-MCP decreased weight loss by 1.1% in both cultivars. 'Natchez' had increased firmness of 0.5 N at harvest and retained firmness through storage compared to 'Kiowa'. 'Kiowa' had lower a* (increased redness) and higher c* (light intensity) than 'Natchez' throughout storage. RDR increased throughout storage and 'Natchez' (91 per 3 blackberry samples) indicated a higher RDR count compared to 'Kiowa' (61 per 3 blackberry samples). Overall, 'Natchez' had increased firmness but higher RDR count, while 'Kiowa' had enhanced color values through the study. This study indicated both 'Kiowa' and 'Natchez' are suitable for growers in Alabama but have differing postharvest quality attributes. Moreover, the addition of the 1-MCP controlled weight loss in both cultivars but had minimal effect on other parameters measured. Future studies should explore techniques of optimizing the application of 1-MCP sachet and/or the mode of application on non-climacteric fruit.

Pyrus communis: A Model System to Study Ripening and Senescence

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Fruits constitute a critical part of a healthy diet. However, they often perish prior to consumption due to unpredictable ripening. Especially in climacteric fruit, blockage in the perception or synthesis of ethylene has been used to prolong shelf life. European pear (*Pyrus communis*) are classified as climacteric fruit. However, System 2 ethylene production requires a genetically pre-determined period of cold conditioning, which triggers ripening—in addition, applying 1-MCP, an ethylene perception inhibitor, indefinitely blocks ripening. Using a physiological and developmental transcriptomics approach, we have shown that in 1-MCP fruit stored in a controlled atmosphere, activating alternative respiration via glyoxylic acid stimulation of AOX expression can reverse the effect of 1-MCP. Interestingly, 1-MCP fruit without CA storage responds differently to glyoxylic acid. It shows classic signs of senescence. The underlying processes of ripening and senescence can be discerned by utilizing the fruit that has been treated differently post-1-MCP application. This knowledge is expected to aid in identifying strategies to prolong fruit shelf life.

Vegetable Crops Section

Evaluating the Effects of Flight Parameters on Spray Deposition Efficiency of an Unmanned Aerial Application Systems (UAAS)

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The increasing demand for precision in agricultural practices has led to the use of unmanned aerial application systems (UAAS) for pesticide application. It is essential to understand how operational flight parameters influence spray performance to ensure their efficient application. The objective of this study is to evaluate the effects of flight speed, droplet size, and application volume on spray deposition, with the DJI Agras T40 sprayer drone as the application platform. A three-factorial experimental design was employed to test 18 treatments, combining three flight speeds (4, 7, and 10 m/s), three droplet sizes (150, 250, and 350 µm), and two application volumes (18.75 and 28.10 L/ha). Spray droplets captured on Kromekote cards were analyzed for deposition (coverage, droplet density, and droplet spectra) and uniformity (effective swath width) using a computer-based scanner system with specialized software. Results show that lower flight speeds (4 m/s) and higher application volumes (28 L/ha) led to increased coverage and droplet density. Optimal configurations were identified at 7.93 m/s with a droplet size of 350 µm, maximizing effective swath width and spray uniformity. These findings contribute to the optimization of UAAS-based pesticide application, promoting greater efficiency and reduced environmental impact.

Enhancing Detection of Volatiles in Tomato Fruit by Optimizing Solid-Phase Microextraction Coupled with Gas Chromatography-Mass Spectrometry

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Tomato (*Solanum lycopersicum*) is an economically important crop globally and widely consumed, serving as a key dietary source of bioactive compounds. In addition to its bioactive compounds, the flavor and aroma of tomatoes are crucial factors in consumer preference. Flavor and

aroma are strongly influenced by volatile organic compounds (VOCs). Therefore, comprehensive profiling of VOCs in tomato fruit provides essential information to help improve tomato quality. Here, we optimized the estimation of volatiles using headspace solid-phase microextraction coupled with gas chromatography-mass spectrometry (HS-SPME-GC-MS). We analyzed tomatoes grown under greenhouse and open-field conditions, as well as processed samples, highlighting the significance of agricultural practices on their aromatic composition. Optimized HS-SPME variables, including extraction temperature, time, and fiber type, enabled accurate VOC identification and quantification. The VOCs identified appeared to originate from primary substrates such as amino acids, phenolics, fatty acids, and carotenoids. Principal component analysis (PCA) and partial least squares-discriminant analysis (PLS-DA) of VOC abundance projected key biomarkers such as hexanal, (*E*)-2-hexenal, *p*-cymene, and geranyl acetone in the +/+ coordinate, indicating their higher abundances were mostly associated with ripening. Variations among samples are likely driven by differences in genotype and cultivation methods. Hence, this study provides the foundation for a comprehensive volatolomics analysis of tomato fruit, which not only helps identify key aromatic compounds that drive consumer preference for flavorful tomatoes but also offers valuable insights to breeders aiming to develop high-quality, aromatic tomato varieties.
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Impact of High pH and Bicarbonate on Crop Growth and Development

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Achieving maximum crop yields depends on several factors, including appropriate nitrogen fertilization. However, rhizosphere pH, a key factor in nutrient bioavailability, is often neglected. Optimal pH is essential for healthy plant growth, and factors like nutrient source and rate, and irrigation water quality influence it. High alkalinity from bicarbonate (HCO_3-) accumulation in irrigation water can hinder macro- and micronutrient uptake. This study investigated the effects of pH adjustment source (KOH or $KHCO_3$) at varying pH levels and nitrogen rates on basil growth. A greenhouse experiment was conducted using a randomized complete block design with a 4 x 2 x 2 factorial arrangement, creating 16 treatment combinations. Treatments consisted of four nutrient solution pH levels (5.8, 6.5, 7.0, and 7.5) adjusted with either KOH or $KHCO_3$ and two nitrogen application rates (7.14 or 14.28 mM). Higher nitrogen (14.28 mM) significantly increased overall shoot growth. Leaf necrosis was more prevalent in plants grown with KHCO3-adjusted solutions, regardless of nitrogen rate. Conversely, plants receiving 14.28 mM N and KOH-adjusted solutions were necrosis-free. Shoot fresh and dry biomass varied significantly across pH levels, pH buffer (KOH vs. $KHCO_3$), and nitrogen rates. However, shoot height, canopy circumference, and substrate pH showed no significant differences among treatments. Electrical conductivity (EC) was significantly higher at the 14.28 mM N rate but remained below 1.60 mS/cm. Basil growth was influenced by pH, pH buffer, nitrogen rate, and their interactions. Optimal growth was observed with 14.28 mM N and a pH range of 5.8–7.0 was achieved using KOH.

Decoding the Role of Nitrogen Forms in the Growth of Water Spinach (*Ipomoea aquatica*).

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Plants utilize two major nitrogen forms *viz* ammonium (NH_4) and nitrate (NO_3). These N forms are interchangeable. Aeration influences oxidation-reduction of NH_4 to NO_3 and vice-versa. A study was designed to investigate the growth response of water spinach under two N forms (NH_4 and NO_3) and six levels of submergence (control, 0, 1, 2, 3, and 4 cm). Growth response was evaluated in terms of dry biomass (leaf and shoot) and leaf area. Plants were harvested three times (20, 40, and 60 DAT). Growth response was more distinct with the increase in feeding duration. At harvest 1, only shoot biomass and leaf area were significantly influenced by N forms and submergence levels. However, at harvests 2 and 3, N forms and submergence levels significantly influenced all parameters. Plants supplied with NO_3 @ 2 cm had optimal growth and yield. At harvest 3, dry biomass (leaf and shoot) and leaf area of NO_3 @ 2 cm supplied plants had 55.95, 41.03 and 55.04%, respectively more than the control. Furthermore, the leaf biomass of these plants was 45.06, 50.25, 65.71, 73.44, 73.55, and 85.85% more than NH_4 @ control, 0, 1, 2, 3, and 4 cm, respectively. Similarly, shoot biomass was 39.84, 36.81, 53.38, 60, 62.54, and 68.60% more than NH_4 @ control, 0, 1, 2, 3, and 4 cm, respectively. Leaf area was 46.00, 44.44, 65.22, 78.41, 84.04, and 90.18% more than NH_4 @ control, 0, 1, 2, 3, and 4 cm, respectively. In NO_3, plants @ $\geq$ 1 cm had better growth compared to control and 0 cm.

However, in NH_4, growth was significantly reduced with the increase in submergence and feeding duration. Our findings suggest that NO_3-nitrogen @ 2 cm is the right N form and submergence for optimal growth and yield of water spinach. Moreover, the right N form would improve NUE and contribute to precise and sustainable nitrogen application.

Lettuce Productivity as a Function of PAR Intensity in Controlled Environment Agriculture

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Light transmission and temperature are crucial for greenhouse plant growth. This research explored how different roof and sidewall materials affect Romaine lettuce development. Focusing on glass, polycarbonate, and double-layer polyethylene, the study examined the trade-offs of each. Photosynthetically active radiation (PAR), a key growth driver, was monitored in greenhouses with varying material combinations (glass/glass, glass/polycarbonate, double poly/polycarbonate, and double poly/double poly) during the growing season (December 2024-January 2025). A significant difference in lettuce shoot temperature was observed: 21.3°C in the glass greenhouse, compared to 18.9°C, 18.7°C and 19.1°C in the glass/polycarbonate, double poly/polycarbonate and double poly/double poly structures, respectively. PAR transmission varied considerably, ranging from 950 to 2300 $\mu mol.m^{-2}s^{-1}$on sunny days. The highest PAR (2300 $\mu mol.m^{-2}s^{-1}$) in the glass greenhouse correlated with compact growth, the smallest leaf area (260 cm^2), and the fewest leaves (10.7). Lower PAR (950, 1375, and 1750 $\mu mol.m^{-2}s^{-1}$) in the double poly/double poly, glass/polycarbonate and double poly/polycarbonate greenhouses corresponded with larger leaf areas (354, 322 and 377 cm^2), more leaves (11.9, 12.3 and 12.8), and greater shoot height (19.4, 20.3 and 22.8 cm), respectively. These results suggest a strong correlation between PAR levels, temperature, and lettuce shoot growth. The higher temperatures in the glass greenhouse, coupled with high PAR, likely contributed to the compact growth. Conversely, the lower temperatures and varied PAR levels in the other greenhouse types promoted increased leaf area and plant height, possibly due to greater resource allocation towards light capture. This research highlights the importance of considering light transmission and thermal properties of greenhouse materials for optimized lettuce production. Understanding the advantages and disadvantages of glass, polycarbonate, and double poly enables informed decisions tailored to individual needs and budgets.

Seed Nanopriming with Copper (Cu) Enhances Yield, Quality, and Potential Health-Promoting Attributes in Tomato Fruit

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Seed nanopriming is an emerging agricultural technology that uses nanoscale particles (25–100 nm), including essential metals and minerals, to enhance seed germination, growth, yield, and resistance to biotic and abiotic stresses by stimulating secondary metabolite biosynthesis and promoting plant health. Nanoparticles (NPs) of essential micronutrients, specifically copper (Cu), can be effective seed priming agents. Cu is essential for several metabolism-regulating enzymes, which act as a key prosthetic group in their structure, but their efficacy in crop production and postharvest quality attributes remains largely unexplored. This study investigates the effects of Cu-NPs on the production of tomatoes (*Solanum lycopersicum*), an economically vital crop worldwide. Cu-NPs were synthesized using copper sulfate and onion peel extract as green reducing agents and used to prime seeds of two Texas A&M-developed tomato varieties, TAM-C3 and TAM-C11. The analysis included germination percentage, seedling growth, yield, and bioactive profiling of health-promoting compounds, including vitamin C (AsA), β-carotene, lycopene, and amino acids (AA). Cu-NP seed priming significantly improved seed germination, shoot and root growth, and overall yield, with a 30% higher yield than controls in both tomato cultivars. Cu-NPs priming also increased AsA levels by 1.6 times, enhancing the fruit's antioxidant content and nutritional value. It positively impacted AA profiles, increasing glutamic acid, aspartic acid, and branched-chain AAs, which are key to flavor development and volatile biosynthesis. Elevated proline, histidine, serine, glycine, and threonine levels indicated delayed senescence, prolonged shelf-life, and improved stress tolerance. Additionally, Cu-NPs treatment enhanced carotenoid levels, with lycopene levels 2.2-fold higher in TAM-C3 and 1.3-fold in TAM-C11, while β-carotene levels increased by 1.4-fold in TAM-C11. AsA, lycopene, and β-carotene increase suggest that Cu-NP priming could deliver tomatoes with higher nutritional value and health benefits. This work was partially supported by USDA-NIFA-2024-51181-43464, USDA-NIFA-AFRI 2023-67013-39616 through the Vegetable and

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Ethnic Vegetables in Kentucky: Opportunities for Diverse and Sustainable Agriculture

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The increasing racial and ethnic diversity in the United States, including Kentucky, has led to a growing demand for culturally significant vegetables, which are primarily sourced from Florida, California, and North Carolina. This study explores the potential for local production of ethnic vegetables by minority growers in Kentucky to enhance market accessibility and support sustainable agriculture. In the summer of 2024, field trials were conducted at Kentucky State University's Harold R. Benson Research and Demonstration Farm to evaluate the performance of luffa gourd (*Luffa aegyptiaca*), two varieties of bitter melon (*Momordica charantia*): Satsuma Onaga and Smooth Bitter Melon, and two varieties of yard-long beans (*Vigna unguiculata*): Green and Purple. Seeds were directly sown in raised beds covered with plastic mulch, with a planting distance of 2 ft for luffa and 1 ft for bitter melon and yard-long beans. A cattle panel trellis was used for luffa, while a chicken wire trellis supported bitter melon and yard-long beans. Drip irrigation was installed beneath the plastic mulch, and fertigation was applied based on soil test results. Luffa yielded 18.6 kg per plant, while Smooth Bitter Melon and Purple yard long Beans significantly outperformed their respective counterparts in yield. No major pest or disease issues were observed throughout the study. These findings indicate the potential for ethnic vegetable production in Kentucky, providing valuable insights for small-scale growers to diversify their crops and meet the increasing demand for fresh, locally grown produce.

Field Performance of Tomato Cultivars Resistant to Tomato Spotted Wilt Virus (TSWV) across Multiple Locations in Southern Georgia

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Tomato spotted wilt virus (TSWV) is transmitted by thrips and is a major concern during the spring season in Southern Georgia. In addition, TSWV poses significant challenges to agricultural productivity in the broader southeastern US, impacting a wide range of crops including peanuts, tobacco, peppers, and tomatoes. Despite the use of resistant varieties in tomatoes, TSWV resistance breakdown has been reported in several U.S. states. This study evaluated virus incidence, yield performance, and fruit quality of various commercial TSWV-resistant and susceptible varieties under field conditions. Field trials were conducted at three counties in Georgia including Tift, Grady, and Colquitt during the spring season when TSWV activity typically peaks with the onset of tree flowering. Resistant varieties (STM 2255, Red Snapper, Patsy, Rambler, Myrtle, and the historic check SV 7631) and susceptible varieties (Thunderbird, Grand Marshall, and Camaro) were tested. The results indicate differences in disease incidence, tomato fruit yield, and quality. Resistant varieties showed no foliar TSWV symptoms, indicating their continued effectiveness in southern Georgia, and had higher yields compared to susceptible varieties. Marketable yield and quality were affected by disease symptoms, physiological disorders, and uneven ripening, resulting in unmarketable produce. Marketable yield (25 lbs. boxes/acre) was highest in Myrtle (1836 boxes/acre), Patsy (1832 boxes/acre), Red Snapper (1820 boxes/acre), and STM 2255 (1801 boxes/acre). All the resistant varieties outyielded (1590-1832 boxes/acre) the susceptible varieties (1169-1254 boxes/acre). Furthermore, resistant varieties Myrtle and Patsy outyielded the historic TSWV standard SV7631 (1590 boxes/acre), demonstrating that some of the newer varieties provide higher yield potential for growers. Additionally, SV 7631 and Patsy were the earliest maturing exhibiting the highest percentage of red fruits. Based on these findings, we recommend the cultivation of Patsy, Myrtle, Red Snapper, STM 2255, and Rambler as they demonstrated higher marketable yields and better fruit quality. We do not recommend any cultivar susceptible to TSWV such as Grand Marshall, Thunderbird, and Camaro, or TSWV-resistant SV 7631 under southern Georgia conditions.

Beyond the Label: Selecting the Right Fertilizer for Organic Watermelon Transplant Production

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This study aimed to develop fertilization guidelines for organic watermelon transplant production. We tested three organic fertilizers: Nature Safe (fertilizer label: 7-7-7), Drammatic (2-4-1), and Pre-Empt (assumed to be 6-1-1.7 based on commercial lab testing) in comparison with a conventional fertilizer (Peter's Professional 20-20-20). Nitrate and ammonium are nitrogen forms that are directly available for crops. In freshly made solutions, 6%, 56%,

and 25% of total nitrogen in Nature Safe, Drammatic, and Pre-Empt, respectively, were in these available forms. After being applied to substrate for 21 days with watermelon transplants, 33%, 11%, and 9% of organic nitrogen in Nature Safe, Drammatic, and Pre-Empt, respectively, were converted to nitrate and ammonium forms and became available to crops. Fertilizers were applied at 0 to 1.2 g N/L substrate (0 to 0.8 g N/L for conventional fertilizers). At low nitrogen rates, shoot growth is strongly correlated with nitrogen availability, especially nitrate-nitrogen. Regression analysis predicted that the maximum shoot dry weight with conventional fertilizer was 0.46 g, higher than organic fertilizers. Among organic fertilizers, the maximum shoot dry weight was predicted to be 0.29, 0.33, and 0.43 g/plant at 0.84, 0.89, and 1.69 g N/L for Nature Safe, Drammatic, and Pre-Empt, respectively. Pre-Empt resulted in the highest shoot growth, while Nature Safe resulted in the lowest shoot growth and would require a longer growth cycle to achieve shoot growth comparable to other organic fertilizers. Root dry weight was higher with Pre-Empt compared to Nature Safe and Drammatic but less responsive to nitrogen rates compared to shoot. For growers, Pre-Empt can be applied up to 1.69 g N/L without reducing shoot growth and is suitable for short production cycles. Nature Safe had slow nitrogen release, making it more suitable for longer cycles. Drammatic is best applied at low nitrogen rates (below 0.89 g N/L) due to its high nitrogen availability.

Combat Root Zone Stresses in Organic Hydroponics

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Organic lettuce production in hydroponic systems often experiences yield reduction compared to conventional production. A previous study from our laboratory showed that intermittent nutrient solution flow of Nutrient Film Technique (NFT) systems, combined with a microbial root inoculant (Terra Bella), could help organic lettuce production to achieve a similar yield as conventional production. This study investigated the effects of different frequencies of intermittent nutrient solution flow and Terra Bella application on the growth and yield of lettuce 'Casey' in organic NFT systems. Three flow schemes were tested: continuous solution flow (CF, 0 min no flow), 15 min flow/45 min no flow (15/45), and 15 min flow/105 min no flow (15/105). Results showed that organic lettuce fresh weight increased by 71% when the no-flow period increased from 0 to 105 min. Inoculating Terre Bella to organic NFT systems with intermittent flow decreased lettuce yield to a level similar to CF, which was unexpected. In organic nutrient solutions, regardless of flow scheme and bio-stimulant inoculation, high concentrations of ammonium and nitrite ions were observed, which likely contributed to the lower yield compared to that in conventional production. In a follow-up study, we further tested the effects of aerating organic nutrient solution reservoirs in NFT systems without intermittent flow. Aeration increased organic lettuce fresh weight by 2.6 times compared to non-aeration control. Aeration also increased dissolved oxygen (from 6.4 to 7.8 mg/L) and decreased the ratio of nitrite-nitrogen to nitrate-nitrogen (from 1.1 to 0.3) in organic nutrient solutions. These results indicate that intermittent nutrient solution flow and aeration reduced root zone stress by improving oxygen availability to lettuce roots and reducing the concentrations of ammonium and nitrite toxicity. Both strategies improved organic lettuce growth in NFT systems and have implications in real-world production.

Comparison of Two Nitrogen Sources in Growing Tea (*Camellia sinensis*) and Promoting Soil Microbial Activities

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Two field experiments were conducted at Fleur de Lis Tea Co. (Amite, LA) to evaluate the effect of two nitrogen (N) sources – synthetic urea ammonium sulfate (UAS, 33-0-0, 50% urea with urease inhibitor, 50% ammonium sulfate) and organic bloodmeal (BM, 13-0-0) – on the growth of tea (*Camellia sinensis*) and soil microbial activity. In Expt. 1, UAS and BM were applied at three rates (150, 250, and 350 lbs. N/A/year) to a 1-year-old tea field. Expt. 2 evaluated five treatments by substituting UAS with BM at 0%, 25%, 50%, 75%, and 100%, all at 350 lbs. N/A/year applied to a 2.5-year-old tea field. N applications were divided into seven applications applied every 40 days from April to October over two years (2023 – 2024) for a total of 11 applications. Despite periodic pruning to encourage branching and the building of a 'plucking table,' plant growth metrics, such as leaf greenness and size index (SI = height + width 1 + perpendicular width), were similar across treatments in both experiments. However, tissue nitrogen concentration (N%) was consistently higher in BM-treated plants compared to UAS-treated plants at all application rates in Experiment 1. The highest tissue N% was also observed in the 100% BM treatment in Experiment 2. One year after treatment initiation, plants fertilized with UAS exhibited faster recovery after pruning compared to those treated with BM, though this difference diminished over time. Overall, plant growth responses, as indicated by increases in height and size index, were comparable across all treatments. Further research on leaf

quality (e.g., health-promoting compounds) and a more comprehensive evaluation of soil microbial activity are required to refine recommendations for nitrogen application rates and sources for tea production.

Managing Herbicide Drift in Vegetable Operations: Workshop Effectiveness and Lessons Learned

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Herbicide, insecticide, and pesticide use are common in agricultural operations. Unfortunately, when applying chemicals there is a chance that some will escape from the target area in areas where it is not needed or wanted. Drift from the site of application into non-target areas can cause injury to desirable plants, and in the case of specialty crops, a complete production loss. This educational poster presents the curriculum and results from educational workshops on financial and production risk management to horticulture producers in Louisiana emphasizing herbicide drift management and proper use of chemicals. The workshops aim to help producers document drift incidences by identifying drift damage, relating information to Louisiana Department of Agriculture and Forestry agents, and assessing financial costs. The workshops also offer on-site training on chemical use and cleaning tanks. We present information on setting the field trials for our symptomology and damage identification, and results from our pre-and-post assessment. Attending the workshops has improved the identification of symptomology for Roundup (77%) and increased understanding of equipment cross-contamination risks. Moreover, participants updated their information on best practices for documenting drift loss, from 16.7% pre-workshop to 62.5% post-workshop. As specialty crops are receiving more attention regarding crop insurance, we believe that this presentation will serve as a tool to mitigate and manage production risks related to herbicide use.

Exploring the Role of Grafting in Enhancing Cold Tolerance in Cucumber: A Transcriptomics Perspective

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Cucumber (*Cucumis sativus*) is an important vegetable crop in the United States, with most production shifting towards controlled environment agriculture (CEA) systems. Maintaining the optimum temperature (80–85°F) during colder seasons increases energy costs for growers. Grafting onto cold-tolerant cucurbit rootstocks has shown potential to enhance cold resistance in cucumbers, but the underlying molecular mechanisms remain poorly understood. This study employed a transcriptomics approach to investigate differentially expressed genes (DEGs) and associated pathways conferring cold resistance in parthenocarpic cucumber (*C. sativus* cv. Diva) grafted onto two different rootstocks (hetero-graft): fig-leaf gourd (*Cucurbita ficifolia*), Tetsukabuto squash (*C. maxima* × *C. moschata*), and one self-graft. For gene expression analysis, graft treatments were compared with ungrafted Diva plants. Plants were exposed to three temperature treatments (D/N: G1 = 12/6°C, G2 = 18/12°C, G3 = 24/18°C) for 21 days, with leaf samples collected at Day 0 and Day 21 for RNA sequencing. Due to high mortality, G1 was excluded from transcriptomics analysis. The number of DEGs identified as common between all three graft types compared with ungrafted Diva was only 24 and 15 in G2 and G3 respectively. In contrast, the number of DEGs shared by the two hetero-grafts was higher than the number of common DEGs between hetero- and self-grafts. Differential expression analysis revealed a higher number of under-expressed DEGs in all combinations at Day 0 and Day 21 under G2 conditions, whereas overexpressed DEGs increased at Day 21 in *C. ficifolia* and Tetsukabuto grafts but not in self-grafted plants. Gene Ontology (GO) enrichment and KEGG pathway analysis identified key cold-responsive transcription factor families like WRKY, MYB, NAC, AP2/ERF, POD, and prolines, as being significantly induced under cold stress, with expression patterns varying across rootstock combinations. These findings provide insights into the molecular basis of cold tolerance in grafted cucumbers and highlight potential genetic targets for improving cold tolerance in CEA cucumber production.

Watermelon Section

2024 Results for Managing Fusarium Wilt of Watermelon with Fungicides and Grafting in North and South Carolina

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Fusarium wilt of watermelon, caused by the soilborne pathogen *Fusarium oxysporum* f.sp. *niveum* (FON), is a devastating disease of watermelon capable of drastically reducing yields. In 2024, two replicate field studies were conducted in Clayton, NC and Charleston, SC to evaluate cultivar resistance and fungicide efficacy on the disease incidence and yield response of triploid watermelon cultivars growing in fields infested with FON. The study consisted of 8 treatments set up as a 2x4 factorial in a randomized complete block design with 4 replications. The triploid cultivars Fascination and Cracker Jack were paired with the following fungicide/grafting treatments: 13.6 oz/ac of Propulse at 7, 14, and 21 days after transplant (DAT); 15.4 oz/ac of Miravis Prime at 7 and 21 DAT; grafting to "Carolina Strongback" rootstock; no treatment (control). The plots were 36 ft long x 10 ft and consisted of 12 triploid plants and 4 pollenizers (SP-6 and SP-7) that were grown on black plastic with drip fertigation. Disease incidence data were taken for 7 weeks starting 21 DAT at both locations. Yield data were collected over 3 harvests in NC and 4 harvests in SC. No differences in disease incidence were found for the interaction of cultivar and treatment at either location but cultivar alone had an effect with Fascination having less disease incidence at both locations; Fascination had 34.4% disease incidence compared to Cracker Jack at 54.3% in NC and had 40.7% disease compared to 81.2% in SC. Treatment also had an effect on disease incidence at both locations with grafting having the lowest disease incidence at 4.8% in NC and 0.8% in SC. The interaction of cultivar and treatment made no difference on marketable yield (fruit over 9 lb) in NC but treatment had an effect with grafting having the highest yield at 31,541 lb/ac compared to Propulse at 12,870 lb/ac, Miravis Prime at 11,758 lb/ac, and the control at 7,988 lb/ac. In SC, the interaction of cultivar and treatment made a difference in marketable yield with grafted Fascination having the highest yield at 45,990 lb/ac, which was different from grafted Cracker Jack at 33,958 lb/ac, both of which were different from all other treatments. The data suggest that cultivar tolerance to FON varies between Fascination and Cracker Jack and grafting is superior to fungicide programs and cultivar tolerance in reducing disease incidence and marketable yield loss. In SC, the cultivar response can vary by treatment in reducing yield loss.

Marker Assisted Backcrossing for Gummy Stem Blight Resistance in Watermelon.

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Gummy stem blight (GSB), is an important disease that can cause severe yield losses in watermelon in the southeastern US, where hot humid conditions prevail during the growing season. Growing resistant cultivars is the best management strategy, but since no highly resistant cultivars are currently available, growers rely on fungicide applications for disease control. Two resistance QTL previously identified in *C. amarus*, an inedible crop wild relative of watermelon, was introgression into 'Crimson Sweet' using marker assisted backcrossing. Five BC_2 and BC_3 lines were grown in the field in summer 2024 and inoculated with *Stagonosporopsis citrulli* isolate 12178A. Disease severity was assessed weekly and yield and fruit size were collected at maturity. Three lines showed significantly lower disease severity than the 'Crimson Sweet' control. All the lines had similar yields than the control and three lines had fruit size similar to the control. These introgression lines can be used in future breeding efforts to develop gummy stem blight resistant watermelon cultivars.

Leveraging Genomic Tools to Address Fusarium Wilt in Watermelon

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Breeding for complex traits that are influenced by many genes can be challenging, especially when using marker-assisted selection (MAS). Genomic selection (GS) offers a promising alternative by focusing on combining beneficial gene variations to create improved cultivars. In this study, we explored using GS to improve resistance to Fusarium oxysporum f. sp. Niveum (Fon) race 2 in watermelon, a trait that is complex, controlled by multiple genes, and moderately heritable. Our goals were to: 1) evaluate how accurately genomic prediction (GP) models can predict Fon race 2 resistance in two watermelon populations (F_2 and recombinant inbred lines, RILs), 2) rank and choose the best families from these populations based on their genomic estimated breeding values (GEBVs) for developing new test groups, and 3) check if major genes

linked to Fon race 2 resistance are present in the top-ranking families with the highest GEBVs. Resistance was measured by disease severity (1-5; 1 = healthy, 2 = stunted/chlorotic, or 3 =one or two cotyledon is wilted, 4= completely wilted, and 5=dead) 28 days after planting in soil infected with Fon race 2. We used genotyping-by-sequencing (GBS) data from 205 $F_{2:3}$ and 204 RIL families, with reference genomes from parental lines. We tested six different GS models, including both parametric (G-BLUP, BayesB, Bayes_LASSO) and non-parametric (Random Forest, SVM Linear, SVM Radial) methods. G-BLUP and Random Forest performed best, showing correlation values of 0.48 in the $F_{2:3}$ population and 0.68 in the RIL population, demonstrating the effectiveness of GP for improving Fon race 2 resistance in watermelon breeding.

Watermelon Breeding for Diseases Resistance and Fruit Quality using QTL Mapping and Genomic Selection

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Phytophthora fruit rot (PFR) and Powdery mildew (PM) are major threats to watermelon (*Citrullus lanatus*) production. Developing resistant cultivars through breeding remains the most effective strategy for managing these diseases. A recombinant inbred line (RIL) population (F_{11}), derived from an interspecific cross between the resistant *Citrullus mucosospermus* genotype USVL531-MDR and susceptible *C. lanatus* genotype USVL677-PMS was used to identify quantitative trait loci (QTL) associated with PM and PFR resistance. A total of 183 RILs, along with their parents, were evaluated in two field trials in Charleston during summer and fall of 2023. USVL531-MDR, consistently showed high levels of resistance to both PM and PFR, while USVL677-PMS, was highly susceptible. Disease resistance for PM and PFR segregated independently within the RIL population, suggesting that these diseases are controlled by distinct genetic loci. QTL mapping using *R/qtl2* and a high-density marker dataset (~400,000 SNPs) from whole-genome resequencing (~20× coverage) identified two QTL regions on chromosome 2, separated by approximately 13 Mb—one associated with PM resistance and the other with PFR resistance. Two other QTLs on Chromosomes 5 & 6 were also associated with PFR resistance. Kompetitive Allele-Specific PCR (KASP) markers developed from QTL associated with PM resistance exhibited strong correlation with field phenotype. These markers were also validated in two F_2 populations (USVL531-MDR × 'Sugar Baby' and USVL531-MDR × 'Calhoun Grey'). Genomic selection (GS) was applied for PFR resistance in the RIL population. A genomic estimated breeding value (GEBV) of 0.95 was observed using a Bayesian A model, with a five-fold cross-validation accuracy of 0.71, demonstrating the potential of GS for improving PFR resistance in watermelon. The integration of tightly linked KASP markers for PM and PFR resistance with genomic selection approaches will enhance breeding efficiency, accelerating the development of disease-resistant watermelon cultivars.

Adjusted Nutrient Management and Rootstock Effects on Flowering and Yield in Grafted Seedless Watermelon Production

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Grafting can reduce watermelon losses from soilborne disease. However, delayed peaks in fruit production pose an economic challenge. In the 2023 and 2024 growing seasons, experiments were conducted to determine the effects of three different rootstocks on vegetative and reproductive growth; un-grafted watermelon (*Citrullus lanatus*) 'Fascination' was compared to 'Fascination' grafted to three commercial rootstocks: squash (Cucurbita maxima x C. moschata 'Super Shintosa'), wild watermelon (*Citrullus amarus* 'Carolina Strongback'), and bottle gourd (*Lagenaria siceraria* 'Pelops'). Additional fertigation management experiments were conducted to test whether eliminating fertigation (nitrogen and potassium) prior to flowering and/or providing additional boron and zinc through fertigation and foliar sprays affects the reproductive development. In 2023, squash and wild watermelon grafted plants exhibited later open female flowers compared to the un-grafted control, but, in 2024, bottle gourd grafted plants exhibited a delay. In both years, early rates of flower production were similar among treatments, though grafted plants continued to flower later into the season compared to un-grafted controls. Cumulative yield for bottle gourd and wild watermelon grafted plants were similar to the un-grafted control in the first four harvests in both years but surpassed the control after the remaining harvests. Squash grafted plants followed the same trend in 2023, but, in 2024, cumulative yield was lower and never exceeded that of the un-grafted control. Lower initial squash grafted yields in 2024 could have been caused by delayed initial fruit set which occurred eight to nine days after other treatments. None of the reproductive development traits examined were improved by either of the nutrient adjustment treatments tested in the fertigation management

experiment suggesting that further optimization of grafted watermelon fertigation programs is needed. Overall, we showed that, with a long harvest window, wild watermelon or bottle gourd rootstock can significantly increase yields in the absence of pathogens. Our findings also suggest that initial fruit set rather than flower production contributes to reduced early harvests squash grafted watermelon, though additional research is required to further examine early fruit development in grafted watermelon and develop appropriate management responses.

Evaluation of Biostimulants for Efficacy on Triploid Watermelon Yield and Quality

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Biostimulants (BS) have been evaluated across various conditions and crops due to their beneficial properties. Our prior BS screening trials, utilizing multiple BS products, showed beneficial effects on lettuce, artichoke, pepper, and spinach yield and quality. Following this work, we evaluated whether these BSs could enhance the yield and quality of triploid watermelon. Two trials were conducted to see the effects of the BSs on triploid watermelons in the spring and summer of 2024. The triploid variety 'Fascination' was used, with 'SP-7' as the pollenizer in the spring and 'Co-Pilot' in the summer. BSs were applied as a root drench at the transplanting, vegetative, and flowering stages during the spring trial, and at the transplanting stage and subsequently applied every other week in the summer trial. In both trials, we utilized a randomized complete block design, with plants grown across four beds with eight plots each, with each plot receiving one of eight unique BS treatments. Each plot contained nine triploid watermelon plants and four diploid pollenizers, arranged so that one diploid pollenizer was planted after three triploid watermelons. Experimental treatments included a control and seven biostimulant treatments: silicon, seaweed extract, humic substances, three mycorrhizal fungi treatments, and beneficial bacteria. No significant differences were observed in marketable yield or fruit quality parameters, including fruit length and width, rind thickness, °Brix, flesh firmness, and antioxidant properties (i.e., total phenolic and flavonoid compounds, ABTS, and DPPH assays). The results from this experiment and our prior studies with other crops suggest that the effects of biostimulants are species-specific.

Designing a Nutrient Film Technique Hydroponics System for Assessing Salinity Tolerance in Watermelon Varieties

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It has been previously demonstrated that soilless hydroponics systems allow plants to grow at a faster rate while using the minimum amount of space possible. The use of hydroponics in watermelon has been growing in popularity as vertical agriculture becomes a key part of food production in urbanized regions, and this project seeks to harness the advantages of soilless growing techniques to accelerate watermelon genomics research. An NFT (Nutrient Film Technique) system was designed for growing watermelon plants in order to assess their responses to irrigation water with an elevated salinity level. The irrigation tanks for this trial were designed to emulate irrigation water that had been contaminated up to 30% of the salt levels in seawater, or a conductivity reading of 12 dS m^{-1}. It was observed that there was a significant, measurable difference in biomass between the lines assessed and the irrigation treatments. It is hoped that by applying this system to a larger population it is possible to assess a large population more efficiently than conventional greenhouse techniques.

Optimizing Experimental Criteria for Measuring Drought Tolerance in Wild (*Citrullus amarus)* Versus Cultivated Watermelon Genotypes (*Citrullus lanatus*)

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Optimizing the experimental criteria for watermelon drought tolerance, two preliminary experiments were conducted using a mixture of cultivated and wild watermelon genotypes. Both experiments utilized two soil textures, sandy-organic soil and pure organic soil, allowing for a more representative sample of different soils in which watermelon may be grown. The three cultivars used for these preliminary experiments were *Carolina strongback, Crimson Sweet*, and *Black Diamond*. All drought conditions across all experiments began on the first-second true leaf stage. The first experiment was separated into two parts (A and B), the first characterized by an intermittent

watering schedule and the second being in full drought conditions. By the 12th day of experiment 1a, no observable wilting or drought stress occurred. On day 12, all specimens were fertilized with 20-20-20 and were left without water for the next 11 days (experiment 1b). Data for experiment 1b was collected daily by measuring pots containing soil and plants. The following experiment (experiment 2) was a more refined and streamlined version of the original, with a control watered daily and an experimental group left un-watered for 13 days. 18 members of the control group and a corresponding 18 members of the experimental group were cut each day and compared by fresh, dry, and soil weight. The plants grown in pure organic soil that underwent full drought conditions were observed to have a significantly reduced growth rate and overall vigor compared to the plants in the other experimental group grown in sandy soil. Both experimental plants grown in pure organic or sandy soil showed decreased growth rate and vigor compared to the control group watered daily. Upon completion of the preliminary experiments, the main root scanning portion of the study began. Root scans were obtained using a WinRhizo Scanner and corresponding software. 135 Accessions of *Citrullus amarus* were grown to the first-second true leaf stage and then delicately harvested, ensuring no damage to the roots occurred. The root systems were washed with a strainer underneath to catch any parts of the root that may fall. The roots were scanned and analyzed by the WinRhizo, obtaining data on Length (cm), Surface area (cm^2), Diameter (mm) and Volume (cm^3). For future research, the top-performing plants from the WinRhizo scans will move on to be analyzed by the Licor 6800 to obtain gas exchange data such as stomatal conductance.

2024 Standard Size Watermelon Cultigen Yield and Quality Results for North Carolina

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A standard size watermelon cultigen study was planted on black plastic mulch with drip fertigation at the Horticultural Crops Research Station, Clinton, NC on 1 May 2024. Thirty-one entries from nine seed companies were evaluated, two diploid and 29 triploid. Spacing in-row was 2.5 ft and 10 ft between row centers. Two Wingman and two SP7 pollenizer transplants were interplanted per plot (4 total pollenizers). There were 15 first time first time seen entries in this study. Watermelons were harvested three times in which cumulative yields are reported. The highest yielding cultigens were Essence and ORS 61229 at 51,300 and 46,800 lb/ac, respectively from Origene Seed Company. Average marketable weight across all entires was 36,900 lb/ac. Other high yielding (top third) cultigens in descending order were Rio Grande, Virtue, 53021, Big Jack, Sugar Treat, Black Jack, ORS 61421, Nun 22102, and Cracker Jack. Cracker Jack was the standard cultivar used for comparison and is grown in NC and across the southeastern US, and yielded 41,200 lb/ac. Cultigens yielding the most tonnage had comparable marketable number of fruits per acre. The primary exception was Nun 22102 which was a large seeded diploid watermelon. 'Buttercup' (39,900 lb/ac) was the highest yielding yellow flesh watermelon and 'Fascination' (38,500 lb/ac), the other standard cultivar used for comparison, yielded 15th out of the 31 entries. 'Nun 22104' yielded 34,900 lb/ac but yielded 1,742 fruit/ac and was 775 below the average number of fruit produced per acre (2517). The cultigens with the largest fruit size (>16 lb) were Essence, 53021, Black Jack, Sweet Pontoon, Nun 22102 and Nun 22104. Soluble solids ranged from 10.7 to 12.1. Those cultigens with the highest solids that were 12 or more were ORS 61438, Sweet Pontoon, 53016, Black Jack, and Essence. Cato had a low soluble solids of 10.8 but was the entry with the firmest flesh in the study. Further testing in subsequent years are warranted to determine if responses are consistent, especially since this was the first time many of the entries in this study were evaluated.

American Society for Horticultural Science 2025 Southern Region Conference Watermelon Market Trends: Leveraging USDA-AMS Data to Review the Past Ten Years by Region

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The research and presentation utilize the Market News Portal maintained by Agricultural Marketing Services (AMS), a division of the United States Department of Agriculture (USDA), to provide insight into how watermelon production and pricing have evolved over the 2015 – '24 timeframe. These metrics are also leveraged to estimate revenue on a total and cumulative basis. Data is organized for each state or country of origin to show annual totals, as well as in-season accumulation. Historical prices have been re-scaled using the Consumer Price Index (CPI) to remove the effects of inflation. The research is beneficial to anyone with detailed interest into the watermelon industry and should serve as useful reference material for anyone curious about how each state has fared over the short and medium term.

Posters

Spraying Coverage Analysis of an Autonomous Robotic Platform

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Pesticides are an important tool against pests and diseases around the world. Due to the high demand for food production and making the fields even healthier, cutting-edge agricultural technologies are even more common nowadays. With new advances coming, there are also red flags and a desire to access those technologies and confirm if they are suitable for Georgia specialty crops. Knowing this, this study aimed to verify the spray coverage of multiple attachments of a commercial autonomous robotic platform at different simulated crop spacings and heights. The trial was conducted at the University of Georgia Tifton Campus, Tifton, GA, USA. An XAG R150 Autonomous Sprayer was used as the robotic platform and was equipped with two attachments: An air-assisted atomizer (1) and a vertical hydraulic boom sprayer (2). Three different simulated crop spacings (6, 8, and 12 feet) were used for this trial. These crop "simulated crop spacings" represents the spacing of three commercial crops in Georgia: Tomatoes, vineyards, and blueberries, respectively. The spacings were simulated using wooden staked with water-sensitive paper cards placed at four different heights: 1, 2, 3, and 4 ft above the ground to capture spraying coverage. Two spraying rates were used in this test; 25 and 50 GPA (gallons per acre). The average wind speed was 4 mph along the trial. The spraying coverage data was calculated using a digital microscope (DropScope). A random complete block design was used and each treatment was replicated four times. At 25 GPA, the results from the vertical spraying bars showed a spraying range up to 6 ft on each side of the sprayer (left and right), however, the higher coverage (40%) was observed within 3 ft on each side. At 50 GPA, the results showed the same range (6 ft on each side) but the coverage was approximately 80% coverage within 6ft. The air-assisted attachment at 25 GPA reached a spraying distance of 6 ft in both directions, but the spraying coverage was very low (8-10%). At 50 GPA, air-assisted range also reached 6ft on each side, however, the coverage was only 40% within 4 ft crop spacing at the right side and the left atomizers achieved a maximum of 18% coverage. Spraying coverage was better distributed within 2-3 ft height for both spray rates (25 and 50 GPA). This study demonstrated the effectiveness of commercial a commercial robotic sprayer in within different simulated crop spacings and heights. The vertical bar and air-assisted atomizers were able to provide enough output to reach the higher 12ft crop spacing, however, treatments with low GPA aren't able to provide high or acceptable coverage in larger distances. The 50 GPA treatment results in more coverage in both attachments. Despite these are promising results, more research testing these units in diverse environments such as sloppy and/or GPS-denied environments is needed.

Do Commercial and Consumer Horticulturists Practice Good Sanitation Practices.

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Sanitation practices for disease prevention/control can mean many things for many growers. Practices can range from discarding diseased plant material, disinfecting pots, growing media, benches, floors, tools, etc., removing weeds, pruning/removing infected areas on plants, and many other applications. Commercial and consumer horticulturists may not always think about how sanitation practices can benefit their horticulture endeavors. Many times, they can be hesitant to instill a sanitation program because they feel it is a waste of money, time, and resources (labor) however, they may end up paying as much or more for disease control. To help us gauge how commercial and consumers horticulturists view sanitation practices, two surveys were administered online. These surveys were completely voluntary and took respondents approximately 5-10 minutes to complete. These surveys were approved and granted Exemption Determination by the Mississippi State University HRPP/IRB. Institutional Review Board No. IRB-23-561. Results from commercial horticulturists show that overall, there is no significant difference in what practices they implement, while consumers are significantly better at working in clean zones before moving into diseased zones compared to other sanitation practices. When it comes to cleaning pruning tools, both commercial and consumer horticulturists choose to clean their tools before and after

each pruning task more than any other pruning tool cleaning option. As for sanitation practices with pots and trays, commercial horticulturists significantly clean, disinfect, and reuse their previously used pots and trays. Consumers also do this, however they also will reuse dirty pots just as much as cleaning, disinfecting and reusing. Overall, commercial and consumer horticulturists are choosing to follow good sanitation practices, but only about 60% or less claim they are doing so consistently. Continuing to educate about sanitation will help increase understanding of not only how to maintain/implement these practices, but also the significant benefits they bring, such as disease prevention.

Nutrient Remediation and Seedling Establishment in Blended Bioreactor Media

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Runoff water laden with nitrogen (N) and phosphorus (P) poses environmental issues. Bioreactors are a water treatment technology that can address this challenge. Bioreactors are often observed as reservoirs/trenches filled with a carbon source (often woodchips (WC)) where runoff water is retained for a period of time (hydraulic retention time; HRT) to support desired biological reactions. Bioreactors remove nitrates through denitrification, while phosphate removal may be enhanced through both adsorptive and biological processes. Bioreactor medias were created from ratios of WC and sugarcane bagasse (SB, an abundant byproduct of sugarcane production), where SB was assessed as a carbon alternative. The WC/SB carbon blends were evaluated with or without incorporation of an expanded shale material (ES) which served as a P-sorbing material. Six different media blends were investigated for N and P remediation in the first study, with a follow-up evaluation of used bioreactor media as a seed establishment substrate for raingarden installations. Bioreactor units were comprised of a dual-container system where the substrates were saturated with simulated runoff (containing N and P) for an HRT of 48 h before being drained, sampled, and analyzed to assess remaining N and P content in leachate. After the nutrient remediation study, medias were homogenized by treatment and moved to seedling trays for the plant seedling study. The bioreactor medias were investigated with or without stratification methods (pine bark/peatmoss/perlite potting soil serving as the surface 2.54 cm), with the hypothesis being that stratification enhances plant germination. All bioreactor medias were successful in removing N (>98% removal) from runoff water, while ES medias were more effective in P removal. Wildflowers seeded within expanded shale medias experienced lusher growth, and *Hibiscus moscheutos* 'Luna' achieved significantly (1.5 to 6 times) more growth in stratified bioreactor medias.

The Effects of the COVID-19 Pandemic on High School Students Competing in the FFA Horticulture CDE District Competition

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With shutdowns continuing into 2021, SIU decided to host an online District 5 FFA Horticulture CDE and horse, for that matter. With a year separation from contests and it being held online when it is traditionally in-person and hands-on created interest in how this shutdown affected contestants. They reported preference for in-person contests over online.

Munson's Legacy in Viticulture: A Genomic Exploration for Climate-Resilience

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In the late 1800's American grape breeder Thomas Volney Munson believed that the native wild American *Vitis spp.* should be used to improve American viticulture production. Today, with climate change causing challenges such as shifts in suitable production areas, temperature stress, pest pressures, reduced water availability, and extreme weather events, modern breeding programs are now looking to wild American *Vitis spp.* and *Muscadinia rotundifolia* to help navigate challenges not only in America but globally. Modern breeding programs often use crosses of *Vitis vinifera* with wild American *Vitis spp.* and *Muscadinia rotundifolia*, to integrate climate-resilient traits while maintaining the quality of traditional cultivars. Similarly, Munson used 10 of the 29 American *Vitis* and *Muscadinia spp.* in his work. Throughout his career Munson released over 300 cultivars and varieties, with only 89 surviving today; with his cultivars offering improved quality over native grapes and may carry sought after resistance traits, yet they remain largely overlooked in modern breeding for climate-smart grapes. By

collecting the parental lines, alongside the 89 cultivars that remain today we plan to perform whole genome sequencing and construction of a pangenome that will encompasses the full breath of genetic diversity that is found in the remaining Munson cultivars. Through genomic characterization, we aim to create the resources needed for identification of climate-smart traits and potential resistance genes. Additionally, we aim to clarify the lineage of these remaining cultivars and addressing historical discrepancies in the linage. Through this project we hope to create more sustainable and climate-smart systems for future grape production, by laying the groundwork for climate-resilience in a changing world.

Agriculture 4.0 and UAVs applied to Pecan Orchards: Evaluation of an AI-driven web platform for automated canopy biometry assessments

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Canopy measurement plays a fundamental role in fruit and nut tree crops. Key canopy attributes, such as height and area serve as indicators of tree vigor, growth potential, yield prediction, and orchard health. However, traditional methods still rely on manual measurements and conventional computer-aided processing techniques face significant limitations. These limitations include time consumption and the need for specialized knowledge to handle complex algorithms which makes it less accessible to growers. In contrast, commercially available platforms have the potential to provide more efficient, faster, and user-friendly analyses. Therefore, in this study we evaluated the effectiveness of an AI-driven web platform for automated canopy biometry and tree height assessments. To validate our method, manual measurements and computer-aided analysis were considered ground truth (control) and then compared with the results from the AI-Driven web platform. Six trees at different phenological stages (young, mid-age, and mature) were manually measured using a measuring tape for plant height while canopy area was based on computer-aided analysis (Agisoft Metashape). To test the web-based AI-driven platform drone images were collected from the same pecan orchard using a multirotor unmanned aerial vehicle (UAV) (DJI Mavic 3 Multispectral) equipped with an RGB camera. Drone was deployed at a ~260ft height which resulted in a GSD of ~0.9in/pixel. Regression analysis was the analysis used to validate the web-platform effectiveness. Regression analysis demonstrated high accuracy of the Solvi platform. For trees height, the results achieved a linear fit of $R^2 = 0.9845$. For canopy area, the fit was even higher, with $R^2 = 0.9973$. These results are considering the average of the three phenological stages. When considering young, mid-age, and mature trees separately, the R^2 values for plant height were 0.6562, 0.9031, and 0.8125, respectively, and for canopy area, they were 0.6267, 0.9899, and 0.9894. These results indicates that the AI-driven web platform (Solvi.ag) was effective for measure canopy area and height for mid age and mature trees separately. More studies are needed to verify the accuracy of this platform when the UAV is flow at lower altitudes, reducing the pixel size and incrementing Ortho mosaic resolution.

Determining Consumer Perception for Wine in Alternative Packaging

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Sustainability initiatives are increasingly emphasized in the grape and wine industry. Wine packaging accounts for 34–41% of the total carbon footprint of wine production, primarily due to the widespread use of glass bottles. To reduce this footprint, alternative packaging materials such as aluminum, polyethylene terephthalate (PET), and multilayer flexible pouches are emerging. However, consumers often perceive glass as the optimal packaging material for wine, associating wine in alternatives with lower quality. This study conducted an online discrete choice experiment with 2,000 U.S. wine consumers and purchasers to assess willingness-to-pay (WTP) for wines packaged in aluminum, PET, and flexible bags relative to glass. Participants were randomly assigned to information groups highlighting the carbon footprint and recyclability of the materials. Results showed that consumers discounted wines in alternative packaging, with price reductions ranging from \$4.37–\$8.09 for aluminum, \$8.01–\$11.42 for PET, and \$10.57–\$15.49 for flexible bags compared to glass. WTP was lowest in the no-information group (\$22.36) and highest in the carbon-footprint-only group (\$25.37). Similarly, market share for alternative packaging ranged from 27.22% in the no-information group to 34.40% in the carbon-footprint group. Consumers consistently preferred aluminum over PET and flexible bags among alternative options. These findings underscore the potential of consumer education on the environmental benefits of alternative packaging to enhance adoption and WTP. Promoting the lower carbon

footprint of alternative materials could help shift consumer perceptions and drive sustainability in the grape and wine industry.

Evaluating Methods to Measure Free and Total Sulfur Dioxide in Wine

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Additions of sulfur dioxide (SO_2) during wine production are used to maintain microbial and color stability of wines. SO_2 has three chemical forms (molecular [SO_2], free bisulfite [HSO_3^-], and sulfite [SO_3^{2-}] that vary depending on the pH of the wine. Wine should have 0.5-0.8 mg/L molecular SO_2 to maintain quality. Methods for SO_2 analysis typically measure/calculate free, bound, or total SO_2 (sum of bound and free) using the industry standard method, Aeration/Oxidation (A/O) or colorimetric analysis (typically as kits). The objective of this research was to determine the accuracy, costs, and time for the A/O method and two colorimetric kits to measure free and total SO_2 in standard and wine (*Vitis*) samples. Levels of free and total SO_2 of standard and wine samples were measured using three methods 1): A/O that uses acidified air (free SO_2) or heating (bound SO_2) then total SO_2 is calculated; 2) Megazyme (Neogen® Bray, Ireland) that uses a colorimetric method measured spectrophotometrically at 405 nm (total SO_2) and 575 nm (free SO_2); and 3) BioSystems (Barcelona, Spain) that uses a colorimetric method measured spectrophotometrically at 405 nm (total) and 560 nm (free SO_2). For the standard solution samples, free SO_2 (12.5, 25, 50, 75, and 100 mg/L) and total SO_2 (50, 100, 200, 300, and 400 mg/L) were evaluated. For the wine samples five co-fermentation treatments of Merlot (*Vitis vinifera*) and Noble (*Vitis rotundifolia*) wine were bottled at three molecular SO_2 levels (0, 0.8, and 1.5 mg/L) and evaluated. In terms of costs and time for the analysis, the A/O method was $2.44/sample with a 25-minute run time, Megazyme kits were $5.13/sample with a 15-minute run time, and the BioSystems kits were $4.50/sample with a 10-minute run time. The A/O method offered accurate, timely, and cost-effective analysis of standard and wine samples. For standard SO_2 solutions, the Megazyme kits and the A/O method had the most accurate free and total SO_2, whereas the Biosystems kits were accurate for total SO_2 but not free SO_2. As Noble increased in wine samples, the kits had results that struggled to have total SO_2 levels that aligned with expected values. While kits provide faster options for analysis of SO_2, the reliability of the analysis differed per kit and sample type.

Evaluating the Viticultural Characteristics of Five New Pierce's Disease Resistant Grape Cultivars

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Pierce's Disease (PD) poses a serious risk to grape production in the U.S.. The causal agent of PD, *Xylella fastidiosa subsp. fastidiosa (Xf*) is widespread across the warm humid climates of Southeastern U.S. and this range is expected to expand over the next century as the climate continues to warm. In response to this growing threat, researchers at the University of California Davis released five new to PD resistant wine grape cultivars: Camminare Noir, Paseante Noir, Errante Noir, Ambulo Blanc, and Caminante Blanc. This project evaluated the performance of Camminare Noir in five vineyards in the Texas Gulf Coast over two growing seasons. Early observations identified uneven ripening within and across vines and clusters as a potential problem. Thus, data on canopy density and cluster microclimate, yield components, crop load, fruit ripening, and fruit quality (soluble solids, juice pH, titratable acidity, anthocyanins, tannins, and flavonols) were evaluated on an individual vine basis on twenty vines at each site to better understand this challenge. Significant differences in fruit composition were observed across each site with a >7-fold difference in anthocyanins and >2.7-fold difference in tannins observed. Overall, sites that produced lower quality fruit were associated with higher vigor, lower crop loads, and greater canopy densities. Additional studies will be imposed to determine if these effects can be mitigated through timely canopy and crop management.

Enhancing the Shelf-life of Pawpaw (*Asimina triloba*) Fruits Using Plastic Packaging Techniques

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Pawpaw (*Asimina triloba*), a native American fruit, is highly perishable which restricts its fresh market potential. Cold storage at 4°C extends the shelf-life to one month but results in poor ripening and internal black discoloration. This study investigated the efficacy of plastic packaging with modified atmospheres in extending pawpaw shelf-life. Treatments included plastic bags (control), plastic

bags with ethylene absorbers, and plastic bags with low O_2 and high CO_2 gas mix (12% O_2, 10% CO_2, and the balance nitrogen), with three replicate bags of each treatment, with three replicate fruits per treatment bag stored at 6°C. Data on weight loss, firmness, color, sugar content, and gas composition inside the bags were recorded at 5, 10, 20, 40, and 80 days. Results demonstrated that both the ethylene absorbers and gas mixture treatments effectively lowered the amount of ethylene compared to the control. The firmness significantly decreased after 20 days of treatment, whereas the weight loss was highest for the control and ethylene absorber treatments at 40 and 80 days of treatment. Among all the treatments, the gas mixture maintained higher brightness (L* value), while there was no significant difference in Brix (%). These findings indicate that the gas mix treatment can help to protect some quality attributes of pawpaw. Further research is needed to optimize storage conditions for commercial applications.

Growing Raspberries in the South: Uncovering Heat-Tolerant Varieties for Mississippi

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Traditionally, raspberry cultivation has been concentrated in cooler regions such as California, Oregon, and Washington, where mild climates favor production. But can raspberries grow in Mississippi's challenging subtropical climate? This research explores the potential of heat-tolerant raspberry cultivars to adapt to Mississippi's intense summer heat and fluctuating winter temperatures. Locally produced raspberries could meet growing consumer demand, driven by the fruit's well-known health benefits. This study evaluates the performance of various raspberry cultivars to identify those most suited to Mississippi's challenging climate while maintaining high fruit quality. The experiment utilized a randomized complete block design with cultivars grown under conventional and organic fertilizer treatments. Data collection focused on plant growth, fruit yield, key quality parameters such as berry size, sweetness, and acidity, as well as phytochemical attributes including total phenolics, flavonoids, anthocyanins, and antioxidants. Preliminary results revealed significant variation among cultivars. 'Prelude' and 'Himbo-Top' demonstrated the highest yields under both fertilizer treatments, while 'Tayberry' and 'Loganberry' produced the lowest. Cultivars such as 'Caroline,' 'Bristol,' and 'Loganberry' exhibited higher single berry weights, whereas 'Heritage' and 'Fall Gold' had lower weights. 'Bristol,' 'Anne,' and 'Latham' produced fruits with high soluble solid content, while 'Dormanred' and 'BP1' were less sweet. Acidity levels varied, with 'Polka' and 'Crimson Giant' being more tart, and 'Glencoe' and 'Niwot' being less acidic. This ongoing research aims to provide valuable insights into which cultivars are best suited for Mississippi's climate, to empower local growers with sustainable production options.

Investigating Berry Blends for Better Balance in Southern Wines

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As the grape and wine industry continues to grow across the United States, its economic and agronomic benefits highlight the need to further expand this industry into the Gulf South region. However, local production of high-quality wine grapes remains limited, with few new region-specific cultivars becoming available and currently grown interspecific hybrid bunch grapes often exhibiting high acidity and low soluble solids for winemaking. Blending high-acid grape wines with other fruit wines offers a promising strategy to balance acidity and enhance phenolic composition while simultaneously supporting local growers of these fruits. This study explored blending Mississippi-grown 'MidSouth' grapes, blueberries, and blackberries to improve wine composition and consumer appeal. Physicochemical analysis revealed that blending influenced key properties such as titratable acidity, pH, ethanol, phenolics, and color attributes. Wines made entirely from 'MidSouth' grapes had the highest monomeric anthocyanins and ethanol content. Grape blends with blackberries exhibited the highest total phenolic content and produced lighter colored wines with more red and yellow tones, while blends with blueberries had the lowest pH, highest titratable acidity, and the darkest color. Consumer evaluation indicated that the 100% 'MidSouth' grape wine had the highest overall liking. The 100% 'MidSouth' grape and 50% grape:50% blackberry wines had the highest flavor ratings, and the 75% grape:25% blackberry wine was rated highest for sweetness and body. The blueberry blends, though lower in preference for flavor, body, sweetness, and overall liking, were rated highest for appearance. The findings suggest that blending 'MidSouth' grapes with other small fruits offers the ability to enhance different wine attributes,

depending on the fruit incorporated. With further refinement, this approach could improve the marketability of locally grown fruits while promoting economic and environmental sustainability in the region.

Output Deposition of Spraying Drone Versus Conventional Air Blast Sprayer on Pecan Orchards

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Drones are commonly being used in horticultural and row crops, but there is a lack of data regarding the efficiency of spraying drones compared to conventional sprayers for trees. This study compared the effectiveness of drones and traditional airblast sprayers on young and middle-aged pecan trees. The XAG P100 Pro drone was tested at 5 and 13 GPA, while the airblast sprayer served as the control at 75 GPA for young orchards, 50 GPA for mid-age orchards Each treatment included four replications, with water-sensitive papers strategically placed in various areas across trees' canopy to measure spraying coverage, droplet density, and droplet diameter. For young trees, the drone achieved 1.61% coverage at 5 GPA and 7.47% at 13 GPA, compared to 15.02% for the airblast sprayer. On middle-aged trees, coverage was 1.56% at 5 GPA and 4.46% at 13 GPA, while the airblast sprayer achieved 15.03%. Results showed significant differences in coverage, highlighting the superiority of the conventional sprayer. Volumetric diameter results for young trees were 291.34 µm at 5 GPA, 311.03 µm at 13 GPA, and 323.97 µm for the airblast sprayer. For middle-aged trees, diameters were 284.81 µm at 5 GPA, 253.63 µm at 13 GPA, and 240.55 µm for the airblast sprayer. ANOVA revealed no significant differences in volumetric diameter, suggesting parity between the drone and airblast sprayer.

Relative Susceptibility of Grapevine Rootstocks to Dicamba Drift

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The increasing adoption of genetically engineered dicamba-tolerant cotton varieties in the High Plains region of Texas heightens the risk of off-target exposure for wine grapes (*Vitis* spp.), potentially leading to injury through particle or vapor drift. Grapevines are highly sensitive to dicamba, and visible symptoms extend throughout the growing season. While above ground canopy symptoms such as reduced leaf size, upward leaf cupping, and delayed fruit ripening have been well documented, the effects on root system development and function throughout the growing season remain poorly understood. To the best of our knowledge, no studies have systematically examined this issue. This study aims to bridge that knowledge gap by evaluating the impact of volatilized herbicide exposure on root physiology and performance across multiple cultivars from different genetic backgrounds. Using a simulated particle and vapor drift protocol adapted from Dixon et al. (2021), we will assess differences in root biomass, morphology, and herbicide concentration levels across eleven commonly used rootstock cultivars in Texas. By assessing root system performance with varietal susceptibility, this research will provide critical insights into lethal and sublethal herbicide stress and its short and long-term implications on vine root system health. The findings will contribute to the development of rootstock varietal selection strategies and best vineyard management practices to mitigate herbicide damage risks in commercial vineyard operations in the High Plains region of Texas.

Investigating the Performance of Recently Released Rabbiteye Blueberry (*Vaccinium virgatum* Aiton) Cultivars for Sustainable Production in Alabama

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Blueberry acreage in Alabama has experienced a 37% increase over the last 15 years, demonstrating a considerable industry growth. New rabbiteye blueberry cultivars with improved fruit quality attributes have been recently released. However, very limited information is available on their performance in Alabama conditions. This study aims to evaluate the overall horticultural performance of the recently released rabbiteye blueberry cultivars 'Alapaha', 'Krewer', 'Ochlockonee', 'Pink Lemonade', 'Titan', and 'Vernon' and compare their productivity and fruit quality attributes to the established cultivars 'Climax', 'Powderblue', 'Premier' and 'Tifblue'. An experimental plot was established at the Chilton Research and Extension Center, Clanton, AL in 2019 and a RCBD with four blocks was utilized. The 2024 results suggest 'Pink Lemonade', 'Alapaha', 'Krewer', 'Climax', 'Vernon' and 'Premier' ripened early in the season, whereas 'Tifblue' and 'Titan' had mid-season ripening. Berries of 'Ochlokonee' and 'Powderblue' matured late in the season. 'Ochlockonee' produced the highest total yield of 5.6 kg/plant followed by 'Vernon' with 5.1 kg/plant, while 'Pink Lemonade' had the lowest yield of 0.98

kg/plant. ‘Climax’ produced the sweetest berries with a TSS of 16.0^0 Brix, while ‘Titan’ had the highest flesh firmness. ‘Titan’ also produced the largest individual berry size (3.2 g), whereas ‘Alapaha’ had the smallest individual berry weight of 1.3 g. The outcomes of this study can aid in determining the most suitable rabbiteye blueberry cultivars for production under Alabama conditions and can help sustain rabbiteye production in the Southeast.

Target genotyping using Capture-Seq technology to characterize the population structure and phylogenetic relationships of peaches from Australia and other parts of the world

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Peach *(Prunus persica)* is one of the world’s most widely produced temperate fruit tree crops. In addition, it is considered a model organism for fruit tree research by virtue of its small and relatively simple genome. Currently, genetic studies of *P. persica* are facilitated by 9k and 16k SNP chip arrays, which can be expensive and inflexible. Having only 16k SNP markers available is limiting, considering that other crops like maize have had over 50k arrays available for more than ten years. One goal of this project is to develop a panel of 50k SNP markers for use in peach and related species. These can be used for genetic diversity analysis, genomic selection, QTL analysis, and more. Another goal of our project is to characterize the relatedness and diversity of worldwide peach populations, to assess their potential as sources of breeding material to improve American peach varieties. We began by acquiring tissue samples from 250 unique peach genotypes from the University of Georgia’s Dempsey Farm, USDA-GRIN, and collaborators in Australia. The samples represented 28 different countries and 17 *Prunus* species and interspecific hybrids. Tissue samples were sent to Rapid Genomics for DNA extraction and Capture-Seq analysis. Capture-Seq was carried out using 50k genetic probes, which were based on known SNPs from the 16k SNP array, as well as SSR markers and exonic regions. After processing, over 7 million variants were identified, 134,424 of which were biallelic SNPs with a read depth between 10 and 100, minor allele frequency of 10% or more, and linkage disequilibrium r^2 less than 0.2. This panel of 134k SNP markers was used to run a principal component analysis, which revealed separation between North American and Australian populations, marking Australian peaches as a potential source of novel germplasm for American breeding programs. In the future, these SNPs will be further filtered to create a panel of informative markers. These markers will be used to investigate the diversity of Australian peach populations.

The Yin and Yang of Juvenile-Adult Transition in Fruit Trees

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In some of our most important crops, the long juvenile period in which crops cannot bear fruits is the main disadvantage for breeding programs. Previous studies in Arabidopsis have led researchers to believe that miRNAs 156.1 and 172 may play extremely important roles in the mechanism of transition between these stages. However, the miRNAs involved in the transition mechanisms of stone fruits, or drupes, have yet to be fully characterized. Our research, conducted on Olive, Pistachio, and Peach trees, is to assess the levels of miRNAs 156.1 and 172 in both juvenile and adult tissue to evaluate if this mechanism of transition is conserved across all species, in order to predict if young plants will have long or short juvenile periods before being utilized for breeding. Utilizing the ΔΔCT method to measure relative expression, miRNA 156.1 was found associated with juvenile stages in Olive and Pistachio trees, but was elevated in adult Peach samples. A decrease in miRNA 172, however, was consistent across Olive, Pistachio, and Peach trees.

Influence of Water-Soluble Fertilizer on Petunia Organogenesis

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Petunias are popular bedding plants, flowering throughout summer. Petunia is particularly responsive to tissue culture techniques and can be regenerated from multiple tissues and organs. The purpose was to evaluate the influence of commercial soluble fertilizer on organogenesis using 10 uM of the cytokinin 6-Benzylaminopurine (BAP). Petunia

leaf tissue explants, cut 2 mm wide, were placed on BAP media. Three fertilizer treatments of 5g/L were evaluated. The nutrient salts were Murashige and Skoog salts, 20-20-20 soluble fertilizer and 38-8-8 soluble fertilizer. Results showed that callus and shoots began to form after 7 days on the Murashige and Skoog media, 10 days on the 20-20-20, and 24 days on the 38-8-8. Callus and shoots were dark green on the MS media, light green on the 20-20-20 and yellow green on the 38-8-8. From six leaf segments, MS produced 37 total shoots, 20-20-20 produced 10 and 38-8-8 produced only one. The 20-20-20 fertilizer could possibly be used as a substitute nutrient source for in home tissue culture or as substitute for the Murashige and Skoog medium. This project was supported by a USDA Hatch grant.

Integrated Pest Management Strategies for American Sweetgum (*Liquidambar styraciflua*) and Chili Thrips (*Thrips parvinspinus*)

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American sweetgum (*Liquidambar styraciflua*) is a valuable ornamental tree species in the United States, faces increasing threats from the devastating sweetgum inscriber (*Acanthotomicus suncei*). Meanwhile, the chili thrips (*Thrips parvispinus*), a major pest of pepper and ornamental plants, poses significant challenges for Integrated Pest Management (IPM). This study aims to develop effective strategies to mitigate the impact of *A. suncei* on *L. styraciflua* and explore semiochemical-based solutions for managing *T. parvispinus* outbreaks. In this research, we employed headspace sampling to collect volatile organic compounds (VOCs) from 15 replicates of healthy sweetgum stem segments and bark beetles' hindguts and frass. These VOCs were analyzed using gas chromatography-electroantennographic detection (GC-EAD) and behavioral assays to identify compounds that influence pest behavior. The results showed that *A. suncei* exhibits higher fitness, including shorter development times and higher eclosion rates, when reared on American sweetgum compared to its original host, Chinese sweetgum (*L. formosana*). Volatile organic compounds (VOCs) from *L. styraciflua* and bark beetle were identified as key drivers of host selection. GC-EAD and behavioral assays identified 55 volatile compounds from *L. styraciflua and* 24 compounds and 16 compounds were detected from the hindguts of male and female *Acanthotomicus suncei*, respectively, while 36 volatiles were identified in the frass, among which octamethylcyclotetrasiloxane elicited strong antennal responses and was found to attract beetles. In conclusion, these findings emphasize the critical role of semiochemicals in pest-host dynamics and provide actionable insights for horticultural pest management. The application of attractants or repellents derived from these findings could effectively protect *L. styraciflua* in urban and plantation landscapes. Similar approaches are under exploration for *T. parvispinus* management to enhance IPM outcomes.

Influence of Silicon on Sunflower (*Helianthus annuus L.*) Potassium Uptake

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Silicon (Si) is suggested to benefit some plant species' potassium (K) status. The objective of this study was to evaluate the role of Si in improving K uptake. Sunflowers were grown in pots containing perlite inside a growth chamber. Two irrigation treatments were used: Hoagland's solution with low (1mM KCl) and optimal (5mM KCl) K levels applied with irrigation twice a week once the first true leaves developed. After six days, the treatments were combined with or without foliarly sprayed Si (20 mg Si/L). Fifteen days later, plants were decapitated, and roots were irrigated with Hoagland's nutrient solution, replacing K with rubidium (Rb) for exudate collection and analysis. Plant growth parameters (leaf, stem, and root biomass; shoot length and leaf area) were measured. Physiological parameters (exudation rate (Jv), K and Rb uptake rate) and K plant content were measured. Low K levels decreased overall biomass and caused plants to have thinner stems and leaves, but Si did not influence plant growth parameters at either of the K levels. Nevertheless, plants grown under low K levels showed higher exudation rates than those grown under normal K levels, and Si increased in Jv plants with low K levels.

Stomatal Conductance of Eleven Herbaceous Perennials under Deficit Irrigation

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The Dallas/Fort Worth metropolitan area is projected to reach a population of 10 million by the 2030, and there are growing concerns about water availability for landscape plants. Sustainable landscape design, particularly using drought-tolerant species, is critical for long-term water conservation. To evaluate plant performance across different irrigation protocols, twenty herbaceous

perennials were planted in 12 beds in four blocks. Unfortunately, nine species were lost during the first winter. During 2023 and 2024, irrigation was applied according to one of three protocols: ET_0 0.6, 0.3, and no irrigation. ET_0 was determined based on a local weather station and data from the Texas A&M AgriLife ET Network. Stomatal conductance (g_{sw}) was measured from May to August of 2023 and 2024 using a LI-600 Fluorometer/Porometer. *Conclinum coelestinum, Salvia farinacea* 'Henry Duelberg', and *S. yangii* had similar g_{sw} in both irrigation treatments. However, in 'Henry Duelberg' and *S. yangii*, no difference existed between the 0.3 and unirrigated treatments. *P. muticum had* significant differences across all treatments, and, though an average performer compared to others tested, landscape performance increased with increasing irrigation. *C. coelestinum*, *'Henry Duelberg'*, and *S. yangii*, g_{sw} performed similarly, with landscape performance improving with higher irrigation. Other species tested did not differ in g_{sw} across the treatments. Based on these results, that g_{sw} does increase with irrigation in many of the herbaceous perennials tested, and increases in g_{sw} can be closely tied to landscape performance.

The Decibel Dynamics of New Technology in Landscape Maintenance

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The movement towards the electrification of the landscape industry is becoming more prevalent due to the legislative restrictions and advancements in battery technology. However, with the impending restrictions there is very little research in this area to aid landscapers in integration. One of the major factors for restricting the use of gas-powered landscape equipment is the noise they create, especially gas leaf blowers. Understanding the decibel outputs of both gas and battery-powered equipment and their effects on users and passerby's is lacking. According to manufacturers of gas-powered equipment, decibel levels exceed 95 dBA at the operator's ear and 65-80 dBA at fifty feet. Noise above 85 dBA for a prolonged period of time leads to health risks for the user. The most common health risk is hearing loss, from which 40 million Americans 18 years and older suffer. In the U.S., millions of these devices are used yet little research has been performed in this industry. This study was performed to understand the decibel levels of both types of equipment at eight different points around the operator at distances of three and fifty feet. This spatial data offers information on where the equipment has the highest decibel output as well as an output average. With this data we were able to calculate the percent differences between the gas and battery-powered equipment to understand their differences. Future research will be conducted to understand decibel dosages for landscape maintenance operators who use the equipment for prolonged periods.

Gas exchange rates of bermudagrasses (*Cynodon dactylon* X *C. transvaalensis*) in response to varying light intensities.

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Shade from trees and buildings is a persistent challenge in management of turfgrasses. Selection of cultivars having improved shade tolerance would improve turf performance and function in shaded microclimates. The objective of this research is to determine the shade tolerance mechanisms of hybrid bermudagrasses varying in apparent shade resistance. Six genotypes were planted into 1-inch pots under greenhouse conditions. Light response curves were generated using a portable photosynthesis system (LI-6800) and relevant physiological parameters (e.g., dark respiration, Amax, and quantum yield) were estimated using a rectangular hyperbola model. The most shade resistant entry (OSU2021) demonstrated the greatest Amax and dark respiration. These findings conflict with prior reports which suggest shade tolerance is related to a low dark respiration rate and suggest more replications and repeated studies are needed to have confidence in this approach.

Landscape Performance of Herbaceous Perennials in North-Central Texas under Deficit Irrigation.

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As urban areas expand, the demand for clean water increases, including water for landscape irrigation. This leads to landscape watering restrictions and, frequently, drought stress in landscape plants. Herbaceous perennials are often drought tolerant, either native or well-adapted to the local climate. In this study, 11 species of herbaceous perennials were evaluated using three different irrigation protocols, 60% of ET_0, 30% of ET_0, and no irrigation. Plants were evaluated using a rubric with scores 0-5 in categories of form, foliage, and flower. Form was based on plant overall shape, with 5 being a uniformly shaped plant with no defects and 0 being a dead plant. Foliage was

based on leaf appearance, with a 5 score indicative of leaves with no disease, insect damage, or sign of physiological stress (leaf edge burn, etc…) and 0 being a dead plant or no foliage present. Flower scores were based on flower coverage and flower appearance, with 5 being complete plant coverage and no diseased or damaged flowers, while 0 represented plants with no flowers. These scores were summed to create a landscape performance (LP) score. Across all species, plants irrigated at 60% had the highest LP scores, averaging between 5.4 and 10.1. *Conoclinum coelestinum* (10.0), *Salvia yangii* (9.7), *S. farinacea* 'Augusta Duelberg' (10.1) and 'Henry Duelberg' (10.0) were the highest rated. Interestingly, plants receiving irrigation at 30% ET_0 had LP scores similar to (2.8 to 9.0) or worse than unirrigated plants (2.9 to 8.6). Using a minimum LP score of 7.5, five species maintained acceptable quality in the absence of irrigation, *C. coelestinum* (8.5), *Foeniculum vulgare* (7.5), *S. yangii* 7.5), *S. farinacea* 'Augusta Duelberg' (8.6) and 'Henry Duelberg' (8.3), and *S.* × *sylvestris* 'Mainacht' (7.7). Based on this study, we recommend watering at 60% ET for the best landscape performance, but species and cultivars are available that provide acceptable landscape performance when irrigation is limited.

Using Various Incorporation Rates and Particle Sizes of Eastern Red Cedar Biochar to Produce Potted Begonias

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Finding a substitute for peatmoss in soilless media mixes is becoming more prevalent due to environmental concerns. Peatmoss extraction is causing the destruction of ecosystems and increasing carbon emissions. Due to this, the use of biochar is becoming more widespread. Eastern Red Cedar is also raising environmental concerns including nitrogen immobilization and lower light penetration which has led to a decrease in growth of native grasses. A greenhouse experiment was conducted in Stillwater, Oklahoma from May to July 2024 to evaluate the effect incorporation rates and particle sizes of Eastern Red Cedar biochar on container grown begonias. Treatments for this experiment included four incorporation rates- 15%, 30%, 45%, 60% and a 100% soilless media control with four particle sizes- 2mm, 4mm, 8mm, and >8mm of Eastern Red Cedar biochar. Results showed that incorporation rate and particle size decreased, plant growth and flower development increased. The use of any particle size with the 15% incorporation rate resulted in increased plant growth and flower development. Additionally, the use of the 2mm particle size with the 30% incorporation rate also resulted in increased plant growth, flower development, and ability to hold soil moisture compared to the control. However, particle sizes greater than 2mm reduced the water holding capacity. To conclude, biochar has potential to become a substitute for peat moss in soilless media mixes, but particle size, supplementation rate, and the feedstock used to produce biochar need to be further evaluated.

Screening Texas A&M Potato Breeding Germplasm for Resistance to *Potato Virus Y*

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Potato is the third most consumed human food crop globally. *Potato virus Y* (PVY) is one of the most economically damaging pathogens causing potato diseases worldwide. It affects tuber seed, commercial, and the processing industry; it results in enormous economic losses each year by reducing the yield and quality of tubers. There are several strains of PVY, including recombinant types; the three most important strains are PVY^N, PVY^C, and PVY^O. Three major genes have been identified that confer extreme resistance against PVY (Ry_{adg}, Ry_{sto}, and Ry_{chc}). Breeding for extreme resistance is the best course of action to mitigate the detrimental effects of PVY on the potato crop. In this study, the RYSC3 marker was used to track the Ry_{adg} gene, the STM0003 marker for the Ry_{sto} gene, and the MG64-17 marker for the Ry_{chc} gene in parental clones and breeding clones of the Texas A&M Potato Breeding Program. Of the 549 clones screened, gene Ry_{adg}, gene Ry_{sto}, and gene Ry_{chc} were present in 4.2%, 11.7%, and 3.6% of clones, respectively. Furthermore, 226 of the clones were sent to be evaluated with Targeted GBS Flex-Seq for the presence of Ry_{sto} gene. The Targeted GBS Flex-Seq marker-assisted selection had a Cohen's Kappa concordance statistic of 0.89 compared to the in-house markers-assisted selection. The Texas A&M Potato Breeding Program has promising advanced clones in regional trials with PVY extreme resistance, such as COTX10080-2Ru (Duncan Russet), (Ry_{sto}), AORTX09037-1W/Y (Ry_{chc}), and AORTX09037-5W/Y (Ry_{chc}). The objective of the program is to continue screening to identify clones extreme resistance against PVY and identify clones with multiple copies of PVY extreme resistance genes to maximize transference of PVY resistance to progenies.

Evaluating Watermelon (*Citrullus spp.*) F_2 Hybrid Populations for *Phytophthora capsici* Resistance

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Watermelon, *Citrullus lanatus*, is an important vegetable crop in the United States of which the annual watermelon crop value exceeded $534 million in 2021. In recent years, production has been disrupted by the rapid spread of a serious plant pathogen, *Phytophthora capsici*. The closest ancestors of today's domesticated watermelon is thought to be *Citrullus mucosospermus* and *Citrullus amarus*, several accessions of which have known resistance to *Phytophthora capsici*. These resistant accessions were hybridized with Texas A&M breeding lines and popular commercial cultivars. To screen the F_2 hybrid populations, 10 V-8 agar plates containing at least 1 week old *Phytophthora capsici* growth were blended with 1 liter of sterilized water. Applications were done using a 10 milliliter oral medicine syringe and consisted of approximately 1 milliliter of the resulting sludge being dispensed per cell. Seedlings were evaluated after 28 days. Using chi-square analysis, at $p = 0.05$, no gene model fits the current data. When testing a 1 recessive gene or a 1 dominant gene model, the values of X^2 are 321.57 and 28.80, respectively. When testing a 2 recessive genes or 2 dominant genes model, the values of X^2 are 308.23 and 16.82, respectively. In both the 1 gene model and 2 gene model, for both dominant and recessive gene action, the null hypothesis is rejected due to significant differences between X^2 and the test value. Loss of virulence may have resulted in inconsistent data being collected resulting in statistical outliers and anomalies. Further screening of populations is required to determine heritability and gene action with greater accuracy.

Biomass Source of Biochar and Genetic Background of Tomato Influence Plant Growth and Development and Fruit Quality

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The ongoing challenges of climate change and intensive agricultural practices have led to a decline in soil health and crop yields, highlighting the need for sustainable solutions to restore soil fertility. Biochar, a carbon-rich material produced through the pyrolysis of biomass, has gained attention as a potential soil amendment for improving soil health and boosting agricultural productivity. While previous studies have reported variable effects of biochar on crop yields, most research has focused on a single biochar type and a single plant cultivar. The interactions between different biochar types and plant genetic backgrounds remain largely unexplored\. In this study, we evaluated the effects of six distinct biochars on the growth and fruit quality of three tomato (Solanum lycopersicum) cultivars. We tested two hypotheses: (1) biochars from different feedstocks would produce unique phenotypic responses in a single cultivar, and (2) biochars from the same feedstock would induce different phenotypic outcomes across different tomato cultivars. Our results support both hypotheses, demonstrating that plant genetic background and biochar feedstock source significantly influence growth performance and fruit quality. These findings underscore the importance of considering both biomass source and plant genotype when using biochar as a soil amendment for sustainable agriculture.

Garlic (*Allium sativum*) Cultivar Trial and Allicin Content Analysis in Oklahoma

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Garlic (*Allium sativum*) is a cool season and flavorful vegetable crop that has a long history in culinary, horticultural, medicinal uses. Oklahoma is a state characterized by diverse weather and soil types, but there is an economic opportunity for garlic production with optimal planting techniques and planting recommended cultivars. The number of farmers producing garlic increased from 28 to 44 between 2017 and 2022. This trial was conducted at the Cimarron Valley Research Station with Oklahoma State University in Perkins, Oklahoma and evaluated ten cultivars grown using drip tape irrigation, no mulch, and a no-spray approach to weed and pest control. Total graded marketable yield and allicin content were recorded during the 2023-2024 growing season for softneck and hardneck cultivars including: 'California Early', 'Chesnock Red', 'Duganski', 'German Extra Hardy', 'German White Stiffneck', 'Inchellium Red', 'Music', 'Purple Glazer', 'Romanian Red', and 'Sicilian Artichoke.' In 2024 the top performing cultivars were 'German Extra Hardy' and 'Inchellium Red'. These were significantly higher yields that 'Duganski'. No other statistical differences were observed. Their respective marketable yields were 2,704 and 2,538 pounds per acre. In addition, we recorded allicin content for each cultivar using a spectrophometric assay. Allicin is one of the most important thiosulfates in garlic and its presence adds

market value for those interested in the nutritional and health benefits of garlic. Additional research of allicin content among different cultivars of garlic is needed to guide consumers and healthcare professionals in selecting the best cultivar.

The Root of the Problem: Clonal Propagation on Stoloniferous Perennial Peanut (*Arachis pintoi*)

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Arachis pintoi is a multifunctional, stoloniferous perennial peanut, primarily grown for hay, but with a growing interest in the ornamental industry due to its nitrogen fixation, drought resistance, and more. Although *A. pintoi* is typically grown from seeds, in the US, *A. pintoi* is clonally propagated by division. Furthermore, propagation by cuttings has not been studied. Clonal propagation by cuttings of *A. pintoi* was tested with various cutting length and different concentrations of the growth regulator Indole-3-Butyric Acid (IBA). Cuttings of *A. pintoi* with one, two, and 3-node were taken from greenhouse grown plants. Cuttings were dipped into 1000, 3000, and 8000 ppm, with a control group with no IBA. Twelve treatments with 12 repetitions were placed in a 72-cell tray filled with soilless media. Treatments were placed in a greenhouse with an overhead mist system, watering the plants for six seconds every four minutes. The greenhouse was set to 31/14°C day/night temperature, with a photoperiod of 10 hours. Following a three-week period, cuttings were evaluated for root growth and development. No significant differences among treatments were observed. A total of 59.7% of cuttings failed to produce roots while the remaining rooted cutting displayed negligible variation of root length among the 12 treatments. Three and 2-node cuttings produced marginally more and larger roots than 1-node cuttings, but IBA concentrations had no significant differences. The observation that IBA did not significantly affect root growth could be beneficial for commercial propagation. Lack of significant results could be due to multiple factors including photoperiod and propagation media temperature. Stoloniferous perennial peanut is a long day plant and the short photoperiod with no supplemental lighting could have reduced growth rates. Also, the mist could have decreased the temperature of the soilless media causing slower development.

Impact of High pH and Bicarbonate on Crop Growth and Development

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Achieving maximum crop yields depends on several factors, including appropriate nitrogen fertilization. However, rhizosphere pH, a key factor in nutrient bioavailability, is often neglected. Optimal pH is essential for healthy plant growth, and it's influenced by factors like nutrient source and rate, and irrigation water quality. High alkalinity from bicarbonate (HCO_3-) accumulation in irrigation water can hinder macro- and micronutrient uptake. This study investigated the effects of pH adjustment source (KOH or $KHCO_3$) at varying pH levels and nitrogen rates on basil growth. A greenhouse experiment was conducted using a randomized complete block design with a 4 x 2 x 2 factorial arrangement, creating 16 treatment combinations. Treatments consisted of four nutrient solution pH levels (5.8, 6.5, 7.0, and 7.5) adjusted with either KOH or $KHCO_3$, and two nitrogen application rates (7.14 or 14.28 mM). Higher nitrogen (14.28 mM) significantly increased overall shoot growth. Leaf necrosis was more prevalent in plants grown with $KHCO_3$ adjusted solutions, regardless of nitrogen rate. Conversely, plants receiving 14.28 mM N and KOH-adjusted solutions were necrosis-free. Shoot fresh and dry biomass varied significantly across pH levels, pH buffer (KOH vs. $KHCO_3$), and nitrogen rates. However, shoot height, canopy circumference, and substrate pH showed no significant differences among treatments. Electrical conductivity (EC) was significantly higher at the 14.28 mM N rate, but remained below 1.60 mS/cm. Basil growth was influenced by pH, pH buffer, nitrogen rate, and their interactions. Optimal growth was observed with 14.28 mM N and a pH range of 5.8–7.0 achieved using KOH.

Interactive Effects of Growing Medium and NH_4:NO_3 ratios on Broccoli Growth and Yield

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Plant's response to N forms (NH_4 and NO_3), rate and NH_4:NO_3 ratios varies with growing medium. Substrate CEC and pH determines its buffering capacity against nutrient concentration and pH fluctuations. Studies were designed to investigate the response of broccoli to multiple NH_4:NO_3 ratios in solution and peatlite. Seedlings were grown in five NH_4:NO_3 ratios (0:100, 25:75, 50:50, 75:25 and 100:0) at two N-rates (7.50 and 3.75 mM) in solution culture. Similarly, same five NH_4:NO_3 ratios at 7.5 mM was supplied to seedlings grown in peatlite. In both medium, 100% NO_3 supplied plants had superior growth

and productivity than treatments with NH_4. In solution, among 100% NO_3, plants were significantly larger with more biomass at 7.50 than 3.75 mM. Plants supplied with 100% NO_3 had 99.35, 99.91, 65.93, 87.13, 94.39, 81.08 and 87.93% more biomass, leaf area, height, caliper size, root length, g_{sw} and leaf florescence, respectively than 100% NH_4 @ 7.5 mM. Similarly, in peatlite, biomass (shoot, leaf, and head), leaf area, height and caliper size were 52.43, 38.46, 76.49, 61.06, 40.22 and 31.88%, respectively more in 100% NO_3 than 100% NH_4 supplied plants. Severity of NH_4 stress was more evident in solution. Plants supplied with $\leq$ 25% NH_4 had significantly reduced growth and developed N deficiency (purple pigmentation, chlorosis, necrosis, and defoliation of leaves). In peatlite, NH_4 stress increased with NH_4 proportion but only 100% NH_4 supplied plants had substantial reduction in growth and yield. Our findings suggest that right N form, rate and optimal NH_4:NO_3 ratios for soilless production of broccoli are NO_3, 7.50 mM and 0:100 (100%), respectively. Moreover, N forms and NH_4:NO_3 ratios are crop and growing medium specific.

Assessing Kale Microgreens Yield and Quality Grown Using Different Soilless Media

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Microgreens are gaining attention for their exceptional nutrient density and potential health benefits. While peat-based media have traditionally been used for their cultivation, environmental concerns have sparked interest in more sustainable alternatives. This study examines the impact of four different growing media—coconut coir, hemp fiber, biochar blended with soilless media, and a soilless media control—on the yield and nutritional composition of kale microgreens. The results revealed significant differences in fresh weight across trials ($p < 0.0001$), with trial 1 producing a higher average fresh weight than trial 2. In trial 1, fresh weight varied among treatments ($p = 0.0017$), with the control and biochar treatments yielding the highest fresh weights, followed by hemp fiber and coconut coir. In contrast, trial 2 showed greater fresh weight in coconut coir and hemp fiber treatments compared to biochar and the control ($p < 0.0001$). Despite these variations, % dry matter ($p = 0.99$) and % moisture content ($p= 0.99$) remained consistent between trials. Nutritional analysis also highlighted differences in microgreen quality. Chlorophyll a levels were highest in microgreens grown in soilless media alone and coconut coir, whereas those grown in biochar exhibited the highest chlorophyll b content. These findings emphasize the role of substrate selection in influencing both microgreen yield and nutritional value. Overall, the study underscores the potential of alternative growing media to enhance microgreen cultivation, offering sustainable solutions without compromising productivity or quality.

Exploring Mycorrhizal Fungi Benefits for Soilless Basil Production

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Phosphorus is an essential nutrient for plant growth, but its availability is often limited in many soils, particularly in container systems with soilless media. Arbuscular Mycorrhizal Fungi (AMF) products are marketed for their potential to improve plant growth by improving phosphorus uptake. This study aimed to assess the impact of three commercially available AMF products on basil (*Ocimum basilicum*) growth in a soilless medium. Data was collected on plant growth parameters such as fresh and dry biomass, along with chlorophyll and carotenoid content, to evaluate potential yield and physiological quality improvements. However, results showed no significant differences in biomass or pigment concentration between AMF-treated plants and the control group, which did not receive AMF inoculation ($p>0.05$). This suggests that commercial AMF products may not provide benefits for short-term crops like basil production in soilless conditions. Future research should evaluate the efficacy of these products for crops with longer growing periods.

Treatment of Palletized Broccoli with 1-MCP from Harvesthold® Fresh Sheet, a Polymer-Based Delivery System

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We evaluated a new commercial product for the treatment of fruits and vegetables with 1-methylcyclopropene (1-MCP) named HarvestHold® Fresh sheet (HHF, Verdant Technologies, Centennial, CO), a polymeric sheeting material that releases 1-MCP in response to high humidity. Broccoli was procured as whole heads in 20-lb waxed boxes. The day following harvest, the boxes were opened and two 6 x 13-inch sheets of HHF were placed on top of the broccoli heads with the 1-MCP-emitting surface facing the broccoli. Boxes were stacked on a pallet to a

height of 6 layers, 8 boxes per layer. Six boxes in the palletized product, one in each layer, were fitted with a 0.8 mm i.d., 2-m long, Teflon tube to permit pulling gas samples from the treated box. For gas sampling, 5 mL was removed, discarded, and a second 5 mL was taken for 1-MCP analysis. We followed the release of 1-MCP until the 1-MCP in the boxes and the storage chamber atmosphere diminished to zero. At that point, the room temperature was changed and the following day, the broccoli boxes were opened, the HHF sheets replaced, and the process repeated. Temperatures studied were 0, 5, 10, and 20 °C at 90-95 % relative humidity. A portion of the 0 °C HHF treated broccoli were set aside, held at 0 °C for 19 days and transferred at 15 °C for 4 days for shelf-life evaluation. The 1-MCP in the boxes of broccoli was low, ranging between 0.01 and 0.1 ppm on average, and continued to be detected for 5, 3, 3, and 1 days at 0, 5, 10, and 20 °C, respectively. The concentration of 1-MCP in the room atmosphere was similar to that detected in the boxes, suggesting the 1-MCP dispersed readily from the boxes. There was little difference in the 1-MCP concentration in the various pallet layers. Despite the low concentrations of 1-MCP, the use of HHF at 0 °C yielded greener broccoli heads with higher chlorophyll levels than untreated heads after 2 1/2 weeks of storage, showing the effectiveness of the 1-MCP release from HHF sheets. The impact of low concentrations for extended storage has been little investigated, but the results suggest a better understanding of the interplay between concentration and exposure time on broccoli would be interesting and beneficial for quality retention.

Pheromone-Based observation of *Cylas formicarius* population in sweetpotato

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Cylas formicarius, also known as sweetpotato weevils, are major pests with a life cycle that is significantly influenced by environmental factors. The objective of this research was to utilize pheromone-based traps to monitor male weevil populations over a 21-week sweetpotato production period. Pheromone traps were monitored daily Monday to Friday. The results from Weeks 1 to 12 indicated that weevil counts were low at an average of 6.3 weevils daily, suggesting that there was either limited food availability or dormancy. Weeks 13 to 16 had a gradual increase with an average of 32 weevils daily. The most notable rise occurred from Weeks 17 to 19, approximately 165 weevils daily. A significant decline was observed in Weeks 20 to 21, which may have been the result of resource depletion after sweetpotato harvest. This research demonstrates the importance of targeted pest management, specifically in the North West and South East regions, to prevent future outbreaks. This research was supported by a USDA Specialty Crops Block Grant administered by thr Virgin Islands Department of Agriculture.

Evaluating the Use of Vine Shelters to Reduce Cold Injury in New Vineyards

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Vine shelters, also known as Grow Tubes, are widely utilized in American vineyards during the first three years following planting, offering protection from herbicide drift, herbivory, wind desiccation, and intense solar radiation. Vine shelters come in various materials, heights, colors, and opacity. Although there are a number of benefits to using vine shelters, due to their potential insulative properties coupled with inconsistent temperatures in Fall and Winter, it is thought that some types may contribute to a delay and or disruption in acclimation and even promote de-acclimation during the dormant period, increasing the risk for cold injury. The goal of this study was to evaluate the insulative properties of 12 commercially available vine shelters. Loggers measuring temperature were placed in the middle of each tube as well as a control, without vines, which measured ambient conditions over an entire year. The annual mean temperature was elevated for 3 of the 12 shelters, with a maximum increase of 3% (X30) and reduced for 3 shelters when compared to ambient. Growing degree days (GDD) were also calculated with 6 shelters having up to 10% greater GDD accumulation compared to ambient and 2 with as much as 13% less accumulation. Finally, a spring frost event was recorded over an 8-hour period where 2 shelters maintained an increased temperature of 0.56C and 6 shelters an increase of 0.11C over ambient. This study demonstrated that temperatures within some vine shelter types do indeed differ from ambient conditions confirming the need for a future study with suspect shelters installed in a newly planted vineyard.

Educating All Ages Through the Transition to Organic Partnership Program

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As part of the USDA Southeastern Transition to Organic Partnership Program (TOPP), our project focuses on the evolution that has taken place in the horticulture landscape as there has been a growing concern for environmental awareness through the adoption of organic principles and

practices. To further promote and educate producers, consumers, and potential members of the workforce, field days at the Mississippi State University Beaumont Horticultural Unit and South Mississippi Branch Experiment Station have featured sessions on the TOPP program, including technical assistance and mentorship opportunities. Additionally, we are engaging youth and the broader community in organic principles through our work at the Delta Pathways to Possibilities (P2P) in Greenwood, MS and the Gulf Coast P2P in Biloxi, MS. At these interactive workforce development expos, we have engaged over 15,000 8th graders with hands-on learning experiences and introducing them to agriculture and natural resources with an emphasis on organic agriculture and sustainability. In addition, a TOPP-sponsored Specialty Crop Conference was held in Hattiesburg, MS. Through this 2-day event, we connected with more than 80 attendees on topics such as Food as a Business, fruit and vegetable production, as well as ornamental and cut flower opportunities. To promote collaboration among national TOPP partners, we are hosting a TOPP workshop at the 2025 ASHS Conference in New Orleans, LA. Together these events aim to connect industry professionals, researchers, and students, fostering knowledge exchange on organic practices, crop production, and the future of sustainable agriculture. The goals and outcomes of our activities highlight how these efforts contribute to the growing awareness and adoption of organic practices and inspire the next generation of environmental stewards.

Alternative Oxidase Likely Maintains ATP Biosynthesis During Pear Fruit Ripening

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Pear fruit conditioning is a post-harvest treatment essential for achieving optimal ripening and flavor, especially in European pears that do not fully ripen on the tree. Following harvest, conditioning induces ripening by shifting ethylene production from system-I to system-II. This transition leads to increased ethylene levels and respiration, which are vital for fruit softening and flavor enhancement. In our previous study, we observed a significant upregulation of alternative oxidase (AOX) during conditioning, suggesting its involvement at the preclimacteric stage. To understand the process further, we conducted a protein-protein interaction study using AOX as bait and identified Cytochrome B5 reductase (CB5R) and the ATPase β-subunit as AOX-interacting partners. Our findings indicate that AOX, beyond its role in thermogenesis, may play a regulatory role in ATP synthesis during pear ripening. By interacting with CB5R and β-ATPase, AOX could influence mitochondrial function and energy production, providing new insights into the biochemical processes underlying fruit ripening.

National Sweetpotato Collaborators

Effect of Sanitizer, Fungicide, and Packing Line Configuration on Postharvest Management of Sweetpotato Black Rot Caused by *Ceratocystis fimbriata*

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Black rot of sweetpotato, caused by Ceratocystis fimbriata, is a highly damaging post-harvest disease in the United States sweetpotato industry. Cultural practices and sanitation are often viewed as insufficient for management of black rot. In order to identify effective configurations of sweetpotato packing line equipment, using dump tanks, sanitizers, and fungicides, efficacy trials were conducted. In the experiments, sweetpotatoes were artificially inoculated with the C. fimbriata and subjected to various treatment combinations. Sweetpotatoes were placed into water-filled, plastic bins to simulate dump tanks and placed onto a miniature packing line for spray treatment applications. All packing line combinations that included Mertect sprays, as well as the Jet-Oxide in the dump tank treatment provided significant reduction in disease when compared to the water-only nontreated control. The results of these trials are important for identifying effective uses of products available for the sweetpotato industry.

Weed Species Hosting Sweetpotato Potyviruses

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Sweetpotato (*Ipomoea batatas* (L.) Lam.) is an important crop in Arkansas, providing essential economic value to small-scale farmers. Virus infections, particularly from potyviruses, are predominantly transmitted by whiteflies and aphids, significantly reducing sweetpotato yield and quality. The potential role of weeds as alternate hosts for insects and virus reservoirs remains unclear; therefore, understanding the spread of these viruses is critical for developing effective control measures. This study

investigates the role of weeds as alternate hosts and reservoirs for sweetpotato viruses and facilitating the spread of infections. The study highlights the significance of virus-vector interactions and plant diseases. The study aims to identify weed species that act as sweetpotato virus reservoirs during summer in Arkansas. The weed samples were collected in the summer of 2023 from nine sweet potato farms, including Jefferson County, and three farms in Cross County. In total, 53 samples were randomly collected, which included cut leaf ground cherry (5), small melon (7), palmer amaranth (19), entire leaf morning glory (8), entire ivy morning glory (2), yellow nut sedge (5), horse nettle (3), pitted Mg (1), and Johnson grass (3). Leaf samples were transported in ice coolers and stored in -80º C freezer on the same day. The samples were tested for the potyviruses using the standard multiplexed Reverse Transcriptase Polymerase Chain Reaction. The most dominant weeds in Arkansas sweetpotato growing fields were entire leaf Mg. Among the samples, the weed species that tested positive for viruses include entire ivy Mg (SPVC), yellow nutsedge (SPVG), entire leaf Mg (SPVG. SPVC, SPFMV, and SPV2), entire leaf Mg (SPFMV), entire leaf Mg (SPVG and SPFMV), and horse nettle (SPVG and SPFMV).

Estimating the Effect of Sweetpotato Potyvirus on Different Generations of the Beauregard Variety

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Sweetpotato (*Ipomoea batatas* (L.) Lam.) is a vitamin-rich root vegetable that contains nutrients. It is vegetatively propagated and prone to virus infections. Viral titers accumulate disproportionately with each planting cycle (generation). Sweet potato viruses are vectored by two major insects: Aphids (*Myzus persicae)* that transmit Potyviruses and Whiteflies (*Bemisia tabaci*) that transmit Criniviruses and Geminiviruses. Potyviruses are likely to reduce 25-40% of the yield, while geminiviruses reduce yield by up to 90%, which may likely show foliar symptoms in the field when co-infections occur. Viral diseases also affect marketable yield and quality, such as the roots' taste, appearance, and shape. The research objectives are to: quantify the rate of infection of potyviruses in five different generations of sweetpotato, understand any changes in the shape of the sweet potato roots across the various generations, and investigate any differences in its yield components. The treatments applied for this study are G1, G2, G3, G4, and G6. The research design used was the Randomized Complete Block Design (RCBD), and storage roots were randomly sampled after harvest to test four economically important potyviruses. The Reverse Transcriptase – Polymerase Chain Reaction (RT-PCR) was the protocol used for molecular detection. Results show low infection titers in the younger generations (G1, G2, G3) compared to the older generations (G4 and G6). The yield data recorded a gradual decline in weight across treatments. Farmers are, thus, advised to upgrade their planting material after the third planting season since this trend will likely result in significant yield loss.

Rotation, Cover Crop, and Fumigation Impacts on Guava Root-Knot Nematode Incidence in Field Studies in ‘Covington’ Sweetpotato

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Guava root-knot nematode (*Meloidogyne enterolobii*, GRKN) is an aggressive and invasive plant-parasitic nematode species that causes galling and crop yield losses and poses a significant threat to the sweetpotato industry. GRKN is particularly challenging to manage due to its wide host range and ability to overcome host genetic resistance that is effective in managing other species, such as the Southern RKN (*M. incognita*). This project aims to identify holistic, multi-tactic management options for GRKN in sweetpotato production utilizing non-host rotation and cover crops along with fumigation in multi-year field studies. Non-host rotation crops peanut and corn as well as host rotation crops soybean and tobacco were evaluated along with cover crops black oats, wheat, and fallow in an on-farm location naturally infested with GRKN. Under disease pressure from GRKN, increased marketable yield and reduced galling damage was observed in sweetpotatoes planted after peanuts and corn, while more severe galling damage was observed in sweetpotatoes planted after tobacco. Additionally, fumigation resulted in an increased marketable yield response in sweetpotatoes planted after the non-host crops peanut and corn compared to the sweetpotatoes planted after host rotation crops soybean and tobacco. Additional information and research updates from the SweetARMOR (Sweetpotato Advanced Research and Management of RKN) project are available at www.sweetarmor.org.

Reducing Sweetpotato Infection Through

Vector Management

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Sweet potatoes (*Ipomoea batatas*) are vegetatively propagated and are prone to the accumulation of pathogens, especially viruses. Aphids (Hemiptera: Aphididae) vector potyviruses to sweet potatoes in a non-persistent manner, reducing yield and root quality. In this study, we examined different options for aphid management to reduce the spread of potyviruses: crop borders, crop oils, and insecticides. Crop borders can provide a host where immigrating aphids feed, cleaning out their stylets of virion before moving to the sweet potatoes. Crop oils prevent virion binding to stylet mouthparts and may alter probing behavior. Lastly, insecticides can kill aphids but may act too slowly to reduce virus transmission. To compare these potential management strategies, sweet potatoes was planted in Starkville, MS. Each plot was a total of 10 rows consisting of 4 treatment rows on either side of two middle rows of virus-free plants. Two rows of virus-infected plants bordered each side of the plot to serve as virus inoculum. Roots from the two middle rows were harvested, and a Multiplex RT-PCR was utilized to test for the presence/absence of Sweet Potato Virus G, Sweet Potato Virus C, Sweet Potato Virus 2, and Sweet Potato Feathery Mottle Virus.

Integrated Pest Management of Potyviruses: Evaluating the Effects of Border Crops and Alternative Controls in Sweetpotato Fields

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Transmission of potyviruses by aphids can lead to significant yield losses in sweetpotato production. Unfortunately, insecticides aren't effective in controlling potyviruses as they don't kill quick enough to reduce virus acquisition and transmission. Alternative tactics are needed. Studies have shown that the biopesticide *Bacillus mycoides* strain J (LifeGard WG) primes plant defenses against pathogens while kaolin clay (Surround WP) acts as a physical barrier and pest deterrent. This study evaluated the effectiveness of soybean border crops in combination with these alternative controls in reducing the transmission of aphid-vectored potyviruses in sweetpotato fields. Treatments consisted of a control (non-treated sweetpotato), LifeGard WG, and Surround WP applied to sweetpotato virus-tested plants. In addition, sweetpotato test plots were surrounded by soybean borders. Pan traps were used and inspected on a weekly basis to monitor aphid landing rates within the test area. Plant samples were collected throughout the season and tested for the presence of viruses using a multiplex PCR assay. Preliminary data suggested that the combination of soybean borders and alternative control in sweetpotatoes may disrupt aphid landing rates, and in turn, reduce the transmission of viruses into this crop. Findings from this study will be beneficial towards the development of a sweetpotato clean seed program, providing farmers and stakeholders with tools and strategies to reduce and mitigate virus transmission within sweetpotato fields.

Impact of Jicama and Paper Mulch on Weevil Populations in Sweetpotatoes

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Sweetpotato, Ipomoea batatas, is an important food crop that is grown widely in the US Virgin Islands but is plagued year-round by weevils. Jicama, *Pachyrhizus erosus*, is a tropical legume with a crispy edible tuberous root. However, jicama also produces rotenone, a natural organic insecticide, in the leaves and seeds. The objective of this study was to investigate the impact of intercropping of sweetpotato with jicama or shredded paper mulch on weevil damage. Sweetpotato cuttings, from six cultivars, were taken in July from actively growing plants and planted in raised beds at eight inches in-row spacing for the control and shredded paper mulch treatments. Sweetpotatoes intercropped with jicama were every other plant or every fourth plant. Harvest at 135 and 143 days indicated that the cultivar Murasaki had the highest percent of marketable tuberous roots at 34% while Sakura-40 had the lowest at 2% indicating that this cultivar is most susceptible to weevils. The shredded paper mulch treatment had the best weevil control followed by the jicama sweet potato treatment. Murasaki is known to be weevil resistant which also was verified in this study. This experimental trial will be repeated in January. This project was funded by the VIDOA specialty crops grant and the USDA hatch grant.

Plant Growth Regulator Impact on Sweetpotato Slip Development

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Cultivating sweetpotatoes involves a series of stages, each presenting unique challenges, particularly during the transplanting phase. For this phrase, sweetpotato slips, or vine cuttings, propagate this crop clonally and often display inconsistent characteristics that complicate the process. Moreover, slips transitioning from a controlled greenhouse environment to field conditions introduce a variety of environmental stresses, leading to a high mortality rate in transplants and presenting substantial challenges for producers. Previous studies have indicated that plant growth regulators (PGRs) can induce cell wall lignification, potentially mitigating transplant stresses in various crops; however, their effects on sweetpotato slips have remained unexamined. Two greenhouse trials conducted at Mississippi State University sought to assess the efficacy of several types and concentrations of PGRs on sweetpotato slips. Utilizing a randomized complete block design, the study evaluated four distinct PGRs across thirteen concentrations with three replications, encompassing 38 subsamples per treatment per replication. Extensive data on plant height, stem diameter, node count, chlorophyll content, leaf area, and both dry and fresh weights of slips and roots were collected to understand the impact of PGRs on plant development. The results indicated that sweetpotatoes exhibit heightened sensitivity to multiple applications as opposed to larger singular applications regarding height reduction. Conversely, all treatments, at most rates tested, enhanced chlorophyll content. Nevertheless, other measured parameters remained largely unaffected, including external stem diameter, which exhibited a reduction, node count, fresh and dry weight of slips and roots, and leaf area.

Cultural and Chemical Management of *Rotylenchulus reniformis* in Sweetpotato Production in the Southern United States

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The reniform nematode (*Rotylenchulus reniformis*) poses a significant threat to sweetpotato (*Ipomoea batatas*) production in the southern United States, primarily in the Mississippi Delta region of Louisiana, Arkansas, and Mississippi. Reniform nematode parasitism may cause stunting of the plant in the early growth stages but typically reduces yield by feeding on adventitious roots and preventing them from differentiating into storage roots. This study evaluates current management strategies for this pervasive pest. A field trial demonstrated a 40% increase in sweetpotato yield with the application of nematicides, underscoring their potential efficacy in mitigating nematode damage. Additionally, a comprehensive screening of 13 commercial sweetpotato lines revealed no measurable resistance to *R. reniformis*, highlighting the lack of genetic resistance within currently available cultivars. Given these findings, crop rotation remains the sole viable cultural management strategy for reniform nematode control. However, its effectiveness is limited by the availability of non-host rotation crops and the economic constraints faced by growers. This research underscores the urgent need for integrated management strategies, including the development of resistant cultivars and optimized chemical controls, to sustainably manage reniform nematodes and improve sweetpotato production systems. Future studies will focus on long-term field trials, exploring alternative nematicides and evaluating rotational crops for enhanced nematode suppression. This work contributes to the growing body of knowledge needed to address reniform nematode management and support the resilience of sweetpotato agriculture in the southern United States.

Machine Learning Analysis of Hyperspectral Images for Detection of Sweet Potato Feathery Mottle Virus

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Sweet potato feathery mottle virus (SPFMV), in combination with other potyviruses, can reduce sweetpotato yields by 25-40%. Detecting this virus, like many plant viruses, is challenging due to infections being asymptomatic and the time-intensive nature of the available detection methods. As SPFMV is endemic in the United States, there is a critical need for cost-effective and remote detection methods to be accessible to producers and researchers. Hyperspectral imaging, leveraged with machine learning, offers a promising solution, with studies demonstrating its effectiveness in nondestructively detecting and differentiating plant viruses in crops such as *Vitis vinifera* and *Nicotiana tabacum*. However, limited research has focused on sweetpotato. In this study, a hyperspectral image library of virus-tested and SPFMV-infected plants was developed,

consisting of Beauregard and Orleans sweetpotato cultivars, as well as the common indicator plant *Ipomoea setosa*. This library was used to train distinct convolutional neural networks to classify unlabeled images to assess SPFMV infection status. After training and validation, the saved models were utilized to analyze vegetation indices and examine the virus's impact on photosynthetic efficiency, such as changes in the chlorophyll ratio. Initial results indicate that training with a modified ResNet50 architecture achieved accuracies exceeding 85%. Feature importance analysis of this model shows a strong correlation between infection and chlorophyll-based vegetative indices. This study is paramount to making hyperspectral image analysis and machine learning model training more accessible and confirm its efficacy as a tool for virus detection in sweetpotato.

Optimizing Light Intensity for Rooted Cuttings Production of Sweetpotato (*Ipomoea batata* L.) at the Micropropagation and Repository Unit (MPRU)

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Sweetpotato (*Ipomoea batatas*) nurseries require efficient propagation systems to produce high-quality planting material for field production. This study evaluated the impact of daily light integral (DLI) and planting density on the growth and quality of rooted cuttings under controlled environmental conditions. 'Covington' sweetpotato cuttings were rooted under four DLI treatments: 13.3, 19.9, 25.7, and 32.4 $mol \cdot m^{-2} \cdot d^{-1}$, utilizing LED fixtures with photon flux ratios of 16.6% blue (B), 6.2% green (G), and 77.2% red (R) light. Two planting densities, 483 and 859 $plants \cdot m^{-2}$, were also evaluated. Environmental conditions were maintained at 26.9 ± 0.5°C, 71.6 ± 8.1% relative humidity, and an 18-hour photoperiod. Increasing DLI linearly increased shoot and root dry mass for both planting densities. For example, cuttings under 32.4 DLI had 300% and 143% higher root and shoot dry mass, respectively, than those under 13.3 DLI. Furthermore, no negative impacts were observed in fresh mass, dry mass, stem diameter, and number of nodes with the 2-times higher planting density. This suggests that doubling planting density within a DLI range of 13.3–32.4 $mol \cdot m^{-2} \cdot d^{-1}$ does not compromise plant quality, enhancing production efficiency per unit area. These findings suggest that optimizing light intensity can enhance both plant growth and quality, supporting the implementation of supplemental lighting in greenhouses. Ensuring adequate light intensity may also justify increased planting densities, enabling higher production per unit of growing area. This study contributes to the development of optimized propagation protocols for sweetpotato in controlled environments, offering a framework for improving nursery efficiency and scalability.

Genome-wide Association Study (GWAS) to Analyze the Genetic Variation of Fusarium Wilt Resistance in Louisiana Sweetpotato Population

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Fusarium wilt (*Fusarium oxysporum f.sp. batatas*) is a soil-born fungus that affects sweetpotato causing significant damage to crop yield and quality. The use of resistant cultivars is one of the most effective ways to reduce disease incidence. Screening for the disease is time-consuming, resource-draining, and error-prone due to environmental fluctuation. Trait-linked molecular markers represent an efficient, stable, and alternative screening approach.In this study, a genome-wide association study (GWAS) was conducted on the Louisiana sweetpotato population to identify novel candidate loci and gain insights into the underlying genetic mechanisms. Phenotypic data was collected for 264 F1 lines over 2 years with 3 replicates in the experimental design. The sweetpotato accessions was genotype using DArT sequencing which yielded 9415 markers. GWAS was performed using GWASpoly package utilizing an additive model which resulted in identifying 4 markers significantly associated with fusarium wilt for resistance screening.

Discovery of a Major QTL for Resistance to Fusarium Wilt (*Fusarium oxysporum f. sp. batatas*) in 'Covington' Sweetpotato (*Ipomoea batatas*)

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Fusarium oxysporum f.sp. batatas, the causal agent of Fusarium wilt disease, was once the most damaging pathogen of sweetpotato in the United States. Breeding for cultivar resistance has largely addressed this issue, however, little is known about the genetic basis for this resistance. Historically, sweetpotato breeders have relied on the high heritability of Fusarium wilt resistance, and in the era of genomic tools, identification of a region controlling for resistance would be a major first step in implementing marker-assisted selection for this trait. We assayed a biparental mapping population, NCDM04-0001 x 'Covington' (DC), consisting of a susceptible by resistant cross composed of 454 progenies, for resistance to Fusarium wilt disease using visual assessments and an ordinal disease severity rating scale. Parental and check lines performed largely as expected, and the DC population exhibited a normal distribution across trials over three years and in a joint analysis. We next performed a QTL analysis using a linkage map for the DC population that was aligned to the Ipomoea trifida diploid reference genome, a wild relative of sweetpotato with simpler genetics. Across greenhouse trials, we repeatedly detected a major QTL on chromosome 10, herein named qIbFo-10.1. This QTL had a heritability of 33.8%, suggesting that genetics explain a large amount of variation for resistance to this critically important trait. Future efforts should focus on identifying gene(s) within this space and developing molecular tools to select for Fusarium wilt disease resistance earlier in the breeding pipeline, resulting in more rapid breeding cycles and resistant variety releases.

Occurrence of Fungal Plant Pathogens in Sweetpotato Production in Uganda, Africa.

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Sweetpotatoes are key for micronutrient nutrition in developing countries due to their rich content of beta carotene, vitamins, and minerals like iron and potassium. Orange-fleshed sweetpotato is particularly valued in Sub-Saharan Africa's biofortification programs for its high nutritional and provitamin A content. However, sweetpotato yield in Uganda is declining due to pests and diseases, with pre-harvest diseases and pests like the sweetpotato weevil causing up to 100% yield loss, and viruses leading to up to 47% losses. Nonetheless, the impact of post-harvest diseases in Uganda is currently unclear. Therefore, this study aims to Identify the composition of potential postharvest fungal pathogens from storage roots collected in fields and markets located near Kampala, Uganda. In this study, we surveyed the Kamuli and Mpigi districts and collected 154 root samples between farms and markets. We isolated, purified, and morphological and molecularly identified all the fungal isolates from these samples. Tissue sample analyses revealed the presence of bacterial and fungal organisms, with some of them being known sweetpotato pathogens: *Fusarium spp, Penicillium spp, Aspergillus spp, Macrophomina phaseolina, Geotrichum candidum, Diaporthe sp*. Some other isolates have not been reported as postharvest pathogens of sweetpotato. Therefore, pathogenicity tests will reveal the most threatening species in our collection. Based on this information, we can provide a more updated composition of postharvest pathogens found in sweetpotato production systems.

The Relationships Between Generation, Virus Loads, and Yield in US Sweetpotatoes: Final Results From a Multi-State Trial

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Sweetpotato (*Ipomoea batatas*) farmers face significant challenges balancing disease management, seed stock quality, and the cost of replacing seed. Potyviruses substantially threaten yield and quality, yet the relationship between seed generation, virus prevalence, and yield over time is not fully understood. This study examines multi-year data from randomized block trials across five U.S. states, incorporating multiple widely cultivated sweetpotato varieties. Findings reveal that higher seed generations are consistently associated with increased virus load and reduced yield across all trial locations. These results underscore the economic risks of delayed seed replacement and the importance of certified disease-free seed. A return-on-investment analysis offers practical recommendations to growers, helping them make informed decisions about seed replacement intervals. This research supports the National Clean Plant Network's (NCPN) mission by advancing strategies for sustainable sweetpotato production and improved disease management.

Genotype Reveal: Variation in Nitrate and Phosphate Signaling Responses Highlight Sweetpotato Cultivar Differences During the Onset of Storage Root Formation

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Sweetpotato (*Ipomoea batatas*) is a versatile crop that thrives in both marginal and high input production systems. Emerging evidence support the hypothesis that sweetpotato cultivars vary in response to nitrogen (N) and phosphorus (P) availability. This study profiled the expression of key N and P transporters at the onset of storage root formation among ten sweetpotato cultivars grown under N (-N) and P (-P) deficient conditions. The expression profile of IbPHT1;4, a low-affinity phosphate transporter, differentiated all genotypes, correlating with long-term greenhouse studies. The cultivars Bayou Belle (BB), Beauregard (BX), Bonita (BN), Avoyelles (AV), Murasaki (MU), and breeding line19-20 upregulated IbPHT1;4 under -P. In contrast, Evangeline (EV) (downregulated) and Bellevue (BV), Vermillion (VM), and Orleans (OR) (no differences) showed varying responses. IbNRT2.5, a low affinity N transporter (LAT), was upregulated in all cultivars grown under -N conditions, although fold changes varied. A second LAT, IbNRT1.1, showed significant variability under -N. While AV exhibited upregulation, EV, BV, MU, BX, and 19-20 showed downregulation. There were no differences among BB, BN, and VM. To gain insights about possible N and P interactions, BB was grown under control, -N, -P, and -NP. IbPHT1;4 was significantly downregulated under -N and showed no change under -NP; IbNRT2.5 was downregulated under -P and unchanged under -NP, indicating interdependence of N and P for transporter induction. These findings provide molecular evidence underlying cultivar-specific nutrient response and enables genotype- and site-specific nutrient management strategies to enhance sweetpotato production efficiency and sustainability.

Evidence for the Crucial Role of Nitrogen in Mediating Sink Strength and Storage Root Formation in Sweetpotato cv. Beauregard

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The sink strength of developing adventitious roots is believed to limit storage root formation in sweetpotato. Sucrose synthase (SuSy) is the most actively expressed enzyme in sucrose metabolism in developing storage roots and correlated with sink strength. In model systems, declining nitrogen (N) availability has been associated with increased carbohydrate allocation to root systems. To test the hypothesis that N limitation is a switch that triggers increased SuSy activity and turns on storage root formation, we subjected sweetpotato cv. 'Beauregard' to progressively declining N treatments in a split-root system. SuSy expression and root system architecture were evaluated over 15 days and storage root formation was assessed at 50 DAP. Declining N availability enhanced SuSy activity in the root base tissue across all time points and was associated with increased lateral root count at 15 DAP. Previous work has shown that the anatomical cue of the onset of storage root formation, the appearance of anomalous cambia, is initially limited to the root base tissue. Decreasing N supply was associated with increased storage root (diameter > 1.5 cm) counts relative to the negative and positive controls. The omission of N was associated with decreased root base SuSy activity and an overall reduction in storage root number. These data support the hypothesis that N limitation is a critical switch for storage root formation in sweetpotato. Our findings have profound implications for increasing N fertilizer efficiency and enhancing our understanding of the internal and environmental variables that mediate storage root formation and productivity in this globally important crop.

Variation in Root Architectural Adaptations in Putatively Low- and High Lead-Accumulating Sweetpotato Cultivars.

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The plant root system is not only vital for nutrient uptake but also plays a significant role in abiotic stress adaptation and defense. In sweetpotato, optimum root system architecture (RSA) development determines storage root (SR) yield potential. Root architectural responses to simulated natural lead levels (Pb) during the establishment and SR formation phases were characterized in two sweetpotato cultivars with known contrasting storage root yield potentials. Cultivars 'Bayou Belle' (BB) and 'Beauregard' (BX) grown on sand substrate were provided with 0.5X Hoagland's nutrient solution with varying levels of Pb: 0, 10, 20, and 30 mg·L-1. The first experiment sampled entire root systems at 5, 10, and 15 days, corresponding to key adventitious and SR development stages. The cultivars varied in RSA attributes in response to Pb levels. In contrast to the cultivar BB, BX provided

with 10 mg·L-1 Pb showed 83%, 21%, and 15% increase in main root length relative to the untreated controls at 5, 10, and 15 days, respectively. The cultivar BB consistently showed increased lateral root number and length relative to BX across all treatment levels. A second experiment was performed to produce SR samples at 50 days. The cultivar BX accumulated a 200- and 300-fold increase in Pb in SR at 20 and 30 mg·L-1 Pb, respectively, relative to BB storage roots at similar Pb levels. There were no differences in Pb accumulation across treatment levels in the cultivar BB. These findings are consistent with the hypothesis that increased root mass was associated with low accumulation of Pb and provide a basis for incorporating RSA traits in selecting Pb-tolerant cultivars.

Consumer Risk Perceptions of Sweetpotato Products and Processes

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Currently situated in the U.S. market as a staple traditional starchy vegetable and a nutrient-rich “superfood” choice, the sweetpotato has the potential to increase micronutrient intake across American diets. However, as negative diet health and wellness perceptions increase regarding emerging processing, preservation, and genetic engineering techniques, the impact on the sweetpotato sector is unknown. To understand the relationships of these factors within consumer buying preferences and overall public health, we conducted a consumer survey with 300 participants from an online consumer database out of the North Carolina State University region. The objective of the study was to assess how consumers are influenced by product familiarity, awareness or acceptance of genetic engineering, perceptions of sustainability practices, and the role of heavy metals and nutrient content in sweetpotato purchasing. Preliminary analysis shows that although consumers have a general lack of awareness concerning the safety of genetic engineering, willingness to buy bioengineered varieties of sweetpotatoes may be influenced by consumers perceiving an increase in sweetpotato benefits such as sustainability practices on the farm level, nutrient increases, and heavy metal reductions. These results will inform strategies for marketing sweetpotatoes, improving consumer education, and addressing public health concerns regarding the potential for genetic engineering as a tool for increased micronutrient and sustainability practices.

Chelated Iron as a Safener to Herbicide Treatments Applied ‘POST’ on ‘Covington’ Sweetpotato

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Iron chelates are commonly used in agriculture as a micronutrient fertilizer to promote plant growth and development. Currently, no herbicides are labeled for ‘POST’ application for broadleaf weeds in sweetpotato. In 2020 and 2021 a field study was conducted to evaluate chelated iron (Sequestrene 330) as a safener to herbicide treatments applied ‘POST’ on ‘Covington’ sweetpotato. The two components in the study were 1.) ‘non-rooted’ sweetpotato cuttings were either ‘treated’ or ‘not-treated’ with a chelated iron solution prior to transplanting all plots. 2.) A nonionic surfactant (NIS; 0.25% v/v) was included as a stand-alone treatment and with basagran (840 g ai ha-1) plus NIS, bicyclopyrone (50 g ai ha-1) plus NIS, halosulfuron (39 g ai ha-1) plus NIS, linuron (560 g ai ha-1) plus NIS and paraquat (280 g ai ha-1) plus NIS, additionally, fluridone (746 g ai ha-1), glufosinate (594 g ai ha-1) and metribuzin (504 g ai ha-1) were all stand-alone treatments. The study was a randomized complete block design (RCBD) with four replications. Study location in both years was the Horticulture Crops Research Station (HRCS) Clinton, North Carolina. In 2020, differences in stand-count were due to the main effects of chelated iron treatment and chemical treatment. Stand-counts were 9 % higher in plots without the chelated iron treatment compared to plots where chelated iron was included. Stand-counts for the glufosinate and paraquat plus NIS treatments were lower than the non-treated control by 77% and 74%, respectively. In 2020, all herbicide treatments had phytotoxicity ratings that differed statistically from the non-treated control at 7 days after treatment (DAT) and only NIS, linuron plus NIS and metribuzin had phytotoxicity ratings below 30%. A final phytotoxicity rating was recorded at 56 DAT when basagran plus NIS and fluridone had similar ratings to metribuzin, NIS and linuron plus NIS when compared to the non-treated control. In 2020, yields of no.1’s were highest for NIS alone, linuron plus NIS, fluridone, metribuzin and basagran plus NIS when compared to the non-treated control, while treatments that produced the lowest canner yields were halosulfuron plus NIS, glufosinate and bicyclopyrone plus NIS. In 2020, jumbo yields were lower for bicyclopyrone plus NIS and glufosinate when compared to the non-treated control. In 2020, jumbo yield was 57% higher with treatments that did not include the chelated iron treatment, while marketable (sum of no.1’s, canners and jumbos) and total (sum total of no.1’s, canners, jumbos and culls) yields were 30% and 23% higher, respectively. In 2020, total yields of the paraquat plus NIS, halosulfuron plus NIS, glufosinate and bicyclopyrone plus NIS treatments were statistically

different from the non-treated control. In 2021, stand-counts for the paraquat plus NIS and glufosinate treatments were lower than the non-treated control by 40% and 97%, respectively. In 2021, statistical differences in the yields of marketable (sum of no.1's, canners and jumbos), total and no.1 roots were limited to bicyclopyrone plus NIS, glufosinate and halosulfuron plus NIS treatments when compared to the non-treated control. Statistical differences in canner yield were limited to the glufosinate treatment when compared to the non-treated control and there were no significant differences in jumbo or cull yields in 2021.

Hardening Off Sweetpotato Slips: Enhancing Survival and Productivity in Field Conditions

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High mortality rates and low stand counts during the transplanting of sweetpotato slips pose significant challenges for farmers, often resulting in reduced yields and economic losses. This study aims to evaluate how different greenhouse hardening treatments influence the growth and overall performance of sweet potato slips once transplanted into field conditions. It examines two sweet potato cultivars, B14 and Orleans, under two watering regimes: watering up to planting (Wutp) and no watering one week before planting (NW1wbp) at temperatures 75°F and 85°F in 2023 and 2024. In 2023, both cultivars had nearly 100% survival rates; however, the 2024 data revealed significant variation in stand counts attributed to fluctuating environmental conditions. GH85_Wutp showed the highest counts for B14 and Orleans, while GH85_NW1wbp was the least favorable. Both cultivars did not exhibit significant differences in vine length in 2023. However, in 2024, the Wutp treatments demonstrated greater vine lengths than NW1wbp, particularly at 85°F. In 2023, B14 had the highest node count for GH75_Wutp, but in 2024, Orleans surpassed B14 in GH75_Wutp and GH85_Wutp, achieving the highest counts in both. In 2023, the treatment GH75_Wutp achieved the highest yield of 3575 kg/ha, while GH85_NW1wbp recorded the lowest yield at 2776 kg/ha. In 2024, GH85_Wutp achieved a yield of 3682 kg/ha, while GH85_NW1wbp saw a significant decline to 1597 kg/ha, the lowest that year. The findings from this study indicate that while high temperatures can enhance crop yields, reduced water availability significantly undermines productive outcomes, emphasizing the need for strategic management practices for growers aiming to ensure profitability.

Sweet Potato Research & Development in Quebec, Canada

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In 2023, Canada imported nearly 82,000 metric tons (MT) of fresh sweetpotatoes (60% destined for processing). Domestic consumption has rose significantly, from 0.7 kg per person in 2007 to nearly 3 kg in 2023. However, only 2,350 hectares (5,800 acres) of sweetpotatoes were planted in Canada in 2023. In 2019, Nordany Brokers Inc., based in Québec, launched a project to develop sweetpotato varieties adapted to Québec's agroecological conditions, aiming for harvest maturity at 100 days after planting (DAP). Currently, Nordany imports about 40,000 MT of sweetpotatoes annually from the U.S. In 2019, 750 seedlings from eight parental crosses selected for early maturity were planted in an unirrigated field in Nicolet, Québec, and harvested at 93 DAP, resulting in 124 promising clones. In 2020, these clones were evaluated at two locations, with 10 plants per clone and harvested at 100 DAP. Sixty-four clones were selected for further testing. In 2021, these 64 clones were planted at three locations, with 20 plants per clone. Eight clones were selected and planted in 2022 at two sites—one in Québec and one in Ontario—with 500 plants per clone. Harvested at 100 DAP, four superior clones were chosen and sent to the USDA Plant Protection Service for cleaning and registration. These clones outperformed commercial US varieties at 100 DAP. By mid-2024, two clones were released and sent to the sweet potato program at North Carolina State University (NCSU). These clones are being multiplied on a North Carolina farm for evaluation in 2025. Additionally, over 3,000 seeds from 18 parental crosses have been field evaluated between 2021 and 2024. Several promising clones have been identified for further testing under Canadian conditions.

Curing Me Softly: Simulated Water Deprivation Increases Continuity and Area of Lignified Tissue in 'Beauregard' Sweetpotato Periderm

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The periderm is the storage root's first line of defense against abiotic and biotic stress and helps to determine its storability and marketability. This work characterized storage root (SR) periderm lignification in a greenhouse culture system subjected to simulated water deprivation

(WD) treatments. Virus-tested sweetpotato cv 'Beauregard' cuttings were planted at the following staggered times relative to the control (0d): 10 (10d) and five days (5d) earlier, respectively. Staggered plantings were performed to generate SRs of uniform diameter as preliminary studies showed that WD reduced SR growth when planted and harvested simultaneously as the control plants. Water deprivation treatments were applied 10 (10d) and 5 (5d) days before harvest. The experiment was terminated when the control plants attained 30 days of growth. Storage root sections 1-2 mm thick were obtained from the widest part of the storage root, stained with phloroglucinol, followed by image capture with a microscope. Digital image analysis was performed by measuring the area of the continuous lignified zone (CLZ) below the phellogen layer and calculating % CLZ after measuring the total area of the cross-section. Simulated WD at 10d and 5d was associated with a six- and three-fold increase in % CLZ, respectively. None of the control SRs showed 100% CLZ while 50% of SRs subjected to 10d WD showed an intact ring of lignified tissue below the phellogen layer. Storage roots from control plants consistently showed breaks in the phellem tissue relative to SRs subjected to WD treatments. This is the first report of increased lignification in sweetpotato periderm tissue associated with simulated WD before harvest under controlled conditions. These findings can lead to follow-up work to validate increased skin durability associated with periderm lignification.

Optimizing Sweetpotato Breeding With Data Management

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Sweetpotato (*Ipomoea batatas*) is a globally important crop, contributing significantly to food security and nutrition. However, traditional breeding programs face challenges such as prolonged breeding cycles, environmental variability, and the complexity of managing large datasets. These challenges hinder the development of improved varieties that can adapt to diverse growing conditions and meet the growing demands for food production. To address these issues, innovative tools and technologies have been integrated into the sweetpotato breeding program at NC State. Tools such as Field Book, Sweetpotatobase, and interactive platforms like ShinyApps have streamlined data collection, management, and analysis, enabling breeders to work more efficiently and make data-driven decisions. These tools provide robust solutions for overcoming environmental variability, enhancing trait selection, and managing large-scale datasets.

The adoption of data-driven methodologies has significantly improved productivity in the sweetpotato breeding program. These approaches are not only applicable to sweetpotato but also offer a model for transforming breeding programs for other crops. Harnessing big data and computational tools is essential to address the challenges of modern agriculture and ensure resilient food systems in the face of climate change and population growth.

Identification of Genetic Loci Associated with Resistance to Root-Knot Nematodes and Insect Pests of Sweetpotato

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Sweetpotato (*Ipomoea batatas*) is an important food crop and plays a pivotal role in preserving worldwide food security. Due to its polyploid genome, high heterogeneity, and phenotypic plasticity, sweetpotato genetic characterization and breeding can be difficult. Genome wide association studies (GWAS) can provide important resources for breeders to improve breeding efficiency and effectiveness. GWASpoly, was used to identify single nucleotide polymorphisms (SNPs) associated with resistance to root-knot nematodes and ground dwelling insect pests of sweetpotato. For resistance to *Meloidogyne enterolobii*, a SNP explaining 32% of the phenotypic variation was identified on chromosome 10, whereas a single SNP was identified on chromosome 1 for resistance to M. incognita that explained 25% of the variation. Two SNPs were identified on chromosomes 2 and 11 that are associated with resistance to flea beetles, with each explaining 10% of the phenotypic variation. For the wireworm-Diabrotica-Systena complex, a SNP explaining 10% of the variation was identified on chromosome 12. Lastly, on chromosome 2 a SNP accounting for 15% of the variation was identified. This information will be used to develop and validate Kompetitive Allele Specific PCR (KASP) markers for use in marker assisted selection in sweetpotato.

Impact of Seed Generation on Yield and Virus Infection for Several Varieties: A CleanSEED Project Update from California

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One of the main challenges for sweetpotato producers is cultivar decline, which is the loss of storage root yield and

quality due to the accumulation of viruses because of continuous vegetative propagation over many years. Virus indexing coupled with diagnostic molecular techniques are essential tools for the detection and identification of the main viruses impacting sweetpotatoes. In this work, we report the rapid spread and infection of four sweetpotato potyviruses in a commercial field in California. From 2021 - 2024, sweetpotato cultivars (Beauregard, Bellevue, Covington, and Vermillion) of varying generational age (G0, G1, G2, and G6) were grown in a commercial field and then evaluated for viruses on harvested roots. Post-harvest storage roots were sent to University of California Foundation Plant Services (FPS), in Davis, CA, were assessed for six viruses known to infect sweetpotatoes using RT-PCR and RT-qPCR. G0 plants were planted directly from virus-tested plants grown in the greenhouse at FPS; G1 and older roots had been grown in commercial fields in Merced County in prior years. Results indicated rapid infection with all four potyviruses (SPFMV, SPV2, SPVG, and SPVC) after just one growing season, including those that were from G0 plants. Roots from older seed, however, had greater number of infected roots as well has a much higher incidence of two or more potyviruses. G4 seed of both Beauregard and Covington were 100% infected with all four potyviruses. To further confirm these results, high throughput sequencing and indexing onto *Ipomoea setosa* were performed. Seed generation also impacted harvested yield and quality. Cultivars responded differently, but in general older seed had significantly less yield and more culls. Total marketable yield of Beauregard with G1 seed was higher 49%, 21%, 42%, and 64% in years 2021 – 24, respectively, as compared to older seed. Yield differences between Covington seed age were minor, but new seed had reduced culls.

Enhancing the Market Quality of Fresh Produce Using Sweetpotato-Based Nanoparticle Coatings

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Sweetpotato roots contain abundant amounts of high molecular carbohydrates including starch, cellulose, and pectin. Eco-friendly nanoparticles from these different carbohydrate fractions were extracted from sweetpotato pulp and peel tissues of different cultivars. The physicochemical properties of the nanoparticles were characterized using scanning electron microscopy, transmission electron microscopy, Fourier transform infrared spectroscopy, and x-ray diffraction. Significant differences existed among cultivars and between the pulp and peel tissues in the nanoparticle physicochemical properties. Potential applications of utilizing sweetpotato tissue nanoparticle coatings for extending the postharvest life and market quality of various fruit and vegetable products were demonstrated. The benefits included reduced weight loss and lower respiration rate, particularly with the addition of sodium alginate. Ongoing research is continuing to determine the optimal formulations of the sweetpotato nanoparticle coating materials as sustainable alternatives for improving fresh produce market quality and reducing food waste.

Recent Developments in Understanding Acrylamide Formation in Fried Sweetpotatoes

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Popularity of fried sweetpotato (e.g., chips and French fries) has grown considerably in the past couple decades. However, the potential for these products to contain acrylamide, a toxin formed at high temperatures in carbohydrate rich foods, is a concern. The Maillard reaction between reducing sugars and free asparagine is the primary route of formation, and much has been learned recently on factors affecting its content in fried sweetpotatoes. Recent developments in understanding acrylamide formation in fried sweetpotatoes include the effects of reducing sugars, free asparagine, and other free amino acids as well as how curing, storage time, and horticultural practices influence the content of these acrylamide precursors. In fried sweetpotatoes and model systems, free asparagine has been shown to be the limiting substrate for acrylamide formation. Reducing sugar content notably affects acrylamide formation only in sweetpotatoes with exceptionally low reducing sugars (e.g., uncured, genetic factors). Other free amino acids also impact acrylamide formation and can be categorized as acrylamide promoters, inhibitors, or those with no effect. Curing increased reducing sugars while changes in free asparagine content depended on the variety. While in storage from 2 to 10 months, free asparagine and reducing sugars generally decreased with time. Horticultural practices (e.g., cover crops, soil amendments, fertilizer regimes) can also affect free asparagine contents in sweetpotato storage roots, impacting acrylamide formation potential when prepared as fried products.

These advances in food and horticultural science facilitate development of acrylamide reduction strategies for fried sweetpotato products.

Blind Ring Test at the Sweetpotato Clean Centers: Efforts to Improve Virus Testing Protocols

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There are six clean centers for sweetpotato under the National Clean Plant Network (NCPN) umbrella. The goal of these centers is to produce, test, maintain and distribute pathogen-tested, true-to-type, vegetatively propagated nuclear stock of sweetpotato to growers and stakeholders. In 2024, a blind ring test among all six clean centers and two USDA collaborators was carried out to verify that all centers are able to correctly detect each of the targeted viruses affecting sweetpotato. The NCPN-SP minimum virus standard protocol requires testing for Sweetpotato feathery mottle virus (SPFMV), Sweetpotato virus G (SPVG), Sweetpotato virus C (SPVC), Sweetpotato virus 2 (SPV2), Sweetpotato leaf curl virus (SPLCV), and Sweetpotato chlorotic stunt virus (SPCSV) using conventional RT-PCR and quantitative PCR methods. Virus-infected sweetpotato vines were obtained from USDA, Beltsville, MD; grown in a contained greenhouse at NC State University, Raleigh, NC and tested to verify infections using NCPN standard methods. Nucleic acid extractions were obtained from leaf tissue, randomized and shipped to each collaborator for validation of testing protocols. Each collaborator received a total of 15 samples which included a healthy and water control. Out of the 8 labs that participated in this blind ring test, 6 have submitted results recording a testing accuracy range of 65% to 85%. It is known that the accumulation and perpetuation of viruses in sweetpotato is a major constraint for production of seed and the commercial crop and that potyviruses are the most prevalent on sweetpotato growing areas in the US. The NCPN ring test will integrate data from the six sweetpotato clean centers as a baseline that will allow us to understand testing capabilities and accuracy in each center in order to determine the next steps for improving our detection methods.

Resistance and Susceptibility Mechanisms of Sweetpotatoes Coinfected with Sweetpotato Chlorotic Stunt and Sweetpotato Pakakuy Viruses

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Sweetpotato chlorotic stunt virus (SPCSV) and sweetpotato pakakuy virus (SPPV) co-infection pose a significant threat to global Ipomoea batatas production and germplasm transfer. SPCSV induces severe yield loss through synergistic effects, while SPPV persists in meristems. Severe stunting, vein clearing, and leaf distortion have been reported in SPPV-SPCSV-infected sweetpotatoes in Hungary. We investigated molecular strategies underlying I. batatas resistance and susceptibility to SPPV-SPCSV co-infection in two cultivars: Melinda (susceptible) and Tio Joe (resistant), using RT-qPCR, metagenomic, and transcriptomic analyses. Melinda developed vein clearing and downward leaf curling by five weeks post-inoculation (wpi), while Tio Joe remained mostly asymptomatic until 12 wpi. SPCSV levels were 100-fold higher than SPPV and eight times higher in Melinda than Tio Joe. Melinda's susceptibility was characterized by high virus titers and an ineffective defense strategy, involving salicylic acid-mediated systemic acquired resistance that led to overexpressed pathogenesis-related genes and heightened cellular antioxidation. Conversely, Tio Joe demonstrated quantitative resistance against the viruses, supported by overexpressed genes such as sirtuin and RALF-like proteins and enriched pathways, including proteasome and wax biosynthesis. It tightly regulated its gene expression, inhibited viral replication, and activated innate immunity while suppressing reactive oxygen species accumulation. The stark contrast between Tio Joe's and Melinda's defense strategies highlights targets for future research and provides insights for breeding virus-resistant sweetpotatoes to mitigate yield losses and enhance food security.

A Sweet Surprise: *Drosophila hydei* Unveiled as a Key Vector of Sweetpotato Black Rot.

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Ceratocystis fimbriata is the causal agent of the sweetpotato disease known as black rot. This pathogenic fungus can develop and spread in post-harvest environments. Although previously regarded as a controlled disease, the resurgence of black rot in 2015 underscored the necessity for further research to ascertain the various sources contributing to the dissemination of the pathogen. To this end, we conducted a study to determine the diversity of arthropods in storage facilities in four North Carolina counties. Our findings revealed the presence of 16 taxonomic categories, with the species *Drosophila hydei* (Sturtevant) being the most abundant. Investigations were conducted to ascertain the capacity of the fly to transport pathogen spores and to determine whether the spores were carried externally or internally. The study demonstrated that *D. hydei* can move the pathogen without a statistically significant difference ($p > 0.05$) between internal and external movement. Subsequently, a transmission test was conducted using different inoculum sources and four fly densities (10, 30, 50, and 80). The flies were exposed to the inoculated sources for six hours, after which the sources were changed to clean sources (a Petri dish containing culture medium and healthy sweetpotatoes). The results of the transmission test demonstrated that the fly can transmit the disease to sweetpotato ($p < 0.05$) and that this transmission is not density-dependent ($p > 0.05$). Finally, qPCR technology was employed to standardize two pathogen regions (T3G9 and T5G26) in extracted fly DNA from subjects exposed to varying inoculum sources. The results of our research support the significance of monitoring and managing *D. hydei* in storage facilities, while also introducing new molecular markers for the rapid and effective detection of *C. fimbriata*.

Developing New Tools to Help Manage Nematode Pests in Sweetpotato

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Sweetpotatoes are infected and damaged by multiple species of nematode which reduce both the quantity and quality of storage roots. These pests include multiple species of root-knot nematodes (*Meloidogyne* species) and reniform nematode (*Rotylenchulus reniformis*). More recently, a new hypervirulent species of root-knot nematode (*Meloidogyne enterolobii*) has been spreading in the sweetpotato industry via infected storage roots. Breeding for resistance to these nematode pests has been limited in part due to the labor-intensive nature of phenotyping. To help sweetpotato growers manage these pests, the US vegetable laboratory is working in collaboration with multiple institutions to identify new sources of resistance to both root-knot and reniform nematodes in sweetpotato, develop new genotyping and phenotyping tools to accelerate resistance breeding, and test new detection tools to help slow the spread of invasive species to new regions. We will provide brief updates on all our ongoing nematology research with regards to sweetpotato and solicit feedback on where future research efforts should be focused.

Screening Sweetpotato Germplasm for Resistance to *Meloidogyne incognita*

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Meloidogyne incognita is the most common root-knot nematode found in agricultural regions worldwide. It can cause severe damage to many crops including sweetpotato storage roots, causing them to be unmarketable and resulting in significant yield losses. Identifying resistant crop varieties is one of the most effective ways to manage *M. incognita*. To identify germplasm with resistance to *M. incognita*, 47 sweetpotato accessions obtained from the U.S. Department of Agriculture GRIN germplasm repository were screened in a greenhouse assay including 2-3 biological replicates per accession. ‘Beauregard’ was used as a susceptible control and ‘Regal’ as a resistant control. Sweetpotato slips containing 3 nodes each were planted in an autoclaved 1:1 mixture of sand and potting mix in Deepot D25L containers and arranged in a randomized block design. Two weeks after planting, each plant was inoculated with 10,000 *M. incognita eggs*. Eight weeks after inoculation, plants were harvested and rated for fibrosity, galling, number of egg masses, and eggs per gram of root. Resistance was defined as accessions with mean galling $\leq 10\%$ and mean eggs per gram of root ≤ 500. Based on these criteria, 12 accessions were identified as having resistance to *M. incognita*.

SCRI CleanSEED Update from NC: LED Lights, Hardening Tests and Sweetpotato virus testing

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The CleanSEED project aims to improve sweetpotato (*Ipomoea batatas*) production by enhancing clean foundation seed (CFS) through optimized propagation methods, hardening techniques, and virus management across U.S. clean centers. Objective 2 develops Best Practices for efficient CFS production in greenhouse settings, led by the NC State Sweetpotato Clean Center. The first goal maximizes clean plant production by evaluating different light treatments in greenhouse and growth chamber experiments. A growth chamber experiment at Fox Science Teaching Laboratory in August examined four light intensities (200–500 PPFD) and two planting densities (483 and 859 plants·m^{-2}) on 'Covington.' Results showed cuttings under 500 PPFD produced 300% higher root dry mass and 143% higher shoot dry mass compared to 200 PPFD. A subsequent greenhouse experiment in late spring 2025 at the Horticultural Field Laboratory (HFL) will study three sweetpotato varieties ('Covington,' 'Orleans,' 'Beauregard') under HPS and LED lights at 200 PPFD for six weeks, collecting data on vine nodes, lengths, and biomass. The second goal investigates hardening conditions to enhance in-field survival, testing three varieties under two watering and storage treatments, with data on stand establishment, vine node count, vine length, and yield at harvest. Data from 2023 showed no significant yield differences across treatments, and 2024 yield data is pending analysis. The third goal monitors virus levels in clean plant material, testing 215 pooled samples from eight certified seed grower greenhouses using NCPN standards, detecting no viruses and ensuring the quality of the clean plant material used in propagation.

Consumer Insights on the Intersection of Biotechnology, Public Health, Environmental Sustainability Practices, and Food Purchasing Decisions for Sweetpotato

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Sweetpotatoes hold significant potential in the U.S. market as a starchy vegetable and nutrient-rich “superfood” able to increase micronutrient intake in the American diet. However, public health initiatives like the FDA’s “Closer to Zero” project regarding heavy metal consumption and sustainable food systems have led to evolving consumer concerns regarding emerging food technologies, such as processing, preservation, and genetic engineering. We are interested in public perception of these key issues and how questions about health, sustainability, and sweetpotato agricultural practices impact consumer food choices. This study examined the critical intersection of consumer education and perceptions, public health, and agricultural innovation in the context of a nutrient-dense staple that can increase diet quality in the U.S. To understand these dynamics, we surveyed 300 consumers from an online database in the North Carolina State University region. Participants were asked about food choices, perceptions of biotechnology, organic production, and awareness of topics such as heavy metals and environmental practices. The survey was designed to examine how factors like product familiarity, understanding and acceptance of biotechnology, perceptions of sustainability practices, and concerns about heavy metals influence sweetpotato purchasing decisions. The survey showed that while consumers lack a general awareness of the safety of genetic engineering (GE), their willingness to purchase GE products increases when the perceived benefits, such as improved farm-level sustainability practices, enhanced nutrients, and a reduction in heavy metal uptake, are addressed by biotechnology. However, negative associations with food processing, such as perceptions of lower health content and higher environmental costs, raise additional barriers to acceptance of improved food production technologies. This research offers insights to bridge the gaps between agricultural innovation, public health concerns, and consumer acceptance. Because North Carolina grows over 60% of the nation's sweetpotato production, this study sheds light on an essential high-value crop and its impacts on local economics. The findings are critical for advancing inclusive next-generation biotechnology that promotes healthier, environmentally conscious dietary practices in the United States.

Physicochemical Properties of Sweetpotato Starch

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The physicochemical properties of the starch fraction extracted from the pulp of various sweet potato genotypes were characterized. The physicochemical properties included starch granule morphology, crystallinity, amylose content, gelatinization temperature, swelling power, solubility, and thermal stability. Significant differences in the physicochemical properties existed among the genotypes. Correlations between these properties and their potential functional applications were explored, including the suitability of certain genotypes for

industrial uses such as thickening agents and biodegradable materials. This comparative analysis provides useful insights into the diverse functionalities of sweet potato starch, paving the way for future product development for utilization in the food and non-food industries.

Sweetpotato Variety Performance in Spring Cover Crops

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A field study was conducted at the Vegetable Research Station, Kibler, Arkansas in 2024, to evaluate the performance of sweetpotato [*Ipomoea batatas* (L.) Lam.] varieties under spring-planted cover crops. This was a split-split plot experiment with three factors- weeding (main plot), cover crop (subplot), and cultivar (sub-subplot). Weeding treatments were hand-weeded and not-weeded; cover crops were cereal rye + clover, cereal rye + vetch, cereal rye + winter pea, and fallow, and sweet potato varieties were 'Heartogold,' 'Morado,' 'Hatteras,' and 'Beauregard14'. Data included total cover crop biomass, weed count, vine length and sweetpotato yield. Crover crop biomass was highest with cereal rye + vetch followed by cereal rye + winter pea and cereal rye + clover, respectively. Weeds from each plot were counted in a representative 3-square-foot area. Among the weeds are Echinochloa colona, Texas panicum, Palmer amaranth, Yellow nutsedge, and Large crabgrass. Grass weeds accounted for 92% of total weed species. The highest weed density occurred with cereal rye + clover cover crop in both weeded and non-weeded plots. The interaction effect of sweetpotato variety and cover crop, on weed density was significant, where the lowest total weed density occurred in plots with Heartogold planted into cereal rye + vetch cover crop. Regardless of variety and weeding treatment, sweetpotato vines were longest in cereal rye + vetch cover crop. Comparing varieties averaged across cover crops and weeding treatments, Morado had the longest vine, while Heartogold had shortest four weeks after transplanting (4WAT). At 8 WAT, Morado planted in cereal rye + vetch cover crop had the longest vines in both weeding treatments. Total marketable yield was calculated as the sum of jumbo, no.1, and canner roots. Overall, hand-weeding increased yield by 115% relative to the non-weeded treatment. Among cover crops, cereal rye + vetch with handweeding and cereal rye + winter pea without handweeding resulted in the highest marketable yield of sweetpotato. Sweetpotato roots were significantly smaller in non-weeded plots compared to handweeded plots, regardless of cover crop and variety. Therefore, jumbo roots were rare in non-weeded plots. Whether handweeded or not, Hatteras produced the highest yield, averaged across cover crops. Beauregard14 produced the lowest yield under handweeded treatment and Heartogold yielded the least without handweeding.

Sweetpotato Variety Development in CA

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California is the 2nd largest producer of sweetpotatoes in the U.S., but because it is a relatively small acreage crop (~18,500 acres), relies on breeding programs at LSU and NCSU for new variety development. I conduct variety screening trials in sweetpotatoes because this provides critical information for growers about newly released varieties, their production potential, disease resistance, and other important characteristics. The variety screening trials provide the California industry access to new germplasm and data showing the variety suitability to this growing environment. Cultivars are evaluated for plant production, disease and nematode resistance, shape, skin and flesh color, taste, and storability. New entries are first placed into the Advanced Line Trial, a non-replicated screening trial, before advancing to the National Collaborators Trial in replicated plots in grower fields. Six new releases with improved yield, quality, and pest and disease resistance have been released since 2008 (Covington, 2008; Murasaki-29, 2008; Bonita, 2011; Burgundy, 2014; Bellevue, 2015; and Vermillion, 2021), all of which were originally screened through these trials. 'Vermillion' has replaced ‘Burgundy’ and planted acreage has increased each year since its release. These five varieties represent about 70% of the total acreage in California. For the consumer purchasing a sweetpotato in a grocery store in the western U.S. or Canada, most likely it was first selected in these trials. 'Bellevue', which is named after a road in Merced County where this variety was first grown, has shown good environmental adaptability and is also grown commercially in Australia, Canada, northern Europe, Portugal, and Egypt.